JULY 18-21，2012 QINGDAO，CHINA
2012年7月18-21日 中国·青岛

PROCEEDINGS 0F 2012 CHINA INTERNATIONAL CONFERENCE ON INSURANCE AND RISK MANAGEMENT

# 2012中国保险与风险管理国际年会论文集


主编：陈秉正
迈克尔·鲍尔斯

EDITOR-IN-CHIEF：CHEN Bingzheng
Michael R. Powers

主　办：
清华大学经济管理学院中国保险与风险管理研究中心
伦敦城市大学卡斯商学院

ORGANIZERS：
CHINA CENTER FOR INSURANCE AND RISK MANAGEMENT OF TSINGHUA UNIVERSITY SEM
CASS BUSINESS SCHOOL，CITY UNIVERSITY LONDON

共同主办：
青岛大学经济学院

CO-ORGANIZER：
SCHOOL OF ECONOMICS，QINGDAO UNIVERSITY


CD-ROM


清华大学出版社
TSINGHUA UNIVERSITY PRESS

# Conference Program Committee

Michael R.Powers (Co-Chairman), Tsinghua University, Temple University, USA

Chen Bingzheng (Co-Chairman), Tsinghua University, China

Ai Jing, University of Hawaii at Manoa, USA

Chan Waisum, Chinese University of Hong Kong, China

Kevin Dowd, Nottingham University Business School, UK

Guo Jinlong, Chinese Academy of Social Sciences, China

He Wenjiong, Zhejiang University, China

Li Xiaolin, Central University of Finance and Economics, China

Liu Dongjiao, Zhongnan University of Economics and Law, China

Liu Xihua, Qingdao University, China

Tuo Guozhu, Capital University of Economics and Business, China

Tzeng Larry, Taiwan University, China

Wang, Jennifer L. Taiwan Chengchi University, China

Wang Wen, University of International Business and Economics, China

Wang Xiaojun, Renmin University of China, China

Wang Xujin, Beijing Technology and Business University, China

Zheng Wei, Beijing University, China

Wei Hualin,Wuhan University, China

Xu Wenhu, Fudan University,China

Yang Hailiang,The University of Hong Kong, China

Zhu Minglai, Nankai University, China

Zhuo Zhi, Southwestern University of Finance and Economics, China

# Table of Contents

## Chapter3. Insurance Economics

## Chapter4. Property and Liability Insurance

## Chapter5. Life and Health Insurance

## Chapter6. Pension and Social Security



## Chapter7. Actuarial Theory, Method and Practice

# Research of Excess Returns of the Liquidity Risk of each Sector in Chinese Stock Market

LI Lili,ZHANG Yulan
College of Economics, Qingdao University, Qingdao, China, 266071

**Abstract:** Liquidity is an important property of the security market, and it is one of the important factors influencing the price behavior and a key indicator of market efficiency. During the process of stocks trading, liquidity risk can increase the transaction costs. At present, foreign studies generally believe that liquidity risk can lead to excess returns on the stock market. However, as an emerging market, Chinese stock market has its own unique properties in price limits, volatility, quote depth and delivery system. Researches cannot agree with each other on excess returns coming from liquidity risk, and the models of liquidity risk are inconsistent. To establish an effective model of liquidity risk to measure its impact on the stock markets is an important aspect of the current study.

Based on domestic and abroad researches and the current situation of Chinese stock market, we put forward a new index to measure liquidity risk. Selecting the A-share data of more than 900 listed companies in Shanghai Stock Exchange from July 1, 2006 to December 31, 2008 , we distinguish industries and study the stocks' excess return of the liquidity risk during bull and bear market periods based on the stock yield, market yield and stock liquidity risk. At the same time, the impact of the size of companies, the carrying amount of market capitalization ratio, the proportion of outstanding shares on stock returns is also taken in consideration to measure the excess returns of stocks on the basis of the multi-factor. The innovation of this paper is: At first, considering the continuity and stability, we establish new measurement of liquidity risk and combine the stock price with its volume on the day and the previous day; secondly, considering the impact of the market factor, company size, liquidity risk on the excess returns of stock, we make an empirical analysis and a comparative analysis of the excess returns coming from liquidity risk on each sector of stocks based on a panel data model. It will have great significance on investigating the efficiency of capital markets, asset pricing and liquidity risk management.

**Key words:** Liquidity Risk; Excess returns; Panel Data; Stock market

# I. Introduction

The three attributes of the financial assets are profitability, safety and mobility. The stock liquidity is the possibility of large volume of rapid transactions at lower cost without changing the current stock price, and it contains three dimensions: time, price and volume. The liquidity of the securities market makes the smooth progress of the secondary market trading possible. Liquidity makes it possible to optimize the allocation of capital resources through the securities markets. Financial crises are accompanied by the sudden loss of market liquidity and as an important part of the market microstructure and risk management, liquidity rouse widespread interest in academia.

## A. Foreign research background

In other countries, the study of liquidity is more distant, and scholars are not consistent in the concept of liquidity. Tobin (1958) explored the meaning of liquidity for the first time; [1] Smithson (1995) thought the liquidity risk was the uncertainty of the transaction costs and market value caused by the market (or assets) that lacked liquidity; [2] Bangia (1999) divided liquidity risk into exogenous liquidity risk and endogenous liquidity risk. The former was determined by the common factors for all securities and the latter was related to the size of transactions. When the number of transactions was not greater than the quote depth, the transaction would not affect the market price, and the investors would be only faced with exogenous liquidity risk; when the transaction size exceeded the depth of market quotations, the transaction would affect the price and investors would be faced with both exogenous and endogenous liquidity risk. [3] Some early scholars also studied the effect of scale and the book-market value effect. Banz (1981) first discovered the effect of scale, and showed that both the total rate of return and the risk-adjusted rate of return were negatively correlated with the size of the company by empirical analysis; [4] Rosenberg, Reid and Lanstein (1985) found the book-market effect, and the excess return of 0.36% per month could be got if the ratio of the book and market value was greater in the years 1973-1984. [5]

The financial scholars' study on the liquidity risk premium is relatively mature, and many scholars believed that there was liquidity risk premium. Amihud and Mendelson (1986), who first proposed the liquidity premium theory, deduced the relational model (also known as the A.M model) of the expected return and the bid-ask spread, and they measured the liquidity by the relative bid-ask spread, and made an empirical test of the AM model using the data of the 1960-1980 New York stock exchange;[6] Acharya and Pedersen (2005) proposed a new theoretical model of the liquidity risk premium, i.e. the liquidity-adjusted CAPM, and they expressed the sensitivity of specific stock liquidity to the fluctuation of market liquidity using the covariance of the market liquidity and the market rate of return. They found that the expected rate of stock return was positively related to the liquidity risk, assuming that the unit transaction cost was not affected by trading position without considering the endogenous liquidity risk. [7] Of course, some scholars believed that the liquidity risk premium did not exist, or there was no significant relationship between liquidity risk and asset returns or even negative correlation. Brennan (1996) using NYSE data from 1984 to 1991 found that the level of liquidity and the stock returns were negatively correlated, but this relationship was not sound; [8] Chordia et al. (2001) measured liquidity by trading volume and took the volatility of trading volume as an indicator of the liquidity risk, and found that the expected rate of return was negatively correlated with trading volatility, that was, the expected rate of return was negatively correlated with the liquidity risk. [9]

Many empirical studies have also shown the effect of scale, the value effect and the liquidity risk premium. Although the phenomenon in the stock market was generally confirmed in the United Kingdom, United States, France and other developed countries, the conclusions of the emerging markets were different. Rouwenhorst (1999) found the effect of scale and the value effect, based on 20 emerging markets in the International Finance Corporation (IFC), but the portfolio's rate of return and the turnover were positively correlated;[10] Bekaert (2007) found that the expected return and liquidity showed a significant positive correlation in many emerging markets.[11]

## B. Domestic research background

In the country, some scholars have also explored the measurement of liquidity and the liquidity risk premium. Huang Feng (2007) thought that liquidity reflected the impact of trading volume on trading prices, and the price fluctuation caused by the emergence of new information should be excluded, and the disclosure of new information was often occurred during non-trading hours, for which he used the price amplitude ((the highest price - the lowest price) / the opening price) to substitute the molecule of Amihud indicator.[12] Li Yuanhui and Ding Huiping (2009) found the liquidity levels of different industries and different regions were different using VAR approach based on samples selected from the Shanghai and Shenzhen Stock Exchange. From the industry' point of view, the medicine and bio-products industry showed larger liquidity risk in the Shanghai Stock Exchange, and the wood, furniture industry showed greater liquidity risk in the Shenzhen Stock Exchange. From a regional perspective, the liquidity risk of the western region was higher than the other two regions. And the overall liquidity risk level of the stock in the Shenzhen Stock Exchange was slightly higher than that in the Shanghai Stock Exchange. [13] Wang Mingtao and Zhuang Yaming (2011) proposed the concept of target liquidity. They found strong correlation of the lack of liquidity and its volatility through an empirical test based on the 148 A-shares listed on the Shanghai Stock Exchange and the target liquidity had a significant impact on liquidity risk. They also showed that the liquidity risk of the bull phase was significantly less than that of the bear phase and the size of the stock market capitalization had little effect on liquidity risk. [14] At the same time, scholars have also been exploring the effect of scale and the value effect. Lu Jing and Tang Xiaowo (2004) showed that the effect of scale did not exist in the Chinese stock market;[15] Li Yihong and Wu Shinong (2003) believed that research results were affected by the liquidity indicators, the empirical method, the structure of estimated data, the policies and important events;[16] Zhou Fang and Zhang Wei (2011) made an empirical study on the scale effect, the value effect and the liquidity risk premium in China's stock market through improving the Fama three-factor model and the LACAPM. They proposed a new non-liquidity indicator to measure liquidity risk combined with turnover by improving the indicator raised by Amhuid (2002) and they thought "liquidity premium" existed and there was some intrinsic correlation of the liquidity, company size and the book-market ratio. [17]

By numerous researches, some scholars believed that liquidity risk premium existed in the Chinese stock market. Wu Wenfeng et al. (2003) used the ratio of the absolute value of day yield and the transaction amount to represent non-liquidity, and found that the indicator and the earning rate were positively correlated, that was, and there was compensation for liquidity risk in China's stock market.[18] Of course, some scholars hold the opposite view that there was not liquidity risk premium phenomenon in the domestic stock market, such as Xi Honghui (2006) measured the stock liquidity by daily volatility-adjusted turnover and non-liquidity indicators, and analyzed the relationship of the liquidity, its volatility and stocks' expected returns finding a significant negative correlation of the expected return and stock liquidity levels in the control of other factors that affected stock returns and showing fluctuations of the liquidity could not explain the expected stock returns.[19] Some scholars believed that the liquidity risk and the expected stock returns influenced each other. Yang Chaojun and Wang Lingzhi (2011) showed a kind of bidirectional causality between the fluctuation of liquidity and the rate of return based on the causality test of fixed effects VAR. [20]

On the whole, you can find that liquidity risk is a hot issue of the domestic financial research. Many scholars have proposed their own views on the measurement of liquidity risk and its premium, but have not reached the same conclusion yet, mainly due to the difference of liquidity indicators, the situation of China's securities market and the impact of policies, major events or other factors. Empirical results vary greatly if different liquidity indicators, different samples or different analysis methods are selected.

## C. Significance

The liquidity of the stock market is an important indicator to evaluate the quality of the security market. For investors, the liquidity is valuable, and the better liquidity, the lower transaction costs and the impact of trading volume on the price is smaller, and the market is more stable, and investors have more confidence in the market, and the allocation of resources will be more efficient. By studying the liquidity premium of China's securities market, we can not only be able to recognize the risk aversion of investors, but also investigate the efficiency and order of the securities market, in order to guide the pricing of financial assets and financial risk management. Therefore, the study will help to enhance market liquidity assessment, to guard against liquidity risks, to further improve the trading mechanism of the securities market, to strengthen the information disclosure system, to reform the situation of split share, to improve the confidence of investors, to make the stock market more stable. It will have important meaning to academia, investors, and the Securities Regulatory Commission.

At present, the conclusions of the study on domestic liquidity premium are not consistent, and the problem of liquidity is still a difficult and hot issue in the financial field. This paper is based on studies at home and abroad and the current situation of China's stock market. We improve the original indexes and propose a new indicator of liquidity risk. We distinguish industries and study the stocks' excess return of the liquidity risk during bull and bear market periods based on the stock yield, market yield and stock liquidity risk. At the same time, the impact of the company size, the carrying amount of market capitalization ratio, the proportion of outstanding shares on stock returns is also taken in consideration to measure the excess returns of stocks. The research considers both exogenous liquidity risk and endogenous liquidity risk, and adapts to the order-driven stock market in our country. It will have great meaning to investigating the efficiency of capital markets, asset pricing and liquidity risk management.

# II. Empirical Analysis

## A. Index selection

### 1）Liquidity indicator (NL)

Scholars have proposed many indicators to measure liquidity considering the bid-ask spread, trading volume, transaction amount, turnover, etc. On the basis of previous studies, we put forward a new indicator called NL.

$$NL_t = \frac{\left(P_t^h - P_t^l\right)/P_{t-1}^c}{T_t}$$

Among them, $P_t^h$ refers to the highest stock price for the day, $P_t^l$ the lowest stock price, $P_{t-1}^c$ the closing stock price the day before, $T_t$ the turnover for the day. The indicator leads to organic combination of the price and volume. The molecule uses the relative bid-ask spread rather than the absolute bid-ask spread or the daily yield to enhance the comparability and mitigate the impact of the events and announcements or other non-trading factors. We take the stock closing price the day before into account for the T +1 securities trading system. The denominator selects the turnover rather than the absolute volume or transaction amount is based on the comparability, because the absolute volume and transaction have trends and such suspicions can be avoided by choosing the turnover.

### 2）Size of the company

Most of the existing researches show that the scale effect, also known as the effect of small companies, exists in our stock markets. Banz(1981) pointed out that the size of the company had a significant impact on the expected return of the stock, and after a lot of researches by domestic and foreign scholars, the conclusion was confirmed and they pointed out that a higher rate of return would be got by investing in stocks with smaller market value. Due to the split share structure and other historical reasons, shares are divided into tradable shares and non-tradable shares in China' stock market, and the latter cannot be freely traded in the secondary market, which means that the actual stock supply is greater than the number of currently outstanding shares and the market value calculated according to the current stock prices actually is overestimated. Therefore, when we examine the relationship between stock returns and firm sizes, some scholars think it will be more accurate to measure the size of the company using the market value calculated according to tradable shares, because all trading, stock prices, yield and other indicators are for the outstanding shares, and only tradable shares can be traded in the secondary market. At the same time, some scholars, such as Chen Shou, Chen Libo (2002), believed that there was no essential impact on the sort of the yields of the investment combination with different scales. After analysis, this paper selects the market value of tradable stocks (i.e. the closing price multiplied by the number of outstanding shares), and uses its historical average level of the sample to measure the size of the company in order to make a distinction among small, medium, big cap stocks and make comparative analysis of the excess returns caused by liquidity risk of stocks with different sizes.

### 3）Proportion of outstanding shares

According to the analysis above, the stock supply will be greater with the lifting of the ban of non-tradable shares, and stock prices should theoretically decline. Therefore, this paper takes the proportion of tradable shares into account when measuring the excess returns of stocks. For certain stocks, the rate of return should be lower with the increase of the proportion of shares in circulation. Investors will have expectations on companies with lower proportion of tradable shares that more stocks will be traded. In addition, it is difficult to transfer the non-tradable shares timely at ideal prices because of relevant laws and regulations, so investors will ask for higher returns. This paper uses the ratio of the quantity of outstanding shares and that of total shares to measure the proportion of outstanding shares.

### 4）The ratio of book-market value

This paper also considers the impact of the ratio of book-market value, i.e. the value effect, on stock returns. As early as the 1980s, Stattman (1980), Rosenberg, Reid, and Lanstein (1985) found the average rate of returns of the stocks in the U.S. stock market was positively correlated with the ratio of book-market value, i.e. higher ratio of book-market value could result in higher average yield, and the average yield of stocks with lower ratio of book-market value was often lower. The phenomenon is known as the value effect. This paper takes the ratio of book-market value as a factor of stock returns, and uses the ratio of net assets per share and the closing price per share to measure it.

## B. Data selection

This paper aims to study the relationship of the liquidity risk and the excess returns of stocks and makes comparative analysis of the excess returns caused by liquidity risk of the stocks with different market trends and different sizes in different industry sectors. In addition to liquidity risk, the impact of the proportion of outstanding shares and the ratio of book-market value on stock excess returns is also taken into account. According to the Industrial Classification Guidelines of the China' Securities Regulatory Commission, listed companies are divided into 13 categories, including agriculture, forestry, animal husbandry, fisheries (The industry code is A); extractive industries (B); manufacturing (C); electricity, gas and water production and supply (D); construction (E); transportation and warehousing (F); the IT industry (G); wholesale and retail trade (H); finance and insurance (I); real estate (J); social services (K); communication and cultural industries (L); comprehensive (M) etc. And the manufacturing sector is the largest.

This paper selects daily stock data of each industry during the bull phase, i.e. from July 1, 2006 to October 16,2007 (the Shanghai A-share Index rose to 6395.76 points from 1784.46 points), and the bear phase, i.e. from October 16, 2007 to December 31, 2008 (the Shanghai A-share Index fell to 1911.79 points from 6395.76 points), as a sample. The sample includes stocks listed on the Shanghai A-share, and stocks with ST, S, SST, *ST, S*ST and long-term suspension (continuous period of suspension is over 40 days) were removed taking our special trading system as well as the effectiveness and comparability of data into account, and the final sample contains 507 shares. The data generated includes the highest price, lowest price, closing price, turnover, stock yield, the proportion of tradable shares and the yield of the SSE A-Share Index. All the raw data is from the RESSET database. This paper uses the Eviews6.0 as the major analysis software in order to ensure the reliability of the results.

## C. Empirical process and results

### 1）Panel data model

This paper establishes a panel data model, and makes empirical analysis of the relationship of the excess return of stocks and the liquidity risk, the ratio of book-market value, the proportion of tradable shares or other factors. The form of the model is:

$$Y_{it} = \alpha_{it} + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \mu_{it}$$

Where $i = 1,2,3,\ldots,n$ ; $t = 1,2,3,\ldots,m$ ; $Y_{it}$ refers to daily excess returns of stocks, i.e. stocks yield subtracts the yield of the SSE A-Share Index, $X_{1it}$ refers to non-liquidity indicators, i.e. the NL, and $X_{2it}$ the proportion of tradable shares, $X_{3it}$ the ratio of book-market value.

### 2）Empirical results

At first, the paper analyzed the manufacturing sector. It included two steps: first, we made the overall analysis of the industry during the bull and bear phase respectively to examine the existence of the impact of the liquidity risk premium, the value effect and the proportion of outstanding shares on the excess return; second, we made similar analysis of the small-cap, medium-cap, large-cap stocks and compared with the overall analysis and examined if there were significant differences within the industry or not.

**Table 1.Redundant Fixed Effects Tests (C)**

| Effects Test | Statistic | d.f. | Prob. |
|---|---|---|---|
| Cross-section F | 1.2741 | -299170 | 0.1480 |
| Cross-section Chi-square | 37.0034 | 29 | 0.1461 |

**Table 2.Correlated Random Effects - Hausman Test (C)**

| Test Summary | Chi-Sq. Statistic | Chi-Sq. d.f. | Prob. |
|---|---|---|---|
| Cross-section random | 18.6924 | 2 | 0.0001 |

The analysis results show that the impact of the proportion of outstanding shares on the excess return is not significant. Through F test (Table 1),the Hausman test (Table 2) and the estimation of model coefficient (Table 3), we find the individual fixed effects model is more suitable to analyze the manufacturing sector in the bull market phase, and the coefficients of non-liquidity indicator and the ratio of book-market value are negative, so it can clearly be seen the liquidity premium does not exist for the manufacturing industry, and it can even be said that the liquidity risk and stocks yield are negatively related, and the value effect does not exist. The similar analysis results are found in the bear phase. The results can be seen from the appendix.

**Table 3.Estimation of Model Coefficient (C)**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.0043 | 0.0008 | 5.49 | 0.00 |
| $\beta_1$ | -0.0806 | 0.0189 | -4.26 | 0.00 |
| $\beta_3$ | -0.0062 | 0.0016 | -3.84 | 0.00 |

The paper also comparatively analyses the small-cap, medium-cap, large-cap stocks in both the bull phase and bear phase. In the bull phase, for the large-cap stocks, to choose the individual random effects model is more appropriate, and it can be seen from Table 4 that the non-liquidity indicator and the ratio of book-market value is not significant, so there are no liquidity premium and value effects; for the medium-cap stocks, the individual fixed effects model is more suitable, and we can see from Table 5 that there are no liquidity risk premium and value effects; for the small-cap stocks, to select the individual fixed effects model is more suitable, and Table 6 shows that the stock excess returns are negatively correlated with liquidity risk and there is no value effect. In the bear phase, the paper also makes a similar analysis and the similar results are got. The results can be seen from the appendix.

**Table 4.Estimation of Model Coefficient (C: large-cap)**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.0032 | 0.0012 | 2.75 | 0.01 |
| $\beta_1$ | -0.0007 | 0.0210 | -0.03 | 0.97 |
| $\beta_3$ | -0.0046 | 0.0025 | -1.85 | 0.06 |

**Table 5.Estimation of Model Coefficient (C: medium-cap)**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.0077 | 0.0015 | 5.23 | 0.00 |
| $\beta_1$ | -0.2530 | 0.0485 | -5.22 | 0.00 |
| $\beta_3$ | -0.0075 | 0.0027 | -2.73 | 0.01 |

**Table 6.Estimation of Model Coefficient (C: small-cap)**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 0.0046 | 0.0016 | 2.95 | 0.00 |
| $\beta_1$ | -0.4132 | 0.0615 | -6.72 | 0.00 |
| $\beta_3$ | -0.0008 | 0.0034 | -0.23 | 0.82 |

In addition, the industry of wholesale and retail trade also accounts for a large proportion in Shanghai A-shares. Through the F-test (Table 7) and the Hausman test (Table 8), we see that the individual random effects model is more suitable for the industry in the bull phase, and it can be seen from the appendix that the coefficient of the illiquid risk indicator is negative, and there is no liquidity premium, and the liquidity risk and stock excess returns are negatively related, and there is no value effect. For the bear phase, conclusions are undifferentiated. After analyzing the large-cap, medium-cap, small-cap stocks, the result is similar, that is, there is no liquidity risk premium. The results can be seen from the appendix.

**Table 7.Redundant Fixed Effects Tests (H)**

| Effects Test | Statistic | d.f. | Prob. |
|---|---|---|---|
| Cross-section F | 0.7364 | -299,046 | 0.8456 |
| Cross-section Chi-square | 21.4070 | 29 | 0.8439 |

**Table 8.Correlated Random Effects - Hausman Test (H)**

| Test Summary | Chi-Sq. Statistic | Chi-Sq. d.f. | Prob. |
|---|---|---|---|
| Cross-section random | 3.4610 | 2 | 0.1772 |

Then, we similarly analyze other industry sectors like the comprehensive industry; social services; communication and cultural industries; real estate; finance and insurance; transportation; warehousing; electricity, gas and water production and supply industry; IT industry; construction; extractive industries; agriculture, forestry, animal husbandry and fisheries. And the same conclusion is reached. And the results can be seen from the appendix. This article also analyses the liquidity risk instead of the liquidity indicator we put forward with the other indexes proposed by other scholars, such as the indicators that use the average price of the highest and the lowest or that day closing price rather than the previous closing price as the denominator. The conclusions are compared with those we get using the liquidity indicator we proposed, and we find no difference does exist among different industry sectors or the large, medium and small cap. The liquidity risk premium does not exist and there is a certain degree of negative correlation of the liquid risk and the excess return.

# III. Summary

It can be seen from the results that the excess return caused by liquidity risk does not exist. It is not consistent with the conclusions of many foreign and domestic scholars, and it shows that our stock market, as an emerging market, has its uniqueness, and it is fault to apply the conclusions of foreign markets to China's stock market blindly. In addition, through the literature review, we can know the conclusions of the Chinese stock market are not consistent, and some scholars believed that a positive correlation existed between the liquidity risk and excess stock returns, while some scholars believed that the liquidity risk premium did not exist or even a negative correlation of them was observed. And the conclusions of this paper support the latter. Due to different sample selections, index selections and so on, different conclusions can be got. For the selection of liquidity indicators, no coherent conclusion is reached.

However, the impact of liquidity risk on the stock market cannot be ignored. As we all know, China's stock market is often known as the “capital market” or the “policy market”, and the instability of capital and policies bring large liquidity volatility to the stock market, and the contradiction of stock supply and demand in China’ stock market has been a prominent issue. Therefore, it is important to take more effective measures to strengthen the management of liquidity risk. This paper suggests: first, further improve the trading mechanism of China's stock market; second, strengthen the construction of the laws and regulations related to liquidity risk; third, learn from foreign experience and nurture powerful institutional investors to improve risk control system; forth, further build information disclosure system of the stock market; fifth, develop the philosophy of rational investment and reduce the incidence of “herding”.

# Thank-you speech

After more than five months, we finally finish this paper. We overcome numerous difficulties and obstacles during the writing process through the help of classmates and teachers, and they gave us selfless guidance to help to make improvements of the paper. In addition, when we went to the school library to find materials, the teacher in the library also gave us a lot of support and help. Take this opportunity to express our most sincere thanks for all teachers! We also appreciate the scholars involved in this paper. This article refers to the research literature of many scholars, and without all you scholars’ research and inspiration, we will be very difficult to complete the writing of this thesis. Thank our friends, who gave and will give us a lot of valuable materials and enthusiastic help in the process of writing and publishing the paper.

Our academic standard is limited, and the paper is inevitable of shortcomings and we look forward to your criticism and suggestion!

# References

[1] Tobin J. Liquidity preference as behavior towards risk [J]. The Review of Economic Studies, 1958, 25(2):65-86.

[2] Smithson, C.W., Smith, C.W., Wilfovel, D.S., Managing Financial Risk [M]. Burr Ridge, Ill; Ivwin Professional Pub, 1995.

[3] Bangia, A., Diebold, F.X., Schuermann, T., Stroughair, J. Liquidity on the outside [J]. Risk, 1999, June: 68-73.

[4] Banz, Rolf W., The Relationship between Return and Market Value of Common Stocks, Journal of Financial Economics, 1981(9): 3-18.

[5] Rosenberg, Barr, Kenneth Reid, and Ronald Lanstein, 1985, “Persuasive Evidence of the Market in Efficiency, ” Journal of Portfolio Management, 11, 9-17.

[6] Amihud Y., H.Mendelson, 1986, “Asset Pricing and the Bid-Ask Spread, ” Journal of Financial Economics, 17, 223-249.

[7] Acharya, V.V., Pedersen, L.H. Asset Pricing with Liquidity Risk [J]. Journal of Financial Economics, 2005, 77(2): 375-410.

[8] Brennan M J, Subrahmanyam A. Market microstructure and asset pricing: On the compensation for illiquidity in stock returns [J]. Journal of Financial Economics, 1996, 41(3): 441-464.

[9] Chordia T, Subrahmanyam A, Anshuman V R. Trading activity and expected stock returns [J]. Journa1 of Financia1 Economics, 2001, 59(1): 3-32.

[10] Rouwenhorst K.G., Local Return Factors and Turnover in Emerging Stock Markets, Journal of Finance, 1999(54):

1439-1464.

[11] Bekaert G., Harvey C., Lundblad C., “Liquidity and Expected Returns: Lessons from Emerging Markets,” Review of Financial Studies, 2007,(20): 1783-1831.

[12]Huang Feng, Liquidity Risk and Its Premium in Chinese Stock Markets [D], Doctoral Papers of Finance of Antai and Economics and Management College in Shanghai Jiaotong University, 2007, (10).

黄峰.中国股票市场的流动性风险及其溢价效应研究[D],上海交通大学安泰与经济管理学院金融学专业博士论文,2007,(10).

[13] Li Yuanhui and Ding Huiping, Analysis of Liquidity risk Based on China’s Stock Market [J]. China Business and Market, 2009 (9) :74-76.

李远慧,丁慧平.中国股票市场流动性风险分析[J].中国流通经济,2009(9):74-76.

[14] Wang Mingtao and Zhuang Yaming, New Models for Measuring the Liquidity Risk of Stocks [J]. Chinese Journal of Management Science, 2011,19 (2) :1-9.

王明涛,庄雅明.股票市场流动性风险计量模型研究[J].中国管理科学,2011,19(2):1-9.

[15] Lu Jing and Tang Xiaowo. The Relationship between Liquidity and Expected Stock Returns [J]. Journal of Industrial Engineering and Engineering Management, 2004 (2) :109-110.

陆静,唐小我.股票流动性与期望收益的关系研究[J].管理工程学报,2004(2):109-110.

[16] Li Yihong and Wu Shinong, Empirical Research of Liquidity Premium in Chinese Stock Markets [J]. Management Review, 2003 (11) :34-43.

李一红,吴世农.中国股市流动性溢价的实证研究[J].管理评论,2003(11):34-43.

[17] Zhou Fang and Zhang Wei, Study on Liquidity Risk Premium Based on Chinese Stock Market [J]. Journal of Financial Research, 2011 (5) :194-206.

周芳,张维.中国股票市场流动性风险溢价研究[J].金融研究,2011(5):194-206.

[18] Wu Wenfeng, Rui Meng, Chen Gongmeng. Compensation Returns for the Non-liquidity of China’ Stocks [J]. World Economy, 2003,26 (7) : 54-61.

吴文锋,芮萌,陈工孟.中国股票收益的非流动性补偿[J].世界经济,2003,26(7):54-61.

[19] Xi Honghui, Liquidity Risk and Expected Stock Returns [J]. Statistics and Decision, 2006, 294 -97.

席红辉,流动性风险与预期股票收益[J].统计与决策,2006,294-97.

[20] Yang Chaojun and Wang Lingzhi, An Analysis on the Effect of Liquidity Level and Liquidity Risk to Asset Return:Empirical Evidence from Chinese Stock Market [J], Journal of Systems & Management, 2011,20 (4): 456-461.

杨朝军，王灵芝.流动性水平、流动性风险对资产收益的影响—来自沪深股市的经验证据[J].系统管理学报,2011,20(4):456-461.

# 中国股票市场板块流动性风险的超额回报研究

李莉莉，张玉兰
经济学院，青岛大学，青岛，中国，266071

**摘　要：**流动性是证券市场的重要属性, 是影响价格行为的重要因素和衡量市场效率的主要指标之一。在股票交易的过程中，流动性风险的存在使得交易成本增加。目前，国外研究普遍认为股票市场上存在流动性风险所带来的超额回报，然而中国股票市场作为新兴市场，在涨跌停板制度、波动性、报价深度、交割制度等方面有其独特之处，已有研究关于流动性风险超额回报是否存在的说法并不一致，流动性风险测度模型也不一致，建立有效的流动性风险衡量指标并测度其对股市的影响是当前研究的重要方面。

本文结合我国股票市场现状，在国内外已有研究的基础上，对原有指标进行了改进，提出了新的流动性风险指标（当日最高价、最低价之差比前一日收盘价与当日换手率的比值）。选取从2006年7月1日到2008年12月31日上海证券交易所900多家上市公司的A股数据作为研究对象，区分行业，以个股日收益率、市场日收益率和个股短期流动性风险水平为基础，分别研究其在牛市和熊市时期各行业股票流动性风险的超额回报情况，与此同时，还考虑了公司规模、账面市值比、流通股比例等对股票收益率的影响，在多因素基础上对个股的超额回报进行衡量。本文的创新点在于：第一，在考虑连续性和稳定性的基础上，提出了新的衡量流动性风险的非流动性指标，将当日和前一日的价、量数据有机结合；第二，本文基于面板数据模型进行实证分析，考虑市场因素、公司规模、流动性风险等对股票超额回报的影响，对股票市场各板块流动性风险的超额回报情况进行了对比分析。此研究对于考察资本市场的效率、资产定价和流动性风险管理具有重要的意义。

**关键词** ：流动性风险；超额回报；面板数据；股票市场

# Appendix

**Table I. Estimation Results**

| Industry | Bull phase | | | | | Bear phase | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Code (size) | Variable | Coef. | Std. | t-Stat. | Prob. | Variable | Coef. | Std. | t-Stat. | Prob. |
| A | c | 0.0076 | 0.0018 | 4.27 | 0.00 | c | 0.0174 | 0.0025 | 6.97 | 0.00 |
| | $x_1$ | -0.5185 | 0.0871 | -5.95 | 0.00 | $x_1$ | -0.4192 | 0.0612 | -6.85 | 0.00 |
| | $x_3$ | -0.0037 | 0.0036 | -1.01 | 0.31 | $x_3$ | -0.0195 | 0.0080 | -2.45 | 0.01 |
| | Prob.(F-stat.)=0.00 DW=1.8905 | | | | | Prob.(F-stat.)=0.00 DW=1.7484 | | | | |
| A(Small-cap) | c | 0.0113 | 0.0032 | 3.57 | 0.00 | c | 0.0169 | 0.0043 | 3.97 | 0.01 |
| | $x_1$ | -0.6448 | 0.1441 | -4.48 | 0.00 | $x_1$ | -0.4425 | 0.0979 | -4.52 | 0.00 |
| | $x_3$ | -0.0090 | 0.0060 | -1.49 | 0.14 | $x_3$ | -0.0161 | 0.0137 | -1.18 | 0.24 |
| | Prob.(F-stat.)=0.00 DW=1.7905 | | | | | Prob.(F-stat.)=0.00 DW=1.7076 | | | | |
| A(Medium-cap) | c | 0.0065 | 0.0035 | 1.88 | 0.06 | c | 0.0205 | 0.0050 | 4.14 | 0.00 |
| | $x_1$ | -0.9867 | 0.2384 | -4.14 | 0.00 | $x_1$ | -0.6358 | 0.1774 | -3.58 | 0.00 |
| | $x_3$ | 0.0077 | 0.0070 | 1.09 | 0.28 | $x_3$ | -0.0184 | 0.0127 | -1.44 | 0.15 |
| | Prob.(F-stat.)=0.00 DW=1.8883 | | | | | Prob.(F-stat.)=0.00 DW=1.8696 | | | | |
| A(Large-cap) | c | 0.0059 | 0.0027 | 2.17 | 0.03 | c | 0.0158 | 0.0042 | 3.74 | 0.00 |
| | $x_1$ | -0.2927 | 0.1244 | -2.35 | 0.02 | $x_1$ | -0.3427 | 0.0863 | -3.97 | 0.01 |
| | $x_3$ | -0.0047 | 0.0061 | -0.76 | 0.45 | $x_3$ | -0.0209 | 0.0167 | -1.25 | 0.21 |
| | Prob.(F-stat.)=0.00 DW=2.0314 | | | | | Prob.(F-stat.)=0.00 DW=1.7134 | | | | |
| B | c | 0.0056 | 0.0024 | 2.33 | 0.02 | c | 0.0048 | 0.0023 | 2.11 | 0.04 |
| | $x_1$ | 0.0269 | 0.0388 | 0.69 | 0.49 | $x_1$ | -0.0006 | 0.0108 | -0.05 | 0.96 |
| | $x_3$ | -0.0200 | 0.0077 | -2.60 | 0.01 | $x_3$ | -0.0161 | 0.0088 | -1.83 | 0.07 |
| | Prob.(F-stat.)=0.00 DW=1.8189 | | | | | Prob.(F-stat.)=0.00 DW=1.7614 | | | | |
| B(Small-cap) | c | 0.0083 | 0.0027 | 3.07 | 0.00 | c | 0.0077 | 0.0026 | 2.99 | 0.00 |
| | $x_1$ | -0.0858 | 0.0666 | -1.29 | 0.20 | $x_1$ | -0.1156 | 0.0333 | -3.47 | 0.00 |
| | $x_3$ | -0.0160 | 0.0067 | -2.38 | 0.02 | $x_3$ | -0.0098 | 0.0062 | -1.58 | 0.11 |
| | Prob.(F-stat.)=0.00 DW=1.8227 | | | | | Prob.(F-stat.)=0.00 DW=1.7499 | | | | |
| B(Medium-cap) | c | 0.0094 | 0.0023 | 4.08 | 0.00 | c | 0.0062 | 0.0027 | 2.33 | 0.02 |
| | $x_1$ | -0.0512 | 0.0847 | -0.60 | 0.55 | $x_1$ | -0.0461 | 0.0381 | -1.21 | 0.23 |
| | $x_3$ | -0.0173 | 0.0040 | -4.28 | 0.00 | $x_3$ | -0.0185 | 0.0072 | -2.56 | 0.01 |
| | Prob.(F-stat.)=0.00 DW=1.8161 | | | | | Prob.(F-stat.)=0.00 DW=1.5889 | | | | |
| B(Large-cap) | c | 0.0056 | 0.0024 | 2.33 | 0.02 | c | 0.0048 | 0.0023 | 2.11 | 0.04 |
| | $x_1$ | 0.0269 | 0.0388 | 0.69 | 0.49 | $x_1$ | -0.0006 | 0.0108 | -0.05 | 0.96 |
| | $x_3$ | -0.0200 | 0.0077 | -2.60 | 0.01 | $x_3$ | -0.0161 | 0.0088 | -1.83 | 0.07 |
| | Prob.(F-stat.)=0.00 DW=1.8189 | | | | | Prob.(F-stat.)=0.00 DW=1.7614 | | | | |
| C | c | 0.0043 | 0.0008 | 5.49 | 0.00 | c | 0.0056 | 0.0007 | 8.16 | 0.00 |
| | $x_1$ | -0.0806 | 0.0189 | -4.26 | 0.00 | $x_1$ | -0.0437 | 0.0073 | -6.03 | 0.00 |
| | $x_3$ | -0.0062 | 0.0016 | -3.84 | 0.00 | $x_3$ | -0.0045 | 0.0013 | -3.43 | 0.00 |
| | Prob.(F-stat.)=0.00 DW=1.7916 | | | | | Prob.(F-stat.)=0.00 DW=1.7467 | | | | |
| C(Small-cap) | c | 0.0046 | 0.0016 | 2.95 | 0.00 | c | 0.0110 | 0.0017 | 6.50 | 0.00 |
| | $x_1$ | -0.4132 | 0.0615 | -6.72 | 0.00 | $x_1$ | -0.1535 | 0.0218 | -7.03 | 0.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $x_3$ | -0.0008 | 0.0034 | -0.23 | 0.82 | $x_3$ | -0.0066 | 0.0038 | -1.74 | 0.08 |
| | Prob.(F-stat.)=0.00 DW=1.7876 | | | | | Prob.(F-stat.)=0.00 DW=1.7972 | | | | |
| C(Medium-cap) | c | 0.0077 | 0.0015 | 5.23 | 0.00 | c | 0.0057 | 0.0011 | 5.33 | 0.00 |
| | $x_1$ | -0.2530 | 0.0485 | -5.22 | 0.00 | $x_1$ | -0.0472 | 0.0120 | -3.93 | 0.01 |
| | $x_3$ | -0.0075 | 0.0027 | -2.73 | 0.01 | $x_3$ | -0.0034 | 0.0017 | -2.01 | 0.04 |
| | Prob.(F-stat.)=0.00 DW=1.7662 | | | | | Prob.(F-stat.)=0.00 DW=1.7457 | | | | |
| C(Large-cap) | c | 0.0032 | 0.0012 | 2.75 | 0.01 | c | 0.0018 | 0.0011 | 1.68 | 0.09 |
| | $x_1$ | -0.0007 | 0.0210 | -0.03 | 0.97 | $x_1$ | -0.0092 | 0.0090 | -1.02 | 0.31 |
| | $x_3$ | -0.0046 | 0.0025 | -1.85 | 0.06 | $x_3$ | -0.0037 | 0.0026 | -1.39 | 0.16 |
| | Prob.(F-stat.)=0.00 DW=1.8558 | | | | | Prob.(F-stat.)=0.00 DW=1.6870 | | | | |
| D | c | 0.0055 | 0.0007 | 7.40 | 0.00 | c | 0.0045 | 0.0006 | 7.17 | 0.00 |
| | $x_1$ | -0.2186 | 0.0218 | -10.05 | 0.00 | $x_1$ | -0.0477 | 0.0061 | -7.80 | 0.00 |
| | $x_3$ | -0.0032 | 0.0016 | -1.98 | 0.05 | $x_3$ | -0.0007 | 0.0013 | -0.56 | 0.58 |
| | Prob.(F-stat.)=0.00 DW=1.6987 | | | | | Prob.(F-stat.)=0.00 DW=1.7648 | | | | |
| D(Small-cap) | c | 0.0070 | 0.0022 | 3.23 | 0.00 | c | 0.0052 | 0.0021 | 2.43 | 0.02 |
| | $x_1$ | -0.5482 | 0.0955 | -5.74 | 0.00 | $x_1$ | -0.1184 | 0.0245 | -4.83 | 0.00 |
| | $x_3$ | -0.0018 | 0.0046 | -0.39 | 0.70 | $x_3$ | 0.0028 | 0.0049 | 0.58 | 0.56 |
| | Prob.(F-stat.)=0.00 DW=1.7948 | | | | | Prob.(F-stat.)=0.00 DW=1.8103 | | | | |
| D(Medium-cap) | c | 0.0053 | 0.0020 | 2.70 | 0.01 | c | 0.0067 | 0.0016 | 4.20 | 0.00 |
| | $x_1$ | -0.2173 | 0.0540 | -4.02 | 0.01 | $x_1$ | -0.1522 | 0.0242 | -6.28 | 0.00 |
| | $x_3$ | 0.0007 | 0.0039 | 0.18 | 0.86 | $x_3$ | 0.0027 | 0.0019 | 1.44 | 0.15 |
| | Prob.(F-stat.)=0.00 DW=1.6421 | | | | | Prob.(F-stat.)=0.00 DW=1.6772 | | | | |
| D(Large-cap) | c | 0.0068 | 0.0019 | 3.48 | 0.00 | c | 0.0030 | 0.0018 | 1.66 | 0.10 |
| | $x_1$ | -0.1258 | 0.0368 | -3.42 | 0.00 | $x_1$ | -0.0076 | 0.0104 | -0.73 | 0.46 |
| | $x_3$ | -0.0092 | 0.0036 | -2.57 | 0.01 | $x_3$ | -0.0016 | 0.0041 | -0.39 | 0.69 |
| | Prob.(F-stat.)=0.00 DW=1.8286 | | | | | Prob.(F-stat.)=0.00 DW=1.6629 | | | | |
| E | c | 0.0087 | 0.0012 | 7.19 | 0.00 | c | 0.0080 | 0.0012 | 6.63 | 0.00 |
| | $x_1$ | -0.4387 | 0.0565 | -7.76 | 0.00 | $x_1$ | -0.1618 | 0.0168 | -9.65 | 0.00 |
| | $x_3$ | -0.0037 | 0.0019 | -1.89 | 0.06 | $x_3$ | 0.0011 | 0.0024 | 0.47 | 0.64 |
| | Prob.(F-stat.)=0.00 DW=1.7719 | | | | | Prob.(F-stat.)=0.00 DW=1.7076 | | | | |
| E(Small-cap) | c | 0.0096 | 0.0020 | 4.73 | 0.00 | c | 0.0090 | 0.0020 | 4.47 | 0.00 |
| | $x_1$ | -0.4612 | 0.0819 | -5.63 | 0.00 | $x_1$ | -0.1462 | 0.0253 | -5.78 | 0.00 |
| | $x_3$ | -0.0047 | 0.0031 | -1.54 | 0.12 | $x_3$ | -0.0010 | 0.0035 | -0.28 | 0.78 |
| | Prob.(F-stat.)=0.00 DW=1.6919 | | | | | Prob.(F-stat.)=0.00 DW=1.7543 | | | | |
| E(Medium-cap) | c | 0.0114 | 0.0025 | 4.55 | 0.00 | c | 0.0060 | 0.0022 | 2.76 | 0.01 |
| | $x_1$ | -0.6481 | 0.1525 | -4.25 | 0.00 | $x_1$ | -0.1734 | 0.0360 | -4.81 | 0.00 |
| | $x_3$ | -0.0066 | 0.0042 | -1.55 | 0.12 | $x_3$ | 0.0048 | 0.0046 | 1.03 | 0.31 |
| | Prob.(F-stat.)=0.00 DW=1.7991 | | | | | Prob.(F-stat.)=0.00 DW=1.6515 | | | | |
| E(Large-cap) | c | 0.0063 | 0.0019 | 3.41 | 0.00 | c | 0.0090 | 0.0022 | 4.09 | 0.00 |
| | $x_1$ | -0.3348 | 0.0852 | -3.93 | 0.01 | $x_1$ | -0.1759 | 0.0286 | -6.16 | 0.00 |
| | $x_3$ | -0.0009 | 0.0030 | -0.28 | 0.78 | $x_3$ | 0.0008 | 0.0045 | 0.17 | 0.86 |
| | Prob.(F-stat.)=0.00 DW=1.8364 | | | | | Prob.(F-stat.)=0.00 DW=1.7072 | | | | |
| F | c | 0.0049 | 0.0007 | 6.62 | 0.00 | c | 0.0063 | 0.0007 | 8.62 | 0.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $x_1$ | -0.1995 | 0.0240 | -8.31 | 0.00 | $x_1$ | -0.0475 | 0.0077 | -6.17 | 0.00 |
| | $x_3$ | -0.0038 | 0.0017 | -2.26 | 0.02 | $x_3$ | -0.0067 | 0.0016 | -4.22 | 0.00 |
| | Prob.(F-stat.)=0.00 DW=1.8267 | | | | | Prob.(F-stat.)=0.00 DW=1.7406 | | | | |
| F(Small-cap) | c | 0.0049 | 0.0015 | 3.38 | 0.00 | c | 0.0094 | 0.0016 | 6.02 | 0.00 |
| | $x_1$ | -0.3433 | 0.0528 | -6.50 | 0.00 | $x_1$ | -0.1114 | 0.0173 | -6.45 | 0.00 |
| | $x_3$ | 0.0006 | 0.0036 | 0.16 | 0.87 | $x_3$ | -0.0082 | 0.0038 | -2.13 | 0.03 |
| | Prob.(F-stat.)=0.00 DW=1.7806 | | | | | Prob.(F-stat.)=0.00 DW=1.7898 | | | | |
| F(Medium-cap) | c | 0.0043 | 0.0012 | 3.57 | 0.00 | c | 0.0061 | 0.0012 | 5.09 | 0.00 |
| | $x_1$ | -0.2588 | 0.0427 | -6.06 | 0.00 | $x_1$ | -0.0481 | 0.0138 | -3.48 | 0.00 |
| | $x_3$ | -0.0003 | 0.0028 | -0.09 | 0.93 | $x_3$ | -0.0054 | 0.0024 | -2.22 | 0.03 |
| | Prob.(F-stat.)=0.00 DW=1.9052 | | | | | Prob.(F-stat.)=0.00 DW=1.6892 | | | | |
| F(Large-cap) | c | 0.0045 | 0.0012 | 3.64 | 0.00 | c | 0.0032 | 0.0011 | 2.91 | 0.00 |
| | $x_1$ | -0.0830 | 0.0342 | -2.43 | 0.02 | $x_1$ | -0.0087 | 0.0104 | -0.84 | 0.40 |
| | $x_3$ | -0.0070 | 0.0027 | -2.62 | 0.01 | $x_3$ | -0.0053 | 0.0023 | -2.27 | 0.02 |
| | Prob.(F-stat.)=0.00 DW=1.8319 | | | | | Prob.(F-stat.)=0.00 DW=1.7405 | | | | |
| G | c | 0.0044 | 0.0009 | 4.72 | 0.00 | c | 0.0071 | 0.0009 | 8.21 | 0.00 |
| | $x_1$ | -0.1784 | 0.0265 | -6.74 | 0.00 | $x_1$ | -0.0393 | 0.0056 | -7.01 | 0.00 |
| | $x_3$ | -0.0053 | 0.0024 | -2.16 | 0.03 | $x_3$ | -0.0083 | 0.0024 | -3.40 | 0.00 |
| | Prob.(F-stat.)=0.00 DW=1.7645 | | | | | Prob.(F-stat.)=0.00 DW=1.7728 | | | | |
| G(Small-cap) | c | 0.0074 | 0.0020 | 3.80 | 0.00 | c | 0.0099 | 0.0018 | 5.43 | 0.00 |
| | x1 | -0.4064 | 0.0694 | -5.86 | 0.00 | $x_1$ | -0.1432 | 0.0199 | -7.19 | 0.00 |
| | x3 | -0.0099 | 0.0053 | -1.87 | 0.06 | $x_3$ | -0.0032 | 0.0050 | -0.64 | 0.52 |
| | Prob.(F-stat.)=0.00 DW=1.7663 | | | | | Prob.(F-stat.)=0.00 DW=1.7981 | | | | |
| G(Medium-cap) | c | 0.0050 | 0.0016 | 3.12 | 0.00 | c | 0.0071 | 0.0016 | 4.49 | 0.00 |
| | $x_1$ | -0.2119 | 0.0528 | -4.02 | 0.01 | $x_1$ | -0.0298 | 0.0076 | -3.94 | 0.01 |
| | $x_3$ | -0.0048 | 0.0035 | -1.37 | 0.17 | $x_3$ | -0.0096 | 0.0046 | -2.10 | 0.04 |
| | Prob.(F-stat.)=0.00 DW=1.7933 | | | | | Prob.(F-stat.)=0.00 DW=1.7565 | | | | |
| G(Large-cap) | c | 0.0032 | 0.0016 | 1.97 | 0.05 | c | 0.0051 | 0.0012 | 4.09 | 0.00 |
| | $x_1$ | -0.0969 | 0.0346 | -2.80 | 0.01 | $x_1$ | -0.0252 | 0.0088 | -2.87 | 0.00 |
| | $x_3$ | 0.0001 | 0.0045 | 0.03 | 0.97 | $x_3$ | -0.0063 | 0.0036 | -1.75 | 0.08 |
| | Prob.(F-stat.)=0.00 DW=1.7382 | | | | | Prob.(F-stat.)=0.02 DW=1.8002 | | | | |
| H | c | 0.0042 | 0.0008 | 5.31 | 0.00 | c | 0.0053 | 0.0007 | 7.35 | 0.00 |
| | $x_1$ | -0.0496 | 0.0143 | -3.45 | 0.00 | $x_1$ | -0.0126 | 0.0033 | -3.87 | 0.00 |
| | $x_3$ | -0.0079 | 0.0019 | -4.05 | 0.01 | $x_3$ | -0.0092 | 0.0018 | -5.06 | 0.00 |
| | Prob.(F-stat.)=0.00 DW=1.6911 | | | | | Prob.(F-stat.)=0.00 DW=1.8120 | | | | |
| H(Small-cap) | c | 0.0043 | 0.0016 | 2.75 | 0.01 | c | 0.0090 | 0.0016 | 5.81 | 0.00 |
| | $x_1$ | -0.1815 | 0.0462 | -3.93 | 0.01 | $x_1$ | -0.1341 | 0.0188 | -7.15 | 0.00 |
| | $x_3$ | -0.0035 | 0.0046 | -0.77 | 0.44 | $x_3$ | -0.0039 | 0.0044 | -0.89 | 0.37 |
| | Prob.(F-stat.)=0.00 DW=1.6210 | | | | | Prob.(F-stat.)=0.00 DW=1.7953 | | | | |
| H(Medium-cap) | c | 0.0066 | 0.0014 | 4.80 | 0.00 | c | 0.0062 | 0.0013 | 4.64 | 0.00 |
| | x1 | -0.2233 | 0.0462 | -4.83 | 0.00 | $x_1$ | -0.0064 | 0.0038 | -1.68 | 0.09 |
| | x3 | -0.0044 | 0.0026 | -1.73 | 0.08 | $x_3$ | -0.0108 | 0.0032 | -3.38 | 0.00 |
| | Prob.(F-stat.)=0.00 DW=1.7479 | | | | | Prob.(F-stat.)=0.00 DW=1.8737 | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| H(Large-cap) | c | 0.0040 | 0.0013 | 2.94 | 0.00 | c | 0.0037 | 0.0010 | 3.64 | 0.00 |
| | $x_1$ | -0.0116 | 0.0156 | -0.74 | 0.46 | $x_1$ | -0.0122 | 0.0059 | -2.07 | 0.04 |
| | $x_3$ | -0.0106 | 0.0043 | -2.49 | 0.01 | $x_3$ | -0.0065 | 0.0024 | -2.69 | 0.01 |
| | Prob.(F-stat.)=0.00 DW=1.7408 | | | | | Prob.(F-stat.)=0.00 DW=1.7949 | | | | |
| I | c | 0.0034 | 0.0018 | 1.83 | 0.07 | c | 0.0014 | 0.0018 | 0.76 | 0.45 |
| | $x_1$ | -0.0151 | 0.0282 | -0.54 | 0.59 | $x_1$ | 0.0115 | 0.0159 | 0.73 | 0.47 |
| | $x_3$ | -0.0042 | 0.0058 | -0.72 | 0.47 | $x_3$ | -0.0044 | 0.0034 | -1.31 | 0.19 |
| | Prob.(F-stat.)=0.9784 DW=1.9017 | | | | | Prob.(F-stat.)=0.8161 DW=1.7868 | | | | |
| I(Small-cap) | c | 0.0069 | 0.0030 | 2.29 | 0.02 | c | 0.0048 | 0.0040 | 1.19 | 0.24 |
| | $x_1$ | -0.0561 | 0.0332 | -1.69 | 0.09 | $x_1$ | -0.0078 | 0.0261 | -0.30 | 0.76 |
| | $x_3$ | -0.0109 | 0.0079 | -1.38 | 0.17 | $x_3$ | -0.0125 | 0.0102 | -1.22 | 0.22 |
| | Prob.(F-stat.)=0.2876 DW=1.8678 | | | | | Prob.(F-stat.)=0.6609 DW=1.8343 | | | | |
| I(Medium-cap) | c | 0.0002 | 0.0034 | 0.06 | 0.96 | c | 0.0002 | 0.0026 | 0.08 | 0.93 |
| | $x_1$ | -0.0387 | 0.1273 | -0.30 | 0.76 | $x_1$ | 0.0216 | 0.0239 | 0.91 | 0.37 |
| | $x_3$ | 0.0090 | 0.0102 | 0.88 | 0.38 | $x_3$ | -0.0036 | 0.0043 | -0.84 | 0.40 |
| | Prob.(F-stat.)=0.6778 DW=1.9783 | | | | | Prob.(F-stat.)=0.5368 DW=1.6937 | | | | |
| I(Large-cap) | c | -0.0005 | 0.0042 | -0.11 | 0.91 | c | 0.0001 | 0.0031 | 0.03 | 0.97 |
| | $x_1$ | 0.1364 | 0.0711 | 1.92 | 0.06 | $x_1$ | 0.0264 | 0.0353 | 0.75 | 0.46 |
| | $x_3$ | -0.0126 | 0.0191 | -0.66 | 0.51 | $x_3$ | -0.0034 | 0.0049 | -0.69 | 0.49 |
| | Prob.(F-stat.)=0.1803 DW=1.9080 | | | | | Prob.(F-stat.)=0.6853 DW=1.7461 | | | | |
| J | c | 0.0071 | 0.0008 | 8.49 | 0.00 | c | 0.0087 | 0.0007 | 12.05 | 0.00 |
| | $x_1$ | -0.2634 | 0.0281 | -9.38 | 0.00 | $x_1$ | -0.1347 | 0.0096 | -14.08 | 0.00 |
| | $x_3$ | -0.0037 | 0.0019 | -1.88 | 0.06 | $x_3$ | -0.0038 | 0.0012 | -3.05 | 0.00 |
| | Prob.(F-stat.)=0.00 DW=1.7811 | | | | | Prob.(F-stat.)=0.00 DW=1.7748 | | | | |
| J(Small-cap) | c | 0.0063 | 0.0015 | 4.20 | 0.00 | c | 0.0099 | 0.0016 | 6.33 | 0.00 |
| | $x_1$ | -0.4846 | 0.0722 | -6.71 | 0.00 | $x_1$ | -0.2224 | 0.0279 | -7.98 | 0.00 |
| | $x_3$ | 0.0026 | 0.0038 | 0.68 | 0.50 | $x_3$ | -0.0012 | 0.0038 | -0.32 | 0.75 |
| | Prob.(F-stat.)=0.00 DW=1.8270 | | | | | Prob.(F-stat.)=0.00 DW=1.7335 | | | | |
| J(Medium-cap) | c | 0.0070 | 0.0015 | 4.66 | 0.00 | c | 0.0085 | 0.0012 | 6.87 | 0.00 |
| | $x_1$ | -0.3217 | 0.0571 | -5.64 | 0.00 | $x_1$ | -0.1241 | 0.0156 | -7.94 | 0.00 |
| | $x_3$ | -0.0011 | 0.0036 | -0.32 | 0.75 | $x_3$ | -0.0030 | 0.0018 | -1.67 | 0.09 |
| | Prob.(F-stat.)=0.00 DW=1.7573 | | | | | Prob.(F-stat.)=0.00 DW=1.8177 | | | | |
| J(Large-cap) | c | 0.0049 | 0.0019 | 2.57 | 0.01 | c | 0.0072 | 0.0014 | 5.18 | 0.00 |
| | $x_1$ | -0.1003 | 0.0461 | -2.18 | 0.03 | $x_1$ | -0.0986 | 0.0176 | -5.59 | 0.00 |
| | $x_3$ | -0.0022 | 0.0052 | -0.42 | 0.67 | $x_3$ | -0.0052 | 0.0026 | -1.97 | 0.05 |
| | Prob.(F-stat.)=0.3569 DW=1.7654 | | | | | Prob.(F-stat.)=0.00 DW=1.7625 | | | | |
| K | c | 0.0038 | 0.0011 | 3.40 | 0.00 | c | 0.0083 | 0.0011 | 7.58 | 0.00 |
| | $x_1$ | -0.1107 | 0.0298 | -3.71 | 0.00 | $x_1$ | -0.1251 | 0.0166 | -7.54 | 0.00 |
| | $x_3$ | -0.0062 | 0.0031 | -1.97 | 0.05 | $x_3$ | -0.0051 | 0.0022 | -2.36 | 0.02 |
| | Prob.(F-stat.)=0.0244 DW=1.7124 | | | | | Prob.(F-stat.)=0.00 DW=1.8277 | | | | |
| K(Small-cap) | c | 0.0091 | 0.0024 | 3.78 | 0.00 | c | 0.0096 | 0.0022 | 4.33 | 0.00 |
| | $x_1$ | -0.4733 | 0.1172 | -4.04 | 0.01 | $x_1$ | -0.1928 | 0.0395 | -4.88 | 0.00 |
| | $x_3$ | -0.0119 | 0.0073 | -1.63 | 0.10 | $x_3$ | -0.0053 | 0.0054 | -0.98 | 0.33 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Prob.(F-stat.)=0.0002 DW=1.7509 | | | | Prob.(F-stat.)=0.0001 DW=1.8328 | | | | |
| K(Medium-cap) | c | 0.0005 | 0.0019 | 0.25 | 0.80 | c | 0.0059 | 0.0016 | 3.80 | 0.00 |
| | $x_1$ | -0.0452 | 0.0307 | -1.47 | 0.14 | $x_1$ | -0.0775 | 0.0207 | -3.75 | 0.00 |
| | $x_3$ | -0.0049 | 0.0062 | -0.01 | 0.99 | $x_3$ | -0.0017 | 0.0028 | -0.61 | 0.54 |
| | Prob.(F-stat.)=0.7322 DW=1.8273 | | | | | Prob.(F-stat.)=0.0177 DW=1.9082 | | | | |
| K(Large-cap) | c | 0.0066 | 0.0020 | 3.30 | 0.00 | c | 0.0108 | 0.0020 | 5.32 | 0.00 |
| | $x_1$ | -0.2475 | 0.0760 | -3.26 | 0.00 | $x_1$ | -0.1501 | 0.0310 | -4.83 | 0.00 |
| | $x_3$ | -0.0028 | 0.0043 | -0.64 | 0.52 | $x_3$ | -0.0085 | 0.0038 | -2.26 | 0.02 |
| | Prob.(F-stat.)=0.0178 DW=1.6205 | | | | | Prob.(F-stat.)=0.00 DW=1.7699 | | | | |
| L | c | 0.0056 | 0.0068 | 0.84 | 0.40 | c | 0.0056 | 0.0068 | 0.84 | 0.40 |
| | $x_1$ | -0.4060 | 0.2128 | -1.91 | 0.06 | $x_1$ | -0.4060 | 0.2128 | -1.91 | 0.06 |
| | $x_3$ | 0.0034 | 0.0327 | 0.11 | 0.92 | $x_3$ | 0.0034 | 0.0327 | 0.11 | 0.92 |
| | Prob.(F-stat.)=0.00 DW=1.8884 | | | | | Prob.(F-stat.)=0.00 DW=1.8884 | | | | |
| L(Small-cap) | c | 0.0056 | 0.0068 | 0.84 | 0.40 | c | 0.0056 | 0.0068 | 0.84 | 0.40 |
| | $x_1$ | -0.4060 | 0.2128 | -1.91 | 0.06 | $x_1$ | -0.4060 | 0.2128 | -1.91 | 0.06 |
| | $x_3$ | 0.0034 | 0.0327 | 0.11 | 0.92 | $x_3$ | 0.0034 | 0.0327 | 0.11 | 0.92 |
| | Prob.(F-stat.)=0.00 DW=1.8884 | | | | | Prob.(F-stat.)=0.00 DW=1.8884 | | | | |
| L(Medium-cap) | c | 0.0056 | 0.0068 | 0.84 | 0.40 | c | 0.0056 | 0.0068 | 0.84 | 0.40 |
| | $x_1$ | -0.4060 | 0.2128 | -1.91 | 0.06 | $x_1$ | -0.4060 | 0.2128 | -1.91 | 0.06 |
| | $x_3$ | 0.0034 | 0.0327 | 0.11 | 0.92 | $x_3$ | 0.0034 | 0.0327 | 0.11 | 0.92 |
| | Prob.(F-stat.)=0.00 DW=1.8884 | | | | | Prob.(F-stat.)=0.00 DW=1.8884 | | | | |
| L(Large-cap) | c | 0.0056 | 0.0068 | 0.84 | 0.40 | c | 0.0056 | 0.0068 | 0.84 | 0.40 |
| | $x_1$ | -0.4060 | 0.2128 | -1.91 | 0.06 | $x_1$ | -0.4060 | 0.2128 | -1.91 | 0.06 |
| | $x_3$ | 0.0034 | 0.0327 | 0.11 | 0.92 | $x_3$ | 0.0034 | 0.0327 | 0.11 | 0.92 |
| | Prob.(F-stat.)=0.00 DW=1.8884 | | | | | Prob.(F-stat.)=0.00 DW=1.8884 | | | | |
| M | c | 0.0051 | 0.0008 | 6.51 | 0.00 | c | 0.0073 | 0.0008 | 9.49 | 0.00 |
| | $x_1$ | -0.2279 | 0.0297 | -7.67 | 0.00 | $x_1$ | -0.0975 | 0.0093 | -10.52 | 0.00 |
| | $x_3$ | -0.0035 | 0.0018 | -1.95 | 0.05 | $x_3$ | -0.0021 | 0.0016 | -1.29 | 0.20 |
| | Prob.(F-stat.)=0.00 DW=1.7177 | | | | | Prob.(F-stat.)=0.00 DW=1.7922 | | | | |
| M(Small-cap) | c | 0.0030 | 0.0017 | 1.81 | 0.07 | c | 0.0097 | 0.0018 | 5.44 | 0.00 |
| | $x_1$ | -0.3452 | 0.0646 | -5.34 | 0.00 | $x_1$ | -0.1990 | 0.0240 | -8.29 | 0.00 |
| | $x_3$ | 0.0052 | 0.0044 | 1.18 | 0.24 | $x_3$ | 0.0023 | 0.0047 | 0.48 | 0.63 |
| | Prob.(F-stat.)=0.00 DW=1.6614 | | | | | Prob.(F-stat.)=0.00 DW=1.7698 | | | | |
| M(Medium-cap) | c | 0.0053 | 0.0014 | 3.76 | 0.00 | c | 0.0077 | 0.0015 | 5.26 | 0.00 |
| | $x_1$ | -0.2144 | 0.0523 | -4.10 | 0.00 | $x_1$ | -0.1217 | 0.0194 | -6.28 | 0.00 |
| | $x_3$ | -0.0056 | 0.0032 | -1.78 | 0.08 | $x_3$ | -0.0016 | 0.0033 | -0.49 | 0.62 |
| | Prob.(F-stat.)=0.00 DW=1.6845 | | | | | Prob.(F-stat.)=0.00 DW=1.8166 | | | | |
| M(Large-cap) | c | 0.0067 | 0.0014 | 4.93 | 0.00 | c | 0.0080 | 0.0012 | 6.45 | 0.00 |
| | $x_1$ | -0.2621 | 0.0640 | -4.09 | 0.00 | $x_1$ | -0.1302 | 0.0174 | -7.47 | 0.00 |
| | $x_3$ | -0.0041 | 0.0026 | -1.56 | 0.12 | $x_3$ | -0.0005 | 0.0022 | -0.23 | 0.82 |
| | Prob.(F-stat.)=0.00 DW=1.7938 | | | | | Prob.(F-stat.)=0.00 DW=1.8072 | | | | |

# Incorporating Longevity Risk and Medical Information into Life Settlement Pricing

Patrick L. Brockett[1]
Department of Information, Risk, and Operations Management
Red McCombs School of Business
The University of Texas at Austin
Austin, TX 78712
brockett@mail.utexas.edu

Shuo-li Chuang
Department of Information, Risk, and Operations Management
Red McCombs School of Business
The University of Texas at Austin
Austin, TX 78712
shuolic@mail.utexas.edu

Yinglu Deng
School of Economics and Management
Tsinghua University
Beijing, China
dengyl@sem.tsinghua.edu.cn

Richard D. MacMinn
Katie School of Insurance
College of Business
Illinois State University
Normal, Illinois 61790-5480
richard.macminn@ilstu.edu

[1] Indicates corresponding author

## ABSTRACT

A life settlement is a financial transaction in which the owner of a life insurance policy sells her policy to a third party. We present an overview of the life settlement market, exhibit its susceptibility to longevity risk, and discuss it as part of a new asset class of longevity related securities. We discuss pricing where the investor has information concerning the expected life expectancy of the insured as well as perhaps other medical information obtained from a medical underwriter. We show how to incorporate this information into the investor's valuation in a rigorous and statistically justified manner. To incorporate medical information, we apply statistical information theory to adjust a pre-specified standard mortality table so as to obtain a new mortality table that exactly reflects the known medical information. We illustrate using several mortality tables including a new extension of the Lee- Carter model that allows for jumps in mortality and longevity over time. The information theoretically adjusted mortality table has a distribution consistent with the underwriter's projected life expectancy or other medical underwriter information and is as indistinguishable as possible from the pre-specified mortality model. An analysis using several different potential standard tables and medical information sets illustrates the robustness and versatility of the method.


Key words: Life Settlement, Asset Class, Double Exponential Jump Diffusion Model, Information Theoretic Dynamic Pricing.

## 1. INTRODUCTION

While the effect of longevity risk is traditionally thought of in terms of its impact on pensions, social security systems and the solvency of corporate defined benefit plans, there is another market that is vulnerable to longevity risk, perhaps even more than the above areas, namely the life settlement (and life securitization) market. A life settlement is a financial arrangement whereby the third party (or investor) purchases a life insurance policy from the person who originally purchased the life insurance policy. This third party pays the insured an amount greater than the cash surrender value of the policy -- in effect, the trade-in value of the policy as determined by the originating insurance company[2] -- but less than the face value (or the death benefit). The investor also agrees to pay future premium payments in exchange for the right to collect the death benefit upon the death of the insured.

A life settlement can be a win-win situation, as the investor can obtain a return on their initial investment and premium payments once the death benefit becomes payable (assuming the insured does not live too much longer than expected when setting the purchase price) and the owner of the policy obtains more money than they would if they had surrendered the policy for its cash value or allowed it to lapse (*cf.*, Doherty and Singer 2003)[3]. Life settlements are a part of the newly emerging and growing asset class of longevity and mortality related financial instruments providing investors with assets essentially uncorrelated with other market related assets in the investors' portfolio, hence increasing diversification effects (*cf.*, Cowley and Cummins. 2005).

This life settlement market has a vulnerability to longevity risk as increased longevity implies longer periods during which investors are paying premiums prior to collecting their money, and hence there is a potential for losing money, going bankrupt, or seeing a severe reduction in the expected return on the investment. The

[2] The cash value of the policy is also known as the non-forfeiture value since this is the least amount the insurer can pay to a surrendering policy holder. Formula for calculating the cash value can be found in Bowers et al (1997).

[3] According to a 2001 study of lapse rates for life insurance policies by the Life Insurance Marketing Research Association (Purushotham 2001), the majority of life insurance policies that lapse (4.3% of policies) are surrendered for cash value. By four years after purchase, more than 75% of policies that lapse are full surrenders of the policy, leaving potentially millions of dollars on the table to be reclaimed by life insurers in the absence of a secondary market for life insurance policies vending at more than the face value, a secondary market provided by the life settlement market.

rise and fall of the viatical settlement market, from whence the life settlement market arose, illustrates these dangers and susceptibility to increases in longevity. A brief history of the viatical settlement market illustrates the longevity risk inherent in the life settlement market.

The practice of buying and selling "viatical settlements" began in the late 1980s when a devastating medical AIDS epidemic presented a financial shock to thousands of previously healthy Americans (*e.g.*, see Stone and Zissu 2006). Due to the extremely high medical costs associated with treatments for this disease and due to the difficulty for HIV positive individuals to work and maintain an active income, many AIDS patients and their families became financially vulnerable. Thus, a secondary market in life insurance developed to relieve some of the monetary stress of the AIDS victims.[4]

Originally seen by the capital markets as a new financial opportunity, entrepreneurial investors emerged to offer to buy AIDS patients' life insurance policies for a price less than the face value, but more than they could get from lapsing their policy or surrendering it for the cash value. The investors would make the required premium payments (also a difficulty for terminally ill or declining health insureds) and become the beneficiary of the policy (after a "waiting period" had passed). Ultimately, when the insured died, the investor obtained the life insurance policy proceeds. Since AIDS patients were given very little time to live (usually two to three years), the investor did not have many premium payments to make and, after subtracting the initial payment to the insured and subsequent premiums from the final payout of the life insurance policy, the investor could theoretically obtain a large profit (Quinn 2008).

As the financial success of viatical settlement investments became publicized, the secondary market for such life products grew with companies created that specialized in accommodating investors' desires for viatical settlements. It was not much later, however, that this new market collapsed, succumbing to a change in the longevity risk.

Papers presented at the 1996 International AIDS Conference in Vancouver gave evidence of a new drug capable of substantially reducing the level of HIV in those infected (perhaps even to zero). This had a twofold impact: First, it offered new hope for increased life expectancy to the AIDS patients. Second, however, this sudden jump in longevity sounded a death knell for firms that had survived from the profits obtained from viatical settlement sales. This second effect is illustrated by the collapsed value of the viatical settlement firm, Dignity Partner, and by the significant decrease in prices offered to AIDS patients for their insurance policies. With evidence that policies might take a much longer to mature, prices in the viatical market plummeted (Stone and Zissu 2006).

As the viatical settlements market collapsed, investment companies expanded their secondary market life insurance purchases to the elderly to keep the life insurance backed securities asset market alive. Companies chose elderly people with estimated low life expectancies because a low life expectancy meant a greater possibility of profiting sooner from the purchase of life insurance policies. Today, this life settlement market has growing potential[5] as baby boomers are just now entering old age. Additionally, as the population ages, funding retirements over their remaining years of life becomes an escalating concern, especially with increasing simultaneous concerns about funding via Social Security[6].

---

[4] According to Quinn (2008, p 762), the term “viatical settlement” was coined by Richard Bandfield, a financial planner whose practice assisted the terminally ill. Quinn comments that the term had “a poetic and spiritual definition.” Viatical is from the Latin viaticum, which refers both to Christian communion given to the dying and to provisions given before a journey.

[5] According to Annin, DeMars, and Morrow (2010 p. 1); "It is estimated that in the past five years alone, more than $40 billion of the face value has been sold in the life settlement market."

[6] For example, Couzin-Frankel (2011) relates that every increasing year of life expectancy in the

Life settlements for seniors have also become popular in part due to the extensive marketing pursued by life settlement companies. The senior market now comprises the majority of the entire viatical and life settlements industry. Typically life settlement candidates are over age 65, with some deterioration of health but not terminally ill. They generally have a policy with a death benefit of $250,000 or more and no longer need or can afford the policy (Weber and Hause 2008). Moreover this market may continue to grow. Due to gradual increases in technology and beneficial medical treatment in the United States, the number of centenarians (individuals over the age of 100) has increased from 15,000 in 1980 to roughly 72,000 in 2000 and the number is predicted by the Social Security Advisory Board to reach to 4.2 million, (or approximately 1% of the projected total population) by 2050 (Scotti and Effenberger, 2007). It is estimated that about 50% of individuals born in the USA in the year 2000 will still be alive at age 101 (Vaupel, 2011).

The life settlement market developed at a rapid pace in its early years. A recent survey estimates that the available life settlement market will grow from $13 billion in 2004 to $161 billion over the next few years (Bernstein 2005) through a combination of an aging population, increasing life expectancy and increasing market penetration. Life settlement asset class formation has attracted attention from a broad range of market participants and regulators, including dominant investment banks and major reinsurance companies as intermediaries, the Securities and Exchange Commission (SEC), the National Association of Insurance Commissioners (NAIC) and National Conference of Insurance Legislators (NCOIL), as well as, state regulators, rating agents and life expectancy underwriters.

However, just as advancements in treating AIDS led the viatical settlement market to succumb to longevity risk, the substantial increases in longevity during the 20th and 21st centuries can pose substantial longevity risk to the current life settlement market. A large longevity jump could occur in the future if an effective treatment of coronary heart disease or cancer is found, as these two causes of death combined constitute more than half of all deaths among people over the age of 40 (Johnson, Bengtson, Coleman and Kirkwood 2005 p. 109). Thus, the modeling of longevity risk is of potentially more importance in the life settlements market than it is in the pension market because the life settlement market is based (and funded) on shorter horizons.

## 2 DESCRIPTION OF THE LIFE SETTLEMENT MARKET

The life settlement market was estimated at $10 billion at 2005, and continued to grow to $12 billion in 2007. Similar to other financial product markets, the life settlement market experienced a contraction during 2008 and the face amount value was estimated at $11.7 billion in 2008 (Conning Research 2008). It still remains attractive as an asset class since as Cox, Lin, and Wang (2006 p.720) explain, life insurance securitization such as found in life settlements are a breakthrough since "it is the first pure mortality security. It stripped out pure mortality risks and thus increased the transparency of the deal."

Weber and Hause (2008) also argue that life insurance assets (such as those involved in life settlements) have sufficiently distinctive characteristics so as to warrant being considered a separate asset class. Some of the distinctive characteristics they describe for this asset class include: 1) The death benefit is cash (a major asset class) provided at the time needed and *without* needing valuation adjustment based on up or down phases of the equity or bond markets; 2) The cash value has asset class attributes, *e.g.*, in a universal or whole life policy the cash value has the dominant characteristic of a fixed account with a minimum guaranteed return while a variable universal life policy's cash value is itself a portfolio reflecting the asset allocation of the policy owner; 3) The life insurance asset has unique tax related characteristics (tax deferred accumulation of cash value, tax-free and possibly estate tax-free death proceeds), the ability to keep policy proceeds out of the reach of creditors, the possibility of using policy cash values

---

population costs the USA Social Security Administration an additional $50 billion.

to produce retirement income, and the inherent leverage of relatively low periodic payments into a large capital accumulation. These attributes tend to make a life insurance asset uncorrelated with other common asset classes such as equities, fixed income securities, money market funds, etc.. In addition the death benefit is contingent on death and not a capital market event that might cause a change in value, giving it another distinction as an asset class. Rosenfeld (2009) provides further discussion related to life settlements as an asset class.

Before the life settlement market emerged, policy owners had limited choices if they no longer wanted, needed, or could afford the premium payments. Policy owners could cash out a policy by surrendering the policy to the insurance company to receive the surrender value or they could simply stop making premium payments and allow the policy to lapse. In most cases, the policy would be worth considerably more than the surrender value; hence, surrender is an unattractive option. The surrender value is typically based on the commissioner's standard ordinary (CSO) mortality table, in force at the time the policy was issued and so many years before the decision to surrender. These are smooth mortality tables used for conservative non-forfeiture value calculations and do not anticipate extraordinary health changes in individuals, but only aggregate group mortality change characteristics. Thus, if later on the insured has experienced some chronic disease, their mortality profile may be different than that anticipated by the CSO tables and another mortality table may more accurately reflect their anticipated individual mortality probabilities. The cash value calculation is incorporated as part of the insurance contract and is not negotiable, and lapsing the policy forfeits or slowly depletes the cash value in most cases. Under either choice scenario, the extra value in an unwanted or unneeded policy was relinquished to the life insurance company that issued the policy and not captured by the insured. Moreover, prior to the life settlement market development, investors had little access to this asset class other than through their own insurance policies.

A life settlement, however, provides a secondary financial market for this contract and produces an option, other than the surrender or lapsing, to the policy holder. In this way, the policy holder may gain the extra value inherent in the policy rather than relinquishing it to the insurer. When the owner of a life insurance policy no longer needs or wants the policy, the policy is underperforming, the insured can no longer afford to pay the premiums, the business need for the insurance is no longer exists, or a key employee leaves, this secondary market provides the opportunity to resell the policy to a third party for the secondary market price for the policy (*cf.*, Lewis (1989) for a discussion of changes in the need to hold life insurance).

Several market participants and intermediaries play a role in the production of the life settlement; these players include the policy owners, financial advisors or insurance agents, settlement brokers, life underwriters, *i.e.*, who evaluate the life expectancy of the underlying insured life at the time of sale, providers, *i.e.*, parties acquiring the policy and paying the insured for the right to claim the life insurance benefits, and investors, *i.e.*, who either bundle collections of life settlements and securitize them for resale, or keep them for investment purposes as a new asset class in their own portfolio. The majority of investors in today's life settlement market are large institutional investors seeking to acquire large pools of policies which can then be securitized, similar to securitizing mortgages. Retail investors also participate in the life settlement market, generally by purchasing fractional interests in settled policies. To the investor, the life settlement portfolio provides an essentially zero-beta asset which can help diversify a larger portfolio of sensitive financial market assets[7].

[7] It can also be used as a zero beta asset for valuation of portfolios in a Black type Capital Asset Portfolio Model (Black 1972) instead of the Market portfolio which has well known identifiably problems since Roll's (1977) criticism of the CAPM.

The process or procedures involved in the life settlement transaction are as follows:

1. Insured individuals or policyholders initiate the process to contact a producer, *i.e.,* usually financial advisors or insurance agents. Sometimes the producer contacts the insured because they know the insured needs to sell their life insurance policy.

2. The producer contacts one or more life settlement brokers with a license to do business in life settlements in the policy holders' state of residence since insurance is a state regulated industry.

3. The settlement broker(s) collects the medical information concerning the current health status of the policy holder and "settles" the policy by contacting life expectancy underwriters.

4. The contacted life expectancy underwriters are responsible for preparing a life expectancy assessment and evaluating the mortality risk of the insured based on the current health information provided by the settlement broker.

5. Providers review the data on policy terms, life expectancy, premium amounts, and then bid on the policy. The successful bidder takes over premium payments in return for collecting the ultimate life insurance benefit upon the death of the insured. This bid is based on supplied information and settlement applications prepared by settlement brokers.

6. The existing insured elects to either hold, *i.e.*, not sell in the secondary market, or to sell their policy. If sold the policy can be held in a portfolio or resold to form a life settlement securitization issue which expands the asset class to the broader class of investors with interests in life settlements.

## 3 PRICING OF LIFE SETTLEMENTS

Two main mathematical methods have arisen for pricing life settlements, a deterministic pricing method and a probabilistic or stochastic pricing method (*c.f.,* Insurance Studies Institute (2008); Zollars, Grossfield and Day (2003); Forman (2010)).[8] The deterministic model is the first and simplest model, and was used almost exclusively in the early days of viatical settlements when life expectancies were short (Zollars, Grossfield and Day 2003). It is still used in some securitization models. We discuss each method in turn

### 3.1 DETERMINISTIC LIFE SETTLEMENT PRICING

In viatical settlements (and in the early history of life settlement pricing), the life expectancy[9] of the insured was considered the most critical (often the only) variable used in determining the secondary market price of the policy as this represents the expected life length of the insured when the life insurance policy was sold to the third party as a life settlement (the time to payment for the investor). The pricing model was deterministic, like a bond with a payoff at the death of the insured (bond principal equal to the insurance face value) but with negative coupons (premiums) occurring annually until death, a date which was assumed to be the life expectancy with probability one. If T represents the random future life of the insured, then the life expectancy is $\mu = E(T)$. This life expectancy is computed using an appropriate life table, or in the case of life settlements, is usually given by a medical expert based on their examination of the current medical record of the insured. If the discount factor is v =1/(1+r) where r denotes the investors' required rate of return, then the present value of the payoff of a life insurance policy with a benefit of \$B is calculated as $Bv^{\mu}$. The premiums paid until the year of death constitute an annuity due (payments at the beginning of the year) and they are subtracted off (in present value) to get the value of the offer. Expenses are further subtracted to arrive at an offer price for the policy. We show below that this deterministic method yields a systematically biased assessment of the value of the payoff and leads to a systematically inaccurate evaluation of the value of the life settlement product.

**Theorem 1**. The deterministic life settlement pricing model systematically underprices the value of the life settlement benefit in a portfolio of settlements.

**Proof:** In a portfolio of similar policies where *T* is the (common) time to death, and *B* is the common face value, the expected benefit using the Law of Large

[8] There is also a Monte Carlo simulation approach which is more difficult and less often used. See Zollars et al for details.

[9] Some analysts used the median value (i.e., the value where 50% of a cohort of equivalently rated insureds would die) instead of the mean. Some added a few extra years on for conservativeness.

Numbers is $E(Bv^T)$, with v=1/(1+r). According to Jensen's inequality, if *X* is any random variable, and *f* is any convex function, then *E[f(X)]≥ f(E[X])* with equality if and only if *X* is constant. Taking the random variable as $X=T$, and using the convex function $f(x)=v^x$, yields the inequality

$$\text{Expected Portfolio Benefit Value} = E\left(Bv^T\right) \geq Bv^{\mu} = \text{Deterministic Value}$$

Taking into account the sequence of premium payments needed to be made prior to death and expenses, the biased result for the deterministic pricing model continues to be exhibited. This is shown below.

**Theorem 2**. The deterministic pricing model systematically underpays the policyholder for the expected value of their life settlement.

**Proof**: An annuity of n payments of $P payable at the beginning of each year starting at time 0 (an annuity due) has a present value at interest rate r equal to $\ddot{a}=\left(1-v^n\right)/rv$ where *v=1/(1+r)* (*c.f.*, Kellison 1991 p 63). The annuity that pays continuously for t periods equals $\bar{a}=\left(1-v^t\right)/\delta$ where is the force of interest, $\delta=\ln(1+r)$, (Kellison 1991 p. 107, Bowers *et. al*., 1986 p. 124), and $\ddot{a}=\left(\delta/rv\right)\bar{a}$. Thus, the present value *X(T)* of the life settlement with face value benefit *B* payable at time *T* and premiums *P* payable at the beginning of each year until the year of death is $X(T)=Bv^T-P\left[\left(\delta/rv\right)\bar{a}\right]=C_1v^T-C_2$, where $C_1=\left[B+\left(P/rv\right)\right]>0$ and $C_2=P/rv$. Since *X(t)* is a convex function of *t*, Jensen's inequality again implies the expected value of the life settlement $E\left[X(T)\right]\geq X\left(E(T)\right)=$ the deterministic pricing value.

Hence the deterministic pricing model underprices the policy settlement value to the policyholder. Further subtracting the expenses does not alter this conclusion.

### 3.2 PROBABILISTIC LIFE SETTLEMENT PRICING

Recognizing the length of life as random variable, we can use standard actuarial mathematics to price the expected life settlement value $E\left(X(T)\right)=E\left(Bv^T-P\ddot{a}\right)$; we only need the probability distribution of T to be able to do so (*cf.*, Bowers et al 1986). The first, and very important, step to this end is to select a mortality table for the life being settled. Different life tables can, as we shall show, produce different values even if they have the same life expectancy.

Information consistent with the medical underwriter supplied assessments must be incorporated into the life table which is to be used. According to Forman (2010) most life settlement companies use some version of the 2008 Valuation Basic Table (VBT), having moved from the 2001 VBT. Other tables are also used (*e.g.* an impaired lives table if the insured is in deteriorated health), and of course the VBT (or any other selected table) most likely will not be consistent with the life underwriters' assessment of life expectancy, so the table must be adjusted in some manner to get to a table which has the required characteristics in order to do the calculation

One standard adjustment approach is to start with a standard table (*e.g.*, the 2008 VBT) and then multiply each mortality rate by a constant factor c selected so as to obtain a new table which produces the underwriter's life expectancy estimate. The derived table terminates when the adjusted mortality rate exceeds 100%. This method is ad-hoc, and while it reproduces the life expectancy, it may not reflect other medical underwriter information. Forman (2010), for example, gives an example of a life expectancy report on a 84 year old woman whose medical records led the underwriter to an estimate of a of 9.2 years of mean life expectancy, a median life expectancy of 9.3 years, and an 85% mortality value of 13 years. The suggested mortality multiplier was 2.03, but this single multiplier may not reproduce all three data points from the starting life table. The report further states "Please note it is recommended that the information provided in this life expectancy evaluation be used in its entirety. If only a subset of the data is used, you will be losing the interrelationships between the analytics." Thus, a methodology must be developed capable of starting with an originating life and then adjusting it to reflect all known information regardless of what internally consistent information is supplied by the underwriter. We discuss how to accomplish this after discussing the choice of originating mortality table.

# 4 THE CHOICE OF ORIGINAL MORTALITY TABLE PRIOR TO ADJUSTMENT

## 4.1 THE CHOICE OF A STANDARD TABLE FOR ADJUSTMENT

There is a plethora of life tables available for use, depending on sex, smoking status, health status, retirement status, etc. of the insured life to be settled. As mentioned previously, the 2008 VBT (available from the Society of Actuaries) is commonly used. Other tables include impaired life tables since, as noted by Weber and Hause (2008), the life settlement often involves someone having a deteriorated health status but who is not terminally ill. The selection of an appropriate starting table can improve the accuracy of the end result, even after adjusting it to reflect medical underwriting information.

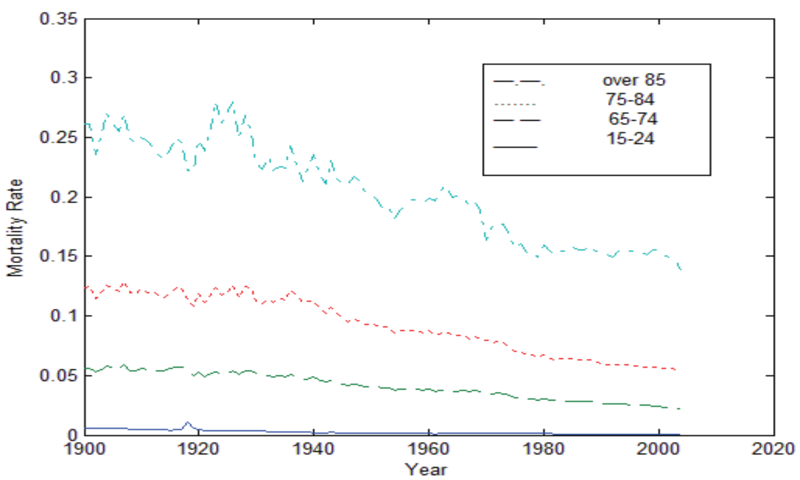
One consideration not explicitly addressed in these mortality tables is the possibility of sudden jumps in mortality or jumps in longevity (such as those that destroyed the viatical settlements market) and their impact on the pricing of life settlements. Jumps in mortality (as opposed to longevity) may also occur (such as an infectious disease that differentially impacts vulnerable elderly populations) and this will increase the internal rate of return on the life settlement for the investor. Currently, jump changes that increase or decrease the expected mortality rate are not incorporated in the mortality models used. Jumps can constitute an important source of return uncertainty in life settlement investments. Below we detail a mortality model which allows stochastic jumps in mortality and longevity, and subsequently we use this model (as well as others) to price life settlements.

## 4.2 A DOUBLE EXPONENTIAL JUMP DIFFUSION MORTALITY MODEL TO INCORPORATE LONGEVITY RISK

A basic requirement of the mortality model to use for life settlement purposes should be to allow for changes in mortality and longevity rates over time differentially over age groups; this allows the model to anticipate the type of change in medical technology that killed the viatical settlement market or the cures in cardiovascular disease that predominantly effect older insureds. This approach then accommodates additional uncertainty in the financial settlement apart from the evolution of mortality with random departures from an assumed life table.

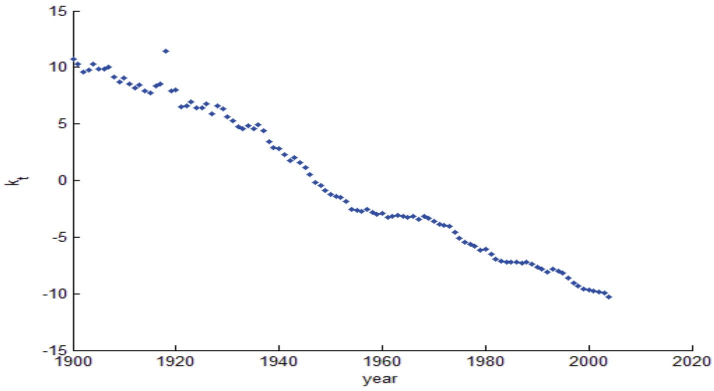
A collection of models that consider both time and cohort effects are based on the Lee-Carter one-factor model, *i.e.,* see Lee and Carter, 1992. In the Lee-Carter framework, $\mu_{x,t}$ denotes the mortality rate of the group at age is x during the year t. It is decomposed into age-specific parameters $a_x$ and $b_x$ and a mortality trend time-series $k_t$, using the formula $\ln(\mu_{x,t}) = a_x + b_x k_t + e_{x,t}$ with e denoting a stochastic error term. In this model the $a_x$ vector represents the age mortality pattern of the historical data, $k_t$ represents the improvements over time that have occurred in mortality and $b_x$ represents the improvement rates at age x for general level changes in mortality $k_t$ over time. Using the historical data from HIST290 National Center for Health Statistics, Figure 1 illustrates that the mortality improvement effects do indeed differ by age group but with a common downward trend.

Figure 1, Mortality Rates by Age Group, HIST290 National Center for Health Statistics Data 1900-2004



The common trend over time ($k_t$) is given in Figure 2.

Figure 2 Trend in mortality ($k_t$) over years




In this figure, one can observe definite jumps in mortality (such as the 1918 flu pandemic) and in longevity that would have affected returns on life settlements. The extension of the Lee-Carter model and the Chen and Cox (2009) model given in Deng, Brockett and MacMinn (2010) accommodates such jumps. In the Deng, Brockett and MacMinn model, the parameters $a_x$ and $b_x$ are fit as usual using the singular value decomposition method outlined in Lee and Carter (1992). The time varying series ($k_t$) was modeled as a double exponential jump diffusion (DEJD) detailed below.

The dynamics of the mortality time-series $k_t$ are specified as:

$$dk_t = a\,dt + \sigma\,dW_t + d\left(\sum_{i=1}^{N(t)}(V_i - 1)\right)$$

where $W_t$ is standard Brownian motion, $N(t)$ is a Poisson process with rate $\lambda$, and $\lambda$ describes the expected frequency of the jumps. The larger the $\lambda$, the more times jumps occur in the mortality time-series. Here $V_t$ is a sequence of independent identically distributed ( *iid* ) nonnegative random variables and $Y = \log(V)$ has a double exponential distribution with the density:

$$f_Y(y) = p\eta_1 e^{-\eta_1 y} 1_{\{y \geq 0\}} + q\eta_2 e^{\eta_2 y} 1_{\{y<0\}}$$

$$\eta_1, \eta_2 > 0, \quad p \quad q \geq 0, \quad p + q = \quad .$$

| Age Interval x | *Weighting for Age Interval x* | Age-specific Parameters $a_x$ | $b_x$ |
|---|---|---|---|
| <1 | 0.013818 | -3.4087 | 0.1455 |
| 1-4 | 0.055317 | -6.2254 | 0.1960 |
| 5-14 | 0.145565 | -7.1976 | 0.1492 |
| 15-24 | 0.138646 | -6.2957 | 0.0994 |
| 25-34 | 0.135573 | -5.9923 | 0.1044 |
| 35-44 | 0.162613 | -5.4819 | 0.0855 |

| Other Parameters | Parameter Value |
|---|---|
| $k_0$ | -10.302 |
| $t$ | 10 |
| $\alpha$ | -0.20 |
| $\sigma$ | 0.31 |
| $\lambda$ | 0.029 |
| $\gamma$ | -1.25 |

| | | | | | |
|---|---|---|---|---|---|
| 45-54 | 0.134834 | -4.7799 | 0.0608 | $p$ | 0.035 |
| 55-64 | 0.087247 | -4.0137 | 0.0468 | $\eta_1$ | 0.89 |
| 65-74 | 0.066037 | -3.2347 | 0.0426 | $q$ | 0.065 |
| 75-84 | 0.044842 | -2.4196 | 0.0409 | $\eta_2$ | 0.93 |
| >85 | 0.015508 | -1.6119 | 0.0290 | | |

The parameters $p$ and $q$ represent respectively, the proportion of positive jumps and negative jumps among all jumps. Thus, $p\lambda$ is the expected frequency of positive jumps and $q\lambda$ the expected frequency of negative jumps. The parameters $\eta_1$ and $\eta_2$ describe the positive jump size or severity and the negative jump size or severity respectively. Thus, $Y|Y>0$ is exponentially distributed with mean $1/\eta_1$ while $Y|Y\leq 0$ is exponentially distributed with mean $1/\eta_2$. In this way, the positive jumps and negative jumps are captured by similar distributions but with different parameters based on the asymmetry of jumps in the mortality time-series $k_t$ and the leptokurtic feature of $dk_t$. More details of the DEJD and its use in the context of pricing longevity derivatives are given in Deng, Brockett and MacMinn (2010).

The mortality model specification incorporating the double-exponential distribution has the advantage of mathematical tractability allowing a closed-form formula for the expected future mortality rate to be derived (*cf.*, Kou, (2004), Deng, Brockett and MacMinn (2010).[10] The additional parameters of the series $k_t$ are calculated from the observed $k_t$ time series using maximum likelihood (*cf.*, Deng, Brockett and MacMinn (2010), Ramezani and Zeng,, (2007)). The DEJD also fits the data better than the original Lee-Carter model (*cf.*, Deng, Brockett and Macminn (2010)) thus indicating that such jumps have significance. Table 1 gives the parameter values obtained. We apply the DEJD model to generate a mortality table for use in pricing life settlements that also allows for jumps in mortality and longevity.

## 4 USING INFORMATION THEORY TO OPTIMALLY ADJUST THE STANDARD TABLE

In spite of starting from a seemingly appropriate life table, the medical underwriter's estimate of life expectancy (mean or median) may be incompatible with the dynamics of this table, *e.g.*, the 2001 CSO table may project a 12 year life expectancy for a person whereas the underwriter estimates the expectancy to be 8 years. Information theory provides a rigorous and non-*ad hoc* statistical methodology for adjusting the selected mortality tables so as to incorporate any known individual characteristics into the adjusted table while remaining as close as possible to the original one (*cf.*, Brockett 1991). How to use any known medical information about an individual in underwriting and pricing is a common and important unsettled issue since the security analyst can price life contingent financial instruments (such as life settlements) more accurately with the adjusted table that is consistent with the medical information.

In its simplest form the problem can be summarized as follows: if the medical underwriter has estimated that the expected remaining life is *m* years, how does one value a life settlement using this information in addition to using a "most appropriate" starting mortality table distribution (which does not have mean *m* but has other pertinent mortality progression features, such as mortality jumps or being related to disable retired persons). In order to do the pricing using the probabilistic approach, the analyst must construct a mortality table which has $ET=m$, where T denotes the years of life remaining for the life being settled (a random

[10] One can also use the stochastic mortality model to do Monte Carlo simulation estimates of life settlement values.

variable). In this section we show explicitly how to obtain an adjusted table that is as indistinguishable as possible from the chosen standard table and that satisfies the underwriter's estimate $ET = m$.

### 4.1 MINIMUM DISCRIMINATION INFORMATION ESTIMATION

To begin and to develop the intuition for the proposed method, consider the problem of distinguishing or discriminating between two candidate probability densities $f$ and $g$ for some random phenomenon (such as length of life) after observing a value t of the random variable. For example, $f$ and $g$ could correspond to potential densities for the survival time of the individual.

For distinguishing between two densities $f$ and $g$, the statistic $\ln\left(f(t)/g(t)\right)$ is a sufficient statistic and represents the log odds ratio in favor of the observation having come from $f$. It can be thought of as the amount of information contained in the particular observation $t$ for discriminating in favor of $f$ over $g$ for modeling the phenomenon (Kullback, 1959). This is the interpretation on which maximum likelihood estimation is based. By the law of large numbers, in a long sequence of observations $\{t_l\}$ from $f$, the long-run average log odds ratio is:

$$E_f\left(\ln\frac{f(t)}{g(t)}\right) = \sum_l f(t_l)\ln\frac{f(t_l)}{g(t_l)} \qquad (1)$$

which reflects the expected amount of information in an observation for discriminating between $f$ and $g$. This quantity is called the *divergence* between the densities $f$ and $g$ in the statistics and engineering literature and is denoted by $I\left(f|g\right)$. It is not difficult to show that $I\left(f|g\right) \geq 0$, with $I\left(f|g\right) = 0$ if and only if $f = g$. Thus, the size of $I\left(f|g\right)$ is a measure of the "closeness" of the densities $f$ and $g$. Such a global measure of divergence between potential probability distributions corresponding to models for the future life random variable will be used for adjusting a standard mortality table to obtain a new "closest" table which reflects the underwriter's information.

To phrase this problem in a general setting, assume we are given a density function $g$, and we wish to find another density $f$ that is as close as possible to $g$, and that satisfies $k+1$ given expected value or generalized moment constraints involving the expected values of some collection of functions $a_i(t)$:

$$\begin{aligned}
1 &= \theta_0 = \sum f_l \\
\theta_1 &= \sum a_1(t_l) f_l = E_f\left[a_1(T)\right] \\
&\cdots \qquad\qquad\qquad\qquad (2) \\
&\cdots \\
\theta_k &= \sum a_k(t_l) f_l = E_f\left[a_k(T)\right]
\end{aligned}$$

In the first constraint $a_0(t) \equiv 1$ which simply insures that the $f$ is a probability distribution. If we set $a_1(t) = t$ and $\theta_1 = m$ then the second constraint says that the mean for $f$ is set to be $m$. As another example, by taking $a_2(t)$ to be unity on a certain interval and zero off the interval, we arrive at a constraint on the probability for that interval, *e.g.*, if the 85 percentile is give as 13 years, then $a_2(t) = 1$ for $t \leq 13$ and 0 otherwise, and $\theta_2 = .85$. The formulation in (2) would also be useful, for example, if one wanted to use a medical study that gives decennial survival probabilities but for which yearly survival probabilities are required. One would then find a survival density that was as close as possible to a standard mortality table and that reflected the decennial survival rates quoted by the medical study. If the median instead of the mean (or both) are given then this can also be expressed in terms of the generalized expectation constraints as in (2). If relative risk values for persons having a particular medical condition (*e.g.*, cardiovascular disease) are given in the medical literature, these can be written in the context of (2) also.

To phrase the problem mathematically, the objective is to find a vector of probabilities $f = \left(f_1, f_2, \ldots\right)$ that are as close as possible to the given probability distribution $g = \left(g_1, g_2, \ldots\right)$ but which satisfies the moment constraints (2). Written as a mathematical programming problem, we wish to find a collection of probabilities $f = \left(f_1, f_2, \ldots\right)$ that solve the problem:

$$\min_f I\left(f|g\right) \quad (3)$$

subject to the constraints (2). Here $g = \left(g_1, g_2, \ldots\right)$ is the given vector of probabilities corresponding to the standard probability distribution. Brockett, Charnes and Cooper (1980) show that the problem (3) subject to (2) is a convex programming problem and that the dual mathematical programming problem is actually unconstrained and involves only exponential

$$f_l = g_1 \exp\left[-(\beta_0+1)-\beta_1 a_1(t_l)-\cdots-\beta_k a_k(t_l)\right] \tag{4}$$

where the $\beta_i$'s are constant parameters selected in such a way that the constraints (2) are all satisfied.[11] They further show that the parameters $\beta_i$ can be obtained easily as the dual variables in an unconstrained convex programming problem:

$$\min_\beta \sum \{g_l \exp[-(\beta_0+1)-\beta_1 a_1(t_l)-\cdots-\beta_k a_k(t_l)] - \beta_0+\theta_1\beta_1+\cdots+\theta_k\beta_k)\} \tag{5}$$

The solution to (5) can be obtained easily by any number of efficient nonlinear programming codes. In our computations we use Excel Solver.

## 4.2 ADJUSTING A STANDARD LIFE TABLE TO REFLECT UNDERWRITER INFORMATION

The life expectation used in the life settlement pricing is the expected value of a random variable $T$ that equals the number of years a person now aged $x$ will live.[12] In standard actuarial notation, we have $T$=0 with probability $q_x$, $T$=1 with probability $p_x q_{x+1}$ and, in general, $T=k$ with probability ${}_k p_x q_{x+k}$ where $q_x$ denotes the mortality rate at age $x$, and ${}_k p_x$ denotes the probability a life age x survives k years, $p_x = 1-q_x$ and ${}_{k+1}p_x = {}_k p_x\left(1-q_{x+k}\right)$. Assuming we are given a standard mortality table for an individual age $x$ listing mortality rates at age $x$, $x+1$, etc., the distribution of the random variable $T$ is given by the $(\omega - x+1)$ dimensional probability vector $g=\left(g_0, g_1, \ldots, g_{\omega-x}\right)$, where denotes the end age for the mortality table and the probability of death exactly $k$ years in the future is $g_k = {}_k p_x q_{x+k}$ for $k=0,1,\ldots,\omega-x-1$ as calculated from the standard table.

[11] Note from (4) that if we start with a member of the exponential family for g, the resultant f is also of the exponential family of probability distributions. This facilitates estimation and statistical analysis.

[12] Some underwriter use the median instead of the mean, but as noted previously this is still of the form (2) and can be readily accommodated. We shall, however, use the mean value in our illustrative analysis.

and linear terms (making solving the problem computationally simple). The number of unknowns in the dual is equal to the number of constraints. Moreover, they prove the unique solution has the general form:

Now consider the problem of finding another mortality table that is as close as possible to the standard table but which additionally satisfies certain given constraints, such as those given in (2). This translates into finding a probability distribution $f=\left(f_0, f_1, \ldots, f_{\omega-x}\right)$ that minimizes (3) for the random variable $T$ and which satisfies the constraint set (2). From the above results the density (4) is the least distinguishable probability density from $g$ among the class of all densities satisfying the constraints.

Let us now illustrate this using the information about the insured most commonly used in life settlements: The medical underwriter has developed an estimate that the curtate expectation of life for the individual whose policy is being settled is $m$ years. Thus, the constraint set for the new table to be used in probabilistic pricing is twofold:

$$1 = \sum f_k, \qquad m = \sum k f_k \tag{6}$$

Appealing to the principle of minimum discrimination information, we select the density $f$ to satisfy:

$$\min I\left(f \middle| g\right) = \min \sum f_l \ln\left(f_l \middle| g_l\right)$$

subject to the constraints (6).

We could apply the result (5) directly; however, it is perhaps more instructive to show how to obtain the desired density directly by standard methods in this simple situation. Let $n=\omega-x$. The probability distributions that we are considering can be viewed as $n+1$ vectors $f=\left(f_0, f_1, \ldots, f_n\right)$ that satisfy $f_k \geq 0$, $\sum f_k = 1$ and $\sum k f_k = m$. Letting $\beta_0$ and $\beta_1$ denote the Lagrange multipliers for the equality constraints (6) allows us to replace the original problem and minimize the function:

$$L(f,\beta) = \sum f_k \ln\left(f_k \middle| g_k\right) - \beta_0\left(1-\sum f_k\right) - \beta_1\left(m - \sum k f_k\right)$$

subject to $f_k \geq 0$, $n=1,\ldots,$ . The $n+3$ first-order conditions found by differentiating with respect to $f_0, f_1, \ldots, f_n, \beta_0, \text{and } \beta_1$ are as follows:

$$\ln\left(f_k \middle| g_k\right)+1+\beta_0+k\beta_1=0,\ k=0,\ldots,n;$$
$$-1+\sum f_k=0;$$
$$-m+\sum k\,f_k=0$$

The first $n+1$ equations give $f_k=g_k\exp\left(-1-\beta_0-k\beta_1\right)$ for $k=0,\ldots,n$. The last two equalities allow the determination of the parameters $1+\beta_0$ and $\beta_0$.

Consider the function $\Phi(\beta)=\sum g_k e^{-k\beta}$.

Since $\sum f_k=1$, we have $1=\sum g_k\,e^{-1-\beta_0-k\beta_1}=e^{-1-\beta_0}\,\Phi(\beta_1)$. Therefore, $1+\beta_0=\ln\Phi(\beta_1)$. Thus, if we can find $\beta_1$ then we can also determine $\beta_0$.

To determine $\beta_1$ note that $\Phi'(\beta_1)=-\sum g_k\,k\,e^{-k\beta_1}$, so that

$$\Phi'(\beta_1)=-\sum k\,g_k\,e^{-k\beta_1}=-e^{(1+\beta_0)}\sum k\,g_k\,e^{1-\beta_0-k\beta_1}$$

$$=-e^{(1+\beta_0)}\sum k\,f_k=-e^{(1+\beta_0)}m=-\Phi(\beta_1)\,m$$

Hence, in order to find the precise numerical value for $\beta_1$, we solve:

$$\Phi'(\beta_1)=-\Phi(\beta_1)\,m$$

or equivalently:

$$\frac{d}{d\beta}\ln\left(\Phi(\beta)\right)=-m.$$

This can be done by any of a number of software programs (*e.g.*, we used Excel Solver). Obtaining $\beta_0$ through the equation $1+\beta_0=\ln\Phi(\beta_1)$ yields both parameters $\beta_0$ and $\beta_1$ from which we readily calculate the desired adjusted probability distribution $f_k=g_k\,e^{-(1+\beta_0+\beta_1 k)}$.

## 5 ILLUSTRATIONS AND COMPARISONS OF LIFE SETTLEMENT PRICING

In this section we shall present numerical illustrations of the previous information theoretic probabilistic pricing of life settlements. Comparisons are made across different assumed "standard" starting tables. For compatibility of the illustrations across the various numerical computations, we shall use the same person whose life is being settled in all examples. We assume that a State Farm Insurance Company Whole Life policy paid up at age 100 was issued on a female standard risk non-tobacco user in good health at age 40 in 1986 who is age 70 in 2006, the year of settlement. To keep the numbers reasonable and to conserve space, we assume the insurance policy has a face value (death benefit) of $50,000. The policy details are adapted from Appendix C in Baranoff, Brockett and Kahane (2009) and are listed in Table 2.

Table 2. Policy Details

| Face Amount | Annual Premium | Guaranteed Cash Value (Using 2001 CSO Mortality Table) |
|---|---|---|
| $50,000 | $565.50 | $8,438.50 at age 70 |

### 5.1 ILLUSTRATION OF ADJUSTING A MORTALITY TABLE TO REFLECT INFORMATION

For the purposes of illustration, we assume that the medical underwriter has estimated that the life expectancy of the insured is 8.5 years. We assume a uniform distribution of deaths during the year of death. Considering that the 2001 CSO table upon which the policy cash values were predicated predicts a life expectancy of 16.4 years for a 70 year old female, the individual is in somewhat of a deteriorated but not life threatening condition.

To illustrate the adjustment process we start with a standard life table designed for disabled retired lives.[13] Table 3 presents the mortality rates for this standard table starting with the settlement age of 70. The expectation of life for this individual using the disabled retired lives table is 12.9 years, so the mortality rates must be adjusted up to create a new table consistent with the underwriter's assessment of 8.5 years.[14] The

[13] Available from the Society of Actuaries at www.soa.org/files/pdf/rp00_mortalitytables.pdf

[14] If instead of having estimated the mean as 8.5 the underwriter had specified that he thought the mean

death year probabilities $g_k$ are calculated from the mortality rates $q_k$ as previously described and are given in the third column of Table 3.

Adopting the information theoretic approach to adjust the standard table, we present in the fourth column of Table 3 the adjusted death year probabilities $f_k$ calculated as the solution $f_k$ which minimizes $I(f|g)$ subject to

$$1 = \sum f_k, \quad \text{and} \quad 8.5 = \sum (k + .5) f_k$$

the .5 term in the second summation arises because of the uniform distribution of deaths assumption). As derived previously, the solution is of the form

$$f_k = g_k \exp(-1 - \beta_0 - k\beta_1),$$

and the computation described earlier produces $\beta_0 = -1.80579$ and $\beta_1 = 0.080089$. Thus, $f_k = 2.2384 \; g_k(1.083384)^k$. The resulting mortality rates for the adjusted table are denoted by $q_x{}'$. While the computations are carried out to the end of the life table (age 115), Table 3 only presents the results for the first 20 years to preserve space. The final column shows the adjusted mortality rates.

Table 3. Standard (Disabled Retired) Life Table and Adjusted Life Table That Achieves a Life

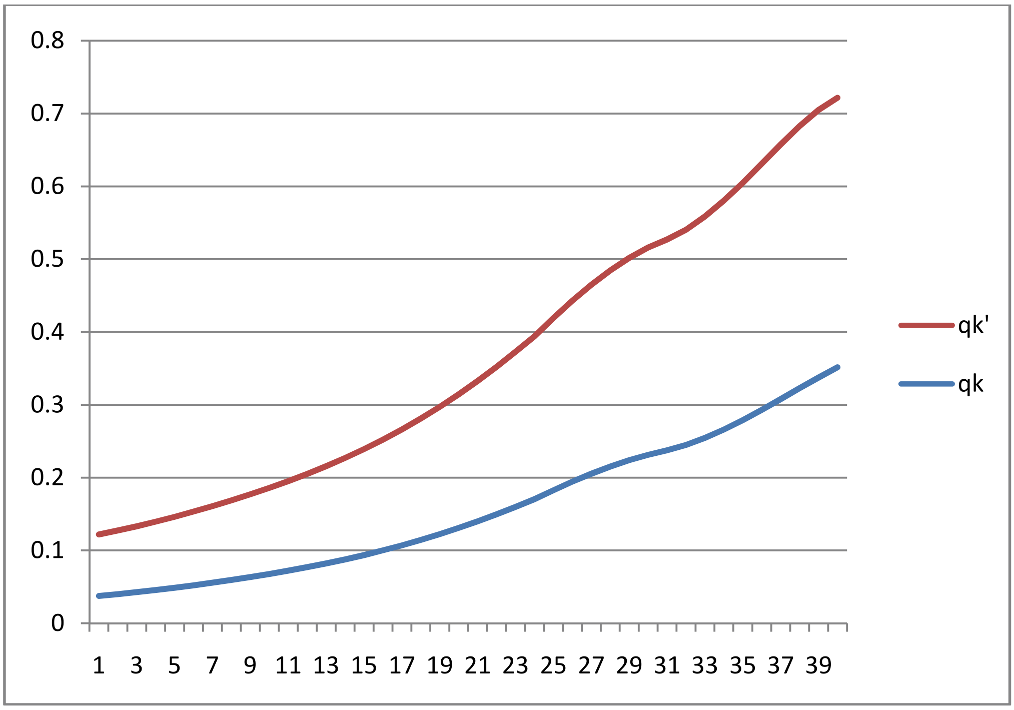
| k | Age | Disable Retired Mortality Rate | Disable Retired Probability of Death in Year | Adjusted Table Probability of Death in Year | Adjusted Table Mortality Rate |
|---|---|---|---|---|---|
| | | $q_k$ | $g_k$ | $f_k$ | $q_k'$ |
| 0 | 70 | 0.037635 | 0.037635 | 0.084244971 | 0.084244971 |
| 1 | 71 | 0.04014 | 0.038629331 | 0.079815447 | 0.087158077 |
| 2 | 72 | 0.042851 | 0.039582997 | 0.075491166 | 0.090306965 |
| 3 | 73 | 0.045769 | 0.040466784 | 0.071236709 | 0.09367724 |
| 4 | 74 | 0.048895 | 0.041252021 | 0.067029826 | 0.097255786 |
| 5 | 75 | 0.05223 | 0.041911121 | 0.062859342 | 0.101030493 |
| 6 | 76 | 0.055777 | 0.042419677 | 0.05872535 | 0.104993713 |
| 7 | 77 | 0.059545 | 0.042759447 | 0.054639666 | 0.109148968 |
| 8 | 78 | 0.063545 | 0.04291471 | 0.050617401 | 0.11350274 |
| 9 | 79 | 0.067793 | 0.042874253 | 0.046677536 | 0.118069311 |
| 10 | 80 | 0.072312 | 0.042631876 | 0.042841385 | 0.122873479 |
| 11 | 81 | 0.077135 | 0.042186889 | 0.039131298 | 0.127954823 |
| 12 | 82 | 0.082298 | 0.041538754 | 0.035564599 | 0.133355628 |
| 13 | 83 | 0.087838 | 0.04068631 | 0.032153663 | 0.139117883 |
| 14 | 84 | 0.093794 | 0.039628981 | 0.028907647 | 0.145285264 |
| 15 | 85 | 0.100203 | 0.03836591 | 0.025832298 | 0.151897517 |
| 16 | 86 | 0.107099 | 0.036897312 | 0.022931369 | 0.158989803 |
| 17 | 87 | 0.114512 | 0.035226024 | 0.020207685 | 0.166592177 |
| 18 | 88 | 0.122464 | 0.033358288 | 0.017663404 | 0.17472492 |
| 19 | 89 | 0.130972 | 0.031306802 | 0.015301255 | 0.183403989 |
| 20 | 90 | 0.140049 | 0.02909203 | 0.013124419 | 0.192643582 |

was between 6.5 and 8.5, the resulting adjusted mortality table turns out to be the same as that obtained using the single equality constraint, even though the inequality constrained table has one more parameter to estimate.

Expectancy Equal to 8.5 Years

To illustrate the effect of the information theoretic adjustment, Figure 3 shows the unadjusted and adjusted mortality rates. The optimal adjustment is not simply a multiple as is often used in life settlement pricing.

Figure 3. Mortality Rates For a 70 Year-old Using the Disabled Retired Life Table Rates $q_k$ and Then Adjusting Them to Obtain New Mortality Rates $q_k'$ That Make The Life Expectancy Equal 8.5 Years




5.2 LIFE SETTLEMENT PRICING USING SEVERAL STARTING TABLES

The first and simplest pricing model is the deterministic model which assumes that the benefit payment occurs at the predicted life expectancy date with probability 1, *i.e.*, the mortality rates in the mortality table are zero for all dates other than the precise expected death date, at which point the mortality rate is one. As mentioned previously, pricing using this deterministic method is like pricing a bond with principal (face value) paid at the date of expected death and the coupons being negative and in value equal to the specified premium. For deterministic life settlement pricing of the policy specified in the previous section having a life expectancy of 8.5 years, the present value of the future benefit is $\$50,000\times\left(1/(1+r)\right)^{8.5}$ and the premium payments constitute an annuity due for 8 years of amount \$565.50 at the beginning of each year. Subtracting the annuity of premium payments from the discounted benefit value yields the deterministic value. Further subtracting expenses yield the price to be paid.

We next turn to the probabilistic pricing model and investigate the sensitivity of the life settlement value obtained from the adjusted table to the choice of the starting standard mortality table used. Again adjustment is made so that the adjusted table in each case has an expected life of 8.5 years for the 70 year old considered previously. For each starting table we solved the information theoretic optimization problem to find the parameters $_0$ and $_1$ needed to adjust the table to obtain the mean of 8.5, and then calculated the expected present values for this adjusted table using the formula $X(T)=Bv^T-P\ddot{a}$ and using the adjusted table probability distribution for T. Our choice of starting tables includes the Disabled Retiree table discussed previously, a Healthy Annuitant life table,[15] the 2001 CSO Table

[15] Available from

used to establish the cash values, the 2001 VBT table,[16] the 2008 VBT table[17] and finally the DEJD

mortality model presented earlier which allowed for historically observed potential jumps in mortality and longevity over the years. Table 4 presents the results of calculating the life settlement value using the formula $X(T) = Bv^{T} - P\ddot{a}$ starting from different tables and using differing internal rates of return r. Figure 4 displays these results graphically.

Table 4. Present Value of the Life Settlement Starting from Different Mortality Tables All Adjusted to Have Life Expectancy of 8.5 years

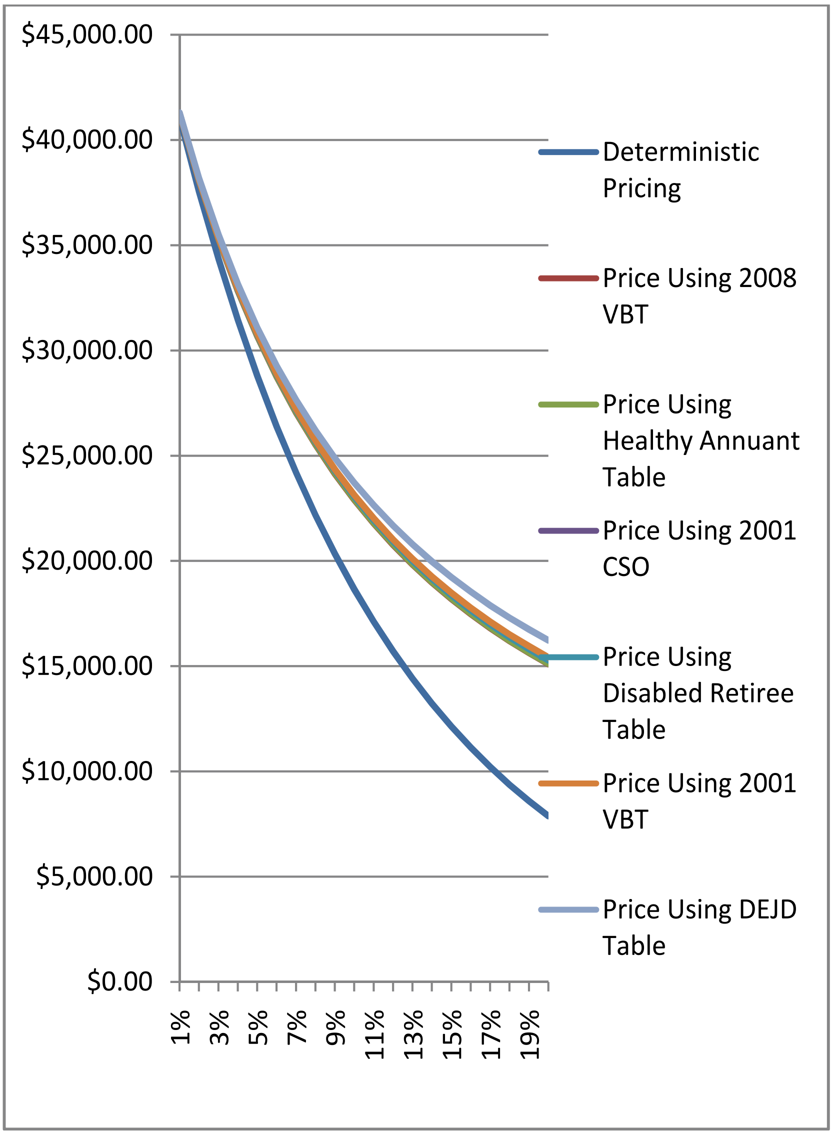
| Assumed Rate of Return | Deterministic Pricing | Price Using 2008 VBT | Price Using Healthy Annuitant Table | Price Using 2001 CSO | Price Using Disabled Retiree Table | Price Using 2001 VBT | Price Using DEJD Table |
|---|---|---|---|---|---|---|---|
| 1.00% | $41,282 | $41,479 | $41,482 | $41,489 | $41,491 | $41,493 | $41,531 |
| 2.00% | $37,966 | $38,489 | $38,496 | $38,515 | $38,519 | $38,525 | $38,622 |
| 3.00% | $34,935 | $35,871 | $35,883 | $35,916 | $35,920 | $35,933 | $36,099 |
| 4.00% | $32,162 | $33,566 | $33,583 | $33,632 | $33,637 | $33,656 | $33,895 |
| 5.00% | $29,622 | $31,529 | $31,550 | $31,614 | $31,619 | $31,646 | $31,957 |
| 6.00% | $27,293 | $29,718 | $29,743 | $29,823 | $29,826 | $29,863 | $30,242 |
| 7.00% | $25,158 | $28,103 | $28,130 | $28,226 | $28,227 | $28,273 | $28,718 |
| 8.00% | $23,198 | $26,656 | $26,685 | $26,796 | $26,794 | $26,849 | $27,354 |
| 9.00% | $21,398 | $25,354 | $25,384 | $25,509 | $25,504 | $25,569 | $26,128 |
| 10.00% | $19,743 | $24,178 | $24,209 | $24,348 | $24,339 | $24,413 | $25,021 |
| 11.00% | $18,221 | $23,112 | $23,144 | $23,295 | $23,282 | $23,365 | $24,018 |
| 12.00% | $16,819 | $22,144 | $22,175 | $22,337 | $22,320 | $22,412 | $23,104 |
| 13.00% | $15,529 | $21,260 | $21,291 | $21,463 | $21,441 | $21,542 | $22,270 |
| 14.00% | $14,339 | $20,451 | $20,481 | $20,663 | $20,637 | $20,746 | $21,504 |
| 15.00% | $13,242 | $19,709 | $19,737 | $19,928 | $19,897 | $20,015 | $20,800 |
| 16.00% | $12,229 | $19,025 | $19,052 | $19,251 | $19,216 | $19,341 | $20,150 |
| 17.00% | $11,294 | $18,395 | $18,420 | $18,626 | $18,586 | $18,718 | $19,548 |
| 18.00% | $10,431 | $17,811 | $17,834 | $18,048 | $18,003 | $18,142 | $18,990 |
| 19.00% | $9,632 | $17,270 | $17,291 | $17,511 | $17,461 | $17,607 | $18,471 |
| 20.00% | $8,893 | $16,767 | $16,786 | $17,011 | $16,958 | $17,109 | $17,986 |

www.soa.org/files/pdf/rp00_mortalitytables.pdf

[16] The 2001 CSO table and the 2001 VBT table are available from the Academy of Actuaries in Appendix A located at http://www.actuary.org/life/CSO_0702.asp

[17] The 2008 table and report are available from www.actuary.org/pdf/life/tables_march08.pdf

Figure 4. Comparison of Life Settlement Values Starting from Different Mortality Tables Adjusted to have Life Expectancy of 8.5 years




It is worth noting that after information theoretic adjustment, Table 4 shows definite differences between the values obtained using different starting tables, however for this low value ($50,000 face) policy for the most part these differences appear relatively small. For larger policies, the difference in price can be significant. Additionally, according to the Society of Actuaries Life Settlements Survey Task Force (SOA 2010), the median size of the face value of settled policies in some product lines, such as Universal Life Policies with Secondary Guarantees, is over $1,000,000, with some companies reporting an average size for their settled policies of over $3,000,000. The magnitude of the difference between adjusted values by starting table chosen also becomes more pronounced at higher internal rates of return, and Murphy (2006) estimated that the rate of return could be in the range 15-18%. Thus, choice of starting table is important.

It is also worth noting that as expected (and proven) the deterministic method always under prices relative to all of the mortality tables used, even though it also has the same life expectancy. Also it is worth noting that the adjusted DEJD model gives the largest value. Perhaps this later result is due to the DEJD model allowing for both jumps in mortality and in longevity, with unexpected mortality jumps historically occurring more frequently. Since mortality jumps increase returns to the life settlement investor, investors should be willing to pay more to purchase under this model than under models which do not anticipate any potential for such jumps.

## 6 EXTENSIONS AND CONCLUSION

This paper showed that the commonly used deterministic method for pricing life settlements is systematically biased, and that the probabilistic method is superior. The paper then presented an easily implemented method for adjusting a mortality table to exactly reflect information useful for pricing life settlement products using a probabilistic or stochastic mortality methodology in a non-ad-hoc and statistically rigorous manner.

The results of this paper can be extended in several directions. First, the amount of information that can be incorporated into the information theoretic adjustment process can be substantially more than just the life expectancy we used in our illustration. As noted earlier, Forman (2010) gives a life settlement underwriter's report estimating not only the mean but also the median and 85% of the projected life distribution. All of these can be incorporated into the adjustment process using the information theoretic optimization methodology of this paper. Additionally, due to our mathematical programming formulation, inequalities can be input as constraints as well. For example, one may specify that the mortality rates in the adjusted table are monotone; alternatively concavity in the rates at older ages may be specified. Finally smoothness can be imposed if desired. See Brockett (1991)and Brockett and Cox (1984) for guidance on how this might be done. Finally, the information theoretic approach can be applied to mortality rates themselves rather than mortality probabilities if so desired (the mathematics does not depend on the objective function and constraint sets involving probability measures, only nonnegative quantities). Constraints on the adjusted mortality rates may be more easily incorporated in this formulation.

An important additional problem faced by life settlement medical underwriters when attempting to furnish mortality estimates for the life settlement industry is how to incorporate other medical study results on potential infirmities into their life value estimate. Using the information theoretic approach outlined here the relative risk of a particular disease found in the medical literature can be incorporated as a constraint as well. This constraint would specify that the expected number of deaths in the adjusted table is a given multiple (the relative risk) of the number of deaths expected by the table used for comparison purposes in the medical study (which need not be the same table as the one the analyst is using as a starting point for creating an adjusted table for their life settlement

pricing use).

## REFERENCE

Annin, Roger, Tim DeMars, and Scott Morrow (2010) Actuaries and Life Settlements, *Contingencies* Nov/Dec 2010, 30-34.

Baranoff, Etti., Patrick Brockett, and Yehuda Kahane (2009), *Risk Management for Enterprises and Individuals*, Flat World Knowledge, Inc.

Bernstein Research Call (March 4, 2005), Life Insurance Long View - Life Settlements Need Not Be Unsettling

Black, F. (1972), Capital market equilibrium with restricted borrowing, *Journal of Business* 45, 444–454.

Bowers, Newton L., Jr., Hans U Gerber, James C. Hickman, Donald A. Jones, and Cecil J. Nesbitt (1986) *Actuarial Mathematics*, Society of Actuaries, Itasca, Il.

Brockett, Patrick L. (1991) Information Theoretic Approach to Actuarial Science: A Unification and Extension of Relevant Theory and Application, *Transactions of the Society of Actuaries*, Vol. 43, 73-135.

Brockett, Patrick L., Charnes, A. and Cooper, William W. (1980). MDI Estimation via Unconstrained Convex Programming. *Comm. Statist. B* Vol. 9(3) 223-234.

Brockett, Patrick L. and Samuel H. Cox (1984) Statistical Adjustment of Mortality Tables to Reflect Known Information, *Transactions of the Society of Actuaries*, Vol. 36, 63-75.

Brockett, Patrick L. and Yun Song (1995) Obtaining a Life Table for Spinal Cord Injury Patients Using Information Theory, *Journal of Actuarial Practice*, Vol. 3, No. 1, 77-91.

Chen, Hua, and Samuel H. Cox (2009) Modeling Mortality With Jumps: Applications to Mortality Securitization, *The Journal of Risk and Insurance* 2009: 727-751

Conning Research, (Oct. 8, 2008), Life settlements: New Challenges to Growth. Available from http://www.conning.com/viewpublications-article.aspx?id=2603&terms=Life settlements: New challenges to growth.

See also http://www.reuters.com/article/2008/10/08/idUS157184+08-Oct-2008+PRN20081008

Couzin-Frankel, Jennifer (2011), A Pitched Battle over Life Span. *Science* 29 July 2011: 549-550.

Cowley, Alex and J. David Cummins. (2005) Securitization of Life Insurance Assets and Liabilities, *The Journal of Risk and Insurance* June 2005: 193-226

Cox, Samuel H., Yijia Lin and Shaun Wang (2006) Multivariate Exponential Tilting and Pricing Implications for Mortality Securitization *The Journal of Risk and Insurance* December 2006: 719-736.

Deng, Yinglu, Patrick L. Brockett and Richard D. MacMinn (2010) Longevity/Mortality Risk Modeling and Securities Pricing, to appear *The Journal of Risk and Insurance.*

Doherty, Neil A. and Hal J. Singer (2003) The Benefits of a Secondary Market For Life Insurance Policies, *Real Property Probate & Trust Journal* Fall 2003: 449-478.

Forman, Brian (2010) Life Settlements, Presentation to the Actuaries Club of the Southwest June 10, 2010, Available from http://www.docstoc.com/docs/74887957/Life-Settlements-Life-Settlement

Insurance Studies Institute. (February 11, 2008). Introduction To Methodologies Used To Price Life Insurance Policies In Life Settlement Transactions. Retrieved October 30 2011, Available from http://www.insurancestudies.org/2008/02/research/introduction-to-methodologies-used-to-price-life-insurance-in-life-settlement-transactions/

Johnson, Malcolm Lewis, Vern L. Bengtson, Peter G. Coleman and Thomas Kirkwood (Eds.). (2005). *The Cambridge Handbook of Age and Ageing*. Cambridge University Press, Cambridge, UK

Kou, S.G., Wang, H. (2004), Option Pricing under a Double Exponential Jump Diffusion Model, *Management Science*, 50(9): 1178-1192.

Kellison, Stephen (1991) *The Theory of Interest, Second Edition*, Irwin Press, Homewood, Il.

Kullback, S. (1959). *Information Theory and Statistics.* Wiley Press, New York.

Lee, R.D., and L.R. Carter, 1992, Modeling and forecasting U.S. mortality, *Journal of the American Statistical Association*, 87: 659-675.

Lewis, Frank D. (1989) Dependents and the Demand for Life, *The American Economic Review* June 1989: 452-467

Murphy, Michael (December 27, 2006) Life Settlements: A High-Return Emerging Investment Category *Ezine@rticles*, Available from http://EzineArticles.com/?expert=Michael_Murphy

Purushotham, Marianne (2001), U.S. Individual Life Persistency Study *Life Insurance Marketing Research Association* (LIMRA International Inc.).

Quinn, Sarah. (2008) The Transformation of Morals in Markets: Death, Benefits, and the Exchange of Life Insurance Policies, *The American Journal of Sociology* November 2008: 738-780

Ramezani, C.A. and Y. Zeng, (2007) Maximum likelihood estimation of the double exponential jump-diffusion process, *Annals of Finance*, 3:487-507.

Roll, Richard (1977), A critique of the asset pricing theory's tests Part I: On past and potential testability of the theory, *Journal of Financial Economics* **4** (2): 129–176,

Rosenfeld, Sam (2009) Life Settlements: Signposts to a Principal Asset Class, Wharton Financial Institution Centre Working Paper #09-30

Scotti, Veronica and Dirk Effenberger, (2007) Annuities: Private Solution to Longevity Risk*, Swiss Re Sigma*, No. 3.

SOA, (2010) Report of the Society of Actuaries Life Settlements Survey Subcommittee (January 2010) *Society of Actuaries* , Available from www.soa.org/files/pdf/research-2010-01-life-settlements-survey.pdf - 2010-01-28

Stone, Charles A. and Anne Zissu (2006) Securitization of Senior Life Settlements: Managing Extension Risk, *The Journal of Derivatives* Spring 2006: 66-72.

Vaupel, James W. (2011) Longer and longer lives: Some remarkable new research findings, Presentation at the Longevity Risk Symposium 7, Frankfurt, 8 September 2011, Available from http://longevity-risk.org/Pres_Vaupel.pdf

Weber, Richard M., and Christopher Hause, C. (2008) Life Insurance as an Asset Class: A Value-added Component of an Asset Allocation. *Ethical Edge Insurance Solutions, LLC*. Retrieved October 30, 2011, Available from http://serp.freecause.com/?rm=y_click&tid=62125&uid=69803043&cuid=&url=http%3A%2F%2Fethicaledgeconsulting.com%2Fmedia%2Fservices%2FlfAssetClass%2FLife%2520Insurance%2520as%2520an%2520Asset%2520Class%2520-%2520Weber%2520and%2520Hause.pdf&ys=c5324e9e0f1370b4660e600d5245482fdd332f05

Zollars, Dan, Scott Grossfield and Deborah Day (2003) The Art of the Deal: Pricing Life Settlements, *Contingencies*, Jan/Feb 2003 34-38.

# Dealing with the Challenges of Suddenly Regional Political Risk and the Global Financial Crisis ---The Strategic Reflection on Risk Prevention of Chinese Export Credit Insurance

The Project Team of Yunnan Insurance Association

.

Kunming Yunnan 650021

**Abstract:** In the historical process of human society, people usually take “three risk management measures” to respond to the suddenly serious natural disasters or accidents, such as pre-disaster warning prevention, rescue and relief in the disaster, post-disaster compensation and reconstruction. For the function of "risk concentration" and "risk spreading" of insurance industry, it is duty--bound responsibility. However, we are often in the "stunned" and even in the "helpless” dilemma, when the unexpected political risk and heavy disaster happens. This series of significant new situations and new problems, not only relates to the interests of personal security and property of our country’s import and export enterprises, but also relates to the problems of overall situation of our national economic interest security and social stability. It is the commonly faced challenge and pressure for policy insurance of our credit export and domestically commercial insurance. Therefore, the author thinks: it is necessary to put forward question and countermeasure about the Dilemma that four responses should be applied when current domestic and foreign insurance industry faces suddenly serious big events. (The first one is how to deal with the important political risks, such as sudden change in the current international situation, regional national political unrest, wars and military conflict? The second one is how to deal with the deep influence and negative effect produced by the post financial crisis. Reflection and countermeasures of global economic growth face a new turning point, the new pressures and challenges are faced by the domestically and internationally commercial and policy insurance industry. The third one is how to deal with compensation and reconstruction after global extraordinary natural disaster; How to deal with the serious consequences radiated by” domino effect” caused by these losses. The four one is how to construct the big channel and strategic construction that is to make Yunnan province become a “bridgehead” facing southwest countries , to build opening frontier" window" and" position" of China facing to South Asia, Southeast Asia and of the"10 plus 3","9 plus2"," Pan-Pearl River Delta " and other domestic and foreign）. This is the breakthrough and concerning point that the article will explore; it is also the innovation of the paper.

**Key words:** Four responses of crises; The Strategic Policy of Chinese Credit Insurance; Risk management; Service product innovatio

## Ⅰ动荡战乱的阿拉伯世界引发国家政治与经济重大危机的反思

从地理位置上看，由北非横跨西亚、中东，一直延伸到波斯湾的阿拉伯世界，由长短不齐的直线条法定裁定为 22 个国家，被称其为“居于亚欧大陆和非洲大陆腹心地的新月带”。盛产全球最紧缺的资源、最触动世界经济神经和敏感点的“石油黑金”。享受着“国宝为己”、“坐地为富”的独特资源优势和天赐财富。但令人难以料想和预测：自一战后阿拉伯国家分别独立以来，震惊全球的最大

一次政治动乱、战争和军事冲突的危机，会始发于最为平静和安稳的北非。

2010 年 12 月 17 日，26 岁大学毕业找不到工作沦为街头水果小贩的突尼斯青年瓦吉吉，遭到城管人员打耳光的欺辱后，羞愤交加，身浇汽油在警察局门口点火自焚，继而引发了震惊全球的阿拉伯世界，10 多个自认为是同一个民族、同一个信仰、同一个历史背景的伊斯兰国家相继爆发了国家动荡的政治风险，至今越演越烈，国家安全形势继续恶化。这个曾被称之为非洲“最稳定的国家”的突尼斯 (2007 年被评为“非洲最具竞争力的国家”，2010 年联合国人文发展指标中突尼斯排列全球 81 位，还高于 89 位的中国)。突尼斯国家动荡的冲击波很快点燃了中东、东亚、非洲等国家和地区的政治动乱、战争与军事冲突、国家动荡不安的混乱局面。导致突尼斯总统本•阿里被迫放弃经营 23 年的国家基业出逃；在位 30 年的埃及总统穆巴拉克下台，出庭受审；叙利亚、也门大规模反政府暴乱的流血冲突不断升级、利比亚国家与北约多国联军和反政府军全面战争爆发，铁腕执政 41 年的卡扎非被置于死地，国度沦陷；整个阿拉伯世界的 10 多个国家的政治、经济、国家安全问题几乎处于瘫痪和无法控制的状态。这对于我国造成的对外投资与贸易的负面影响和巨大损失是非常严重的。

本课题研究在此且不论阿拉伯国家动荡原由的众说纷纭之评议，仅就其对我国海外企业造成的经济损失和所处困境作简要分析，反思其教训，探究出对策，能有助于今后和未来应对如此政治风险作出防范和化解之策，尽最大可能避免和减少我方损失，确保我国经济利益安全为重。

## A 中国在全球的投资状况分析

改革开放以来我国的对外贸易日益增强，尤其是近几年来随着中国经济的快速增长，国际知名度和信誉度的大幅提升，中国企业“走出国门”的机遇越来越多，获得双赢的利益倍显，但风险的机率也随之伴生。这确实为一把“双刃剑”，如何应对机遇与挑战，压力与动力的新形势下的新情况、新问题，特别是突发重特大政治危机事件的应变之策和能力，给国家与企业带来了始料不及的难题与灾难性的重大经济损失，这也是不能迴避的客观现实。从下表资料中可以得出如下分析：

**表一 ：货币单位：美元(亿)**

| 中国在全球投资统计 | | | | | |
|---|---|---|---|---|---|
| 欧洲 | | | | | |
| 国家 | 英国 | 瑞士 | 希腊 | 其他 | 小计 |
| 数额 | 85 | 72 | 50 | 141 | 348 |
| 东亚 | | | | | |
| 国家 | 印度尼西亚 | 新加坡 | 越南 | 其他 | 小计 |
| 数额 | 98 | 70 | 64 | 84 | 316 |
| 西亚 | | | | | |
| 国家 | 伊朗 | 哈萨克斯坦 | 俄罗斯 | 其他 | 小计 |
| 数额 | 151 | 72 | 67 | 162 | 452 |
| 西半球（除美国） | | | | | |
| 国家 | 巴西 | 加拿大 | 委内瑞拉 | 其他 | 小计 |
| 数额 | 149 | 102 | 89 | 277 | 617 |
| 阿拉伯世界 | | | | | |
| 国家 | 阿尔及利亚 | 沙特阿拉伯 | 伊拉克 | 其他 | 小计 |
| 数额 | 92 | 81 | 43 | 155 | 371 |
| 非洲南撒哈拉地区 | | | | | |
| 国家 | 尼日利亚 | 南非 | 刚果（金） | 其他 | 小计 |
| 数额 | 149 | 154 | 59 | 75 | 437 |
| 其他国家 | | | | | |
| 国家 | 美国 | 澳大利亚 | | | |
| 数额 | 281 | 340 | | | |
| 总计 | | | | | 3162 |

数据来源：heritage 并经作者整理 数据截止 2010 年 12 月

自本世纪初中国开始实施的“走出去”战

略前景广阔，近年来呈加速增长态势。在刚刚过去的 2010 年，中国累计实现非金融类对外直接投资 590 亿美元，对外投资流量再创历史新高。截至 2010 年底，累计中国非金融类对外直接投资 2588 亿美元。中国商务部预计，未来 5 到 10 年中国对外投资可能会超过每年吸收外资的数量（2010 年，中国吸收外资超过千亿美元）[1]。这标志着中国已逐步迈向从商品输出到资本输出的历史进程，与此同时，建立有效海外投资安全保障体系的问题尤为重要和迫切。现阶段，中国国企"走出去"的道路荆棘密布，仍十分艰难，面临凸显而来的社会动荡、国乱民灾、政府变更、汇率莫测、灾害频发、企业投资失策以及经营管理不善等诸多风险，即使是具有丰富国际运营经验的西方跨国公司也如履薄冰，对于尚处国际化运作初级阶段的中国企业而言，其应对难度可想而知。

据国资委、商务部统计：截止 2009 年底，仅中央企业投资设立的境外单位已近 6000 户，境外资产总额超过 40000 亿人民币。仅在利比亚承包的大型项目就有 50 个，涉及工程项目合同金额达 188 亿美元，但获得的保险赔付却不足 4 亿人民币，中资企业在利比亚的项目进展和经营状况受到相当大影响。中东动乱爆发，中方企业直接经济损失就高达 300 亿美元以上。[2] 对此，中国贸易促进委员会、中国国际商会副会长于平先生十分堪忧地表示：当前中国企业在海外被拖欠的账款至少超过 1500 亿美元，并且每年还以 150 亿美元的欠款额在增长。中国这么大一笔资产孤悬海外，带来巨大风险与损失的现实，却让国人始料不及，风险与损失的防范与化解之策更令国人无可奈何！中国对外开放"走出去"的战略决策如何实施？成本与代价如何计算？这更令国人再度反思！这不仅是作为信用保险业务应承担的高风险，而且是应从国家政治与经济安全利益的战略高度上，去关注和研究的重特大风险规避的新情况与新问题。也就是说，这次利比亚等国动荡的大规模政治风险的充分暴露，给我们的沉重教训和警示就在于：中国企业在走出去时，首先要学会保护自己，然后才是克敌制胜。这是中国出口信用保险公司副总经理周纪安 2011 年 5 月"陆家嘴论坛"上表达的"汗颜"与"悔悟"之言。但谁来为"走出国门"的中国企业来"保驾护航"呢？我国国内外的政策性、商业性保险业难道不该为此 "汗颜"与"悔悟"吗？

这说明我国的对外投资企业乃至关系到国家经济利益的重大安全问题在风险防范的保障上还存在制度上的缺失和漏洞，无论在国内外市场激烈竞争的角逐中还缺乏保险补偿后备措施的配套。当今世界各国的风险投资在经济全球化的国际市场博弈中，风险系数是很高的，成本代价是莫测的，投资效益是不确定的。就连发达国家在高科技领域中的试验成功率也仅为 10-20%，而能够应用于实际生产生活中的高科技产品成功率就更低于 5%。可见风险投资是一种非常艰难的创新项目。没有风险投资的后备补偿为配套保障和经济支撑，风险投资项目是不可能得到持续发展的。这就给我国国内商业性保险及政策性出口信用保险业提出了一个新的课题和待开发的新险种项目，即：如何研究和开发投资风险的责任保险、财产保险、人身保险、信用保证保险、综合险等一系列有关的直接或间接的经济损失的新保险产品问题，而并非是停留在某几个单一险种和险别的老险种承保经营业务上。这就必须以科学发展观为指导，下决心、下功夫进行国内国际市场进行充分调研分析，论证试点才能推广应用，以确保我国对外贸易经济和海外企业的利益和可持续性发展。

## B. 中国撤侨行动的利弊反思

冷战后最大规模的 35860 名中国公民及 2100 名外籍人员自 2011 年 2 月 22 日至 3 月 5 日，在中国政府的快速果断、有秩序地组织下安全撤离。这是我国 60 年来最大一次海陆空大撤离行动（不包括近期以来，叙利亚国内冲突进一步升级，已造成 560 多人死亡。我国使馆将采取对在叙利比亚的 1400 名中国公民的又一次撤侨行动）。[3] 中国撤侨行动说明了中国政府对本国公民利益保护的人本之道为世界所赞扬，其国家形象的政治意

义何等重大，而令韩国等国家对本国公民的撤离行动的迟缓和无力之助深感愧疚与无奈。

但中国政府和海外企业对此所付出的经济代价和在国外的外贸损失也是十分巨大的。因为，从中国在海外企业投资的微观经济角度上讲，如果在没有发生重特大政治风险和不可抗力的意外事故的情况下，中国海外企业追求国际市场竞争的经济利益是自身经济效益体现的最佳选择与目的。这是市场经济规律作用与趋势之必然。但上述重特大政治风险的突发性，却决定了中国海外企业撤离行动必须坚守的三条原则是：

首先确要保海外一切工作人员的人身及生命安全。此次撤离利比亚的外国人中，美国 600 人，英国 3500 人，加拿大 1000 人，而中国是 3.6 万人。且不论中国撤离海外人员的成本有多高，仅目前中国在非洲的投资项目已达上千项，工作人员超过 100 万人。在已发生动乱的几个中东北非国家中，中国海外企业至少有 300 亿美元的项目投资业务孤悬海外受损。据统计，在过去的 3 年中，中国与阿沙特阿拉伯的经贸总额都超过千亿美元。中国超过 50%的石油进口来自中东地区，其中沙特阿拉伯约占 18-20%，是中国最大的石油进口国。[4] 中国投入在非洲的企业主要集中在工程、道路、农业等劳动密集型部门，海外人越多，劳动密集型程度越集中，投资越大，风险系数越高；

其次要保护好重要机密文件和合同文本。由于长期以来阿拉伯国家的宗教信仰、文化差异以及上层建筑意识形态的国体和政体不同，与经济全球化、国际市场经济规律不相适应，二者差距甚大。至今的阿拉伯人依然普遍缺乏时间观念、效率观念、守约观念，依法办事的程序不严谨，办事效率不高，致使一些合同项目停留在口头上，滞后甚至是消失在等待与扯皮中。因为阿拉伯人依然顽强地保留着他们那种游牧社会、小农经济的自足生活方式；

最后才能考虑和处置好工程设备及生产生活设施。以致中方企业撤离后的直接与间接经济损失那是“秋后算账”也理不清的“呆坏账”了。事实上，在很大程度与可能上，超过了中国海外企业预期赢利的愿望，成了“倒挂赔本”的买卖。负面影响甚劣的是：中东北非的政治动乱风险还进一步加剧了中方输入性通胀风险的恶化和海外工程款回收以及重建工程的双重代价的损失。正如卡扎菲政府所声称：利比亚的石油财富将在这次战乱中被“燃尽”。

据国家商务部近期的一份《对外投资合作发展报告(2010)》统计：2010 年国在海外 177 个国家和地区对外投资的企业达 1.6 万家，在海外的中国工作及劳务人员 502 万人，海外资产 16000 亿人民币，仅 2009 年在海外承包工程累计签订的合同额达 5603 亿美元，营业额年均增长 30%以上。[5] 随着中国经济发展与国际市场的需求，中国对外贸易和海外投资的规模日趋扩大，发展迅猛。如何保障中国企业、公民的海外财产与人身安全以及国家经济利益问题，已经成为当今新形势下国家应对政治风险、信用风险、经济风险、人身风险、财产风险、责任风险等重大社会风险的重大外事。这就是中国信保当前直接面临的严峻挑战和压力。

从我国的海外投资项目上看：80%以上分布在东南亚和非洲等发展中国家，一旦爆发政治风险、战争与军事行动、恐怖活动、国家动荡等重大社会风险，中国的海外投资企业、国民以及国家的经济利益将成为首当其冲的“受害者”和附属“牺牲品”。而传统的国内信用保险业务中。仅以开展商业性信用和信誉担保业务为主，往往忽视了政治风险、战争、军事行动、恐怖活动、国家动荡等突发性的重大社会风险的承保和风险防范（国内商业性财产保险、人身保险、责任保险、信用保险等业务，都将此列为除外责任，删除不给予承保）。而中信保是不以商业盈利为目的的国家政策性保险，积极开展此项重大政治意义的保险业务，坚持“转方式，调结构”的主线，是应对国际新形势变化、调整保险服务产品结构，优化承保方式，扩大承保规模，开拓国际市场，促进经贸发展，提升国家信誉度，防范和化解突发重大风险的有效对策措施和实现途径。这也是本课题

对中信保发展具有与时俱进研究的战略意义和现实意义。

## Ⅱ 巨灾巨额自然灾害损失惨重，中信保应速启动“理赔绿色通道”，主动、及时提供经济补偿保障，确保中国海外投资企业和外贸出口经济的稳定增长。

近两年来，全球严重的自然灾害频繁发生，损失惨重，影响和制约了经济的复苏。例如：2010 年黑海、乌克兰、哈萨克、中国西部遭受数百年难遇的大旱，俄罗斯西部 1000 万公顷、29%的耕地面积绝收；受暴雨洪水肆虐，巴基斯坦等国农作物一片汪洋；加拿大小麦产量因洪灾减产 36%，创下 2002 年来新低；印度北部的露天粮库，受灾损失 5—10%的谷物；4 月 27 日，美国南部地区 7 个州遭受历史上最严重的一次龙卷风袭击，死亡 350 余人，数千人受伤，大面积房屋及财产损毁。今年以来，非洲大面积遭受近百年一遇之大旱，不少国家“天灾人祸”不断，动乱加灾难，百姓处在不足于生存底线的危机之中，联合国的人道援助也无奈于“杯水车薪”。特别严重的是 2011 年 3 月 11 日，日本发生 9 级特大地震，引发海啸与核泄漏，据日本警察厅 4 月 21 日统计：已造成 14133 人死亡，13346 人失踪，目前仍有 13.2 万人留守避难所，数十万人被迫流离家园。其他受损房屋超过 30 万栋，预计直接损失高达 25 万亿日元（约合 3007 亿美元），占本国全年 GDP 的 3—5%，迫使日本政府可能拟发行 1210 亿美元的“复兴再生债”，用于补充 2011 财年预算的“缺口”和“空壳”。又据日本损害保险协会同日透露：目前已受理赔付案约 12.4 万件，赔款金额达 1859 亿日元（约合人民币 147 亿元），是迄今为止最高的板神大地震赔款（783 亿日元）的两倍之多。但估计全部申请赔案数应达 42.2 万件，目前的赔付率还不到 3 成，预计赔款总额达 4000 亿日元（智库预测将高达 1 万亿日元之多）。[6]

作为世界第二大经济强国的日本，发生“3.11”特大地震损失的辐射效应也影响到世界多国，致使拖欠中国进出口货物和贷款的合同无法执行，影响了对外贸易经济和海外投资的正常发展，这对中国信保又提出严峻的挑战与压力。随着经济全球化和 WTO 的世贸新兴市场的拓展，进出口保险业务的承保比重的提升，巨灾巨额的重大自然灾害损失以及波及面和辐射强度，已不是一个国家和地区为其“受害者”和“牺牲品”，而“多米诺骨牌效应”的“乘数效应”将对经济全球化的世界经济产生“震荡波”的广泛影响。与此同时，承保巨灾巨额损失保险补偿问题，也不可能是一个进出口国家和政策性信用保险所能承担的。对此，如何研究新变化的情况下，政策性保险与国内外其它国家的同类保险以及商业保险共同联合再保险的“分保”问题，这是世界再保险业务的一条成功经验，也并非以“政策性”与“商业性”，“国内”与“国际”之差别和不同的承保模式而“分割”保险危险分散的属性和原则（分业经营与混业经营也只不过是经营手段并非目的而已）。这也是中信保中应十分关注和重点研究的具有超常规发展信用保险创新模式的新课题和应及时解决的重大现实问题。

我国同样处于世界上自然灾害严重的国家之列，据国家民政部统计：全国每年仅各种自然灾害的直接损失高达 2000 亿人民币，约占 GDP 的 6-7%，尤以地震、洪水、暴风暴雨、旱情等重大灾害的巨额经济损失为烈，其人员伤亡更乃全球之最(仅 1976 年唐山 7.8 级大地震，死亡 24 万余人，重伤 16 万余人，为届时全球 13 次特大地震中最悲惨的一页；汶川 9 级特大地震死亡 10 万余人；玉树大地震死亡 6 万余人)。[6] 今年以来，全国旱涝交加，据国家防总统计：迄今全国耕地受旱面致达 7034 万亩。蒙、黔、陇、滇四省旱情数十年或百年难遇，共计 5386 万亩耕地受灾减产或绝产，525 万人和大量畜禽饮水困难。云南自 2011 年近百年罕见旱情以来，今年旱情面积和程度又超过前两年。[7] 然而，我国现阶段的国内商业性保险经营业务却由于种种原由，都把国情国难的最严重自然灾害如地震、洪水损失拒之财产保险责任之外，从基本险中删除，为不保不赔之列。

这势必给中国企业“走出去”的对外贸易造成国内重灾损失不能获得补偿的“第一道门坎”障碍。从而直接影响到政策性出口信用保险“第二道门坎”的输出反馈效能。对此，本课题研究认为：对于巨灾巨额的重特大灾害风险的损失，无论是国内国外保险业，无论是商业性还是政策性经营，无论是理论研究还是实践运作，都没有任何理由、更不能够“自圆其说”地为其辩解和不作为。因为“无险不保，无险不赔”、“国际再保险业”早已成为当今现代保险业拓展服务、竞争市场、创新品牌、联姻双赢、个性舒展、特色亮点的彰显优势，是市场经济条件下及其规律作用的产物。这是不以人的意识而转移的客观现实，谁领先改革、开拓和创新一步，谁就成功受益在望。此问题的提出，值得高度关注与行之。

## Ⅲ 后金融危机震荡波辐射负效应的反思，全球经济增长面临新的拐点，国内外商业性与政策性保险业再次面临新的压力和挑战

备受全球关注的美国债务违约警报虽得以暂缓解除，但美国长期债务危机状况依然严峻与恶化。据美国财政部数据显示：美国联邦政府至2011年5月16日已突破14.29亿美元的法定举债上限，如果国会不能在8月2日前提高债务上限，美国政府将面临违约风险，后果不堪设想。又据国际货币基金组织最新披露：美国联邦公债已占GDP的99%，明年预计会上升到103%，财政状况将进一步恶化。美国债务专家彼得森、世界经济研究资深研究员卡门.莱因哈特也指出：当一国债务总额超过国内GDP比例90%后，该国经济增长将迟滞，预计直到2016年，美国的经济增速都将低于3%。这次美国两党虽就债务上限问题达成妥协协议，但却要求美国联邦政府在10年削减10000亿美元开支，这将使美国的年度开支降至半个多世纪以来的最低水平。[8] 这是给奥巴马政府又一击的当头捧，也是给奥巴马总统今年8月4日迎来50岁生日的“夹心饼干”之礼品。

美国政府长期以来的过渡举债以及削减政府的开支是一把“双刃剑”。一方面它不但严重影响了美国的经济复苏(估计三季度美国GDP增速下降10%，全年拉低2%)；另一方面，它对全球经济会产生“蝴蝶效应”、“鲶魚效应”、“短板效应”，甚至是“多米诺骨牌效应”的辐射与震荡波的严重负面影响和制约。不少业内专家分析指出：此举将长期而惯性地推高全球通胀，进而影响到中国的出口增速，GDP增速也将下滑约2%。毕竟“瘦死的骆驼比马强”,美国经济在当今仍处于世界经济“火车头”的超级大国之位，被称为“美国打喷嚏，世界患感冒”的病毒传染。

实际上，有分析人士认为：美国国会两党已就提高债务上限问题达成初步协议。美国的举债额度将以两阶段上调约 24000 亿美元，只够维系 8 到 12 个月的需求，而减少 24000 亿美元的财政赤字则需要 10 年的时间。一年的借债十年只能还不到一半，这十年期间估计还要不断的调高债务上限，否则又要面临违约的风险。从达成协议来看，无疑是美国两党做给世界看的游戏，归根结底，还是要全球为他们债务买单。说白了，这是继美国 2008 年以来的金融危机带给全球金融风险，经济增长滞留与低迷的负面影响与灾难后的再一次危机风暴的到来。它将给全球经济输入通胀性压力与恶化的后果以及直接影响到世界各国对外经济贸易的增长，已是无可置疑了。

8月初，评级机构标准普尔历史性地下调美国信用评级，美债危机席卷全球金融市场，据经济参考报报道，美债安危、美元稳定性等经济话题将是这次拜登访华的一大焦点。拜登将就人民币汇率问题向中国施压，正如美国财政部国际事务次长布雷纳德所称：中国的人民币仍被低估，美对人民币升值的速度不太满意。

根据美国财政部15日公布的最新数据，继今年4月和5月连续两月增持后，中国在6月继续增持57亿美债，现持有美债总额达11655亿美元，目前仍是美国最大的债主，相当于每个中国人每人借给世界上最富有的美利坚共和国一千美金，这还是低息贷款，风

险多大，难以预测。据美国财政部公布的数据显示：目前美国143000亿美元的公共债务中，美国国内持有98000亿，占68.6%%，国外持有占比为31.5，其中：中国占8.1，日本占6.4，其他为50多个国家持有。然而，面对美债危机的更严峻的事实是，白宫官方一再表明美拒绝对华承诺“美债不违约”之表态。那么，业内专家的分析认为，如果按美债最低下跌20%计算，中国将损失2304亿美元，相当于中国人均亏损177美元(折合人民币1140元)。[9] 正如业内经济学家所评论：欠债的是大爷，要钱的是孙子。中国和美国是否上演一场“现代黄世仁讨债”？

毕竟，经历过数百年资本主义市场经济的锤炼与培育的美超级大国，其霸主与奸商之技，已是“滚瓜烂熟”、“胸有成竹”，借债的美国却负债不慌，身居“高处能胜寒”，而债主国却神恐神慌，因为美国可通过种种不择手段之计，迫使美元贬值和人民币等升值，可大大缩水其债务之重负，真可谓“丢卒保车”。正如国际大炒家索罗斯自己所总结并遵循的一条“金融学反射原理”，即：“我挣钱比花钱来得更容易”。由于美元的强势地位，导致了世界各国不断接受美国的负债，美国也就心安理得不断的借债，绑架世界各国，掠夺世界财富。借债是最简单易行的掠夺，而且会通过不断的贬值美元来达到低成本的融资目的。但由于美元储币地位使得中国不得不持有美元债务，中国作为最大的债权国，而且还要不断承受美国借债的需求。这就是超级大国投鼠忌器的“美元陷阱”，让中国受之于无奈之境地。

应特别关注的是：截止2011年8月日，我国人民币再次突破6.3925对美元汇率中间价报关的不断升值趋势，连续5个交易日创新高纪录。据中国外汇交易中心数据显示：去年末，人民币对美元的汇价逼近6.60，今年以来接连突破6.60、6.3925、6.395几个重要关口，呈直线型走势。人民币年内升值幅度已超过3.5%，超乎市场预期[10]。业内人士分析：从外部环境上看，近期受美债评级调降影响，国际金融及证券市场剧烈动荡，全球经济再现陷衰退拐点，投资者信心下降。加之美联储第三轮量化宽松货币政策（OE3）等蓄意调控的推手，促使人民币升值偏高。有市民对自己10万美元结汇折算（自去年底6.229与今年8月16止的汇价），居然损失了2300元人民币。如果按预测至本年内人民币升值5-6%，那么结汇折算下来大吃一惊的“哑巴亏”何止一人之损呢？这还未对CPI 等持续上涨的市场消费物价趋势对企业资产和个人收益缩水的实际影响的测算在内。有分析认为：若手中的外汇资产收率要达10%以上，才能保本不缩水。可见，美元贬值人民币升值，将给中国出口企业和对外投资与贸易带来的负面效应甚至是灾难性的经济损失是不可估量的。尤其是出口企业成本增高、利润损失和融资困难问题倍显突出。据国家商务部披露：2010年我国出口企业平均利润为1.47%已低于国内工业企业平均利润，今年1-2月为1.44%，更加剧外贸困境的现实。为此，如何应对“后金融危机”挑战与压力，又再次成为我国进出口保险业面临的新动态、新课题、新情况和新问题。国内企业大河之水不满，出口贸易之流必断，无“g 原始资本”，何来“g\效益增殖”？应对后金融危机风险，迎难而上，主动请战，打开局面，敢于先争的勇气和胆识，有中国政府坚决的决心和信心，良好的信用和信誉，高度的责任感和崛起的经济支撑，中信保一定能够为“桥头堡”建设当好“排头兵”。

据美国一个民间“债务钟”的网站披露：美国社会面临的总债务约 550000 亿美元，也就是说，平均每个美国人负债 18 万美元，每个美国家庭负债额达到 66 万美元。然而，美国国债中，80% 就是美国的百姓和企业。既然如此，中国的企业与百姓为何不能成为自己国家的债主？为何不能享受自己国家多给予一点高额债券的回报利益？为何不赋予国内中央大型垄断与营利企业和公司（包括国内商业性与政策性银行业及保险业等），也可代表国家信誉发行比国债更有收益率（如复利计息可使债权人保值增值，规避通胀损失）的行业债券，惠及自己的企业与民众，这是双赢的大好事。同时，也大大减持和转移了中国将三分之一以上的外汇储备放在美

债“同一个篮子”中的风险，让国家自己的企业和民众的口袋里装有风险储备的基金，才能底气充益，走出国门也有壮胆和防灾防损的自救补偿能力，何而不乐哉！这也是保险投融资应对国际政治经济风云复杂变化应研究和开发的投资新险种之一。

## Ⅳ 政策性保险服务产品的结构调整和创新，塑造中国人的信用风范，是应对“后金融危机”挑战与压力的有效实现途径，是夯实和促进云南头堡建设的基础和创新动力

尽管国际形式动荡变化，险象环生，中国作为一个发展中国家的大国，历来是以“讲信用、负责任”而立国。中信保就是为国争光的楷模与垂范。就在 2011 年 3 月 17 日联合国安理会通过在利比亚设立禁飞区的决定后第二天，3 月 18 日中信保就做出对中国葛洲坝集团股份有限公司和中国建材集团进出口公司分别赔款达 1.62 亿和 4815 万元人民币的“绿色通道”快速理赔之举，赶在 3 月 19 日美英法多国联军对利比亚进行军事打击之前，确保了中国大型骨干企业在海外投资的经济利益，这在世界保险史上是极为罕见的先例，这就是中国人的信用风范和傲骨精神，也是中信保服务的信誉内核与职能体现。[11] 中信保只有在这个核心内涵服务的基础上才能“做大做强”，胸怀祖国，走向世界。这是中信保研究应从国家利益高度突破单一经济研究范畴，更具有政治意义所在。

中信保要紧紧抓住机遇，围绕国家新一轮西部大开发和“两强一堡”重大战略和决策这个中心服务。要千方百计创新信用保险产品，调整保险服务结构，提升企业高附加值产品、高端科技含量产品的出口；用好用活中信保与云南省人民政府2010年联合签署《服务云南桥头堡专项合作协议》的具体实施政策；积极推进“瑞丽重点开发实验建设”和“滇中经济圈”建设；打造云南与东盟“10+1”，云南与泛珠三角“9+2”的对内对外开放“桥头堡”前沿阵地；特别是国务院日前刚正式批准的“成渝经济区区域规划”是继“长三角”、“珠三角”、“环上渤海”之后，我国经济的又一重要增长和加速推进新一轮西部大开放战略，实现西南区域开放的重要桥头堡建设。这些新机遇和新市场给中信保创造了良好的发展条件和未来拓展的空间。此外，中信保还可利用好国家大型成套设备出口融资保险专项“421”政策，大力支持我省中小型企业、民营企业和特色农产品、农副产品的出口（如：牛肝菌、天麻、三七、虫草、松茸、茶叶、螺旋藻、香料等）；创新“保单融资”、“订单融资”、“租赁融资”、“保理保单”、“E 计划保单”等多种新型信用保险服务产品，彻底改变“有单不敢接、有单接不了、接单赔不好”的被动服务局面，敢于“接风险、抢订单”，“走出去、抢市场”。如何应对当今国际金融后危机时期的深层次矛盾冲击和负面影响的经济损失；如何应对当今中东、非洲等国突发地缘政治动荡、战争与军事冲突，恐怖势力复活等政治风险损失；如何应对当今重特大自然灾害和巨额损失；如何应对这些损失造成的“多米诺骨牌效应”的辐射影响和损失；从如何促进我国外贸经济增长，维护和保障国家及企业的经济利益；从如何构建云南“桥头堡”对外开放的“窗口”和“平台”，积极支持中国——东盟“10+1”自由贸易建设，开发澜沧江——湄公河次区域经济，打造泛珠三角“9+2”前沿连接点上以及实施国家新一轮西部大开发战略，富民兴滇等现实而重大的问题入手，这些国际国内新形势下，突发的新情况、新问题、这是中信保所面临的与时俱进的重大机遇与挑战，应及时启动的应急风险机制，应主动迅速出台创新信用保险产品、调整服务结构与对象，预测和规避突发重大风险的损失，开辟的新险种、调整服务结构与对象预测和规避突发重大风险的损失，开辟的新险种、新产品和新服务内容，应开展“全天候”风险实时跟踪系统，应快速启动“理赔绿色通道”等等，以改变传统单一的等待“客户报案制”，等待“上级文件批复制”以及片面强调承保出口信用业务，面忽视进口信用保险的保守服务方式。要为云南“桥头堡”建设保驾护航，当好“排头兵”和“领军”

的前沿指战员。这不仅是中信保应研究解决的重难点问题，而且也是中信保与时俱进、创新服务模式、拓展服务平台的有效实现途径。这是应对后金融危机风险，迎难而上，主动请战，打开局面，敢于先争的勇气和胆识，有中国政府坚决的决心和信心，良好的信用和信誉，高度的责任感和崛起的经济支撑，中信保一定能够为“桥头堡”建设当好“排头兵”。 这是本课题研究所关注政策性信用保险公司自身不仅应掌握和应用好现行一系列政策法规的大政方针的执行力问题，而且更应有承担或提出对其修改完善和创新发展制度建设的责任和义务的政策法规性、前瞻性研究问题。建议在“两会”的提案和议案中积极献计献策，特别要充分发挥和出台运用好地方性政策法规为区域性经济社会发展服务，是中信保践行科学发展观的时代特征体现与服务对象的内容结构调整，以及风险管理的职能转换与科学定位问题。也是本课题研究所关注和提出的重要问题。

## Ⅴ 构筑国内外保险服务平台不仅是云南桥头堡实施大前沿和大通道的经济大战略，而且是维护国家安全利益和国家主权的政治大战略

2009 年 7 月，胡锦涛总书记在云南考察工作时提出把云南建设成为我国面向西南开放的重要桥头堡的战略，桥头堡建设成为推动云南经济社会又好又快发展、实现新的历史起点上跨越发展的重要突破口。“桥是大通道，头是大前沿，堡是大基地”。云南桥头堡建设的内涵是“通道、基地、平台和窗口”，就是要把云南全力打造成我国向西南开放的国际通道、产业基地、合作平台和文化交流的窗口。有利于深入落实‘与邻为善、以邻为伴’，‘睦邻、安邻、富邻’方针，加快云南对外开放步伐，切实增强云南在全国对外开放格局中的地位和作用。作为聚焦政治、经济、文化一体的省会城市昆明，更要建设成为中国面向西南开放的国际化门户和桥头堡城市。

我国面向西南开放的区域，主要是以东南亚、南亚为重点，面向印度洋沿岸，延伸至西亚及非洲东部的广大区域，涵盖 50 多个国家近 30 亿人口。这一区域有丰富的石油、天然气等重要矿产和农林渔资源，市场广阔，潜力巨大。云南内连西藏、四川、贵州、广西，外接缅甸、老挝、越南，有 4061 公里的边境线，25 个边境县市，16 个跨境民族，与东南亚、南亚国家地缘相邻、民族相亲、文化相通。把云南建设成为我国面向西南开放的桥头堡，一方面可以打通我国与东南亚、南亚国家的经济文化交流通道，促进中国—东盟自由贸易区建设，拓宽我国特别是西部地区发展的外部空间，把沿边开放提高到一个新的层次和水平。另一方面，通过桥头堡建设，可以充分展示我国维护世界和平、促进共同发展的良好形象，对贯彻落实中央“与邻为善、以邻为伴”的外交方针和“睦邻、安邻、富邻”的外交政策，维护边疆稳定和国家安全，将起到十分重要的作用。[12]

出口信用保险是我国唯一不以盈利目的，开展对外贸易和投资等信用业务的政策性保险。中国出口信用保险公司（以下简称中信保）是由国家财政预算安排资本金，是与国际 WTO 贸易接轨，积极配合国家外交、外贸、产业、财政、金融等政策，通过政策性出口信用保险经济手段，支持国内货物、技术以及海外投资、工程承包等项目出口，为其提供快捷、完善的风险管理、经济补偿、融资促进、信息服务等服务平台。根据《中华人民共和国对外促进法》第五十三条规定：“国家通过进出口信供、出口信用保险、出口退税及其他促进对外贸易的方式，发展对外贸易”。与此同时，国务院、商务部等部委以及云南省委、省政府也相继发文和出台政策对出口信用保险业务给予了全方位的政策指导与扶持，并相应提出了更高、更具体的规定和要求。特别是如何应对金融危机的各种风险；如何应对当前国际形势新变化突发的种种重大政治风险如何应对全球性重特大自然灾害连锁负效应的损失补偿；如何构建我省“桥头堡”建设，打造前沿开放的“窗口”和“阵地”；等等出现的这一系列新情况和新问题，是中信保所面临的挑战，机遇与

压力并存，与时俱进、科学发展是中信保应实施战略决策 。

这里，应特别强调指出的是：构筑云南桥头堡实施大前沿和大通道的经济大战略，不仅是国家“十二五”规划大战略，从历史与现实以及未来的长远战略来看，桥头堡战略更是维护国家安全利益和国家主权的政治大战略 。当今，我国与周边一些国家和地区的国际形势正处于十分复杂而尖锐的矛盾冲突中，甚至处于军事干涉与国家主权之争的严峻对峙状况，而挑起事态的菲律宾、日本、越南等国家，正是在美国涉及亚太区域利益扩张的双重合谋之下进行的。

南沙群岛则是其中分布范围最广、岛礁数量最多的一组大群岛，国际习惯称其为“斯普拉特利群岛”。南海问题的焦点就是最南端的南沙群岛，南沙有 500 多个岛礁，中国只控制其中 4 个，越南占了 29 个，菲律宾、马来西亚、文莱各占了三个以上。中国在南海没有一口油井，而其他国家却有一千多口，每年开采石油 5000-1 亿吨。越南仅 2006 年至少从南沙群岛开采了 1200 万吨油汽。[13] 南海为什么最终成为“问题”？还是归于经济利益驱动的结果。经初步估计，南海的石油地质储量在 230 亿-300 亿吨之间，属于世界四大海洋油气聚集中心之一，有“第二波斯湾”之称。对此，菲律宾总统发言人居然在今年 5 月 4 日宣称，菲律宾正式将黄岩岛称为“帕纳塔格礁（Panatag Shoal）”；钓鱼诸岛（日方称“尖阁列岛”），位于台湾省东北，距基隆港约 190 公里，距日本冲绳岛西南约 420 公里。钓鱼诸岛总面积约 5 平方公里，岛屿周围的海域面积约 17 万平方公里，相当于五个台湾本岛面积。日本也把“钓鱼岛”划归本国，并派军守护。日本东京都知事石原慎太郎，声称：东京政府决定从私人手中购买钓鱼岛，他表示此计划已经获得钓鱼岛“土地拥有者”的同意。[14] 目前南海形势非常严峻，维护我国国家主权与国家经济利益和人民生命财产安全的头等大事已迫在眉目。对此，作为国内外保险业履行对危机管理的风险职能来说，应责无旁贷，如何应对如此复杂而艰巨的国际政治、经济和社会的突发重大风险，这已不是中信保一家能够“单挑”之为，更不是“照本宣科”，按照以往保险业经营中把战争、军事行动与冲突以及因此而涉及到军人和国民的人身保险，意外伤害等等，均列入“除外责任”不予承保和赔付的条款之外。应重新设计和出台新险种、新条款、新的承保与理赔办法或特约承保高危突发风险的责任损失，以填补现行国内外政策性或商业性保险业务经营中的缺漏与不足问题。但无论如何开发何种保险新险种和新产品，无论如何采取何种方式承保，这已不是单方面只算自身经济账的问题，而是如何为国家经济利益安全乃致国家主权以及人民生命财产的安危，而履行保险业保驾护航之职责和功能。否则“临危不见”、“见死不救”何为“保险”之称谓。

据中央新闻媒体报道：截至 2011 年底，中国境外企业已超过 1.8 万家，人数超过 120 万。2011 年中国对外劳务合作派出各类劳务人员 45.2 万人。截至 11 月底，我对外劳务合作业务累计派出各类劳务人员 583 万人。另据不完全统计，2007 年以来，中国工人海外被绑架的事件就有 10 多起。[15] 湄公河（Mekong River），干流全长 4880 公里，是亚洲最重要的跨国水系，世界第六大河流；澜沧江-湄公河是一条流经中国、缅甸、老挝、泰国、柬埔寨、越南 6 国的国际河流，2001 年，中国，缅甸，泰国，老挝共同签署了通航协议以后，中国船员在此却遭遇绑架和被劫杀事件。2011 年１０月 5 日，中国云南“华平号”和“玉兴 8 号”两艘货船在湄公河水域遭不明身份武装人员劫持和袭击。13 名中国船员遇难。[16] 尤其是中国渔民祖祖辈辈都在自己国土海域黄岩岛打渔的渔民，却在当今被菲律宾出动军舰威胁，人民生命财产难保，还谈何谓“走出国门”对外贸易？还谈何保险为之“保驾护航”之职能？

作为国家职能部门的安全防范与经济保障不到位或存在制度设计、对策缺陷等问题，若不及时处理与解决，势必影响到整个国家经济运行和国家安全利益的大局。据海关统计，2011 年 1-11 月，我国进出口 33096.2 亿美元，同比增长 23.6%；其中出口 17240.1

亿美元，增长 21.1%；进口 15856.1 亿美元，增长 26.4%；顺差 1384 亿美元，下降 18.2%。商务部新闻发言人沈丹阳披露：2011 年 11 月末在外各类劳务人员 82.2 万人，较去年同期减少 1.7 万人。截至 11 月底，我国对外劳务合作业务累计派出各类劳务人员 583 万人。面临当前严峻的国际形势，我国对外劳务合作人员还可能有锐减的趋势。[17] 与此同时，2012 年 2 月我国外贸逆差 315 亿美元，进口增速均为出口增速的两倍有余，创近十年最大单月逆差。国家外汇管理局公布的 2011 年第四季度及全年我国国际收支平衡表初步数据显示，去年四季度，我国资本和金融项目呈现 474 亿美元的逆差，这是自 2008 年下半年以来，三年来我国首次出现资本项目的逆差。2011 年 12 月我国银行代客结售汇逆差为 153 亿美元，这也是该数据连续第二个月出现逆差。对此，国家外汇局发出警示：要采取有效措施防范异常外汇资金流动风险。[18] 这就是突发性国际政治、经济风险所带来的“多米诺骨牌效应”、“鲶魚效应”的深层次负面影响，是我们可能始料不及的。但“亡羊补牢、未未晚矣”，当我们大梦初醒时，补救还是来得及减少此风险损失的，关键在于我们是否采取了有效措施和行动了没有。这就是本课题研究再次给我国的政府各职能部门和经济保障部门提出的警示问题。诚然，应对如此突发性特重大危机与风险的财产损失与人身意外伤害的经济补偿或给付是一项巨灾巨额的高额赔付（特别是战争与军事行动以及突发区域牲政治风险与国家动乱所造成的直接与间接损失巨大）。从保险自身经营能力与效益来看，现阶段实施的保额与费率的拟定与计算，显然不在其内，但这不等于不能特约承保，不能国内外分保，不能集国家、政府、全社会多种渠道、多项功能、多种选择之力而为之。此“分散风险”的应用性、技术性操作，可能不会比卫星上天，飞船登月难吧！说到底，还是思想解放与大局意识不到位，桥头堡大战略未实施，与时俱进与科学发展未践行。

## Ⅵ 几点重要警示与对策建议

俗云：“兵马未动，粮草先行”、“晴带雨伞，饱带干粮”。马克思曾在 1875 年论著的《哥达纲领批判》中指出：“用来应付不幸事故、自然灾害等的后备基金或保险基金”[19] 。是社会总产品分配中必须建立社会后备基金的一项重要扣除。是人类防范和化解风险损失的上策之一。对此，要促进我国对外贸易经济发展和国家经济利益的安全，确保我国企业“走出国门”，打造我省“桥头堡”建设的内外部环境与平台，除上述论证中所提出采取的一些纵向对策措施外，还应特别关注以下几方面的横向警示与举措：

### A 法律保驾是我国企业“走出国门”的风险护航保障。

早在 2006 年，中国商务部就向国内企业预警：一些进入非洲的企业不注重国际市场调研，也未向法律部门及中方驻外机构咨询，盲目进入，指望淘金，结果“赔了夫人又折兵”，损失惨重。例如：温州商企自 2004 年在利比亚筹办的国际贸易中心，至今未能如期开业，还遭遇种种意外事件，损失 100 多万美元，教训惨痛。

实际上，在利比亚用当地工人的人力成本较高，且工作效率也十分低下，因为该国人均 GDP 大大高于中国 5-6 倍。有传言，中国一个工程建筑公司招用了 1000 名当地工，干完一个月发工资后，第二天只来了不到 300 人上班。因为当地人信仰宗教，周末不上加，并拒绝加班，还看不起发展中国家来的人，似乎他们中的不少人也已习惯了原来欧洲殖民历史背景下的生活习惯。中国已向海外输出 500-600 多万的劳务人员，似乎在抢他们的职业与饭碗，因为当地人实在没有也不可能像中国劳务人员那样吃苦耐劳，忘我奋斗之精神。

“开拓东南亚、南亚区域性国际市场，不能再慢人一步，这一次我们要早醒早起，抢占涉外法律服务第一高地”。这是云南省东南亚、南亚经贸合作发展联合会 2011 年 8 月 9 日为云南建耀律师事务所授牌，宣布成立作为国内首家从事区域性涉外法律服务的

专门机构和中心平台，为我省企业“走出去”提供保驾护航的法律保障。目前，我省已有 42 家企业到东南亚、南亚投资和开发项目，不少省内外企业正跃跃欲试也准备借道顺势而行。然而，由于各国国情实际不同，法律制定与适用性不同，易造成不熟悉他国法律而导致“吃大亏”的不应有损失。因此，该涉外法律服务中心就是整合国内外法律资源，为我省东南亚、南亚经贸合作发展联合会会员企业及国内外涉外投资企业全面提供专业涉外法律服务。例如：阿诗玛文化产业投资集团有限公司在泰国投资 100 亿人民币开发建设《泰中国际精品区域》的项目，就是得该法律服务中心提供的《法律意见书》的前后期咨询服务，详细了解并掌握了泰国的政策法律环境和投资运作法律程序等一系列的法律关系，确保了百万投资项目的有序开展与建设。而今，该涉外法律服务中心已为中国劲酒集团矿业股份有限公司、云南新大地化工集团、云南赢兆科技公司、云南恒昊矿业集团、云南江苏商会、云南嘉晟矿业有限公司等数十家企业提供了在泰国、越南、老挝、缅甸、菲律宾、印度尼西亚等国的相关涉外法律服务，充分发挥了良好的“法律诊所”服务功能[20]。与此同时，云南省商务厅、云南省商务研究院与双日株式会集团有限公司、双日综合研究所联合签署了《一揽子合作意向书》，双方将在金融、贸易、投资、现代物流、信息产业、商务研究、人才培养等方面广泛开展战略性交流与合作，全面促进区域性周边国家的经济合作发展。此外，早在 2007-2011 年期间，由云南省人民政府与中国出口信用保险公司就签订了《服务云南桥头堡建设专项合作协议》以更具针对性的出口信用保险政策支持，积极解决桥头堡建设中可能面临的国外风险及融资难等问题，促进对外贸易、对外投资与经济合作，推进富裕民主文明开放和谐云南建设。

**B 银保强强联合，国际再保险强强联合，是规避重大政治风险与“桥头堡”建设和投融资保障的中流砥柱。**

由投融资风险带来的经济损失是企业生产经营与市场营销活动中最担忧和揪心之事。如何使这把“双办剑” 转化为良性循环发展的平台，这已不是某个部门和专业领域所能“单挑”承担的。现代经济活动中的第三产业部门，必须组合为大型航母旗舰才能提供市场风险的防范与化解以及采取一系列必要的法律手段、经济手段、行政手段为之应对。为比，金融与保险、证券等行业的强强联姻，正是市场经济条件下，现代经济运行的客观规律作用的产物。正如改革开放的总设计师邓小平所指出的那样：金融是现代经济运行的核心。是纽带、是桥梁，一子皆活，全盘皆赢；一子皆死，全盘皆输。对此，具有国际品牌的汇丰银行于 2011 年 8 月 16 日在昆明设立国内第 24 家、西南第 2 家分行，这是继 2008 年 11 月，恒生銀行(是汇丰银行集团成员之一)作为云南省第一家外资银行的金融服务机构。汇丰银行集团在全球 87 个国家和地区设有 7500 余个分支机构，在国内网点遍及 29 个大中城市，是国内网点最多、地域覆盖最广的外资银行 [21]。正如汇丰银行（中国）有限公司行长兼行政总裁黄碧娟女士所表示的那样：“汇丰銀行进入云南金融市场后，将起到双向开放的桥梁作用。一方面，可帮助外商及国内其他地方企业投资云南，为其提供综合金融服务；另外，云南企业要走出国门拓展东盟市场，同样可借助汇丰银行在全球及东盟的庞大金融网络，获得包括寻找投资对象、避险、融资、信息以及收购当地企业等综合性的金融服务”。汇丰银行昆明分行行长鄢庆芳表示：省市政府提出要将昆明建设成为泛亚区域性全融中心，为云南桥头堡建设和企业“走出国门”促进区域经济社会发展提供全球性金融网络，拓展国内外企业投融资渠道，高端运筹理财，助力东盟区域的人民币跨境业务服务等等，至 2011 年上半年，已为中国东盟近 800

亿美元的双向投资全面提供了金融服务，起到了保驾护航的作用并发挥出增殖的“乘数效应” 达到了风险防范的预期目的。

目前，ABC、AIG、丘博及劳合社的Catlin、 Hiscox、 Liberty 等辛迪加这些私营公司，以及安卓、科法斯、裕利安怡等信用保险公司，都为客户提供政治风险保险产品。最有名的是世界银行集团成员——多边投资担保机构（MIGA），通过直接承保各种政治风险，为海外投资家提供经济上的全方位保障。MIGA 也曾多次来中国，就对外投资政治风险进行讲座，并在 2010 年年初在北京设立在华业务代表。其担保的范围，包括政府违约、战争和内乱、政府征收、不履行主权财务责任等。但听者甚多，参保者却寥寥。

据悉，美国国际集团（AIG）旗下的美亚保险公司在海外有销售“政治风险保险”，其在内地曾向中国保监会递交产品申请，但这一产品一直未能获批。由此看来，趋于国际优势的再保险集团公司要想进入中国国内商企与国内保险强强联合规避政治风险还有很多原因和障碍受阻。事实已证明；在这次抗击全球国际金融风险的搏奕中，有两条最成功的经验是，第一：信心比黄金更重要；第二：世界各国协同配合、齐力举措、同舟共济、共渡难关。难道我们还要“闭关自守”，“拒人于千里之外”而自以为“单挑”之能而“失街亭”吗？

## C 政治调和是化解区域性政治风险与投资风险的有效实现途径。

自 2011 年 6 月 8 日以来，缅甸北部政府军与克钦独立军（KIA）双方发生激烈冲突交火，数百名军人伤亡，2000 余名难民逃离到中国避难。这次冲突战争的动荡风险给中国边境的安全稳定、投资利益、对外贸易交流，特别是已在建工程和未来两国的多项重大合作项目均处于风险损失的危机之中。

其一：与 2009 年缅甸北部的果敢战争冲突一样，交战区域最近离中国边境 10 公里，导致大量难民逃至中国避难，中方企业进入该冲突区域的经商、种植通道被切断，大批经商、种植业主损失惨重。因为冲突方双均有控制中方在缅的多项在建工程项目，冲突双方都在打“中国牌”，都在千方百计向中国求援，望北京主持公道，甚致不惜手段要挟和挑衅，中方企业在缅已建运行的太平一级水电站被 KIA 控制，置为“财质”，尤其是还将在未来计划中投资 2000-3000 亿元人民币水利工程的项目（包括伊洛瓦底 7 座梯级水电站、太平江二级水电站等），大部份都在 KIA 控制中（克钦族即称为中国的景颇族）。该民族组织希望中方不要打压他们，因为这里控制区内还有涉及翡翠、矿产等数十亿美元的中方企业投资。

其二：缅甸政府扼守中国边境南大门，是中国通往东南亚合作的对外“桥头堡”窗口。双方交战前不到一个月，缅甸总统登盛来华访问，两国发表的《中缅关于建立全面战略合作关系的联合声明》中表明要“在业已存在的友好合作基础上进一步提升中缅双边关系水平” 。这样一来，缅北冲突战争背后交织着极其复杂的国家政治与经济等重大战略关系和各方利益保护问题，中国政府不得不作出及时而明确的表态与回应。6 月 16 日，中国外交部发言人表示：“呼吁缅甸冲突双方保持冷静克制，防止事态升级，通过和平谈判解决分歧” 。中国政府的立场态度，既兼顾了缅甸政府与中国双边的国家利益，同时，又维护了缅甸少数民族群体的民族特殊利益与关系，很大程度上调和与化解了政治风险给中方带来的更大经济风险损失（中国政府表态后的第二天，缅甸交战冲突双方均派出代表开始谈判，双方並保持联系）。这不但是政治与经济风险调和的转化，而且是中国“双赢”战略的智慧决策。

其三、调和与化解政治风险是确保经济利益的根本，是保险补偿功能的上策之计。我们只要细算一下家底账目便一目了然。据缅甸官方统计：在过去的 23 年中，中国对缅甸的投资总额累计达 155 亿美元（排名东南亚、南亚投资第一位，泰国投资 95.6 亿美元，排名第二位），包括公路、铁路、油气管道、水电站等建设工程[22]。加之缅甸是中国云南

对东盟“桥头堡”建设的“陆桥”，今年 5 月，中缅陆水联运大通道龙瑞高速公路奠基开工，可打开从云南瑞丽口岸出境，从八莫下伊洛瓦底江直达仰光、印度等国的水陆联运大通道。与此同时，中缅国际铁路云南保瑞段也奠基开工，连接昆明至仰光 1920 公里的铁路大通道，可使中国西部地区出海运输距离缩短 5000 公里以上。又据国际地球权益组织统计显示：截止 2008 年，已有 70 余家中国跨国公司涉足在缅甸的水电、原油、天然气、采矿等 90 多项投资项目。特别是 2010 年 6 月 3 月，中缅双方签署的极具战略性的《中缅油气管道建设协议》，标志着打开了除缅甸向中国输送天然气外，还承担了向中国输送中东、非洲原油的远程任务。作为中缅石油管道配套设施工程的大型原油码头储备基地，可停靠 30 万吨以上深水港工程也于 2009 年开工建设。此外，昆明至皎漂铁路也预计 2015 年完工，并可并入皎漂至瑞丽、仰光、内比都的联网大通道。[23] 由此可见，云南“桥头堡”建设的战略实施，离不开对外窗口的开放和对内阵地的内涵建设的两个抓手与推力。

然而，如果我们把握和处理不好国际政治风险与经济风险的关系，所带来的风险损失是无法估量的。仅缅甸境内的塔桑水电站（TASANG）就是东南亚未来装机容量最大的水电站，中国葛洲坝集团公司持有 51%的海外股份，这恰好又正是缅甸少数民族武装组织所控制的地区，该项目投资建设，因生态环保及强征强迁问题还遭到了当地居民的强烈反对，就在 5 月 8 日，在塔桑水电工作的三名中国工程师和一名翻译遭该地区民族武装绑架失踪。2010 年 4 月 17 日，该电站设施发生了严重的连环大爆炸，39 枚炸弹摧毁了 10 辆汽车、一个大型发电机组、一个仓库、2000 加仑油箱、两个岗哨，4 名中方工人死亡，12 名受伤。[24] 事后，中方吸取经验教训，妥善处理好与该地区少数民族间的关系。由此可见，如果中方工程项目开工前，出口信用保险能够事先能与中方公司以及缅方民族武装组织协商提供和办理好各种财产、责任与人身保险以及各种特约协议的信用保险和保证保险等保险服务产品,,中方企业与个人的财产损失和人身安全保障就可能获得最佳选择的方案与效果，尽最大可能避免和减少损失是保险职能作用发挥之上策，抢险救灾与经济补偿只可为中策与下策。故本课题研究认为，无论我国国内外保险业在国内外市场竞争中，都应事先介入预防为主，积极主动服务为本，这才是现代保险业与时俱进的特色体现和充分发挥“桥头堡”的保驾护航之功能。

## Reference 参考文献

[1] Weng Yang. Chinese News Agency Beijing Electronic Notice [EB].2011.03.31

中新社北京电，[EB].2011.03.31.（记者 翁阳）

[2] Xin Hua news Agency Electronic Notice [EB]. 2011.5.23

新华社电，[EB].2011.5.23.

[3].[4] Phoenix Weekly[J].2011.09

凤凰周刊.[J].2011.09.

[5] Xin Hua network Tokyo Electronic Notice [EB].2011.4.21

新华网东京电，[EB].2011.4.21

[6] China youth daily [N]. 2011.03.10.

中国青年报.[N].2011.03.10.

[7] Xin Hua news flash Electronic Notice [EB]2011.8.17..

新华快讯电，[EB]..8 月 17 日

[8] Spring City Evening News[N].2011.8.2

春城晚报.[N].2011.8.2.

[9] Spring City Evening News[N]2011.7.31

春城晚报.[N].2011.7.31.

[10] Zhong Guohua, Lu XiaohuiSpring .City Evening News[J] 2011.8.17

春城晚报.[N].2011.8.17.(记者：钟国华 陆晓辉)

[11] Bai Enpei Qiushi[J].Beijing:2010.11.16.

白恩培 . 求是 [J]. 北京：2010.11.16.

[12] Department of Commerce Of Yun Nan editor-in-chief Practice of Style [M] Yunnan science and technology press 2009.12.10-11

云南商务厅主编《实务风》［M］云南：云南科技出版社，2009.12.10-11.

[13] http://news.cntv.cn/ [EB]. 2012.05.05

中国网络电视台，[EB].2012.05.05.

[14] CCTV http://www.ribenxinwen.com/ [EB]. 2012.4.17

中央电视，据日本新闻网[EB]. 2012.4.17.

[15] http://www.chinanews.com/home/ [EB].2012.03.14

中国新闻网，[EB].2012.03.14.

[16] Zhang Yi, Cao Xinyang．http://www.xinhuanet.com/ [EB] Bei Jing.2011.12.15

新华网，[EB].北京：2011.１０.１０.电（(记者：张艺、

曹欣阳）

[17] [24] http://www.mofcom.gov.cn/ [EB].2011.12.15
商务部网站，[EB].2011.12.15.

[18] Ren Xiao .China Securities daily [N].2012.01.19.
中国证券报.[N].2012.01.19.( 记者：任晓)

[19] “The selection of Marx and Engels ”the third volume, Beijing: people's press [M].1972.5.9-10
马克思恩格斯选集，第 3 卷[M]，北京：人民出版社，1972.5.9-10.

[20][21]Zhong Guohua .Spring City Evening News[N] 2011.8.17
春城晚报.[N].2011.8.17.(记者：钟国华)

[22] Yang Shuyan.Spring City Evening News[N] 2011.8.9
春城晚报.[N].2011.8.9.(记者：杨舒燕)

[23]. Zhou Yu. Phoenix Weekly 2011.1.9.
凤凰周刊.[N].2011.1.9. (记者：周宇)

# 应对突发区域性政治风险与全球金融危机的挑战

## ——基于中国出口信用保险风险防范的战略反思

云南保险学会课题组

云南保险学会 昆明 云南 650031

[摘要]在人类社会的历史进程中，人们通常应对突发重特大自然灾害或意外事故的决策无非是采取灾前预警预防，灾时抢险救助，灾后补偿重建的“三大风险管理”举措。对于保险业经营“风险集中”与“风险分散”的功能来说，无疑是责无旁贷之职。然而，当突发政治风险及重特大灾难已来临之际，我们却往往处于“目瞪口呆”、甚至陷入“束手无策”之两难境地。这一系列的重大新情况和新问题出现，不仅仅涉及到我国进出口企业自身的财产与人身保障利益，而且还涉及到国家的经济利益安全和社会稳定的大局问题。这对于我国信用出口政策性保险以及国内商业性保险来说，是共同所面临的严峻挑战和压力。对此，笔者认为：很有必要对当今国内外保险业所面临突发重特大事件，应采取“四个应对”的两难问题提出质疑与对策（即：一是如何应对当今国际形势发生重大变化的突发性、区域性国家政动荡与战争和军事冲突等重大政治风险？二是如何应对全球后金融危机带来的深层次影响和负面效应？反思与对策全球经济增长面临新的拐点，国内外商业性与政策性保险业再次面临新的压力和挑战。三是如何应对全球性特大自然灾害损失的补偿与重建；如何应对这些损失造成的“多米诺骨牌效应”辐射的严重后果。四是如何构建云南面向西南开放的“桥头堡”的大通道大战略建设，打造中国面向南亚、东南亚以及“10 十 3”、“9 十 2”、“泛珠三角”等国内外开放的前沿“窗口”和“阵地”我国的保险业如何为国家的经济战略安全提供风险防范的保驾护航功能）。这是本文探究的切入点和引发的关注点，也是本文的一点创新之见。

[关键词] 四个应对危机；中信保战略抉策；风险管理；服务产品创新

**Project Leader introduction:**

Cao Qibao, male (1948-),Taishan,Guangdong Province(Overseas Chinese family).The former dean of Economy college of Yunnan normal university. Dr, Professor , The director of China Insurance Association, The think-tank experts of Yunnan Insurance Regulatory Commission, The president of Yunnan Insurance Association. The main research : Financial insurance study, social development study, crisis management.

**The members of the project group:**

Cao Qibao,Yang Hongwei,Yang Jun, Cui Lihua, Li Zongming,Zhuang Jiwei, LiuYa, Niu Xiaolu, WangJiang

**Address :** Wen Mao Building Room 1207,Road Dong Feng Xi Lu 276 ,Kunming Yunnan. Zip code: 650031

**Telephone:** 0871-6383927 13888082203 13708723138 Fax:0871-3390080

课题负责人简介：

曹骑豹，男（1948--），广东台山人（侨眷），原云南师范大学经济学院院长，博士，教授，现任中国保险学会理事，云南保监局智囊团专家、云南保险学会会长，主要研究方向，金融保险学，社会发展学、危机管理学。

**课题组成员：** 杨红卫 杨 军 崔立华 刘 雅 王 健 牛晓露 庄季伟 李宗名

**联系地址、通讯：**云南省昆明市东风西路 276 号 文贸大厦 12 楼 1207 室 邮编：650031

传真 0871- 3390080 手机 13888082203 13708723138

邮箱：cqb1948@163.com qq 854029335 qq 895987674

# The Exploration of Financial Risks that the Commercial Banks of China Is Facing

DENG Wei ,WEI Xin

College of Economics, Qingdao University, Qingdao, China, 266071

**Abstract:** This paper is based on the thinking of financial risk resist ability of our country's financial industry in the financial crisis, of which the banking is in the dominant position .We make use of the theoretical analysis and empirical analysis method to analyze the three kinds of financial risks faced by our country's banking industry, combined with the parametric and the non-parametric means to establish mathematical model and based on the fact that the level of marketization is not high, the capital market structure is not perfect and the function is not sound in China, which makes our research more comprehensive and realistic. we use the existing macro and micro theory model analyzing these problems, from the perspective of the government to strengthening financial supervision, enhancing the macroeconomic regulation, perfecting legal laws and regulations, to the market's own adjustment ability and the improving of the economic subjects' capability to against risks, to put forward to innovative ideas and suggestions about financial reform , trying our best to make contribution to the development of our national economy and national Renaissance.

Keyword: Financial crisis　Financial risks　Commercial Bank

2008年美国次贷风暴，雷曼兄弟破产、美林银行贱卖、摩根斯坦利寻求合并，金融海啸的浪潮一波高过一波，2009年12月全球三大评级公司下调希腊主权评级，2010年，欧洲其它国家也开始陷入危机，欧债危机愈演愈烈。由于国际金融形势的不稳定，全球实体经济增长明显放缓。在全球经济一体化的趋势下，任何开放国家都不能独善其身，虽然我国由于金融管制较严格加上金融制度不够发达，在金融危机中受创较轻，但仍然暴露出很多问题，如何在金融领域日益开放的情况下保持我国以银行业为主导的金融体系的稳定性，在提高我国金融体制的运行效率、竞争力的同时加强我国金融业的抗风险能力，这些方面都值得我们深入研究。

## Ⅰ 中国商业银行金融风险分析

当前我国仍是以银行业为主导的金融体制，而商业银行的地位又举足轻重。在这种结构下，对商业银行风险问题的研究具有重要意义。为了更科学和精确的衡量金融风险，我们运用计量方法进行计算和分析：

### 1）分析方法

金融风险分为市场风险、信贷风险和操作风险。我们运用多元回归模型来判断银行的利润波动与以上因素变动的相关性大小，进而判断是否受其影响。

### 2）指标选取和模型构建

信用风险为借款人的违约风险，主要表现为不良贷款，因此用不良贷款额代替，记为 x1，市场风险主要为利率风险，可用一年期的存贷款利差代替，记为 x2，风险的直接影响到银行的收益，被解释变量取银行的税后利润，记为 Y，用以上变量建立多元回归模型，可以得出粗略的计量结果，通过其拟合情况来判断银行利润是否受该因素的影响及影响的大小，即用相关性的大小作为判断

指标，而无法用信用风险和市场风险解释的部分，即残差平方和，可以近似用以解释操作风险[1]。

模型为： $\log Y = c + \log(x1) + \log(x2) + \varepsilon$ （1）

2）数据及预处理

样本数据取自中国人民银行、银监会及各家银行定期公布的年报的相关数据，因为2007年前后的相关数据口径不一致，故只选取2007—2011年的相关数据。其中大型商业银行选取了中国工商银行、中国农业银行、中国银行、中国建设银行。股份制商业银行选取了中信银行、中国光大银行、华夏银行、广发银行、深圳发展银行、招商银行、上海浦东发展银行、兴业银行、中国民生银行、恒丰银行、浙商银行和渤海银行。

3）实证结果分析

对大型银行及股份制银行面临的金融风险状况的分析见表1和表2

表 1 大型商业银行

| VARIABLE | COEFFICIENT | STD.ERROR | T-STATISTIC | PROB |
|---|---|---|---|---|
| C | 13.17505 | 1.598138 | 8.244000 | 0.0144 |
| LOG(x1) | -0.661544 | 0.190104 | -3.479903 | 0.0736 |
| LOG(x2) | 0.708150 | 0.749263 | 0.945128 | 0.4444 |
| R-squared | 0.858496 | F-statistic | 6.066962 | |
| Adjusted R-squared | 0.716993 | Prob(F-statistic) | 0.141504 | |

表 2 股份制商业银行

| VARIABLE | COEFFICIENT | STD.ERROR | T-STATISTIC | PROB |
|---|---|---|---|---|
| C | 23.19896 | 4.112032 | 5.641728 | 0.0300 |
| LOG(x1) | -2.657228 | 0.641318 | -4.143383 | 0.0536 |
| LOG(x2) | 0.966657 | 0.806535 | 1.198531 | 0.3535 |
| R-squared | 0.897542 | F-statistic | 8.760118 | |
| Adjusted R-squared | 0.795084 | Prob(F-statistic) | 0.102458 | |

从回归结果可以看出：该模型拟合较好，可以得出商业银行利润受不良贷款和利率波动的影响较大，且大型商业银行和股份制银行的税后利润Y均与不良贷款额x1负相关，与一年期存贷款利率差x2正相关。而利率的波动和不良贷款的大小可以解释大型银行利润波动的86%左右，解释股份制银行利润波动的90%左右。即我国大型商业银行和股份制商业银行受利率波动和不良贷款波动的影响较大，同时通过残差平方和可以看出大型商业银行和股份制银行面临的风险中，操作风险也占一定的分量。但鉴于数据的可得性，该模型得出的结论仍有较大的误差。

银行税后利润与存贷款利率差正相关符合我国商业银行仍以利差为主要利润来源的现状，这也可以看出我国银行业的业务结构比较单一，中间业务发展水平较低，不能对风险进行很好的分散，特别是在利率市场化的大趋势下，面临着较大的风险。

同时我国也面临着较大的信贷风险，一方面

我国银行业的不良贷款余额一直较大，另一方面由于受金融危机影响实体经济受创，我国银行业贷款质量下降。

## Ⅱ商业银行金融风险的来源

我国的金融风险的形成既有金融机构的内部因素，也受到外部宏观环境的影响,在此我们将从银行内部和外部两方面分析中国商业银行金融风险积聚的源头，从而为解决这些问题提供理论基础。

### A.银行内部因素对风险积聚的影响

1）业务结构比较单一，化险水平低

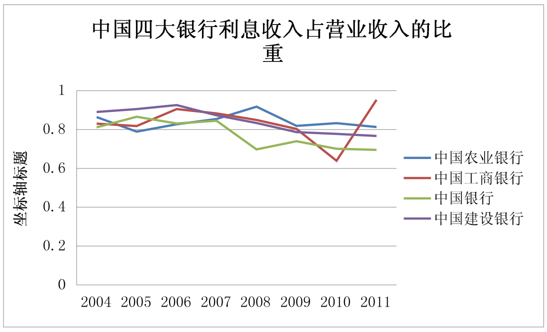



图1. 中国四大银行利息收入占营业收入的比重

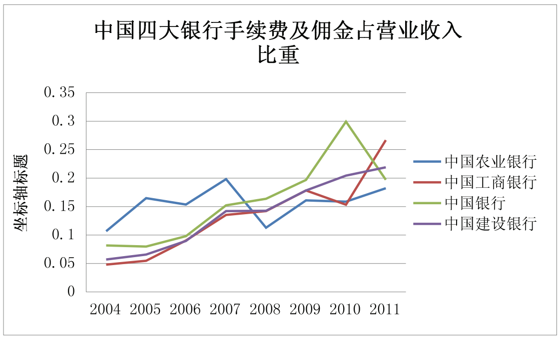



图 2. 中国四大银行手续费及佣金占营业收入的比重

数据来源：《中国银监会年报》，2004-2011 年的相关数据计算得出

由图 1，图 2 可以看出，我国银行营业收入中利息收入占比过大，一直在 78%-93%之间，负债业务主要依赖存款，贷款在资金运用中占有主导地位，而手续费及佣金占比较小，并没有明显体现出银行的服务业性质，但从时间趋势上来看，利息收入的比重有下降趋势，而手续费和佣金的比重持续上升，近几年，我国银行努力发展非利息收入业务，力图与国际接轨，这都符合经济发展趋势。银行业务结构中若高度依赖利息收入，潜在的信贷风险和利率风险就会加大，而且与发达国家相比，我国的存贷利差较大，随着我国金融业的发展，金融领域的开放程度提高，存贷差势必会下降，届时银行的盈利能力将受到挑战。

2）信贷资产质量差, 不良贷款率有反弹趋势

下面我们选取我国商业银行的 2007-2011各季度不良贷款余额以及2011年贷款投向的行业情况进行具体分析：


图3. 2007-2011不良贷款余额

数据来源：中国银监会。

由图 3，2008 年三季度前我国商业银行的不良贷款余额一直处于过高水平，由于 2008 年末进行政策性剥离, 2008 年四季度不良贷款余额下降了一半多，在此之后也平稳下降，但 2011 年四季度又有上升趋势。政策性剥离治标不治本，不能从根本上降低信贷风险和遏制不良贷款的增长，中国银行业信贷风险的降低必须依靠深入的金融体制改革。

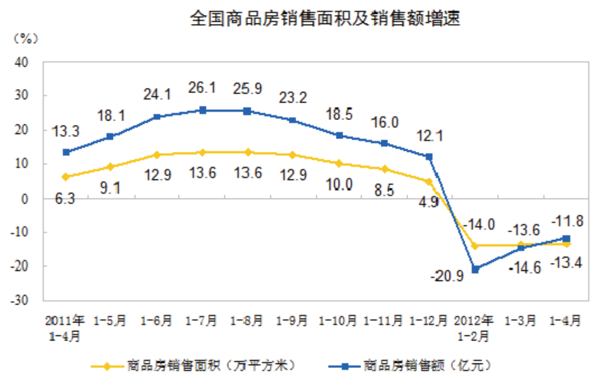



图4. 全国商品房销售面积及销售额增速

数据来源：国家统计局。

在全球经济环境低迷的大背景下，中国

的出口行业受到极大的冲击，制造业和零售业受影响最大，而2011年新增贷款投向主要集中于三大领域：制造业（占比 27.6%）、个人贷款（占比 23.5%）及批发和零售业（占比 22.8%）。（数据来自于2011银行业运行报告），这大大增加了不良贷款带来的风险。在过去几年中，房地产业的快速升温使得银行的大量贷款流入到该行业，而随后国家对房地产行业的调控使得该行业迅速降温，由图4可以看出2011年三季度全国商品房销售面积和销售额增速下降，而2011年底变成负增长，银行的贷款质量迅速下降，信贷风险增加。

**3）银行业经营管理不善，内控机制不足**

目前我国银行业在经营过程中，内控机制不全，经营管理不善，违规经营不少。国有商业银行尚未建立符合现代银行制度要求的公司法人治理结构，股份制商业银行也不同程度存在着公司治理结构不健全、决策执行体系架构不合理、监督机制有效性不足等问题，另外，很多金融机构风险防范意识不高,特别是基层机构部分工作人员还未充分认识到内控和风险管理的内涵，这样，就容易受利益驱使，经常不惜违规经营，产生新的金融风险，形成新的不良资产。

## B.外部宏观环境对风险积聚的影响

1）金融市场不完善

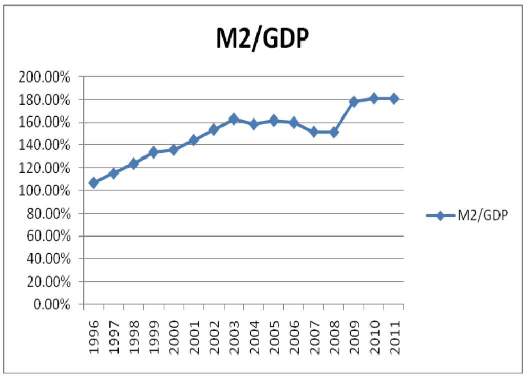



图5. 1996-2011年中国M2/GDP比率走势图

数据来源：《中国统计年鉴》，1997-2011年，其中2011年为6月份数据。

由图，我国M2/GDP自1996年来一直上升，虽然自2003年开始两次下降，但数值一直较高。与金融市场发达的欧美国家相比，我国的这一指标过高，说明我国的企业和居民的投融资活动严重依赖银行存贷款，经济发展过分依赖货币性金融资产的推动，很容易出现通货膨胀或通货紧缩，并且金融风险高度集中与存款性货币银行，不利于分散金融风险，从而降低了金融体系运行的安全性；同时，它也表明非存货性金融机构与金融市场的功能没有充分发挥[2]。

根据巴曙松和陈华良在《中国M2/GDP比率研究的综述与理论脉络》[3]中对中国M2/GDP的研究，对中国而言，M2/GDP在相当长时间内处在非正常的高水准上，在近十年的研究中，基于不同经济发展背景和研究模式下，理论界提出了包括货币化进程、制度转型、储蓄规模过大、不良资产沉淀、资本市场发展落后、融资体制单一、社会保障制度不健全、收入分配差距过大以及宏观经济景气度和外债影响等众多解释因素，这些因素在不同的历史时期起到了不同的作用。另外，银行信贷结构的影响、反经济周期的货币政策操作、市场约束因素的存在以及GDP的估算和统计等原因也对M2/GDP有一定的影响。

**2）垄断力量的存在**

我们采用绝对集中度指标对银行业集中度进行考察，绝对集中度是指特定行业中几家最大企业市场份额之和，设整个市场的总额为 X，第 i 个企业的市场额为 $X_i$，市场份额为 Si，又设 $CR_n$ 为行业中最大的 n 个银行所占市场份额之和，则有公式（2）：

$$CR_n = \sum_{i=1}^{n} \frac{X_i}{X} = \sum_{i=1}^{n} S_i \qquad (2)$$

美国经济学家 J.S.贝恩依据产业内前四位和前八位企业绝对集中指标，对不同垄断竞争程度产业的市场结构做了分类，见图表 3：

**表 3 贝恩的市场集中度分类**

| 市场结构 | CR4 值（%） |
|---|---|
| 寡占Ⅰ型 | 75 以上 |
| 寡占Ⅱ型 | 65~75 |
| 寡占Ⅲ型 | 50~65 |
| 寡占Ⅳ型 | 35~50 |
| 寡占Ⅴ型 | 30~35 |
| 竞争型 | 30 以下 |

在此我们只计算 CR4，取四家国有银行的资产、存款、贷款和利润可以得出我国银行业集中度的 CR4 指标

表 4 中国银行业集中度的 CR4 指标（%）

| 年份 | 2007 | 2008 | 2009 |
|---|---|---|---|
| 资产总额 | 51.96 | 48.73 | 48.32 |
| 存款总额 | 54.49 | 52.29 | 50.68 |
| 贷款总额 | 48.86 | 44.15 | 44.30 |
| 利润总额 | 50.55 | 59.03 | 55.54 |

数据来源：《中国金融年鉴》2006-2010

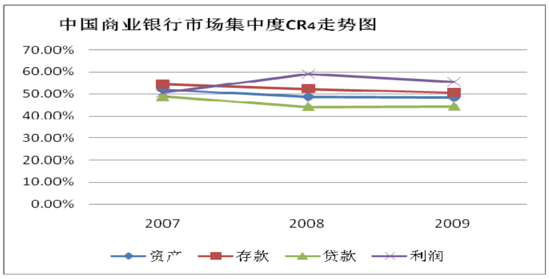



图6. 中国商业银行市场集中度CR4走势图

数据来源：《中国金融年鉴》，2008-2010。

由图 6 可知，CR4 在 40-50 之间，中国银行业集中度较高，属于中度寡占型，竞争程度不高。但信贷市场结构已然发生变化，寡头垄断的局面正被逐步打破，四大国有银行的资产、存款、贷款集中度呈逐年下降趋势，市场中垄断力量在不断减弱和衰退，竞争力量在不断积累和增强但垄断力量仍然很高。垄断造成信用体系的缺失及金融风险的积聚。中国银行体系的稳定是以国家信用为后盾的，在垄断状态下，国有商业银行缺乏足够的激励机制去建立信用评估和监督体系。国有商业银行大量不良资产存在，依靠国家和政府动用财力物力进行政策性剥离，实际上并没有从根本上降低风险，而是在不断的积累风险。

3）财政政策与货币政策对银行业有较大影响

我国金融体系是以政府为主导的，这一性质对我国金融业的稳定与发展有利有弊：一方面，这使得我国的金融机构以国家信用为担保，有利于金融业的稳定，不至于出现覆灭性的银行业信用危机；但另一方面，国有企业不顾成本追求贷款，扩大生产规模，地方政府向一些不具有贷款资质的企业发放贷款，导致银行呆坏账大量积累[2]。在全球金融业普遍不景气的情况下，中国银行业在积极的财政政策和相对宽松的货币政策背景下，2009年信贷投放量达到9.6万亿元，但因信贷集中投放在政府主导的项目、房地产等，银行的信贷资产质量面临考验。根据银行业研究报告，银行信贷集中在房地产市场，形成巨大的泡沫，这轮房地产市场调整，如果房价下跌不超过30%，不会影响银行整体资产质量。但如果房价下跌50%以上，不良贷款积累，将会引起银行贷款素质恶化，同时地方政府不能自主发行地方债券，2009 年地方政府通过融资平台获得7.2 万亿元的贷款，银行并不能真正掌握融资平台的总体负债规模和偿债能力，因此地方政府融资平台带给银行的金融风险高于房地产贷款。因房地产投资贷款和融资平台贷款的积累，银行的坏账积累到银行不能承担的程度时，在国家信用下，对国有银行承担无限担保责任，这又重新积累银行的不良资产。政府通过财政手段救助银行可能会防止银行危机，但势必影响到中小企业贷款、以及财政对医疗、 教育、养老等方面的扶持，同时也会起到阻碍金融改革、税收制度改革、以及房地产调控力度的作用。

4）金融监管体系不完善

我国金融监管系统尚不完善，监管能力有待提高，通过对美国次贷危机引发的金融海啸进行反思，我们能够更加清楚的认识到金融监管的重要性，金融监管缺失使一些国家的金融风险加剧。近年来，由于监管力度不够，我国的金融市场上一直存在违法违规现象，银行体系也面临着风险。加入 WTO 后，在货币市场、资本市场、外汇市场逐步开放的条件下，资本的自由流动将给我国经济和金融市场监管带来更多难题。防范和化解金融风险，保障金融安全，就要加强金融监管，将金融活动纳入规范化、法治化轨道。

## III 政策性建议

基于以上分析，我们从政府加强金融监管、宏观调控、完善法律法规，市场发挥自身

调节作用，经济主体提高自身抵抗风险的能力等方面，提出我们对进行金融改革的意见及建议：

1） 尽快建立健全我国金融市场的法规体系和会计信用体系，维护公平竞争秩序，使金融经营活动在严格明确的法规制度界定下进行。改善信用环境，强化诚信意识，防范道德风险，依法打击恶意逃债，维护银行资产安全。综合运用各种措施，全方位管理，保证国家法纪和政令的畅通和落实，确保金融稳定、健康地发展。为市场主体的经济活动营造透明、公平法律环境，为监管当局进行有效的监督管理提供有力的法律武器，加快培育符合国际标准的信用评级机构，为国内外投资者的投资决策提供可供信任的依据，以此提高金融资产配置效率，降低金融风险。

2）建立强有力的金融监管机制。建立固定的金融监管协调委员会，增强协调磋商能力。充分发挥行业协会的作用，并加强行业自律性管理，建立金融监管信息共享机制，提高监管效率，建立反应灵敏、反馈及时、渠道畅通的监管信息系统。

3）建立健全存款保险制度[4]替代国家信用，由国家引导商业机构设立银行存款保险，分散国家承担的风险，有利于减少国家的负担和加强对银行的监管，降低银行的坏账率，也有利于中小型民营银行的发展，为其提供信用基础。

4)逐步打破金融体系中大型商业银行垄断的格局，引入竞争机制，由国家制定法律法规鼓励规范化的民营银行的建立和发展，创造出适合于中国国情的多维的金融服务体系。

5）规范我国银行业的经营管理，加强对银行业的有效监管，实行集约化经营，优化资产负债结构，借鉴国内外商业银行经营管理的经验，建立健全内控制度，制定相互制衡的业务管理办法和制度，完善信贷决策体系和信贷资产管理责任制，强化银行业的稽核监督工作。

6）完善业务结构，积极发展中间业务结构，突显银行业的服务性行业本质，在加快金融创新，提高服务质量的同时，进一步规范中间业务市场，增加收费透明度，加强信息披露，规范产品销售管理等。

## 参考文献:

［1］Jin Ke & Su Han. ［D］.the Empirical Studies of Operation Risk Status of the Commercial Bank in China.2011

靳珂&苏菡. ［D］.我国商业银行操作风险状况的实证研究. 2011

［2］Li Jian. ［M］.Structural Problems in Financial Development in China. Beijing: Renmin University of China Press.2004

李建. 中国金融发展中的结构问题. ［M］. 北京：中国人民大学出版社. 2004

［3］Ba Shusong &Chen Hualiang .[M].the Overview and Theoretical Context of Chinese M2/GDP Ratio

巴曙松&陈华良. 中国M2/GDP比率研究的综述与理论脉络［M］

［4］Xu Dianqing. ［M］.Sense of Crisis and Financial Reforms. Beijing: China Machine Press.2003

徐滇庆. 危机意识与金融改革. ［M］. 北京：机械工业出版社. 2003

# 对我国商业银行面临的金融风险的探究

邓伟,魏欣

青岛大学经济学院　 中国　青岛　266071

**摘要：** 本文由金融危机引发我们对中国以银行为主的金融业对金融风险的抵御能力的思考，采用理论分析与实证分析相结合的方法，使用参数和非参数的计量方法来建立数学模型，并结合了我国市场开放化程度不高，资本市场结构不完善、功能不健全的现实，具体分析了我国商业银行面临的三种金融风险，这使我们的研究更加全面和现实，我们利用已有的宏微观的理论模型分析问题，从政府加强金融监管、宏观调控、完善法律法规，市场发挥自身调节作用，经济主体提高自身抵抗风险的能力等方面，提出我们对进行金融改革创新的意见及建议，希望可以为我国经济的发展和民族的复兴尽我们的绵薄之力。

**关键词：** 金融危机;金融风险;商业银行

（姚庆海，2006；柴化敏，2008；魏华林等，2009；田玲、张岳，2010）；二是风险转移渠道多层，即在考虑发生巨额灾害损失前提下，将资本市场衍生品作为政府救助和传统保险的有力补充（Lewis and Davis，1998；Osterland，1998；孙祁祥、周奕，2002；陶正如、陶夏新，2007；田玲、高俊，2011），按照灾害保险、社会储备、巨灾债券等融资工具的属性安排各自能分散损失的比例、触发机制等。诚然，以上的“多层”融资机制已对灾害风险和损失在空间上的分散作了较为全面的安排，但对灾害风险在时间上的应对却较为模糊，进而使得所搭建的灾害风险融资机制显得较为笼统且不利于现实操作。比如，哪类参与主体应承担最初产生的损失？哪类主体负责灾后重建的成本？哪类融资工具被用于应对救灾应急？哪类融资工具用来支援灾后重建？毕竟，不同主体、不同融资工具有其本身的特点，而当前的灾害风险管理工作又是由防御、救助、恢复、重建四个层层递进的阶段循环构成的，不同阶段对资金的需求并不相同。我们需要对在哪个阶段由哪些主体通过何种工具进行融资和风险转移分担等进行明确。据此，本文将从灾害风险管理不同阶段的需求动态变化情况入手，结合不同融资工具的成本、时效等特性，提出具有可操作性的多层融资机制框架和细节。如果说已有研究解决的是多层融资机制中额度问题，那么，本文将解决的就是多层融资机制中的顺序问题。

## Ⅱ.灾害风险管理的“资金缺口”

### A. 灾害风险管理的含义

伴随着科学的发展和社会的进步，在总结经验教训的基础上，人们应对自然灾害的理念已在不断改进。最早出现的是应急管理（emergency management），指通过有效措施对包括巨灾在内的突发公共事件进行管理的行为过程，其作用对象的显著特征是“事态已发展到无法控制的程度”，最终目的是要使公共组织及其成员摆脱危机状态，最大限度地降低人类社会悲剧的发生；显然，应急管理主要集中于事件临近或已发生时的管理，缺乏对灾害事件的连续关注，也没有注重对灾害经验教训的积累，属于被动式应灾行为。鉴于灾害是风险的最终“产物”，只有将着眼点从灾害转向风险，从如何预防和处置灾害转向如何理解和管理风险，才是应对灾害的根本之道。因此，从“国际减灾十年”到“国际减灾战略”，灾害管理理念已经从强调传统的灾害应对转变为需要高度重视综合减少灾害风险，逐渐形成了灾害风险管理（disaster risk management）的理念，只是当前尚没有权威定义出现。据此，在遵照当前世界灾害管理主旨，以及我国《国家综合防灾减灾规划（2011-2015）》的主要原则和任务的前提下，本文在此将“灾害风险管理”定义为：是由政府主导，企业、家庭和社会共同介入，与整个国家经济和社会长期发展战略相结合的社会管理过程，其主要功能是对可能给经济和社会发展带来重大影响的巨灾风险进行综合分析和有效沟通，通过选择和实施包括损失控制、损失补偿和损失分担在内的各种措施，将巨灾风险损失控制在经济和社会发展可以承受的范围内，从而保证国家经济和社会的长期稳定发展以及重要社会价值观的实现。主要由灾前防御、灾中救援、灾后恢复及灾后重建等四个部分构成。

### B. “资金缺口”

资金是保证灾害风险管理工作顺利开展的必要载体。灾害风险管理中涉及的资金范围有广义和狭义之分：广义上既包括灾前的防御投入也包括灾后的救助支出，狭义上仅指灾后的救助支出，本文在此特指的是狭义范围的资金。一般而言，灾害风险管理活动可分为灾前防御、灾中救援、灾后恢复以及灾后重建四个阶段。灾前防御阶段主要是形成相应资金储备，灾害发生后的救援、恢复及重建阶段则使用资金。而在一轮灾害风险管理工作周期内，因灾前资金储备安排不足以满足灾后各阶段或某阶段的资金需求，就会产生“资金缺口”。

**表 1. 近十年我国灾害救助中的总量资金缺口**

| 年份 | 直接经济损失 | 民政救灾资金 | 救灾比例 | 资金缺口 |
|---|---|---|---|---|
| 单位 | 亿元 | 亿元 | % | 亿元 |
| | ① | ② | ③=②/① | ④=②-① |
| 2001 | 1942 | 41 | 2.11 | -1901 |
| 2002 | 1717.4 | 40 | 2.33 | -1677.4 |
| 2003 | 1884.2 | 52.9 | 2.81 | -1831.3 |
| 2004 | 1602.3 | 51.1 | 3.19 | -1551.2 |
| 2005 | 2042.1 | 62.6 | 3.07 | -1979.5 |
| 2006 | 2528.1 | 79 | 3.12 | -2449.1 |
| 2007 | 2363 | 79.8 | 3.38 | -2283.2 |
| 2008 | 11752.4 | 609.8 | 5.19 | -11142.6 |
| 2009 | 2523.7 | 199.2 | 7.89 | -2324.5 |

| | | | | |
|---|---|---|---|---|
| 2010 | 5339.9 | 135.6 | 2.54 | -5204.3 |
| 2011 | 3096.4 | 104.3 | 3.37 | -2992.1 |

数据来源：根据《2011 年中国民政事业统计年鉴》及《2011 年 4 季度民政事业统计季报》数据计算所得

然会影响灾害风险管理工作的进程。

要消除以上资金缺口，我们可以通过增加灾前相应财政预算的方式来规避以上问题，但

**表 2.灾后应对与资金需求**

| 阶段 | 救援 | 恢复 | 重建 |
|---|---|---|---|
| 时间 | 灾后 0~14 天 | 5~90 天 | 60 天~今后几年 |
| | 情景应对 | 统筹优选 | 综合集成 |
| 性质 | 纯公共产品 | 混合公共产品 | |
| 主导力量 | 政府、社会 | 市场、政府、社会 | |
| 主要特征 | 抢救生命与财产 | 现金赠款<br>食物救助<br>恢复重要公共服务<br>创造临时就业机会<br>紧急需要评估 | 资产重置<br>基础实施项目<br>小额融资项目<br>中长期规划 |
| 目标 | 伤亡损失最小化 | 社会福利最大化 | 回到震前经济水平 |
| 主要任务 | 抓紧时间救人；<br>打通道路、尽快恢复通水、通电、通讯；<br>临时安置受灾群众；<br>应急指挥 | 过渡性安置受灾群众，保障生存；<br>恢复经济、社会秩序；<br>进行必要的灾后清理和善后工作，为下阶段重建做必要准备；<br>恢复重要的基础设施及公共供应系统；<br>交通运输恢复、物资供给与分配；<br>重建资金的筹集与监督、产业恢复计划与政策 | 恢复企业、市场经济系统和城市设施，经济水平恢复到灾前水平；<br>通过所提供的大量就业，为受灾群众提供收入来源 |
| 管理需求 | 不确定性、突发生、紧迫性 | 承上启下、紧迫性 | 可预测性、计划性 |
| 资金需求特点 | 资金投入要求迅速、快捷，尤其需要救援性资源；<br>主要依赖于灾前日常的储备，来源范围较广、动员面较大 | 以安置性投入为主（如安置房、食品等）；<br>投入对象比较明确 | 建设性资金投入明显增加； |
| 资金投入 | 相对较小 | 逐渐加大 | 金额巨大 |
| 支持主体 | 政府体系、社会体系 | 市场体系、政府体系、社会体系 | 市场体系、政府体系、社会体系 |
| 性质界定 | 应急管理 | 应急向常规转化 | 常规管理 |
| 关注主题 | 个人、家庭 | 家庭、社区 | 产业、经济、生态 |

具体而言，资金缺口有两形式：一种是总量资金缺口，即指灾前资金储备低于灾后资金需求，且无法弥补的情况。我国历次灾害发生后政府的灾害救助投入与灾害损失所形成的比例就是最好的证明，如表 1 所示，作为最主要资金来源的民政救灾资金尚且在直接经济损失面前显得如杯水车薪，就更不用提相比更微不足道的社会捐赠、保险等资金来源了。同时，即便我们解决了总量资金缺口问题，找到了预算再分配、紧急借款等其他灾后补充的资金来源，但现实中的灾后资金流往往如图 1 所示，即因灾后筹资需要经历一定过程进而会产生时滞，导致资金无法在需要时及时到位，从而产生图 1 中低于横轴的另一种资金缺口——临时资金缺口。不可否认，临时资金缺口的存在必

相应我们也将会付出更高的机会成本，如 2009

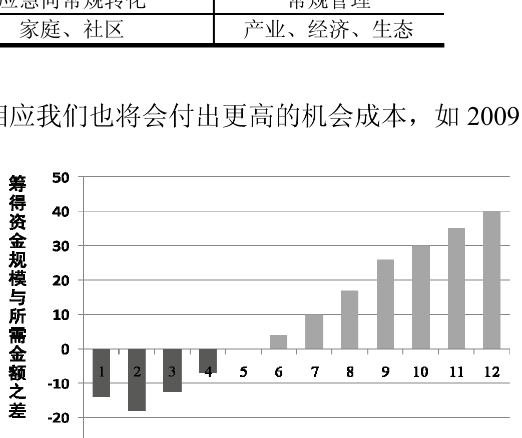



**图 1. 临时资金缺口**

年预算中多出的 310 亿那样，毕竟我国各方面的建设都需要资金；与此同时，通过提高政府财政预算比例来应对灾害风险及灾后损失还会

助长人们“等、靠、要”政府灾后救助的依赖思想，放松或忽略灾后防御及灾中减损，进而降低灾害风险管理工作的效率。我们需要了解不同阶段资金需求的特点，再结合不同融资工具的成本、时效等特性，才能做出较为周密的多层融资机制安排。

# Ⅲ.灾害风险管理各阶段的融资需求

如前所述，灾害风险管理是灾前防御、灾中紧急救援、灾后恢复及灾后重建几个主要过程的递进循环组合，相应的，不同过程阶段中的资金需求在遵循逐阶增进规律的同时又具备各自的特点，灾后资金需求的具体情况如表 2 所示。

1、灾前防御阶段：在灾害防御阶段工作的重点在于针对灾害预测结果进行一些事先的防范工作，周密的防御可以降低灾害对之的冲击。此时与灾后救助资金直接相关的就是根据本年度的灾害预测准备应对灾后损失的资金，即进行灾前融资。此时融资并非越多越好，因为任何融资都是要付出成本的，无论是会计成本还是机会成本，所以需要把握好度。

2、灾中救援阶段（灾害发生~3 至 5 天<=2 周）：此阶段的工作重点在于救人。72 小时内是救人的黄金时间。所以本阶段的资金需求特点为时间短、紧急，在规模上并不要求特别大，依具体灾种而定，比如地震等突发性灾害可能就需求大些，而洪水等非突发性灾害则相对没有那么大。这一阶段是灾害发生后的第一个“十字路口”，人类在这个阶段能否有效应对，将直接影响到人们后期的灾害应对形势走向，决定了人类能否成功降低灾害带来的巨大损失。资金需求周期为灾害发生后至 3 至 5 天，最长可达 2 周。

3、灾后恢复阶段：此阶段的工作重点是尽快恢复基本的生活条件，修复被灾害切断的基础设施，在紧急救援的基础上，为重建阶段做好准备。本阶段的资金投入需求将持续增加，以满足灾民的基本安置，以及开展恢复灾后生活的应急行动。

4、灾后重建阶段：此阶段灾害造成的损失继续在减少，但人们的应对投入仍将持续大幅度增加，核心目标是确保灾区人民基本生活水平达到恢复甚至超过灾前水平。这一阶段的关键是如何从政府投入为主，转向政府引导、市场发挥基础作用；在政府投入中如何从国家投入为主成功转向地方投入为主，充分发挥地方的积极性、主动性。

从以上描述来看，灾前防御、灾中救援、灾后恢复以及重建四个阶段即相互联系交叉，又相互影响，只有做好前一环节才能更好更有效的进行下一环节且节约不少成本。防御阶段为灾后救援、恢复和重建做好充分的物质准备，预备做得好，灾后工作就能更快捷地开展；救援阶段积累的物资在恢复重建阶段仍将发挥巨大的作用，且救援工作做得好，能极大的鼓舞民心、稳定社会，从而更好地开展恢复重建工作；恢复阶段重点帮助被救援的伤员及灾区其他受灾群众恢复基本生活，同时其奠定的基础将有利于重建工作的全面有序展开；重建阶段将进一步巩固救援与恢复的成果，期间强化灾害防御将能有效抵御未来可能发生的灾害。鉴于以上特点，在以人为本、尊重自然的前提下，为统筹各方力量和各种资源，兼顾其各自不同的特点和需求，我们需要将融资工具纳入灾害风险管理过程中进行考察，以寻求融资工具组合中的结合点和平衡点。

# Ⅳ.融资工具的比较与排列

可被用于巨灾风险融资的工具很多，现有研究有两种划分标准。一种是按单次融资过程中的顺序，可被分为灾前融资(ex-ante)和灾后融资两类(ex-post)。其中，灾前融资（即预先安排）指灾害损失发生前布置的所有措施，涉及的是一种事前的开支，具有较明显的资金来源稳定优势，缺点在于可获资金规模有限，具体包括保险、巨灾债券、应急资本和衍生品等（Kunreuther et al.，1995；Wharton Risk Management and Decision Processes Center，2008；von Ungern-Sternberg，2009；Marlett，2009； Cole et al.，2009)。灾后融资（即事后应急）是为应对已发生的损失而安排的融资，包括现金/准备金的获得渠道、短期和长期债务发行及发售期权等。灾后融资的优势在于减少了累积准备金的机会成本，也规避了资金管理者支取准备金的潜在道德风险 (von Ungern-Sternberg, 2009)；其缺点是存在极大的不确定性（是否可获得资金，也没有事先计划好资金的使用），且资金如何使用也存在争议 (National Association of Insurance Commissioners, 2009)。另一种是按资金的来源，可被分为政府融资工具、保险融资工具以

及资本市场融资工具，而财政资金、（再）保险和巨灾衍生品则分别是这三类融资工具的典型。

## A.融资工具的筛选与比较

1、成本比较。此处所提及的融资工具成本，既指直接产生的费用，也指可能会发生的机会成本。图 2 给出了财政救助、（再）保险以及巨灾债券等最常用的三大类融资工具的成本比较情况。其中，横轴表示的是灾害造成的或有损失程度，从左自右依次分为自留、风险转移和资本市场等三个档次，表示或有损失程度逐渐增加；纵轴表示相应的融资工具成本。随着或有损失程度的增加，三类融资工具的成本都在不同程度地增加，只是在不同的损失程度阶段不同成本曲线的重叠顺序不同。①当或有损失程度属于自留阶段时，图 2 中财政救助的成本相对最低，（再）保险的成本其次，资本市场的成本最高。这主要是因为，在灾害损失不大的情况下，财政可用预算中的救灾专款进行救济，其成本较小；而资本市场发行巨灾债券，有较高的初始费用；②当或有损失程度增大到需要风险转移的阶段时，财政救助的成本超过了保险的成本，并在后期甚至超过了发行巨灾债券的成本，这主要是因为，如果灾害损失过大，在没有保险或资本市场等其他融资渠道的前提下，政府紧急调用其他的财政资金救灾，不仅对其他方面的建设产生了挤出效应，还会催生赤字；③当或有损失程度进一步扩大到需要资本市场来转移或分散时，政府财政救助的成本已远超过巨灾债券和保险的成本，而此时（再）保险也因为偿付能力问题以及再保险市场容量及费率问题而造成成本上升，甚至超过资本市场融资的成本。经过这样的比较，我们可以发现，财政救助的成本最化幅度最快，尽管其最初的成本相对最低；资本市场融资的成本较为稳定，尽管其初始成本较高。

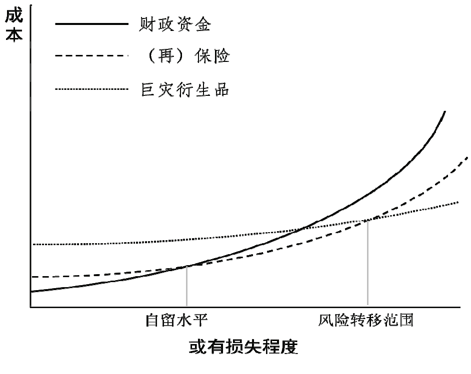



**图 2 三类主要融资工具的成本比较**

2、期限结构比较。所谓期限结构，指的是融资工具开始产生作用的时间及可以影响救济的时间长度。其中，开始产生作用的时间指资金到位的时点，与该工具自身的运作程序相关，运作程序越简单，资金就越容易及时到位；可以影响救济的时间长度则与工具可筹集到的资金规模有关，即筹到的资金越多，可发挥作用的期限相应越长，反之则越短。根据当前国际已有研究结果表明，灾前融资工具因属于主动融资行为，其开始产生作用的时间必然要早于灾后融资工具开始产生作用的时间；但因受灾害预测技术约束以及机会成本的限制，财政救助等典型灾前融资工具不可能筹到很大规模的资金，进而也影响到其救济时间长度。

**表 3 巨灾风险转移与融资工具的综合比较**

| 融资工具 | 成本乘数 | 支出（月） | 可获资金总量 |
|---|---|---|---|
| 慈善捐款（救济） | 0-1 | 1-6 | 不确定 |
| 慈善捐款（恢复与重建） | 0-2 | 4-9 | 不确定 |
| 应急预算 | 1-2 | 0-9 | 较小 |
| 储备金 | 1-2 | 0-1 | 较小 |
| 预算再分配 | 1-2 | 0-1 | 较小 |
| 应急债务便利 | 1-2 | 0-1 | 中等 |
| 国内借款（增发国债） | 1-2 | 3-9 | 中等 |
| 国外信贷（紧急贷款，发行外债） | 1-2 | 3-6 | 较大 |
| 参数保险 | >=2 | 1-2 | 较大 |
| 新型风险转移工具（巨灾债券、天气衍生产品） | >=2 | 1-2 | 较大 |
| 传统保险 | >=2 | 2-6 | 较大 |

注：成本乘数是指相应转移融资工具的所耗成本是其所融预期损失的一定乘数。慈善捐款虽然没有融资成本，但因其往往是从其他地方获得，所以并不能保证其总量的确定性。

表 3 罗列出了常见融资工具的综合比较情况，即对相应成本、时效以及可获得资金总量进行综合比较。显然，采用不同融资工具各有利弊。比如，①从成本的角度看，慈善捐款的成本虽然最小，但因其是从其他地方获得，所以并不能保证其总量的确定性，且并不能在灾害发生后马上得到，因需要一个筹集的过程；②从时效角度看，政府应急预算、储备金以及预算再分配的资金可以灾害发生后立刻到位，尤其是应急预算持续的时间也较长，但可获得的资金总量较小；③从可获资金总量的角度来看，保险、巨灾衍生品等融资工具都可以筹得较为可观的资金，但缺陷在于成本较高。

## B.融资工具的多层排列框架

经过对不同融资工具的比较，我们略知工具各自不同的特性及优势所在。为尽量发挥不同工具的最大效用，我们尝试将这些工具进行整合，使之成为一个相互交错，共同发挥最大功效的综合体，也为我国建立综合风险防范保障体系提供一些有用的建议。鉴于上述工具在成本、期限结构等方面的差异，并基于灾害风险管理各阶段资金需求的特点，我们对融资工具的多层顺列做如下安排。

众所周知，灾害风险的一个重要特点就是，发生概率低，损失程度重。换言之，其发生频率 p 通常与损失程度呈反比。据此，如 3 所示，我们以发生频率 p 为纵轴，以救助、恢复、重建三阶段为横轴，抽象显法了不同融资工具应在的位置。基本的分布原则是：成本越低、稳定性越强的置于较低损失且较为紧急的阶段；成本较高、到位时间较迟的置为损失较高且不太紧急的阶段。具体而言，当灾害风险发生频率较高，如 p≥1/20（即 20 年一遇）时，因灾害损失不大，损失可主要由民众或社会成立的公共储备金来承担，这样既便于将救灾工作日常化，也可以激励全民积极防灾的行为。当 1/20>p≥1/30 时，灾害风险导致的损失可能已让灾民无法自行消化，加上灾害发生情况突然，灾前储备资金可能无法完全满足应急救援和恢复阶段的需求，此时可启用财正应急预算资金，以度过灾害发生后最初的紧迫时期；而在随后的恢复和重建阶段，因损失还不算特别大，动用灾害保险恐增加理赔勘查的成本，建议对此阶段在灾前与世界银行等签署或有债务，借助其低成本的便利完成重建活动。当 1/30>p≥1/100 时，原有的灾前储备和应急预算可能都很难满足紧急救援阶段的资金需求，如 2008 年汶川地震突发后一样，此时需要考虑将预算再分配、紧急借款以及社会慈善捐赠利用起来，而在恢复、重建可发挥灾害保险的作用；但当 1/100>p≥1/200 时，灾害发生后恢复、重建阶段的资金需求规模显然不是传统灾害保险或再保险所能完全承受的，需要考虑通过巨灾衍生品的渠道将分散出去[3]，而在重建阶段因资金需求规模特别巨大，所以应考虑启用增发国债、信贷优惠以及对口援建等方式，将无法分散至世界的损失部分于国内内部消化。不过，如果灾害风险发生频率 p≤1/200，相信这种灾害对社会造成的打击将会是灭亡性质的，损失风险也不可能分散出去。

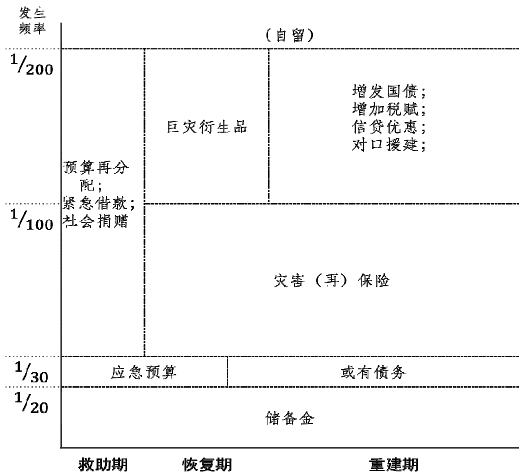



**图 3. 融资工具的多层排列框架**

按图 3 中的顺序安排各融资工具，一来可有针对性的满足不同灾害风险管理阶段的资金需求；二来也可有效控制人们面对灾害风险和巨灾保险的道德风险问题，引导人们对灾害保险的正确需求；三是有利于扩大保险公司应对灾害风险的融资渠道，提高供给灾害保险的积极性；第四是可减少政府民政救助的经济负担，降低准备灾害基金的机会成本。至于图 3 中所用到的具体年发生概率，可按具体风险种类等实际情况斟酌调整。

# Ⅴ. 面向灾害风险管理全过程的多层融资机制

融资工具是灾害风险管理过程中资金融通的主要载体，而融资机制则是资金融通工作顺利且有效实施的保证，更是联结灾害风险管理各环节、紧密团结灾害风险管理各参与主体的纽带和媒介。据此，本文在此大致勾画了集保险市场、资本市场和信贷市场于一体，以灾害风险基本为基本运作核心，统筹灾前主动融资与灾后应急融资，面向灾害风险管理全过程并尽可能衔接其中各阶段、化解资金缺口困境的多层融资机制。

[3]即灾前可将巨灾衍生品的触发机制设定为发生两百年一遇的灾害时启动。

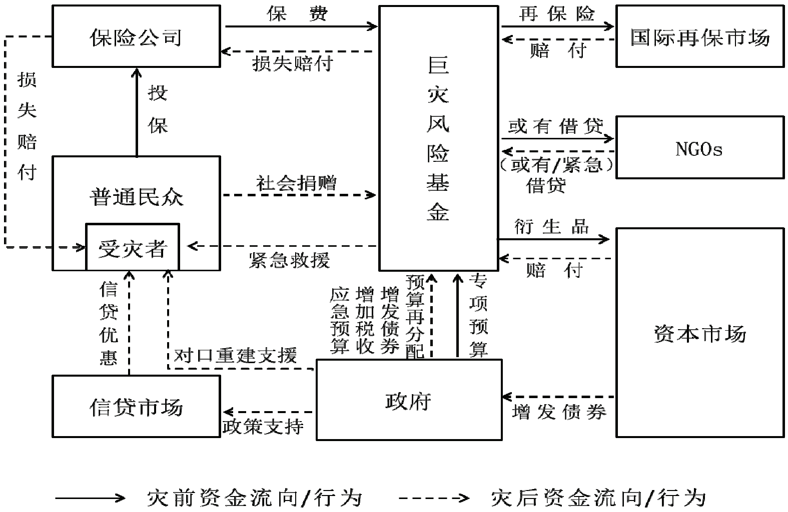



**图 4.多层融资机制及其运作流程**

如图 4 所示，多层融资机制中主要包括的参与主体有普通民众、政府、（再）保险、资本市场、非政府组织（NGOs）、信贷市场等，各主体在该机制中各司其职。考虑到这些主体并不可能相互直接产生联系，所以特别设计一个中心枢纽机构——巨灾风险基金缩短各主体之间的距离，减少资金融通过程中的运作流程和成本。此处，巨灾风险基金扮演的是一个资金池的作用，以融汇来自各方的资金，并协调各参与主体的行为。在灾害防御阶段，保险公司向普通民众收取的灾害保险的保费、政府的财政专项预算以及上年灾害风险管理资金的结余都汇集于巨灾风险基金中，由其根据当年灾害预测情况向国际再保险市场、NGOs 以及资本市场签署相应再保险、或有借贷、衍生品等风险转移协议；一旦灾害发生，在灾害救援阶段，巨灾风险基金可在第一时间将救济拨付下去，并催促灾前签署的风险转移协议履行，使再保险赔付、或有借贷、巨灾衍生品赔付等资金尽快到位，以保证保险公司对受灾者损失赔付的顺利进行，进而满足灾后恢复和重建的资金需求。政府部门在此机制中仅需配合巨灾风险基金的工作，并在适当时候提供一定政策支持，如灾害损失特别严重时，组织进行对口重建支援以及借用政策引导信贷市场给受灾者恢复重建提供信贷优惠。

# Ⅵ. 结语

在“巨震时代”这一特殊的历史时期，研究符合灾害应对周期的损失融资模式，对于我国乃至世界的防震减灾事业来说，都是极具现实意义的。本文针对灾害尤其是灾害风险管理中防御、救援、恢复、重建这一典型的周期，分别从各阶段的资金需求、主导力量等方面深入研究阶段的特征，为构建合适的融资机制奠定基础；从成本、期限结构等两个维度对现有可用的损失融资工具进行集成分析和比较，在此基础上勾画出融资工具的集成框架、排列顺序及位置；在搭建融资机制的运作机理时，从融资主体和融资工具两方面结果出发，提出了融资机制的大致运作模式。不过，灾害损失融资问题的研究，是一项系统性的工作，其效果的好坏有赖于相关体制与政策措施的默契配合。因此，要发挥多层融资机制的最大效果，促进灾害风险管理体制的成功建立及持续运行，还需要相关的领域配合采取必要的改革动作。

**References**

[1] Cole, C. , et al , The Use of Post-Loss Assessments in Catastrophic Financing, 2009.
[2] Jametti, M. and T. von Ungern-Sternberg , Hurricane Insurance in Florida. CESifo, Center for Economic Studies \& Ifo Institute for economic research, 2009.
[3] Kunreuther, H. , R. Meyer and E. Michel-Kerjan , Overcoming decision biases to reduce losses from natural catastrophes, Behavioral Foundations of Policy, 2009.
[4] Lewis, C. M. and P. O. Davis, Capital Market Instruments for Financing Catastrophe Risk: New Directions?, Journal of Insurance Regulation, 1998, 17110－133.
[5] Marlett, D. C. , Insuring coastal properties in the mid-Atlantic region, Journal of Insurance Regulation, 2009, 27(3), 91.
[6] Osterland, A. , The CATs Are Out of the Bag, Business Week, 1998, January 26.
[7] Sun Qixiang and Zhou Yi, Terrorist incidents and Catastrophe Insurance Derivatives, Finance & Trade Economics, 2002.3.
孙祁祥、周奕，恐怖主义事件与巨灾保险衍生品，《财贸经济》，2002 年第 4 卷，第 45 页。
[8] Tao Zhengru and Tao Xiaxin, Catastrophe Insurance Derivatives, Journal of Natural Disasters, 2007.4.
陶正如、陶夏新，巨灾保险衍生品,《自然灾害学报》，2007 年第 4 期，第 132－138 页。
[9] Tian Ling and Gao Jun, An Explain to the Puzzle ofPremiun of Catasthophe Bonds Based on Behavior Finance Theory, Financial Theory & Practice, 2007.10.
田玲、高俊，巨灾风险债券溢价之谜的行为金融学解释，《金融理论与实践》，2007 年第 10 期，第 8－11 页。
[10] Tian Ling and Zhang Yue, Government, Reinsurance and the Structure of Catastrophe Insurance Supply: the Optimal Structure of Catastrophe Bonds and Reinsurance, Commercial

Times, 2010.34.
田玲、张岳，政府效应, 再保险与巨灾保险供给结构——基于巨灾债券, 再保险最优结构的模型分析,《商业时代》，2010 年第 034 期，第 58－59 页。
[11] Wei Hualin, Xiang Fei and Hong Wenting, A Study on Issues Concerning the Damages of Snow Storm and Insurance Compensation, Insurance Studies, 2009.3.
魏华林、向飞、洪文婷，中国南方雪灾损失与保险补偿问题研究,《保险研究》，2009 年第 3 期，第 11－20 页。
[12] Yao Qinghai, How to Deal with the Great Plague of Catastrophe? An Study on the Catastrophe Risks and the Role of Government and Market in Catastrophe Risk Management, Transportation Enterprise Management,
姚庆海，沉重叩问: 巨灾肆虐, 我们将何为——巨灾风险研究及政府与市场在巨灾风险管理中的作用,《交通企业管理》，2006 年第 11 期，第 50－53 页。

# 面向灾害风险管理全过程的多层融资机制

高俊，陈秉正
经济管理学院，清华大学，北京，中国，100084

摘　要：救助援建资金，作为灾害发生后人们所有应对行为的根本动力来源，其规模大小及储备情况等与灾害风险管理的最终成败紧密相关。“拓宽灾害风险转移渠道，推动建立规范合理的灾害风险分担机制”虽然能缩小甚至消除灾害风险管理中的“总量资金缺口”局面，但无法杜绝风险管理过程中的“临时资金缺口”现象。据此，本文将灾害风险管理全过程拆分为防御、救援、恢复和重建四个阶段，从经历时间、主要任务等方面分段研究各阶段的资金需求特点，寻找救助援建资金需求的动态变化规律；然后从供给层面出发，比较不同融资工具的融资成本、期限结构和规模等，排列各融资工具在全过程中应处于的位置和顺序；最终构建出包括灾害风险融资各参与主体，契合灾害风险管理全过程救助援建资金需求的多层融资机制。

关键词：灾害风险管理；灾害风险融资；多层融资

# Research on Securitization of the Country's Catastrophe Insurance Risk

## ----Initial Design of Flood Catastrophe Bond

SHI Jianxiang CHEN Haiyan
Finance College, Zhejiang Gongshang University, Hangzhou, Zhejiang, 310018

**Abstract:** Catastrophe securitization is an internationally accepted chief financial innovation about dispersal of catastrophe risk. Concerning about the present starting situation of catastrophe securitization in China, catastrophe bond is the most suitable issuing tool. The paper selects the flood disaster loss data and occurrence counts in Zhejiang, Fujian and Jiangxi Province between 1990 -2009, and uses the principal of Actuarial Mathematics of Non-life Insurance to fit the distribution of flood disaster loss, on the basis of which, carries out the pricing of flood catastrophe bond.

**Key words:** Catastrophe Insurance, Securitization, Flood Catastrophe Bond

## 一、引言

自 20 世纪 90 年代以来，接踵而来的巨灾风险暴露了传统再保险的缺陷。由于供需缺口的不断加大，再保险价格不断激增。为有效防范巨灾风险，人们将巨灾保险风险转移到了资本市场，开启了巨灾保险风险证券化的序幕，而巨灾债券因其易操作性和可行性很快诞生了。目前，巨灾风险管理创新工具发展很快，谢世清（2009）把巨灾风险证券化工具分成"四个传统"创新工具和"四个当代"创新工具。国内目前探讨较多的是"四个传统"创新工具，即巨灾债券、巨灾期权、巨灾期货和巨灾互换，国际市场上陆续出现的"四个当代"创新工具为或有资本票据、巨灾权益卖权、行业损失担保和"侧挂车"。

近年来，国际上巨灾债券每年的发行规模和速度不断取得突破，已成为（再）保险公司转移巨灾风险的重要渠道。自 1997 年至 2007 年，总共发行了 116 只巨灾债券，总交易金额为 223 亿美元。2010 年全球 23 家非寿险公司新发行巨灾债券总金额达 48 亿美元，超过 2009 年发行量的 36%。尤其从 2003 年开始，巨灾债券的未到期总金额迅速增长，而这正是衡量巨灾债券市场大小和风险承担能力的最重要的指标。巨灾债券在国际市场上已担当起补充再保险市场面对巨灾风险捉衿见肘的承保能力，给资本市场提供新的投资工具的重要角色。

相较而言，我国的巨灾债券市场发展缓慢。众所周知，我国是世界上洪涝灾害多发的国家，受洪水威胁的地区主要分布在东部平原区，特别是长江中下游地区。据《中国大洪水》记载，自 1840 年至 1992 年共 153 年间，长江流域有 59 个年份发生洪涝灾害，其中长江中游地区 43 个年份发生灾害，而这些地区正是我国经济发展迅速，人口和财产密集的地方，潜在的洪涝灾害损失巨大。目前，我国在灾害处理上，更多的是通过政府救灾基金，以及全国各地的救济资金方式。我国曾经在黄河流域推行过商业洪水保险，但未能成功开展，国际上惯用的通过巨灾保险风险证券化方式向资本市场分散洪涝等巨灾风险，在国内还是空白。本文拟借鉴发达国家巨灾风险证券化的经验，根据我国浙闽赣三省 1990—2009 年洪涝灾害损失分布情况，尝试设计巨灾保险风险证券化工具——

洪涝灾害债券。

## 二、洪涝灾害损失分布的拟合分析

### （一）样本描述性统计

本文选取了 1990-2009 年浙闽赣三省发生洪涝灾害的直接损失数据作为样本，经过居民消费价格定基指数的调整，截取损失数据接近或超过 1 亿人民币作为样本数据。浙闽赣三省的地理位置处于长江中下游，遭受洪涝灾害损失较为严重和频繁，为研究洪涝巨灾债券提供了较为丰富的历史数据。

表 1 是样本数据一些统计特征，从其偏度和峰度值可以看出，三省的洪涝灾害损失分布存在严重的右偏厚尾现象。

**表 1　洪涝灾害损失数据统计分析表**　　单位：万元

| 损失均值 | 标准差 | 偏度 | 峰度 | 最大值 |
| --- | --- | --- | --- | --- |
| 57661.77 | 58037.209 | 2.893 | 12.312 | 408302.92 |

数据来源：由中国气象灾害网站公布的《1949~2004 年中国洪水事件表》、1990~2009 年《中国减灾》期刊"灾情信息"文档整理得到。

### （二）洪涝灾害损失分布建模

根据王新军（2003）对财产损失分布建模的阐述，巨灾损失金额的拟合应从经验分布函数（Empirical distribution function）和经验剩余期望函数值（Empirical mean residual life function）出发，参考这两个函数的变化趋势预选损失分布函数。经验剩余期望函数之所以在判断损失分布模型中发挥着独特作用是因为它反映的是损失分布的尾巴情况，这正是右偏厚尾的巨灾损失分布要考虑的核心问题。对于预选的损失分布函数，需要首先进行参数估计，把理论剩余期望函数值与经验剩余期望函数值进行比较调整，其次进行拟合优度检验，并最终确定损失分布函数。

设 X 为洪涝损失分布的随即变量，其取值为 $x_1$，$x_2$，$x_3$，…，$x_n$，密度函数为 $f(x)$。值得注意的是，可以选择对样本数据先进行分组，也可以选择不分组直接进行拟合。假若数据量足够大，可以采用分组方法，会给后续的检验带来便利性。

对于未分组的样本数据，首先是损失样本数据从小到大排序，并代入式（2-1）得出经验剩余期望函数值 $e_n[X;x_k]$，同时计算出经验分布函数值。

$$e_n[X;x_k] = \frac{x_{k+1}+x_{k+2}+\ldots+x_n}{n-k} - x_k \quad (d = x_k) \qquad (2\text{-}1)$$

对于经过分组的样本数据，依然是先把损失样本数据升序排序，代入（2-2）得出分组数据的经验剩余期望函数值 $e_n[x_k;c_k]$，

$$e_n[x_k;c_k] = \frac{f_m\bar{x}_m+\ldots+f_{k+1}\bar{x}_{k+1}}{f_m+\ldots+f_{k+1}} - c_k \qquad (2\text{-}2)$$

其中 $f_1+\ldots+f_m = n$，m 为分组数，$c_k$ 是分组的临界值，$f_k$ 是样本数据落在 $(c_k, c_{k+1}]$ 区间的频数，$\bar{x}_k$ 是各组平均数。

然后根据经验剩余期望函数值的散点图，判断并预选损失分布模型，比较重要的五个分布函数是伽玛分布、对数正态分布、对数伽玛分布、帕累托分布和威布尔分布。模型预选之后需要确定模型的参数，最小距离法和最小卡-方估计是在损失分布的参数估计中相较于极大似然估计方法更加优越的估计方法。在参数估计的迭代过程前，首先要确定迭代的初始参数，依据经验使用矩估计法确定的分布函数近似参数作为初始值比较适宜。而参数的迭代过程，则可选用 Eviews、SPSS、Matlab 系统进行迭代分析。

最后是进行拟合优度检验，例如对分组样本数据进行皮尔逊卡-方法假设检验，同时

也可以用各个分布的理论剩余期望函数值与经验剩余期望函数值进行比较，判断出最理想的分布函数。其中，Pareto 分布和对数正态分布的理论剩余期望函数表达式分别如式（2-3）和式（2-4）所示。

$$e_n[X;x]=\frac{\lambda+x}{\alpha-1} \quad (x>0) \qquad (2\text{-}3)$$

其中 X 服从参数为 $\lambda$ 和 $\alpha$ 的 Pareto 分布。

$$e_n[X;x]=\frac{\exp(\mu+\sigma^2/2)[1-\phi(\frac{\ln x-\mu-\sigma^2}{\sigma})]}{1-\phi(\frac{\ln x-\mu}{\sigma})}-x \quad (x>0) \qquad (2\text{-}4)$$

其中 X 服从参数为 $\mu$ 和 $\sigma$ 的对数正态分布。

（三）洪涝损失分布的确定

本文将会在模型预选阶段，同时采用未分组和分组的样本数据的经验剩余期望函数散点图，来判定预选模型，之后用分组的样本数据对洪涝损失数据进行拟合过程。

对于未经过分组的样本数据，经过顺序排序代入式（2-1）后，得到经验剩余期望函数值，经验分布函数值和经验剩余期望函数值的散点图如图 1 和图 2 示。

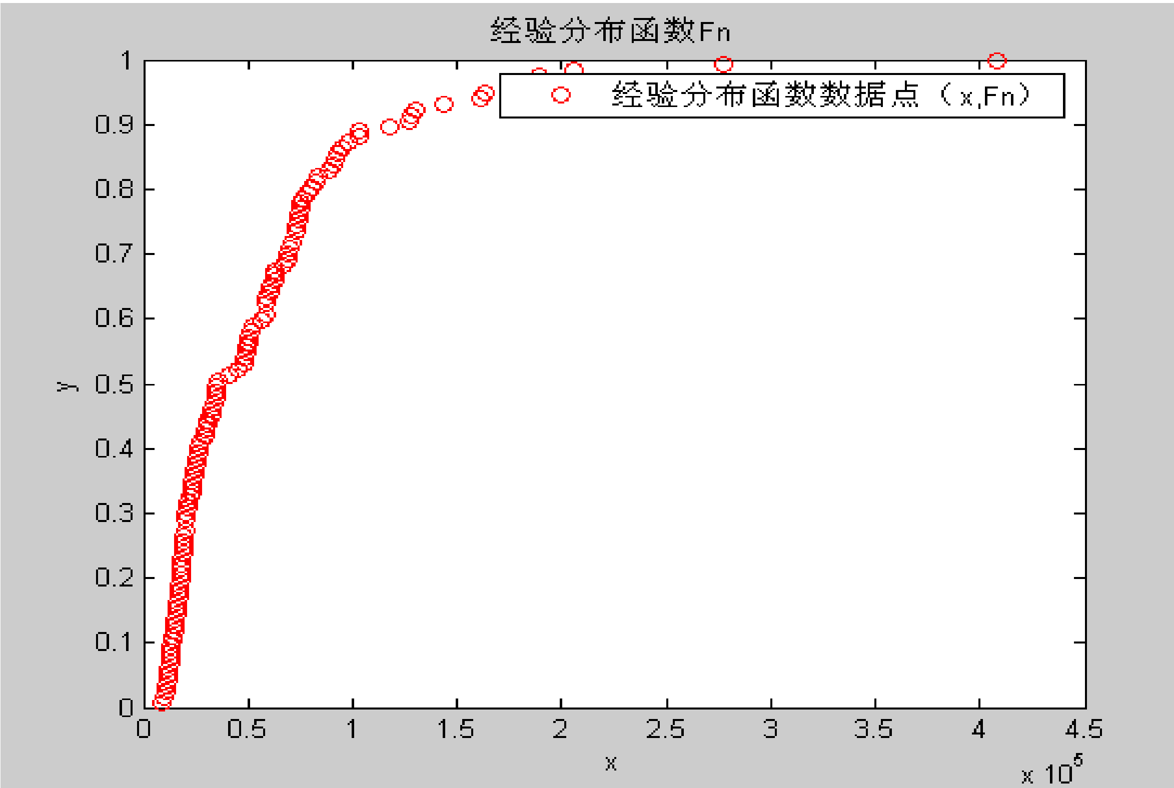



**图 1** 未分组数据经验分布函数值散点图

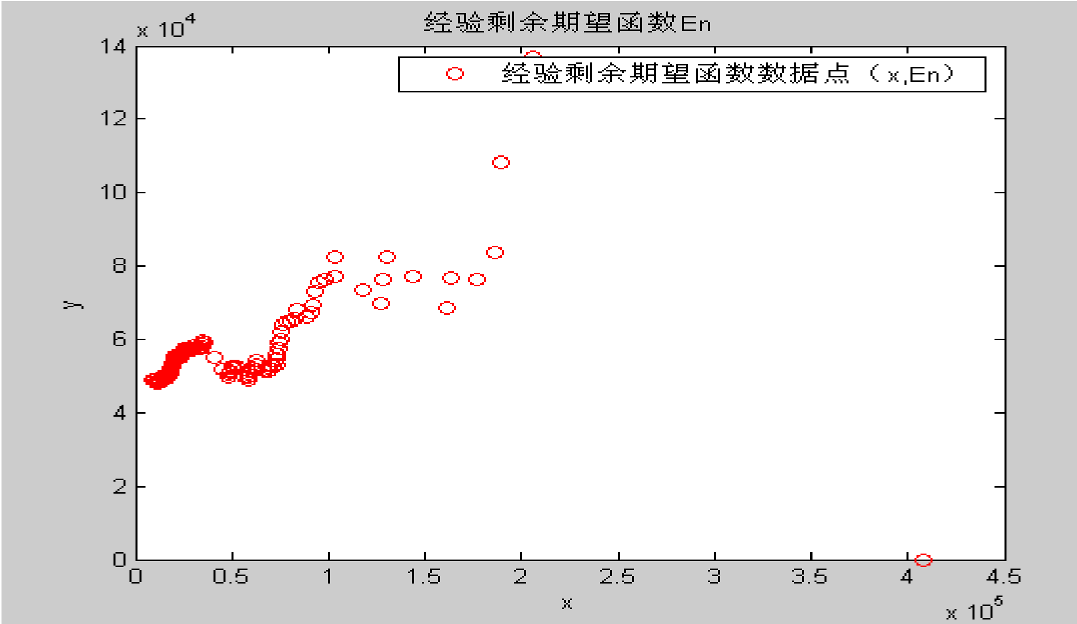



**图 2　未分组数据经验剩余期望函数值散点图**

由图 2 的经验剩余期望函数值散点图（图 2 中最后个点无意义），可以初步预选损失分布符合对数正态分布和帕累托分布模型。利用矩估计法计算帕累托（Pareto）分布的初始参数为：

$$\hat{\alpha}=\frac{2S^2}{S^2-(\overline{X})^2}=156.2142$$

$$\hat{\lambda}=\frac{\overline{X}*M_2}{S^2-(\overline{X})^2}=8.9500e+006$$

对数正态分布的初始参数为：

$$M_2=\frac{1}{n}\sum_{i=1}^{n}x_i^2=S^2+(\overline{X})^2=6.6929e+009$$

，

$$\hat{\mu}=2\ln\overline{X}-0.5\ln M_2=10.6125$$

$$\hat{\sigma}^2=-2\ln\overline{X}+\ln M_2=0.6996$$

$$\hat{\sigma}=0.8364$$

若要使用分组数据法来拟合建模，首先把样本数据分成 $m\approx1.87(n-1)^{0.4}\approx13$ 组，分组情况见表 2，其中 $c_0$=80000 万元，$c_{13}$=420000 万元。分组后的经验分布函数值和经验剩余期望函数值见表 3，散点图如图 3 和图 4 所示。

**表 2　数据分组情况**

| 序号 | 损失区间 $(c_k,c_{k+1}]$（万元） | 频数 |
|---|---|---|
| 1 | 8000—10000 | 9 |
| 2 | 10000—14000 | 11 |
| 3 | 14000—18000 | 11 |
| 4 | 18000—20000 | 10 |
| 5 | 20000—25000 | 9 |
| 6 | 25000—33000 | 11 |
| 7 | 33000—50000 | 12 |

| | | |
|---|---|---|
| 8 | 50000—60000 | 8 |
| 9 | 60000—70000 | 9 |
| 10 | 70000—80000 | 10 |
| 11 | 80000—100000 | 9 |
| 12 | 100000—150000 | 7 |
| 13 | 150000—420000 | 9 |

表 3　分组数据经验分布函数 **Fn(x)**和经验剩余期望函数 **En(x)**

| 组号 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Fn(x) | 0.0855 | 0.1624 | 0.2393 | 0.3162 | 0.4017 | 0.4957 | 0.5641 |
| En(x) | 48987 | 49825 | 52234 | 54990 | 57470 | 59279 | 51864 |
| 组号 | 8 | 9 | 10 | 11 | 12 | 13 | |
| Fn(x) | 0.6325 | 0.7094 | 0.7949 | 0.8718 | 0.9316 | 1.0000 | |
| En(x) | 50468 | 52591 | 62722 | 74800 | 71076 | | |

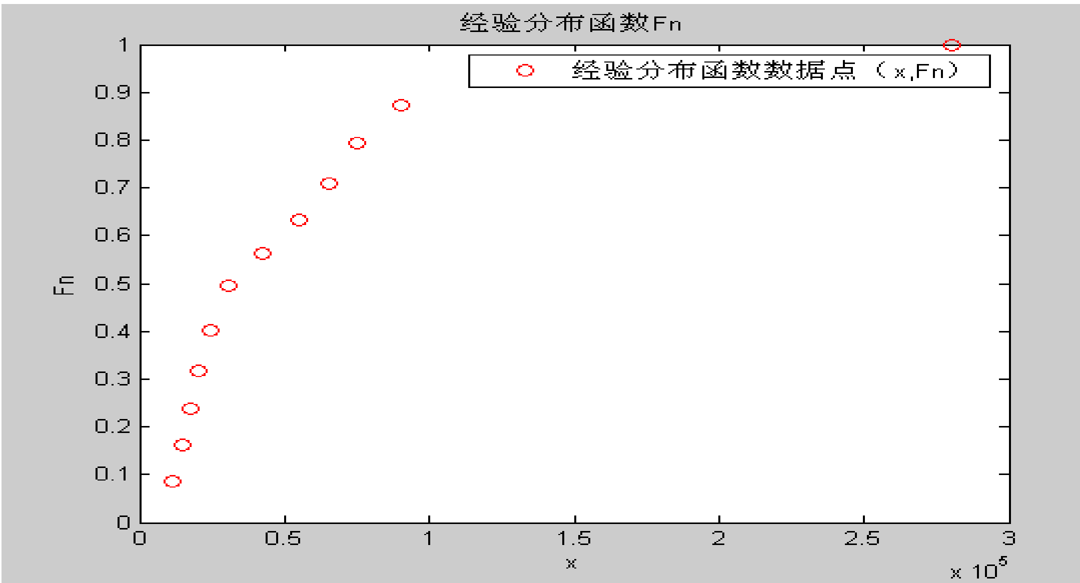



图 **3** 分组数据经验分布函数值散点图

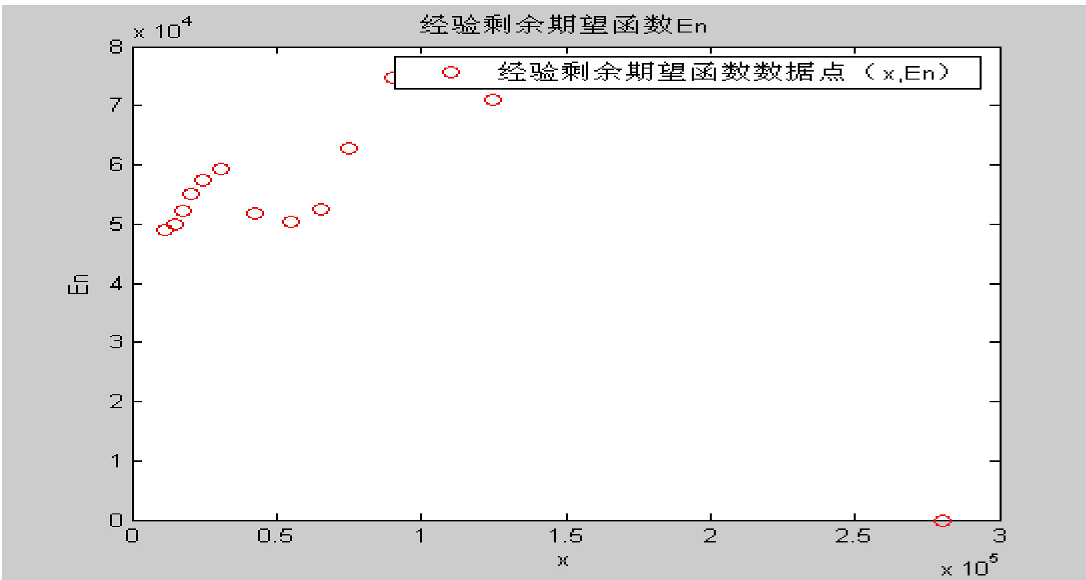



图 **4**　分组数据经验剩余期望函数值散点图

由图 3、图 4 的变化趋势同样呈现了增加的趋势，这与未分组数据的增长趋势相似。依据分布模型的选择原则，首先选择的仍然是 Pareto 分布和对数正态分布，由于增长的趋势强度不大，可以排除对数伽玛分布。从以上未分组和分组数据的经验剩余期望函数散点图，可以更加有把握相信选择 Pareto 分布和对数正态分布为预选模型，然而哪种分布更加准确拟合洪涝损失，则需要进一步的比较和检验工作才能得到判断。

至于分组数据的模型初始参数估计与未分组数据的一样，无需额外的工作。

接着把参数初始值代入 Matlab 系统，利用非线性最小二乘估计法，样本数据的迭代结果和皮尔逊卡-方法检验值如下表 4。

**表 4　分组数据的模型参数估计**

| Pareto 分布 | | | | 对数正态分布 | | | |
|---|---|---|---|---|---|---|---|
| 参数估计 | | 拟合优度 | 皮尔逊卡-方值 | 参数估计 | | 拟合优度 | 皮尔逊卡-方值 |
| $\hat{\lambda}$ | $\hat{\alpha}$ | $R^2$ | $\chi^2$ | $\hat{\mu}$ | $\hat{\sigma}$ | $R^2$ | $\chi^2$ |
| 8.9501e+006 | 171.9029 | 0.9737 | 17.3049 | 10.4509 | 0.9617 | 0.9891 | 15.8746 |

依据皮尔逊卡-方法检验法，此时 $\chi^2(m-p-1)$（m 为分组数，p 为参数个数）为 $\chi^2(10)$，一般分布点取 0.05，卡方值为 18.306641。对较表 4，无论拟合优度还是皮尔逊卡-方值，都表明对数正态分布在拟合样本数据的效果上都优于 Pareto 分布的表现。因此，本文选择对数正态分布作为浙闽赣三省洪涝灾害损失所服从的分布，表达式如（2-5）所示。

$$F(x)=\Phi(\frac{\ln x-\mu}{\sigma}) \tag{2-5}$$

其中，$\mu$=10.4509，$\sigma$=0.9617。

**（四）损失发生次数拟合**

本文选取的损失次数样本为 1990-2009 年期间浙闽赣三省遭受洪涝灾害次数，选用三省洪涝发生次数的样本原点矩 8.1111。运用参数 $\lambda$=8.1111 泊松分布，将这一估计值代入式（2-6）泊松分布公式，计算出概率。

$$P(X=k)=\frac{\lambda^k}{k!}e^{-\lambda}$$

$k$=0,1,2,…　（2-6）

把概率与根据历史数据计算出的“频率”（ 如表 5 所示）进行比较，发现拟合效果较好，因此每年洪涝灾害次数服从泊松分布。

**表 5　三省洪涝灾害次数频率与概率比较**

| 次数 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| 年份数 | 1 | 1 | 0 | 1 | 0 | 5 |
| 频率 | 0.0556 | 0.0556 | | 0.0556 | | 0.2778 |
| 概率 | 0.0099 | 0.0267 | 0.0541 | 0.0878 | | 0.1376 |
| 次数 | 8 | 9 | 10 | 11 | 12 | 13 |
| 年份数 | 3 | 2 | 1 | 1 | 1 | 2 |
| 频率 | 0.1667 | 0.1111 | 0.0556 | 0.0556 | 0.0556 | 0.1111 |
| 概率 | 0.1395 | 0.1257 | 0.1020 | 0.0752 | 0.0508 | 0.0317 |

## 三、洪涝灾害债券的初步设计

### （一）洪涝灾害债券收益率的确定

本文根据 CAPM 模型来确定洪涝灾害债券的收益率，CAPM 的表达式如 3-1 所示。

$$E(R_i)=R_f+\beta_i\left[E(R_m)-R_f\right]$$

（3-1）

其中，$E(R_i)$ 表示金融资产的期望收益率，$\beta_i$ 表示金融资产的贝塔系数，$R_f$ 表示无风险收益率，$E(R_m)$ 表示市场组合的期望收益率。假设洪涝灾害发生的概率是 P，在不发生洪涝灾害的情况下，投资者的期望收益率是 R。本文设计洪涝灾害债券是依据本金偿还条件，把债券分成三种类型：本金保证型、本金部分保证型、本金没收型。当然，不同的债券类型有不同的触发条件，表 6 列出了理论洪涝灾害损失区间及其发生概率。

**表 6　理论洪涝灾害损失情况**

| 序号 | 损失区间 $(c_k, c_{k+1}]$（万元） | 概率 |
|---|---|---|
| 1 | 8000~10000 | 0.0345 |
| 2 | 10000~14000 | 0.0751 |
| 3 | 14000~18000 | 0.0751 |
| 4 | 18000~20000 | 0.0360 |
| 5 | 20000~25000 | 0.0834 |
| 6 | 25000~33000 | 0.1127 |
| 7 | 33000~50000 | 0.1687 |
| 8 | 50000~60000 | 0.0674 |
| 9 | 60000~70000 | 0.0516 |
| 10 | 70000~80000 | 0.0401 |
| 11 | 80000~100000 | 0.0568 |
| 12 | 100000~150000 | 0.0712 |
| 13 | 150000~420000 | 0.0588 |

本文选取上表所列的三种损失金额，3.3~5 亿元，7~8 亿元，10~15 亿元分别作为本金保证型债券、本金部分保证型债券、本金没收型债券的触发区间。这三类损失金额发生的概率分别是 0.1687，0.0401 和 0.0712。

假设无风险利率 $R_f$ 为 4%，金融资产的贝塔系数 $\beta_i$ 为 0.6，市场组合的期望收益率 $E(R_m)$ 为 12%。那么不同类型的洪涝灾害债券的票面利率分别为：

（**1**）**本金保证型债券**，如果巨灾发生收益率为 0，则：

$$E(R) = R(1-p) + 0 * p = R_f + \beta_i \left[ E(R_m) - R_f \right]$$

$$R = \frac{R_f + \beta_i \left[ E(R_m) - R_f \right]}{1-p} = \frac{4\% + 0.6 * (12\% - 4\%)}{1 - 16.87\%} = 10.59\%$$

（**2**）**本金部分保证型债券**，如果巨灾发生收益率为-50%，则：

$$E(R) = R(1-p) + (-0.5) * p = R_f + \beta_i \left[ E(R_m) - R_f \right]$$

$$R = \frac{R_f + \beta_i \left[ E(R_m) - R_f \right] + 0.5p}{1-p} = \frac{4\% + 0.6 * (12\% - 4\%) + 0.5 * 4.01\%}{1 - 4.01\%} = 11.26\%$$

（**3**）**本金没收型债券**，如果巨灾发生收益率为-100%，则：

$$E(R)=R(1-p)+(-1)p=R_f+\beta_i\left[E(R_m)-R_f\right]$$

$$R=\frac{R_f+\beta_i\left[E(R_m)-R_f\right]+p}{1-p}=\frac{4\%+0.6*(12\%-4\%)+7.12\%}{1-7.12\%}=17.14\%$$

**（二）洪涝灾害债券价格的确定**

假定巨灾债券面值为 1 元，如果不发生巨灾，该债券在每个期末支付投资者利息 i 元，并在最后到期日（T）偿还本金。如果巨灾发生，投资者将根据巨灾债券类型获得利息或者本金。假定该支付函数为 $f$，然后债务结束。用 $\tau$ 表示巨灾发生的时刻，如果巨灾在到期前发生，则 $\tau\in\{1,2,\ldots,T\}$。该债券持有人的现金流表示为：

$$i(t)=\begin{cases} i|_{(\tau>1)}+f(i+1)|_{(\tau=1)} & (t=1,2,\ldots T-1) \\ (i+1)|_{(\tau>T)}+f(i+1)|_{(\tau=T)} & (t=T) \end{cases} \quad （3\text{-}2）$$

该债券在 t=0 时的价格 $p$ 表示为未来的现金流的现值：

$$p=\sum_{t=1}^{T}\frac{i(t)}{(1+i)^t} \quad （3\text{-}3）$$

假定发行面值为 100 元的单一时期洪涝灾害债券，不同类型的洪涝债券的价格分别为：

**（1）本金保证型债券**。其年利率为 4%，触发损失区间为（3.3 亿元，5 亿元），发生概率为 0.1687，则：

$$p=\frac{110.59*83.13\%+100*16.87\%}{1+4\%}$$

=104.62

**（2）本金部分保证型债券**。其年利率为 4%，触发损失区间为（7 亿元，8 亿元），发生概率为 0.0401

$$p=\frac{111.26*95.99\%+50*4.01\%}{1+4\%}$$

=104.62

**（3）本金没收型债券**。其年利率为 4%，触发损失区间为（10 亿元，15 亿元），发生概率为 0.0712

$$p=\frac{117.14*92.88\%+0*7.12\%}{1+4\%}$$

=104.62

如果发行面值为 100 元的两时期洪涝灾害债券，不同类型的洪涝债券的价格见表 7。

**表 7　三种类型两时期洪涝债券价格表**

| 债券类型 | 第 1 期 | | | 第 2 期 | | | 债券价格 |
|---|---|---|---|---|---|---|---|
| | 巨灾发生 | 巨灾不发生 | 现值 1 | 巨灾发生 | 巨灾不发生 | 现值 2 | |
| 本金保证型 | 0 | 16.87 | 16.22 | 100 | 116.87 | 100.60 | 116.82 |
| 本金部分保证型 | 0 | 4.01 | 3.86 | 50 | 104.01 | 100.60 | 104.46 |
| 本金没收型(50%) | 0 | 7.12 | 6.85 | 0 | 107.12 | 100.60 | 107.45 |

## 四、结束语

巨灾风险证券化，尤其是巨灾债券从 1997 年至今的十几年间，在发达国家得到了很好发展，在分散巨灾风险、补偿巨灾损失方面发挥了越来越重要的作用。在我国，从 2002 年开始在理论上得到国内许多学者专家的关注和讨论，但至今在实践上仍没有迈出实质性步伐。我国发展巨灾风险证券化的策略，姚壬元（2004）认为应该从巨灾风险证券化的开发与设计、完善巨灾风险证券化发展的外部环境两个大方面继续推进其发展路径。结合目前我国的实际情况，选择巨灾风险证券化产品时，巨灾债券是最佳选择。本文以 1990-2009 年浙闽赣三省的洪涝灾害损

失数据，利用非寿险精算方法，分析拟合损失分布较符合对数正态分布，并依据 CAPM 模型，初步设计洪涝灾害债券的收益率及其价格。但是，鉴于我国巨灾损失数据库的缺失、巨灾风险证券化产品设计的复杂等原因，笔者只根据可得的三省数据及掌握的非寿险精算方法，做洪涝灾害债券的初步设计，许多方面还需更加深入的探讨。

**参考文献：**

[1]谢世清.巨灾风险管理工具的当代创新研究[J],宏观经济研究，2009，（11）.

[2]谢世清、曲秋颖.保险连接证券的最新发展动态分析[J],保险研究，2010，（7）.

[3]周贺君、金燕生.巨灾债券的一种定价模型[J]，学理论，2009，（11）.

[4]王新军.财产险个体损失分布建模的系统分析[J],山东财政学院学报,2003，(2)。

[5]施建祥、邬云玲.我国巨灾保险风险证券化研究—台风灾害债券的设计[J]，金融研究，2006，（5）。

[6]李勇权.《巨灾保险风险证券化研究》[M]，中国财经经济出版社 2005 版。

[7]姚壬元.巨灾保险风险证券化研究[J]，中南财经政法大学学报,2004(5).

[8]Cox, Samuel H. & Hal W. Pedersen, Catastrophe risk bonds[J]. North American Actuarial4(4). 2001

[9] Bruggeman, Veronique , Capital Market Instruments for Catastrophe Risk Financing[J]. American Risk and Insurance Association, 2007

[10] Punter, Alan, The Changing Risk Landscape: the Spectrum of Alternative Risk Financing Opportunities. 1999

# 我国巨灾保险风险证券化研究

## ——洪涝灾害债券的初步设计

施建祥　陈海燕

浙江工商大学金融学院，浙江省杭州市，310018

**摘要：**巨灾保险风险证券化是目前国际上认可的分散巨灾风险的主要金融创新之一，鉴于中国目前巨灾证券化的起步现状，巨灾债券是最合适的发行工具。本文选取 1990-2009 年浙闽赣三省洪涝灾害损失数据和发生次数，利用非寿险精算原理，尝试拟合洪涝灾害损失分布，并在此基础上进行洪涝巨灾债券的定价。

**关键词：**巨灾保险；证券化；洪涝灾害债券

# Internal Control Risk Analysis Model Based on Ordinal Logistic regression

ZHANG Dongling, MU Pengfei, XU Xiaomei
School of Economics, Qingdao University, Qingdao, China, 266071

**Abstract:** Internal control risk management is a more significant issue in the corporate governance. It presents a proposed method for the development of risk evaluation and early-warning for internal control system, and shows the application of the ordinal logistic regression model and its advantages. It involved several steps: n building an internal control risk evaluation index system, applying the linguistic information processing method, building the ordinal logistic regression model, differentiating and analyzing the quality evaluation to reach the internal control risk evaluation result.
**Keywords:** internal control risk; ordinal regression; linguistic Information; corporate governance

## Ⅰ.Introduction

A system of internal control consists of policies and procedures designed to provide management with reasonable assurance that the company achieves its objectives and goals, these policies and procedures are often called internal controls, and collectively, they make up the entity's internal control [1]. The auditors have the responsibilities related to internal control required by Section 404 of the Sarbanes̃ Oxley Act. The requirements for an integrated audit of financial statements and an audit of internal control over financial reporting have had the most significant effect on the auditing profession as anything in several decades. The research highlights the key components of COSO's Internal Control – Integrated Framework, which is the framework being used by public companies to assess the operating effectiveness of internal control. Binary responses (for example, success and failure) and ordinal responses (for example, normal, mild, and severe) arise in many fields of study. Logistic regression analysis is often used to investigate the relationship between these discrete responses and a set of explanatory variables. Several texts that discuss logistic regression are Collett (1991), Agresti (1990), Cox and Snell (1989), and Hosmer and Lemeshow (1989) [2-5]. The ordinal logistic regression model can be applied for differentiate analysis, and in quality control and management, quality classification is a process of differentiating, so based on the above research, we focus on internal control risk analysis and the aim of this paper is to provide a methodological guideline for the management of the risk evaluation for internal control based on linguistics panel data processing.

## Ⅱ. Internal Control System

### A. Internal control objectives

We briefly identify and discuss the three broad objectives management has when designing an effective internal control system (reliable financial reporting, efficient and effective operations, and compliance with laws and regulations). We use this discussion to highlight that while management focuses on internal controls related to these broad objectives, the auditor's focus is on those controls related to the reliability of financial reporting, which may include some controls related to operations and compliance that might also impact financial reporting. This is particularly important to emphasize since PCAOB Standard 2 specifically requires the auditor to report on internal controls over financial reporting. These three objectives are illustrated as follows.

1). Reliability of financial reporting

Management has both a legal and professional responsible for preparing statements for investors, creditors, and other users. The objective of effective internal control over financial reporting is to fulfill these financial reporting responsibilities.

2). Efficiency and effectiveness of operations

Controls within a company encourage efficient and effective use of its resources to optimize the company's goals. An important objective of these controls is accurate financial and nonfinancial information about the company's operations for decision making.

3). Compliance with laws and regulations

Section 404 requires all public companies to issue a report about the operating effectiveness of internal control over financial reporting.

## B. Management's responsibilities for internal control

The management and auditor responsibilities for internal control are different. The management is responsible for establishing and maintaining the entity's internal controls, the specific Section 404 responsibilities for management to publicly report on the operating effectiveness of those controls are more significant. But the auditor's responsibility is to understand and test internal control over financial reporting to provide a basis to express an opinion on the operating effectiveness of those controls. Management's responsibilities related to internal control includes reasonable assurance, inherent limitations, design of internal control, operating effectiveness of controls and controls over the reliability of financial reporting.

## C. COSO components of internal control

COSO's Internal Control-Integrated Framework, which is the most widely used framework among public companies for purposes of reporting in accordance with Section 404. The framework describes five components of internal control that management designs and implements to provide reasonable assurance that its control objectives will be met. Each component contains many controls. The COSO internal control components include as follow Fig.1

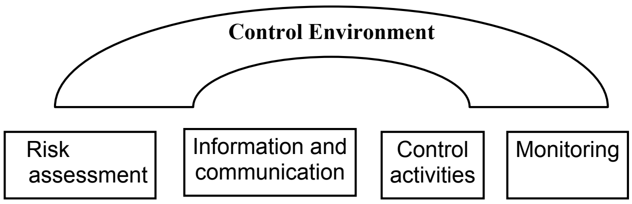



Figure1. COSO internal control components.

# Ⅲ. Internal Control Risk Analysis Model

## A. Ordinal regression model

For binary response models, the response, $Y$ , of an individual or an experimental unit can take on one of two possible values, denoted for convenience by 1 and 2 (for example, $Y=1$ if a disease is present, otherwise $Y=2$ ). Suppose x is a vector of explanatory variables and $p=\Pr(Y=1|x)$ is the response probability to be modeled. The linear logistic model has the form [6]:

$$\log it(p)\equiv\log(\frac{p}{1-p})=\alpha+\beta' x \qquad (1)$$

Where $\alpha$ is the intercept parameter and $\beta$ is the vector of slope parameters. Notice that the LOGISTIC procedure, by default, models the probability of the lower response levels. The basic idea underlying the proportional odds model is re-expressing the categorical variable in terms of a number of binary variables based on internal cut-points in the ordinal scale.

For ordinal response models, the response, $Y$ , of an individual or an experimental unit may be restricted to one of a (usually small) number, $k+1(k\geq 1)$ , of ordinal values, denoted for convenience by $1,2,...,k+1$. For example, the sensory quality of material can be classified into three response categories as 1=no blemish, 2=few defect , and 3=disfigurement. The LOGISTIC procedure fits a common slope cumulative model, which is a parallel line regression model based on the cumulative probabilities of the response categories rather than on their individual probabilities. The cumulative model has the form

$$y = x\beta + \varepsilon \quad (2)$$

if $\varepsilon$ ~Normal(0,1), (2)is the ordinal Probit model and if $\varepsilon \sim \Lambda$, (2)is the ordered legit model. $\beta$ is vector of $m \times 1$, suppose $\alpha_1 < \alpha_2 < ... < \alpha_k$ are the cut points and the further definition is :

$$\begin{aligned} &y = 0, \quad \text{if} \quad y^* \le \alpha_1 \\ &y = 1, \quad \text{if} \quad \alpha_1 < y^* \le \alpha_2 \\ &... \\ &y = k, \quad \text{if} \quad y^* > \alpha_k \end{aligned} \quad (3)$$

For example, if the ordinal values is 0, 1, 2, 3, there will be three cut points $\alpha_1, \alpha_2, \alpha_3$, according the consideration of $\varepsilon \sim \Lambda$, the general switch Logistic function of is follows

$$p_i \sim \Lambda(x, \beta) = \frac{1}{1 + e^{-x}} \quad (4)$$

Then each response probability can be calculated:

$$\begin{aligned} &P(y = 0 \mid x) = P(y^* \le \alpha_1 \mid x) \\ &= P(x\beta + \varepsilon \le \alpha_1 \mid x) \; = \Lambda(\alpha_1 - x\beta) \\ &P(y = 1 \mid x) = P(\alpha_1 < y^* \le \alpha_2 \mid x) \\ &= \Lambda(\alpha_2 - x\beta) - \Lambda(\alpha_1 - x\beta) \\ &... \\ &P(y = k-1 \mid x) = P(\alpha_{k-1} < y^* \le \alpha_k \mid x) \\ &= \Lambda(\alpha_k - x\beta) - \Lambda(\alpha_{k-1} - x\beta) \\ &P(y = k \mid x) = P(y^* > \alpha_1 \mid x) \\ &= 1 - \Lambda(\alpha_k - x\beta) \end{aligned} \quad (5)$$

And it can be validated

$$\begin{aligned} &P(y = 0 \mid x) + P(y = 1 \mid x) + \ldots + P(y = k-1 \mid x) \\ &+ P(y = k \mid x) = 1 \end{aligned} \quad (6)$$

The regression parameters $\alpha$ and $\beta$ can be gained through maximum likelihood estimation method for each $i$, its logarithm likelihood function is as follows:

$$\begin{aligned} &l_i(\alpha, \beta) = 1[y_i = 0]\ln[\Lambda(\alpha_1 - x_i\beta)] + \\ &1[y_i = 1]\ln[\Lambda(\alpha_2 - x_i\beta) - \Lambda(\alpha_1 - x_i\beta)] \\ &+ ... + 1[y_i = k]\ln[1 - \Lambda(\alpha_k - x_i\beta)] \end{aligned} \quad (7)$$

Owing $l_i(\hat{\alpha}, \hat{\beta}) = Max[l_i(\alpha, \beta)]$, the maximum likelihood estimated value for $\alpha$ and $\beta$ is determined as $\hat{\alpha}$ and $\hat{\beta}$ 。

## B. Internal control evaluation based on linguistic method

There are decision situations in which the information can not be assessed precisely in a quantitative form but may be in a qualitative one, and thus, the use of a linguistic approach is necessary. Its application in the development of the theory and methods in decision analysis is very beneficial because it introduces a more flexible framework, which allows us to represent the information in a more direct and adequate way when we are unable to express it precisely. The 2-tuple linguistic is based on the concept of symbolic translation and uses it for representing the linguistic information by means of 2-tuples, $(s_i, \alpha)$, where s is a linguistic term and $\alpha \in [-0.5, 0.5]$ is a numerical value representing the symbolic translation [7].

Definition 1. Let $s_i \in S$ be a linguistic term, and then its equivalent 2-tuple representation is obtained by means of the function θ as:

$$\begin{aligned} &\theta : S \to S \times [-0.5, 0.5) \\ &\theta(s_i) = (s_i, 0), s_i \in S \end{aligned} \quad (8)$$

Definition 2. Let $S = \{s_0, s_1, \cdots, s_T\}$ be a linguistic term set and $\beta \in [0, T]$ a value supporting the result of a symbolic aggregation operation, and then the 2-tuple that expresses the equivalent information to $\beta$ is obtained with the following function:

$$\Delta \; : [0, T] \to S \times [-0.5, 0.5]$$

$$\Delta(\beta) = (s_i, \alpha_i) = \begin{cases} s_i, i = round(\beta) \\ \alpha_i = \beta - i, \alpha \in [-0.5, 0.5) \end{cases} \quad (9)$$

Where round is the usual rounding operation, $s_i$ has the closest index label to "$\beta$," and "$\alpha$" is the value of the symbolic translation.

Definition 3. Let $S = \{s_0, s_1, \cdots, s_T\}$ be a linguistic term set and $(s_i, \alpha)$ be a 2-tuple. There always a function $\Delta^{-1}$, such that, from a

2-tuple it returns its equivalent numerical value $\beta \in [0,T]$.

$$\Delta^{-1}: S \times [-0.5, 0.5) \to [0,T]$$
$$\Delta^{-1}(s_i, \alpha_i) = i + \alpha_i = \beta \tag{10}$$

Yager introduced a weighted aggregation operator [8], in which the weights are not associated with a predetermined value but rather the weights are associated to a determined position. Here, TOWA operator is used to obtain a group evaluation, a collective value for each feature is defined as:

$$\widetilde{R}_i^k = (r_j)^k = \left(s^k{}_j, \alpha^k{}_j\right) = \Delta \sum_{l=1}^{t} \left(w_t \Delta^{-1}(s_{jl}, \alpha_{jl})\right), \tag{11}$$

$k = 1,2,...,m$

The weights, $w = (w_1, w_2, ..., w_t)^T$, are obtained as follows:

$$w_t = Q(i/m) - Q((i-1)/m), i = 1,2,...,m \tag{12}$$

where Q is defined as

$$Q(r) = \begin{cases} 0 & r < a \\ (r-a)/(b-a) & a \le r \le b \\ 1 & r > b \end{cases} \tag{13}$$

with $a, b, x \in [0,1]$. Some examples for the relative quantifiers are "most" (0.3, 0.8), "at least half" (0, 0.5) and "as many as possible" (0.5, 1). Here, we adopt "at least half", and $w = (2/5, 2/5, 1/5, 0, 0)$.

To facilitate the description of the proposed method, the following assumption or notations are used to represent the problem:

Internal control effectiveness characteristic to be evaluated have been determined. Let $X = \{x_1, x_2, ..., x_n\}$ denote a discrete set of $n \ge 2$ objects, and $x_i$ represents the i th characteristic.

Let $S = \{s_l \mid l = 0,1,\cdots,T\}$ denotes the linguistic term set, where T+1 is the granularity. Here, T=6, and s0= "none" (N), s1= "very low" (VL), s2= "low" (L), s3= "medium" (M), s4= "high" (H), s5= "very high" (VH), s6= "perfect" (P).

$$S = \begin{cases} s_0 = N(None), s_1 = VL(Very\ Low), \\ s_2 = L(Low), \ s_3 = M(Medium), \\ s_4 = H(High), s_5 = VH(Very\ High), \\ s_6 = P(Perfect) \ \}, \end{cases} \tag{14}$$

## C. The risk analysis based on ordinal logistic regression model

For ordinal response models, there will be $k-1$ regression functions to depict the relationship between explanatory variables and response:

$$\begin{aligned} \ln\frac{q_1}{1-q_1} &= \beta_{10} + \beta_1 x_1 + ... + \beta_m x_m + \varepsilon_1 \\ \ln\frac{q_2}{1-q_2} &= \beta_{20} + \beta_1 x_1 + ... + \beta_m x_m + \varepsilon_2 \\ &... \\ \ln\frac{q_{k-1}}{1-q_{k-1}} &= \beta_{k-1,0} + \beta_1 x_1 + ... + \beta_m x_m + \varepsilon_{k-1} \end{aligned} \tag{15}$$

Where $\frac{q_j}{1-q_j}$ is the rate differentiated and $\ln\frac{q_j}{1-q_j}$ is the logarithm of rate, $x_1, x_2, ..., x_m$ is the prediction variables, $\beta_{j0}, \beta_1, ..., \beta_m$ is the parameters to be evaluated their value can be estimated by sample observations as $\hat{\beta}_{j0}, \hat{\beta}_1, ..., \hat{\beta}_m$, and for each observation of prediction variable $x^*{}_1, x^*{}_2, ..., x^*{}_m$, we can determined:

$$\begin{aligned} \ln\frac{q_1}{1-q_1} &= \hat{\beta}_{10} + \hat{\beta}_1 x^*{}_1 + ... + \hat{\beta}_m x^*{}_m + \hat{\varepsilon}_1 \\ \ln\frac{q_2}{1-q_2} &= \hat{\beta}_{20} + \hat{\beta}_1 x^*{}_1 + ... + \hat{\beta}_m x^*_m + \hat{\varepsilon}_2 \\ &... \\ \ln\frac{q_{k-1}}{1-q_{k-1}} &= \hat{\beta}_{k-1,0} + \hat{\beta}_1 x^*{}_1 + ... + \hat{\beta}_m x^*_m + \hat{\varepsilon}_{k-1} \end{aligned} \tag{16}$$

Then the solution of $q_{k-1}, ..., q_3, q_2, q_1$ can be solved, and the probability $p_1, p_2, ..., p_k$ of ordinal $1,2,...,k$ is

This research is supported by the Ministry of Educational Humanities and Social Sciences Foundation of China (10YJC630372)

$$\begin{aligned}&p_1 = q_1,\\ &p_2 = q_2 - q_1,\\ &...\\ &p_{k-1} = q_{k-1} - q_{k-2},\\ &p_k = 1 - q_{k-1}\end{aligned} \quad (17)$$

And the probability *of* $E_j$ is $p_j = P(E_j)$ , if $p_i = P(E_i)$ is maximum then the predictable factor $x^*{}_1, x^*{}_2, ..., x^*{}_m$ is differentiated as $E_i$。

# IV. Conclusion

In this paper, for internal control risk evaluation of the enterprises, an assessment model based on multi-classification discrete choice model is proposed. On the basis of building an internal control risk evaluation index system according COSO internal control frame, the evaluating information from experts is aggregated with linguistic information processing approach, a multi-classification discrete choice model is put forward, and the calculation analysis steps are given.

# References

[1] Alvin A.Arens, Randal J. Elder, Mark S. Beasley, Auditing And Assurance Services An Integrated Approach. Preatice Hall, 2009.

[2] Collett, D. (1991), Modelling Binary Data, London: Chapman and Hall..

[3] Agresti, A. (1990), Categorical Data Analysis, New York: John Wiley & Sons, Inc..

[4] Cox, D.R. and Snell, E.J. (1989), The Analysis of Binary Data, Second Edition, London:Chapman and Hall..

[5] Hosmer, D.W, Jr. and Lemeshow, S. (1989), Applied Logistic Regression, NewYork:John Wiley & Sons, Inc.

[6] Wooldridge J.M. (Translated by Wang Z Y). Econometric Analysis of Cross Section and Panel Data. [M]. Renmin University Press of China, Beijing, 1995.

[7] F. Herrera;L. Martı´nez. A 2-tuple fuzzy linguistic representation model for computing with words, IEEE Transactions on Fuzzy Systems[J],2000, 8 (6) 746–752.

[8] R.R. Yager. On ordered weighted averaging aggregation operators in multi-criteria decision making, IEEE Transactions on Systems, Man, and Cybernetics[J]1988, 18, 183–190.

# Feasibility and Contract Design of Area-Based Crop Yield Insurance: In Case of the Crop Insurance of Beijing

ZHU Junsheng[1], ZHAO Le[2], CHU Meng[3]

[1] School of Labor Economics, Capital University of Economics and Business, Beijing, China, 100070
[2] Department of Development and Planning, Rural Affairs Committee of Beijing, Beijing, China, 100053
[3] School of Finance, Capital University of Economics and Business, Beijing, China, 100070

**Abstract:** The paper discusses the operation mechanism and prerequisite of area-based crop yield insurance, analyzes the potential advantages and disadvantages in Beijing. It also design the contract on the base of the international experiences of area-based crop yield insurance.
**Keywords:**feasibility; contract design; area-based crop yield insurance

## 一、研究背景与问题的提出

农业保险是国家扶持农业发展的重要举措，可以分散农业风险、补偿风险损失、保障农村居民生产生活稳定、促进农业和农村经济发展，对于稳定农业生产和保障国家粮食安全有着重大的战略性意义。在国内，农业保险作为一种支农政策的创新，也越来越引起国内学术界和政府的重视。自2004 年开始，连续 8 年的中央 1 号文件都明确提出要建立和完善政策性农业保险制度。2010 年，中国农业保险保费收入 135.7 亿元，成为仅次于美国的全球第二大农业保险市场。

中国绝大部分地区主要试点的是财政提供保费补贴的多种风险作物保险（Multi Peril Crop Insurance，MPCI），属于传统的成本保险和产量或产值保险，灾害发生后保险公司采用逐户查勘、定损的理赔方式。理论研究表明，由于信息不对称引发的逆选择与道德风险问题，传统农业保险的交易成本普遍比较高。和国外传统的农业保险不同，目前国内大多数地区主要采取单一费率的形式，尚没有进行精确的风险区划和差别费率，这使得农户的保费负担与承受的风险特征不一致，加重了逆选择和道德风险的程度。另外，与西方一些国家大规模农场经营也不同，中国农村普遍地域较为分散，大都是小规模经营，组织化程度相对较低，从而造成农业保险在查勘定损与理赔等方面的交易成本较高，直接影响到农业保险的可持续发展。因此，必须创新机制，降低农业保险定损与赔付环节的高成本，提高其供给效率，实现可持续发展。

针对传统农业保险的缺陷，国际农业保险界从 20 世纪 80 年代以来开发了指数保险（主要是区域产量指数和天气指数保险）。和传统的农业保险产品相比，区域产量保险（Area-based crop yield insurance）具有以下相对优势：不易发生道德风险和逆向选择，赔款及时，管理成本低，产品标准化，结构透明，可得性与流通性强，再保险接受程度高等。因此，有观点认为，在转移天气风险方面，区域产量保险为传统的农业保险提供了另外一种可行的选择。在理论上，目前很多研究都将区域产量保险视为农业生产风险管理的重要创新性工具。在实践中，国际上很多国家和地区都在积极地探索区域产量保险。

在北京，区域产量保险是否具有可行性，能否作为制度与技术创新提高农业保险的供给效率，弥补传统农业保险的不足呢？本文将研究北京市实行区域产量保险的可行性，并对区域产量保险合同作出初步的设计。

## 二、文献综述

### （一）对传统农业保险的反思

国外农业保险的研究与实践似乎经历了两个不同的阶段：在第一个阶段，研究者关注的是市场为什么不能自发地提供合意水平的农业保险？比较主流的结论是要求政府介入，提供补贴，建立补贴属性的公共农业保险制度（public crop insurance）。在第二个阶段，当公共保险制度带来了很多问题时，人们开始反思供给体制的创新，强调基于市场的方法来解决农业保险的提供问题。

研究认为，可保风险需要满足一系列条件，具体到农业风险的可保性，需要特别考察以下两个条件（Berliner, 1982，Miranda and Glauber，1997）：第一，风险的发生是独立的。第二，对于风险损失的概率分布，被保险人和保险人拥有大致对等的信息。然而，传统的多风险产量保险在以下几个方面并不满足这两个条件（Makki, 2003; Miranda and Glauber, 1997; Quiggin,1994; Skees, 2003; Wenner and Arias, 2003; World Bank, 2004）。

理论界主要从信息不对称引起的逆向选择与道德风险问题以及农业风险的系统性风险属性等方面进行讨论。

第一，逆向选择问题。很多研究都指出了农业保险中的逆向选择问题（如，Skees and Reed,1986;Miranda,1991;GAO,1989; Goodwin,1993; Knight and Coble,1999; Shaik and Atwood,2003; Babcock, Hart, and Hayes,2004）。由于存在逆选择，那些预期赔偿超过保费成本的农民更可能购买农作物保险，相反，那些预期成本超过赔偿的农民将不太可能购买保险（Skees and Reed,1986;Miranda,1991）。1989年美国国会审计

署对农业保险计划的精算财务结果提出批评，指责农业保险计划80年代早期向难以获得精算信息的县和作物扩张，导致不利的选择风险集合（GAO，1989）。当时，费率厘定时假设一个县之内农场产量的变异系数不变，对一个县内具有同样期望产量的农场采取同样的费率，Skees and Reed（1986）对农场产量的期望值与标准差之间关系的分析以及Goodwin（1993）对个别费率与县费率之间相关性的研究都揭示了这种费率厘定方式的缺陷。

逆向选择表现在农业保险的参与率问题上，国外有很多的实证和计量经济学方面的成果，也存在很多争论。1989 年美国农业部作了一项全国调查，对农民不参加联邦农作物保险的原因进行排序（Wright and Hewitt,1994），发现前五位原因分别是保障太低、保费太高、更愿意自己承担风险、农场是分散化经营的、拥有其他农作物保险。Calvin 与 Quiggin（1999）发现，农民参与联邦农业保险项目的原因中，风险规避仅仅是一个很小的因素，而主要是为了得到政府的补贴。一些模拟研究结果显示作物多重险保险收益会随着农场位置、作物和区域有显著的差异。计量经济学分析表明，能够从农作物保险中获得较高期望收益的农户倾向于购买保险，这说明作物多重险保险存在着逆向选择。其他一些计量经济学研究发现，随着农场规模的增大，农业保险的参与率增加；农场在各种作物和牲畜的管理上分散风险的能力越强，其从作物多重险保险中得到的益处越少，而越倾向于不购买作物多重险保险；农场自然风险或者收入风险变化显著的单位倾向于购买农业保险。

另外，也有一些学者从风险偏好角度考察农业保险的需求，如 Serra 和 Goodwin 等（2003）在对农业保险需求的实证研究中发现，对于美国农民，随着其初始财富到达一定程度以后的增加，其风险规避减弱，因而购买农业保险的动机降低。还有一些学者从其他风险管理策略替代性的角度考察农业保险的需求，如一些研究显示，农场主和牧场主可以使用其他各种风险管理策略来减少其面临的风险（Harwood et al.,1999;U.S. GAO,1999）。这一时期对农作物保险参与率的实证分析也表明，其他的风险管理策略与工具对参与率具有负面的影响（Knight and Coble,1997）。

第二，道德风险问题。对道德风险的研究主要集中于农业保险购买与农业投入之间的关系。由于农户自身决定农业投入量的大小，因此，投入量的变化可能更多地反映的是农作物品种的变化，而不是申请索赔率（application rates）的变化。Horowitz and Lichtenberg（1993）考察了玉米种植户，认为农业保险购买与农业投入呈现正相关关系。但这个结论受到Quiggin, Karagiannis, and Stanton（1993），Babcock and Hennessy（1996）,Smith and Goodwin（1996），Goodwin and Smith (2003)以及 Goodwin, Vandeveer, and Deal（2004）等学者的挑战，他们认为，购买农业保险会降低投入的使用。减少道德风险问题的努力主要集中于监督。比如，美国《农业风险保障法》授权风险管理部门通过农场服务机构提高对于参保农户的监督，识别潜在的欺诈与滥用现象（Rejesus et al）。也有些学者认为可以通过改善保单设计来应对道德风险问题（Chambers,1989;Rubinstein and Yaari, 1983;Crockerand Morgan,1998; Vercammen and van Kooten,1994）。事实上，近年来美国农作物保险计划出现的一些变化，如免赔额降低、补贴水平增加等加剧了道德风险问题。

第三，系统性风险问题。很多学者提出了农业风险的系统性风险问题（Miranda and Glauber,1997; Bardsley, Abey and Davenport,1984; Duncan and Myers,2000）。这种系统性风险的相关性削弱了保险公司在农户之间、作物之间、地区之间分散风险的能力。

综上所述，农业的相关性风险以及信息不对称问题使得保险风险集合与分散的最基本功能缺乏效率。因此，农业保险技术的创新着力于处理农业保险的传统问题，如道德风险、高交易成本、逆选择，特别是系统性风险问题。其中，指数保险就是一种有益的探索(Skees et al. 1999)。

### （二）对区域产量保险等指数保险潜在优势的探讨

作为指数保险的一种，区域产量保险和传统的农业保险产品相比，具有以下相对优势（Barnett,2004; Skees, Hazell and Miranda,1999; Hess, Richter and Stoppa,2002 ;World Bank, 2004）：首先，可以有效避免道德风险问题；其次，可以避免逆选择问题；再次，降低了交易成本。由于指数保险不需要个人保单、现场查勘定损，不需要历史或实际作物产量资料，只需要指数的历史数据，通常更具有可得性，更透明，更具可证实性。由于指数保险的触发条件能够独立地核实，可以降低对于损失的政治干预和操纵。也便于执行和操作，管理和交易成本较低，因此，私营保险公司可以提供这种保险，需要的政府补贴更少或不需要政府补贴。最后，指数保险的保单结构统一，可以以各种面额销售。合同的条款更容易为购买者理解，可以为各种利益相关者购买.由于指数保险合同是标准化与透明的，指数保险可以在二级市场交易，从而在该地区与国家之外转移系统性风险，并与资本市场连通，这就使得指数保险具有流动性。

当然，区域产量保险产品也有局限性。Barnett(2004)认为，指数保险的赔款不基于农场的损失，人们理论上可以不种植农作物而通过购买指数保险获益，因此销售代理必须证实被保险的农户确实种植了农作物。他还指出，指数保险的局限性主要是存在基数风险，即被保险人发生了损失却得不到足额赔偿，或被保险人获得的赔偿超过了实际损失。Skees(2003)指出，指数保险作为风险管理工具的有效性取决于被保险人的损失在多大程度上与指数正相关。

### （三）区域产量保险的运作模式及产品设计研究

区域产量保险的运作模式及产品设计研究主要是以美国的团体风险计划(GRP)为基础的。Miranda（1991）利用美国肯塔基州 102 个大豆种植者的产量数据分析了区域产量保险的运作模式。J.R.Skees, J.R.Black 和 B.J.Barnett (1997)回顾了 GRP 的发展，描述了 1995 年 GRP 合同设计和费率厘定过程。Olivier Mahul (1999)在之前研究的基础上探讨了最优区域产量保险合同问题。James A.Vercammen(2000)则通过加入重要的、现实中存在

的制度限制来扩展 Mahul (1999)的分析。Jean-Marc Bourgeon 和 Robert G. Chambers(2003)在 Mahul(1999)的模型基础上加入了补贴率，考察补贴率对最优区域产量合同设计产生的影响。

### （四）对区域产量保险实践的反思

Barnett，Black 和 Skees（2005）发现，尽管 GRP 存在基数风险，但至少在一些地区和一些农作物上，能够成为 MPCI 产量计划的可行替代性选择。

Deng，Barnett 和 Vedenov（2007）发现，如果农场保险费率被高估了（非公平费率），而 GRP 保费是公平的，那么 GRP 可能是 MPC 的一个可行的替代性选择（甚至在不同质的地区）。

Chaffin（2009）运用模拟研究了农民对不同保险计划的选择，结果显示，农户产量和县产量之间的相关性以及农场在空间上的分散程度是决定农民对于不同保险计划选择的重要因素。除非产量的相关系数超过 0.9，并且农场在空间上分散，研究建议谨慎选择区域保险。

Harun Bulut（2011）认为，农作物保险最适合的形式为个人保险，特别是针对个人农场经营者的风险和特性。在区域产量保险和个人保险费率公平，并且生产者必须二者选一的情况下，没有发现任何购买区域保险的理由，农户会选择完全投保个人保险。如果可以同时购买区域产量保险和个人保险，只要两种保险都收取精算公平保费，损失虽相关但不完全，农户将完全选择个人保险。但是，如果区域保险的保险费率不是公平的（保费较低），那么个人保险和区域保险就可以相互替代，区域保险的需求会受到区域和个人损失的相关性的影响。

Coble，Dismukes 和 Thomas（2007）报告表明，模拟的全国县域和农场平均产量之间的相关性为：玉米是 0.89，大豆为 0.87，棉花为 0.89，相关性足够高到，因而县级水平的区域保险是有潜在吸引力的。但是，用同样的方法测算，得出州水平下和农场的损失相关系数为：玉米为 0.74，大豆为 0.72，棉花为 0.746，比最近 Dismukes，Arriola 和 Coble（2010）年测算的略高。最近测算的数据为：玉米为 0.55，大豆为 0.54，棉花为 0.39。

Barnett，Black 和 Skees（2005）用 1985 年到 1994 年，10 个州的近 67000 个农场的数据，估测了农场和县域的平均产量的相关系数。他们的相关性差异很大，在中心的玉米产区相关系数较高，从俄亥俄州的 0.71 到伊利诺伊州的 0.82，但是在田纳西州只有 0.49，在密歇根州只有 0.36。这一地区间的巨大差异说明区域计划在降低不同地区的农民的风险方面有很大不同。

GRP 和 GRIP 计划的经验表明，由国家农业统计中心（NASS）测算的县域产量的可靠性存在很大的问题。2010 年，RMA 已经中止了 1062 个县的 GRP/GRIP 计划，包括县级的玉米、大豆、高粱和花生，因为 NASS 的校正标准虽然提高了可信度，但使得数据变少了（resulted in fewer but more reliable country estimates）。

### （五）农业保险的技术创新与制度创新：一个简要的评论

区域产量保险作为农业保险的产品创新，是对传统农业保险运行机制存在弊端的矫正，属于技术创新的范畴。但这种产品与技术创新的背后是机制与制度的创新，是试图通过基于市场的方法来提高效率，减少对资源配置市场的扭曲，满足农民日益增长的扩大承保风险的需要，最小化或消除传统产量保险面临的道德风险、逆选择，提高再保险市场应对巨灾系统性风险的能力。

对于大多数保险产品，可保性的前提条件是风险单位的损失不相关（Rejda, 2001）。但对于区域产量保险，前提恰恰是风险是空间上相关的。当农户的产量风险在空间上相关时，区域产量保险合同是对传统的农业保险的有效替代。正是在这个意义上，和传统的农业保险产品相比，区域产量保险具有有效避免道德风险、逆选择以及降低交易成本的相对优势。当然，区域产量保险产品也有局限性或挑战，特别是存在“基数风险”。为了降低基数风险，需要认真设计区域产量保险保单的参数。同时，小气候使得保险事故更为经常在小区域发生，这将使得区域产量合同经营困难。在高度异质性的生产区域，基数风险非常高，区域产量保险保险的问题比较大。另外，区域产量保险的可行性很大程度上还取决于指数本身可能客观、精确地被测量。不管是政府提供，还是第三方提供，区域产量数据要能够及时得到，并不受篡改。

无论是在发达国家，还是在发展中国家，传统的多风险农业保险都被激励问题（逆选择和道德风险）、高管理成本以及政治对定价的干预等问题所困扰。由于发达国家收入高，能支撑高成本，同时农业人口在总人口中的比重很小，因此继续维持着制度。而对于像中国这样的发展中国家而言，由于农业人口占比很高，经济发展水平有限，需要特别考量农业保险制度的成本及其可持续发展能力。

因此，对于发达国家的传统农业保险制度，像中国这样的发展中国家不能简单地复制其昂贵的制度，而是利用其设计、执行农业保险计划方面避免经典障碍的知识，以建立有效率的农业保险递送体系，进行农业保险制度的创新。

中国目前农业保险领域的研究与实践，对政府大规模补贴的财务可持续性缺乏考察，对补贴对市场机制的扭曲程度缺乏考察。对农业保险的相对优越性谈得多，但对不足和问题谈的少。因此，从农业保险的长期可持续发展出发，在探讨政府介入农业保险必要性的同时，要对其成本、意想不到的后果等也要作充分的考察，以避免陷入传统农业保险的困境。

正是在这样的意义上，区域产量保险作为农业保险技术与制度创新，对于中国意义非常重大。

第一，中国的农业保险大部分不承保旱灾之类的系统性非常强的自然灾害，而旱灾恰恰与国内很多地区受灾面积和粮食产量相关性最强的自然灾害。因此，发展指数保险对于国内很多地区都具有非常现实的意义。

第二，中国大部分地区的农民都是“小农”，人均种植面积非常小，呈现原子化状态，传统农业保险的交易成本太高，信息不对称所引发的逆选择、道德风险问题也难以监控。而区域产量保险作为一种指数保险产品，在降低交易成本方面可以发挥巨大的优势。

当然，我国发展区域产量保险也存在许多困难，比如，如何化解基数风险，如何让这种农业保险的技术创新与制度创新为保险公司、政府以及农

民所接受，被保险地区是否具有较为完备和准备的区域产量数据资料等等。

## 三、北京市试点区域产量保险的可能意义——基于对现行农业保险运行中的矛盾分析

虽然现行的北京市农业保险取得了许多成绩，但是也存在着一些问题，比如逆选择和道德风险无法控制、理赔定损困难、保险责任范围太窄等等。对于传统农业保险来说这些问题很难消除，而区域产量保险则可以在很大程度上弥补这些不足。

### （一）逆选择

北京没有进行风险区划和费率分区，对于同种的农作物，北京市实行的是全市统一的费率（见表 1。

**表 1 北京市主要农作物保险的保额和费率**

| 险种 | 保险金额 | 保险费率 | 保险费(元) |
|---|---|---|---|
| 小麦 | 500 | 6% | 30 |
| 玉米 | 400 | 8% | 32 |
| 豆类作物 | 500 | 6% | 30 |
| 西瓜 | 1000 | 7% | 70 |
| 苹果 | 2000、4000 | 9% | 180、360 |
| 桃 | 2000、3000 | 9% | 180、270 |
| 梨 | 2000、3000 | 9% | 180、270 |
| 葡萄 | 2000、3000 | 8% | 160、240 |
| 柿子 | 1000、2000 | 7% | 70、140 |
| 樱桃 | 3000、5000 | 9% | 270、450 |
| 枣 | 1000 | 9% | 90 |
| 露地蔬菜 | 700 | 7% | 49 |

资料来源：北京市 2011 年政策性农业保险统颁条款（试行）

这是以全市的所有农户为一个保险单位，以全市灾害损失的历史数据为计算保费的基础，计算出的保费反映的是全北京市内的平均风险水平，无法体现农户之间的风险差异。

北京市农业保险承保的风险中，冰雹、火灾、泥石流、山体滑坡等灾害都属于局部性灾害，不同区域的农户遭受这些灾害的风险有很大的差异。例如，北京地区冰雹风险具有明显的山区高于城区的空间分布特征，山区又以西北部最大、东部和西部次之、南部最小；西北部山区佛爷顶附近冰雹年发生概率高达 98.1%，6 月冰雹风险概率也在 60% 以上，是北京地区冰雹的主灾区。[1]在这种情况下，那些高风险地区的农户投保积极性很高，因为他们的预期赔偿超过了保费成本；反之，低风险地区的农户就很不情愿参保。低风险农户与高风险农户面对着相同的费率，结果必然造成低风险农户缴纳的保费补贴给了高风险的农户，对低风险的农户是不公平的。

传统农业保险要克服逆选择问题，就要求准确获得每个农户的历史产量数据，并以此为依据，为每个参保农户分别制定费率。但在实践中要做到这一点很难，成本也会异常高昂。区域产量保险不需要每个农户的历史产量数据，只需要根据区域产量的历史数据制定保费。对于同一区域的所有农户，其所缴纳的保费和预期的赔偿都是相同的，因此区域产量保险不存在逆选择问题。

### （二）道德风险

在北京农业保险实践中，道德风险问题主要表现为：

一是有可能伪造证据虚假索赔，或者为获得赔偿而故意制造保险事故。例如，采取小麦、玉米歉收后恶意损毁、倒伏等方式扩大损失，或者设施农业保险中故意破坏大棚造成风灾受损痕迹而导致索赔。当然，目前这种情况发生几率较小，未对承保公司经营产生较大影响。

二是有可能降低农业设备、家畜和化学品等生产资料的投入，放松对农业生产的管理。例如，受农产品市场价格波动影响，蔬菜种植的收益变化剧烈，一旦收益低于保险价值，农户就会人为减少投入、降低管理水平，易发生道德风险。

三是有可能在灾害发生时不积极进行施救，甚至故意增大灾害损失，以期获得保险人的赔偿。例如，北京地区遭受了风灾和雹灾后，很多农田出现倒伏现象，经过保险公司测算，80%的倒伏农作物经后期抢救收割，其中 60%农作物仍然可以进行售卖，这种情况下保险公司只需赔偿 20%的倒伏损失。但是对倒伏的农作物进行抢救收割成本非常高，这笔支出是得不到保险公司赔偿的。这种情况下，有些农民就不再费心思去收割和售卖，导致倒伏的农作物颗粒无收，从而获得倒伏损失的全额保险赔付。[2]

在北京市现有的 19 种农业保险中，仅 2011 年新增加农机险明确将施救费用作为保险责任，其余 18 种条款中均没有对施救费用的赔偿做出规定。这就会使得农户更加倾向于放弃施救，导致农业保险的损失率增加。

北京农业经营者规模小，数量多，北京市农业保险开展的时间短，条款和理赔技术还有待完善，因此保险公司防范道德风险难度很大，而且成本极高。从国外农业保险发展经验来看，区域产量

[1]翟志宏、姜会飞、叶彩华、廖树华、李楠：《基于概率分布模型的北京地区冰雹灾害风险区划》，《中国农业大学学报》，2008 年第 6 期。

[2]王雅婷：《北京通州地区政策性农业保险实施状况调查报告》，《首都经济贸易大学学报》，2009 年第 3 期。

保险可以有效解决上述难题。区域产量保险属于一种指数保险，其赔款是基于整个区域的产量，单一农户的行为就无法对保险的赔付产生影响。因此区域产量保险不会产生道德风险问题，也不会降低农户防灾减损的积极性。

**（三）理赔定损**

北京市现有政策性农业保险属于灾害补偿型农业保险，其赔付金额要根据灾害发生后，实地测量损失的百分比来估算。相比于区域产量保险，这种产品在理赔定损上有两个缺点：

一是对定损技术的要求很高。从农业生产的特性来看，农业是自然再生产的产业，农险参保对象是种、养两业，分布范围广，品种搭配多，生产时间参差不齐，发生灾害复杂，技术要求相对较高，给定损理赔带来一定的难度。以风灾为例，北京市农业保险的责任范围一般包括六级（含）以上风。这就要求开展灾害补偿型保险的地区必须能准确测定风力等级，否则就无法准确定损。比如，在大棚保险产品中，有些棚户盖大棚时用劣质薄膜，阵风过后薄膜损坏要求保险赔付，而阵风等级又不好测定，这时如果赔付就是纵容作假，不赔付取证又难。

二是逐户定损工作量太大。农业保险涉及的农户多、面积大、核保时间限制严等实际情况，一旦发生灾情或巨灾，不像其他险种那样容易定损。理赔人员需对每个农户、每块地一一核实损失，工作量很大。目前保险公司的经营经验不足，专业技术人员缺乏，力量薄弱，还不能完全满足经营活动的需要。

区域产量保险以区域产量的减少为赔付条件，既不需要确定减产损失的原因，也不需要逐户定损，可以有效解决传统农业保险定损难的问题。

**（四）交易成本**

北京市是典型的“大城市小郊区、小农业”。2009 年，北京市有 60.9 万农业从业者，耕地面积仅为 23 万公顷，平均每个农业从业者的耕地面积仅为 0.38 公顷（5.75 亩）。对于传统的农业保险产品，更小的农场意味着在保费中包含更高比例的管理费用。

对于目前的小规模农业经营模式，保险公司要与大量的分散的农户洽谈保险合同，其交易成本就会非常高。此外农业保险标的分散，承保验标、系统数据录入、理赔工作量大，农险管理费用很高。

区域产量保险产品一般是流程化的保险合同，投保前不需要核保检查，理赔时也不需要逐户勘察定损。因此，区域产量保险的管理费用比传统农业保险要低得多。

**（五）保险责任范围**

北京地处大陆性季风气候区，自然灾害频发。旱、涝、冰雹、寒潮、大风和沙尘暴是北京市的主要灾害性天气。据统计，1995 年～2004 年 10 年间，冰雹、风灾、旱灾、畜禽疫病等灾害导致郊区农业平均每年经济损失 6.5 亿元。但目前农业保险的责任范围并没有涵盖北京农户面临的全部自然灾害，最典型的例子就是旱灾。

北京气候干旱，旱年和偏旱年约占所有年份的 36%，有“十年九春旱”之说。同时冬小麦也是北京市主要农作物之一，2009 年北京市冬小麦播种面积 6 万公顷，占到全部播种面积的比例为 18.8%。而冬小麦很容易受到旱灾的影响。尽管北京种植业主要通过采用节水新技术和发展喷灌、管灌等经济化、科技化管理措施，基本解决农业用水问题，但是旱灾的影响并不能完全消除。旱灾成灾面积占全部自然灾害的面积的比重依然很大（表 2）。

**表 2　北京市自然灾害及旱灾受灾面积和成灾面积（单位：千公顷）**

| | 年　份 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|
| 旱　灾 | 受灾面积 | 75 | 166 | 49 | 8 | 32 | 27 | 47 |
| | 成灾面积 | 52 | 81 | 24 | 2 | 0 | 6 | 19 |
| 自然灾害 | 受灾面积 | 96 | 195 | 59 | 28 | 69 | 74 | 76 |
| | 成灾面积 | 63 | 103 | 25 | 10 | 18 | 39 | 34 |
| 旱灾成灾面积的比重 | | 83% | 79% | 96% | 20% | 0% | 15% | 56% |

除了旱灾，还有许多灾害不在北京市农业保险的保障范围之内。例如，小麦开花结实期间还可能因干热风而受损，减产率有可能达到 15%以上（见表 3）。冰冻害也是北京面临的重要灾害，小麦、玉米和豆类都有可能受到冻害的影响。另外，病虫害、渍害、沙尘暴等也不在北京政策性农业保险的保障范围之内。

**表 3　干热风对小麦的危害**

| 等级 | 出现干热风过程次数 | 千粒重下降（g） | 小麦减产（%） |
|---|---|---|---|
| 强 | 一年中有强过程≥1 次或中过程≥3 次 | ＞6 | ＞15 |
| 中 | 一年中有中过程 2 次或中过程≥1 次和弱过程≥1 次 | 3～6 | 5～15 |
| 弱 | 一年中有中过程 1 次或弱过程≥2 次 | 1～3 | ＜5 |

目前农业保险普遍不承保旱灾、冰冻灾害、渍害等灾害最重要的原因是，这些灾害属于系统性风险，往往会导致大面积农作物同时遭受减产损失。对保险公司而言，系统性风险很容易导致巨灾损失，冲击保险公司的财务稳定，甚至使公司面临破产的风险。

在农业保险推广的开始阶段，出于谨慎的考虑不承保系统性风险的安排是合理的，但政策性农业保险不应该永远将系统性风险拒之门外。如果将来发生系统性风险，农户遭受重大损失却无法得到保险的赔偿，那么政策性农业保险的风险保障作用就得不到充分体现，支农惠农的效果会大打折扣，也就无法达到稳定农业生产和保障国家粮食安全的目的。因此，将系统性风险纳入北京市政策性农业保险的保险责任范围是很有必要的。

但是在现有的保险产品责任中直接加入系统性风险并不是一个很好的选择。现在北京的政策性农业保险是列明风险农作物保险，属于灾害补偿型保险，其赔付金额要根据灾害发生后，实地测量损失的百分比来估算。现行的保险条款中要求被保险人在灾害发生后的 24 小时内报案，多数农作物（比如小麦、玉米、西瓜等）都是通过单位面积植株损失数量除以单位面积平均植株数量来计算损失率的。这些条款适合于一些突发性的、显性的灾害（比如冰雹、雪灾、大风和暴雨等），但并不适用于累积性的灾害（比如旱灾和渍害），以及隐性的灾害（比如热害和冷害）。相比于突发性的和显性的灾害，累积性和隐性的灾害的发生时间更难以界定，影响的范围更大，逐户定损也更加困难。

区域产量保险以区域产量的减少为赔付条件，不需要特定灾害的发生作为赔偿的前提，可以很好地保障隐性的和累积性的灾害所造成的产量损失，这对于北京现行的列明风险农作物保险是一个很好的补充。同时，区域产量保险也比较适合应对系统性风险。系统性风险越明显的地方，区域产量保险就越有效。当一个农户因自然灾害导致减产时，整个区域内农场也遭受了同样的灾害而受损，农户就可以通过购买的区域产量保险获得赔偿。因此，要扩大北京政策性农业保险的责任范围，试点区域产量保险是重要的选择。

**（六）保障水平**

我国开展政策性农业保险的目的在于保障农业生产，维护国家粮食稳定，农业保险的推广遵循“低保费、保成本、广覆盖”的基本原则。保险产品的设计以保障农民灾后恢复生产为出发点，保障水平原则上为农业项目的直接物化成本，而不是农作物的预期产量或收入，因而保额相对较低。

例如，北京市小麦平均亩产量在 350 公斤左右，每亩平均收入可达 700 元以上，然而北京市的小麦保险保额仅为 500 元。北京市玉米亩产量约为 400 公斤，每亩收入可超过 800 元，但玉米每亩保额仅为 400 元。其它各种农作物的保额与其预期收入都有明显的差距。

这样的保额虽然能确保农民灾后恢复生产，但对于一些希望通过农业保险保障自己收入的农户，现有农业保险显然无法满足他们的需求。“低保费、保成本”的做法虽然有利于在农险推广初期提高农险覆盖面，但从长远来看，过低的保障水平会影响到农户的投保积极性，因此提高保障水平，变“保成本”为“保收入”是十分有必要的。

区域产量保险本身就是一种保产量的产品，美国和印度的区域产量保险都可以由农户自由选择保额，且最大保额都可以达到区域期望产量的 150%，可见这一产品可以达到的保障水平是比较高的，能够满足农户“保收入”的需求。

相对于传统农业保险，用这种产品来保障农民的期望收入有如下优势：

首先，区域产量保险费率更低。从美国的实践经验来看，同样的农作物，同样的保额，区域产量保险 GRP 的费率是传统农业保险 APH 费率的 1/2 到 1/3。也就是说农户可以用更少的保费获得更大的保障。

从表 4 可以看出，GRP 用更少的保费承担了更多的责任。事实上，GRP 用农险 0.675%的保费，就承担了农险 1.95%的保额，这证明了 GRP 的保险费率水平更低。我们拿 GRP 与个人产量保险 APH 作对比：在 2010 年，投保 GRP 保险的农户，平均每亩获得的保额为 519.5 美元，平均每亩所支付的保费为 13.7 美元，平均费率为 0.0264。而 APH 平均每亩的保险责任金额为 306.9 美元，平均每亩的保费则为 25 美元，平均费率为 0.0817。APH 的保险费率约为 GRP 的 3 倍，平均 1 美元 GRP 保险保费可以获得 37.8 美元的保障，而 1 美元的 APH 保险的保费却仅能获得 12.3 美元的保障。

**表 4　2010 年 GRP 与 APH 的保险费率与保障**

| | 平均每英亩保额（美元） | 平均每英亩保费（美元） | 保险费率 | 每 1 美元保费可获得保障（美元） |
|---|---|---|---|---|
| GRP | 519.5 | 13.7 | 0.0264 | 37.8 |
| APH | 306.9 | 25 | 0.0817 | 12.3 |

资料来源：RMA 官方网站：http://www.rma.usda.gov/。

对比 GRP 和 APH 四种最主要农作物的费率，可以看出，同样的农作物，GRP 的保险费率比 APH 要低很多。因此，如果选择投保 GRP 保险，农业生产者可以用更少的保费获得更高额的保障。

表 5 2010 年四种主要农作物 GRP 和 APH 保险费率对比

| 费率 | 玉米 | 小麦 | 棉花 | 大豆 |
|---|---|---|---|---|
| GRP | 0.0285 | 0.0347 | 0.0249 | 0.0276 |
| APH | 0.0658 | 0. 132 | 0.117 | 0.0876 |

资料来源：RMA 官方网站：http://www.rma.usda.gov/。

其次，区域产量保险需要的保费补贴更低。2010 年，美国 GRP 的保费补贴率为 54%，低于 2010 年 APH 的补贴率 66%以及农险的补贴率 62%。从图 1 可以看出，GRP 几乎每年的补贴率都明显低于 APH。值得注意的是，在 2009 年和 2010 年，农险的补贴率在明显提高，但 GRP 的补贴率却在下降。

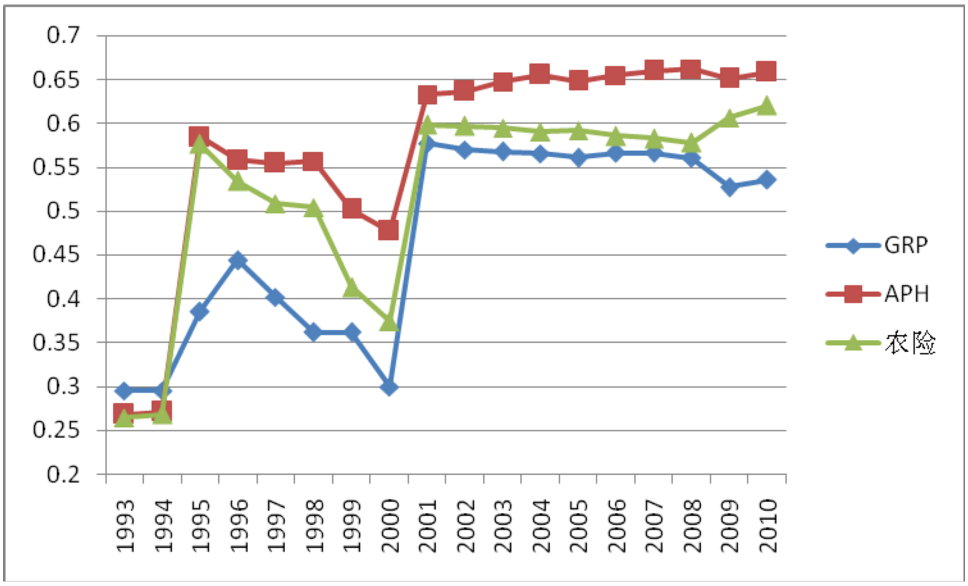



图 1 美国农险保费补贴率的变动
资料来源：RMA 官方网站：http://www.rma.usda.gov/。

印度的 NAIS 计划最多可获得 50%的保费补贴，且在 3~5 年内逐年递减并最终取消。这也说明区域产量保险可以在低保费补贴甚至没有补贴的情况下运营。

第三，北京市现行的政策性农业保险中，较低的保额能够起到防范道德风险的作用。如果提高保额，使得农户通过保险索赔就能获得满意的收入，那么其道德风险就会明显增加。区域产量保险本身不存在道德风险问题，因此适合为农户提供较高的保障。

**（七）条款的通俗性**

北京市现有农业保险条款在确保保险合同本身科学、严谨的同时，一些生僻术语及专业术语也在一定程度上降低了条款的可阅读性。以小麦保险为例，其理赔的计算比较复杂，要考虑的变量包括“小麦生长期”、“损失程度”“损失率”“每亩有效保险金额”“受损面积”等。损失程度包含“全部损失”、“部分损失”、“轻微损失”三种，又根据小麦生长期的不同，其赔偿计算公式多达 8 种（见表 6）。其中“损失率”等于单位面积植株损失数量/单位面积平均植株数量；“每亩有效保险金额”的规定，原文如下：“如果发生一次或一次以上赔款时，保险单的有效保险金额（即原保险金额减去已付赔款后的剩余保险金额）逐次递减，逐次累计赔款金额不得超过保险单列明的保险金额。”

表 6 小麦不同生长期每亩损失赔偿计算公式表

| 小麦生长期 | 赔偿金额 |
|---|---|

| | 全部损失（绝产） | 部分损失（部分绝产） |
|---|---|---|
| 返青期 | 每亩有效保险金额×40%×受损面积 | 每亩有效保险金额×40%×损失率×受损面积 |
| 抽穗期 | 每亩有效保险金额×60%×受损面积 | 每亩有效保险金额×60%×损失率×受损面积 |
| 灌浆期 | 每亩有效保险金额×80%×受损面积 | 每亩有效保险金额×80%×损失率×受损面积 |
| 成熟期 | 每亩有效保险金额×100%×受损面积 | 每亩有效保险金额×100%×损失率×受损面积 |

资料来源：北京市 2011 年政策性农业保险统颁条款（试行）。

农业保险投保者主要为农民，受客观条件的影响，农民对保险知识的了解程度往往较弱。如此专业以及复杂的理赔方式对于农民来说是很难理解的。一旦投保农户对保险条款的实际意义产生误解，就不可避免地在理赔环节产生各种各样的矛盾和纠纷，最终影响农民参与农业保险的积极性以及农业保险的推广工作。

区域产量保险的保险条款相对比较简单，尤其是理赔方式比传统农业保险更为简单。在计算赔偿时，只需要考虑一个变量，即区域的实际产量。由于最终赔偿结果与区域的实际产量之间有一一对应的关系，因此可以编写区域实际产量与最终理赔结果的对照表，使农户更直观地了解到区域产量保险的补偿方式。

## 四、北京市试点区域产量保险的条件

### （一）基数风险

区域产量保险有着许多优势，但也面临着一些挑战，其中最重要的一点就是存在基数风险。基数风险发生的主要原因是局部性的灾害，比如冰雹、火灾、局部大风、局部暴雨、泥石流、山体滑坡等。这些灾害有可能导致个别农户受损，却没有对整个区域的产量造成显著影响，因此农户就得不到保险的赔偿，或者得到的赔偿不足，这样政策性农业保险就起不到稳定农民生产生活的作用。

基数风险的大小取决于同一区域内不同农户之间风险的相关性，风险相关性越大，基数风险越小，区域产量保险就越有效。北京地处大陆性季风气候区，自然灾害频发。旱、涝、冰雹、寒潮、大风和沙尘暴是北京市的主要灾害性天气。其中除了冰雹外，旱、涝、寒潮、大风和沙尘暴皆为系统性风险。整体而言，北京市各区县内的风险具有较高的相关性，这是北京市开展区域产量保险的基础。

事实上，基数风险是区域产量保险与生俱来，无法消除的，但可以通过多种方式进行控制。首先是选择合适的农作物。区域产量保险承保的农作物应该对系统性风险（如旱灾、涝灾、大风、寒潮、沙尘暴等）较为敏感。被保险作物的品种、播种时间、管理水平、种植技术等最好比较相似，对灌溉和非灌溉的农作物要进行区分。其次，合理划分区域。最好根据自然灾害风险区划来划分区域。在北京，短期内可能还做不到这一点，但是根据美国 GRP 保险的成功经验，以每个区县为一个区域推行区域产量保险也是可行的。第三，可以采用区域产量保险与传统农业保险相结合的方式。现有农业保险已经很好的保障了局部性灾害，可以直接将区域产量保险作为现有农业保险的补充。或者针对北京市郊区面临的较高的雹灾风险，可以开发专门的冰雹保险作为区域产量保险的补充。从国际经验看，几乎所有的发达国家都有专门的雹灾保险。在美国，投保了 GRP 计划的被保险的人不能再去投保其它的政策性产量补偿型保险，但是可以自愿投保商业性的雹灾保险和火灾保险。第四，采取区域定损和逐户定损相结合的方法，对于系统性风险采用区域性方法定损。但如果农户遭遇了特定的局部性灾害，如冰雹、局部大风、泥石流等，对报案的农户进行逐户定损。印度 NAIS 就采用了这种方式。

北京市农业生产者规模小，数量大，相比于传统农业保险面临的逆选择、道德风险、高交易成本等问题，区域产量保险的基数风险在整体上是可控的。

### （二）区域产量数据

相对于传统农业保险要求农户的历史产量数据，区域产量保险对数据的要求相对较低。北京市因农业经济规模总量较小，农业信息资料积累齐全，农业科技水平较高，具备连续 30 年以上的，各种农作物，各区县级产量数据，可以作为区域产量保险区域划分和保费厘定的依据。这是北京市开展区域产量保险的优势条件。

### （三）农民的接受程度

作为一种新型的农业风险管理工具，区域产量保险被人们认可和接受还需要一个过

程。如果农户的保险意识差，或者农户对区域产量保险的认知程度很低，都将导致农户对于区域产量保险的需求不足。因此，如果要推广区域产量保险，就迫切需要提高农民对于区域产量保险的意识。

区域产量保险的保单结构统一，保险合同是标准化的，合同的条款更简单，对农户来说更加通俗易懂。印度、蒙古都有开展区域产量保险成功的例子，这证明了只要宣传工作做到位，区域产量保险是能够被发展中国家的农民所接受的。在这方面，北京已经具备开展区域产量保险的条件。

首先，经过三年的运作，政策性农业保险使京郊农民传统的风险观念有了明显转变，在一定程度上学会了利用保险来防范风险，投保的主动性明显增强。

其次，在对政策性农业保险的宣传方面，北京市也已经积累了一些成功的经验。[3]这为推动政策性农业保险工作创造了一个良好的舆论氛围。

**（四）巨灾风险**

区域产量保险可以保障一些系统性风险，如旱灾、冰冻灾害等，这对于农户是一个福音，但是却使保险经营者可能遭受巨灾索赔。北京市相邻区县之间的风险具有较高的相关性，如果以每个区县为一个区域，风险无法在区县之间分散，很可能发生多个甚至全部保险区域同时遭受重大灾害的情况。因此，必须建立有效的巨灾风险管理体系。

在巨灾风险的应对方面，北京市有着比较完善的方法。这是北京市开展区域产量保险的优势条件。

北京市的政策性农业保险分散机制可以分为三个层次（见图 2）：一是赔付率 160%以下的风险，由经办保险公司承担损失补偿责任，由农业保险合同予以保障。二是赔付率超过 160%但低于 300%的风险，通过政府直接购买再保险的方式转移风险，由政府与再保险公司签订再保险协议予以保障。三是赔付率在300%以上的农业巨灾风险，由政府每年按照上年农业增加值的 1‰提取巨灾风险准备金保障。

[3]如加强舆论宣传，通过工作网络，把数千幅政策性农业保险招贴画、上万份宣传资料，下发到各村各种养大户。同时，各区县通过“三农课堂”、“三农零距离”、户外电视显示屏、宣传栏、广播、网络在线访谈互动等媒体，多形式、多渠道、多层次地宣传政策性农业保险目的、条款、投保操作规程以及典型案例等；昌平、大兴、房山、平谷等区县还适时召开政策性农业保险理赔兑现会，增强了政策性农业保险的可信度；举办了保险知识讲座，编发了保险信息等期刊；市农委、北京保监局以及保险公司代表还坐客“首都之窗”，现场解答网民的提问等。

**（五）理赔服务**

理赔是农业保险的关键环节。在开展农业保险初期，农户对于保险的功能作用不甚了解，甚至存在一定的偏见。而且大部分农民对定损、理赔期望过高、矛盾突出。理赔服务跟不上可能引发的农民对保险公司的不满，甚至有造成群体性事件的风险。这种情况在区域产量保险中可能会更加突出。

首先，区域产量保险本身就有基数风险，很有可能有些农户受损了却得不到赔偿，更容易引起农户的误解；其次，区域产量保险不会在灾害发生后立即定损理赔，而是要等到整个区域的平均产量测算完毕才能得到赔偿，如果因此耽误了农民的恢复再生产，也会使得农民对保险公司产生不满。

北京市农险有着规范的理赔服务标准，和较高的理赔服务水平。[4]但是要开展区域产量保险，还应做好以下这些工作：一是要通过多种手段，控制基数风险。二是要加强宣传，消除误解。在销售时要对基数风险进行特别提示，最好让农户书面确认他们已经了解并且承认了区域产量保险存在基数风险。三是要创新区域产量的估算方法，缩短理赔周期。

## 五、北京市区域产量保险的合同设计

**（一）保险区域的选择**

区域产量保险能够成功的前提是单个农户的产量损失应该与整个区域的产量损失有较高的相关性，即基数风险不能太高。因此，在理想状况下，区域产量保险产品应该根据农业生产的风险状况来划分区域。在一份区域产量保险合同所选定的区域内，所有农田的土壤、气候、主要自然灾害的种类及其发生的概率应该比较相似。此外，被保险作物的品种、播种时间、管理水平、种植技术等最好也不要有太大差异，对灌溉和非灌溉的农作物要进行区分。

在实践中，区域产量保险的区域划分主要采用了以下三种方式：

一是加拿大魁北克省的动态调整方式。在加拿大魁北克省，当获得最新数据，或者农户发现自身产量与相邻区域而非他们目前所在的区域更加相关时，区域产量保险合同的区域边界就会重新重新划分。这种方式可以使得魁北克农户面临的基数风险逐渐变低。但是，魁

[4] 2009 年，制定《北京市政策性农业保险理赔服务规程》，明确了保险公司理赔业务操作标准，建立了“先行赔付”、“沟通协赔”、“投诉处理”、“应急处理”和“纠纷调解”五大服务机制，为灾后稳定农民情绪、迅速恢复生产、化解理赔纠纷，确保各项理赔服务工作的公正、规范、有序开展，发挥了积极作用。

北克省所使用的这种动态调整系统对数据的要求非常严苛。

二是美国采用的以一个县为一个区域的划分方式。因为在美国，NASS 县级产量是唯一可获得的区域历史产量数据。因为作为行政区划的县与自然灾害风险区域并不一致，这种建立在县级产量基础上的区域指数并不是最理想的。优点是县级产量数据可获得性更高。

三是印度采用的 4-5 个村庄为一个区域的划分方式。印度 NAIS 计划的风险区域的划定是由邦政府决定的，邦政府可以选择 Gram Panchayat, Mandal, Hobli, Circle, Phirka, Block, Taluka（皆为印度的行政区划，其中 Gram Panchayat 最小）等为一个风险区域。但是，在计划实施 3 年之内，必须做到以每个 Gram Panchayat（包含 4-5 个村庄）为一个风险区域的水平。相比于以一个县为一个区域的划分方式，这种划分方式的基数风险更小，但是区域产量数据的可获得性和可靠性更差。

在北京的农作物区域产量保险合同设计中，近期内是不可能使用像加拿大魁北克省的动态调整系统。首先，这种系统需要有非常精细和准确的区域产量数据；其次，打破行政区划，经常重新划分区域产量保险的边界，无论是从经济上还是从政治上考虑都不太具有可操作性。由于北京市只有县一级的农作物历史产量数据，因此在试点区域产量保险初期，比较切实可行做法是将每一个区县级行政区划作为一个区域。如果以后能建立起村级的历史产量数据，也可以利用详细的资料，通过准确的分析，采用类似于印度的做法，将一个或多个村划为一个区域。

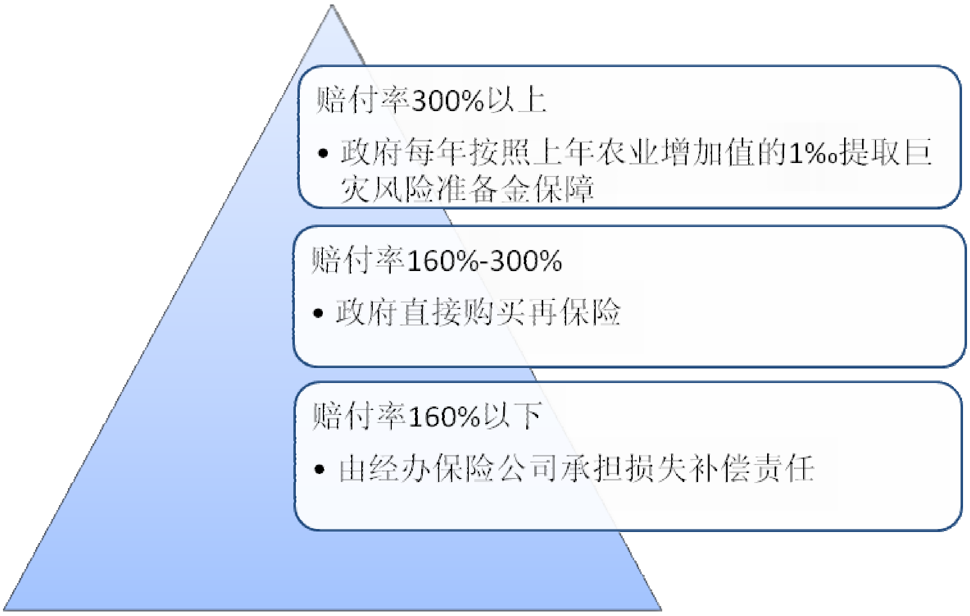



图 2　北京市政策性农业保险风险分散机制

**（二）赔偿支付规则**

借鉴了美国和印度的区域产量保险的赔偿机制，北京市农作物区域产量保险的赔付规则可以设计如下：

$$每亩赔付 = \max\left(0, \frac{触发产量 - 实际产量}{触发产量}\right) \times 每亩保额$$

其中：

$$触发产量 = 县期望产量 \times 保障水平$$

$$每亩保额 = 县期望产量 \times 农产品价格 \times 赔偿比例$$

**（三）保额的设定**

区域产量保险的每亩保额等于每亩期望产量乘农作物价格乘赔偿比例。赔偿比例这个变量存在的意义是为了减小基数风险。假设产品中没有赔偿比例这个变量，那么当实际产量低于触发产量时，赔偿就简单地等于触发产量和实际产量之间的差额，也就是全区域的平均每亩损失。但是，农场的实际损失并不一定等于全区域的平均损失。对基于区域产量保险的期望赔偿与基于农场水平的实际损失之间的相关性，保单持有人有着不同的认识。因此他们会选择不同的赔偿比例，使得区域产量保险的期望赔偿尽可能得接近于农场的期望损失。要达到这一效果，其理想的赔偿比例选择应该等于下述公式中的$\beta_i$。

假设农户 $i$ 的实际产量为 $\tilde{y}_i$，该农户的实际产量 $\tilde{y}_i$ 相对区域实际产量 $\tilde{y}$ 的敏感程度为：

$$\beta_i = \frac{\operatorname{cov}(\tilde{y}_i, \tilde{y})}{\operatorname{var}(\tilde{y})}$$

由于大多数个人水平的产量比县域水平产量波动性更大，为了使得区域产量保险的期望赔偿满足农户的需求，区域产量保险合同中就必须允许投保农户能选择超过 100%的赔偿比例。从国际区域产量保险的实践来看，美国 GRP 和印度 NAIS 的最大保额都等于区域期望产量的 150%。因此，北京市开展区域产量保险，可以将赔偿比例设定为 90%~150%，由投保农户自由选择。

**（四）保障水平的设定**

在前面设计的赔偿支付规则中，触发产量等于区域期望产量的一个比例，我们把这个比例叫做保障水平。

按照区域产量保险最基本的原理，触发产量应该等于区域的期望产量，即保障水平为 100%。但在实践中，美国 GRP 和印度 NAIS 的保障水平的上限都是 90%，而不是 100%。1994 年美国联邦农作物保险改革与农业部重组法案批准保障水平的值最高为 95%。但是迄今为止，95%的保障水平并未实施。将保障水平设定为 100%是不明智的。我们以北京市的昌平区和房山区为例（见表 7 和表 8），损失率 0%~10%之间的风险概率是很高的。如果保障水平为 100%，就会出现高频率的小额索赔，大大增加了理赔费用。

**表 7　昌平区各种农作物生产风险**

| | 大豆 | 稻谷 | 高粱 | 谷子 | 玉米 | 小麦 |
|---|---|---|---|---|---|---|
| 损失>0% | 50.06% | 45.02% | 52.35% | 57.29% | 52.38% | 52.24% |
| 损失>10% | 22.95% | 5.93% | 29.77% | 43.14% | 6.30% | 16.04% |
| 0<损失<10% | 27.11% | 39.09% | 22.58% | 14.15% | 46.08% | 36.20% |

数据来源：庹国柱、赵乐、朱俊生：《政策性农业保险巨灾风险管理研究——以北京市为例》，中国财政经济出版社，2010。

**表 8　房山区各种农作物生产风险**

| | 大豆 | 稻谷 | 高粱 | 谷子 | 玉米 | 小麦 |
|---|---|---|---|---|---|---|
| 损失>0% | 48.57% | 52.14% | 61.44% | 45.02% | 48.38% | 47.17% |
| 损失>10% | 23.76% | 11.56% | 56.65% | 27.01% | 1.44% | 3.71% |
| 0<损失<10% | 24.81% | 40.58% | 4.79% | 18.01% | 46.94% | 43.46% |

数据来源：庹国柱、赵乐、朱俊生：《政策性农业保险巨灾风险管理研究——以北京市为例》，中国财政经济出版社，2010。

北京市应该将区域产量保险保障水平上限设定为 90%。也就是说，只有实际的区域产量低于区域期望产量的 90%，保险公司才进行赔付。损失率 0%~10%之间的小额损失，对农户没有太大的影响，完全可以由农户自身承担。这样做消除了小额索赔，从而减少了损失理赔费用，大大降低了保费。

美国 GRP 和印度 NAIS 都设置了可选择的保障水平。在美国，投保者可以选择县期望产量的 65%、70%、75%、80%、85%和 90%作为 GRP 的触发产量。在印度，NAIS 计划设置了三种保障水平：90%，80%和 60%，分别对应低等风险区域，中等风险区域以及高等风险区域。

保障水平越低，触发产量也就越低，相应的保费也就越低。从表 9 可知，65%保障水平下的 GRP 全国平均费率，仅为 90%保障水平下 GRP 全国平均费率的约 1/3。

表 9　2011 年 GRP 各保障水平下的平均费率水平

| 保障水平（%） | 65 | 70 | 75 | 80 | 85 | 90 |
|---|---|---|---|---|---|---|
| 平均费率水平 | 0.0119 | 0.0133 | 0.0140 | 0.0203 | 0.0237 | 0.0362 |

资料来源：RMA 官方网站：http://www.rma.usda.gov/。

由于保险费率水平较低，低保障水平的 GRP 保险受到了很多农户的欢迎。由图 3 可以看出，区域产量保险 GRP 的需求出现了“两级分化”的情况，承保面积最大的三种保障水平依次为 90%、70%、65%，其中 65%和 70%两种保障水平下的 GRP 承保面积，占到了全部 GRP 承保面积的 50%。很少有农户会选择中等保障水平的 GRP 保险。

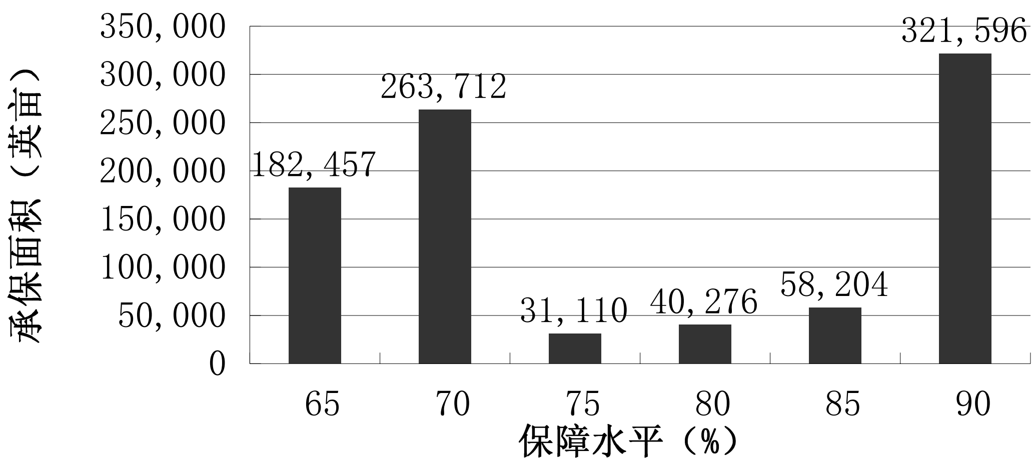



图 3　2011 年 GRP 各保障水平下的承保面积
资料来源：RMA 官方网站：http://www.rma.usda.gov/。

设置不同的保障水平是非常有必要的。一些农户希望通过投保区域产量保险，最大程度上保障自己收入的稳定性。即使幅度不大的农作物减产风险，他们也希望通过保险进行转移，因此他们更倾向于购买较高保障水平的区域产量保险。而另外一些农户只希望转移农作物遭受重大减产损失的风险，不愿意支付更多保费。对这部分农户，低保障水平的区域产量保险就可以满足他们的需求。

对于北京市的保险公司和农户而言，区域产量保险是一个新事物。像美国 GRP 那样设置六种保障水平没有必要而且过于繁琐。因此可以借鉴印度的做法，设置高、中、低三种保障水平，分别为 90%、80%和 70%，这样就基本能够满足不同农户的需求。

**（五）条款通俗化**

农业保险条款设计不通俗、条款规定复杂难懂，在一定程度上制约了农户的保险需求，不利于农业保险在农村地区的进一步推广及其保障作用的有效发挥。因此，区域产量保险条款的设计应尽量通俗化，这样将大大有利于业务的开展。

保单通俗化主要有以下思路：一是语言方面，要确保制定的保险条款语言流畅、语句通顺、文字浅显易懂、内容完整。二是结构方面，从方便消费者的角度，安排保险条款顺序、设计版面、格式及字体，以及增加目录、索引和提示等内容。三是内容方面，增加服务条款、行政运作事项说明等内容, 便于农户了解可以享受的增值服务以及各种情况下的变更手续。第四，可以 50 公斤为一个单位，形成区域实际产量与最终理赔结果的对照表，并在承保业务时向农户进行公示，这可以在一定程度上以通俗的方式解决农户对理赔结果的知情权。举个例子，假设每亩保额为 1000 元，区域期望产量为 500kg，按照我们前面设计的赔偿支付规则计算，区域实际产量与最终理赔结果的对照表如下表所示：

表 10　区域实际产量与最终理赔结果的对照（元）

| 保障水平<br>区域实际产量（kg） | 90% | 80% | 70% |
|---|---|---|---|
| 500 | 0.00 | 0.00 | 0.00 |
| 450 | 0.00 | 0.00 | 0.00 |
| 400 | 111.11 | 0.00 | 0.00 |
| 350 | 222.22 | 125.00 | 0.00 |
| 300 | 333.33 | 250.00 | 142.86 |
| 250 | 444.44 | 375.00 | 285.71 |
| 200 | 555.56 | 500.00 | 428.57 |
| 150 | 666.67 | 625.00 | 571.43 |
| 100 | 777.78 | 750.00 | 714.29 |
| 50 | 888.89 | 875.00 | 857.14 |
| 0 | 1000.00 | 1000.00 | 1000.00 |

**（六）明示基数风险**

从区域产量保险条款的保险责任、赔偿支付规则中，我们可以看出这种产品的赔偿是与区域产量挂钩的，与农户个人产量并不直接相关，因此存在着基数风险。然而“基数风险”对于农户来说是一个全新的概念。农户在投保的时侯，很可能不去仔细阅读保险责任、赔偿支付规则等条款，或者很可能无法准确地理解这些条款。农户对于保险产品可能会有先入为主的印象，会想当然地认为保险赔付是跟自己的损失而不是跟整个区域的损失挂钩的。这样农户就对保险的赔偿状况会就有一个错误的预期，认为只要自己的产量低于触发产量，保险公司就应该赔偿。假设出现了农户个人产量低于触发产量，但区域产量损失没有达到赔偿标准的情况，农户认为保险公司应该赔，但保险公司根据合同条款显然拒赔。这样就必然造成农户的不满和误解，甚至很可能产生一些纠纷，最终损害农业保险的声誉，不利于农业保险的顺利推广。

因此在保险合同中，就必须对基数风险进行专门的明示。可以借鉴美国 GRP 的经验，农户要投保区域产量保险，就必须要专门签署一份文件，以表示自己已经了解并承认了区域产量产品与传统农业保险产品的差异。这一文件中应该体现下面的内容：

该产品的赔偿只与区域的实际产量相关，与被保险人个人农田的实际产量无关，因此有可能出现以下两种情况：

（1）即使个人的农田受到了减产损失，被保险人也有可能无法获得补偿。

（2）即使个人的农田没有遭受任何损失，被保险人也有可能获得补偿。

将基数风险单独进行明示，可以充分保护投保农户的知情权，消除由于认识水平所带来的误解，减少可能发生的纠纷，有利于化解公司经营风险。

**（七）设置局部性灾害的附加险**

区域产量保险的基数风险是与生俱来、无法消除的，这种产品适合承保系统性风险，但无法应对局部性灾害对个别农户造成的损失。相反，传统农业保险更适合承保局部性的灾害。采取区域产量保险与传统农业保险相配合的方式，用区域产量保险的方式保障系统性风险，用传统保险的方式保障非系统性风险，这样就能够大大减轻基数风险的影响。

例如在美国，投保了 GRP 计划的被保险的人不能再去投保其它的政策性产量补偿型保险，但是可以自愿投保商业性的雹灾保险和火灾保险。印度 NAIS 计划则采取了区域定损和逐户定损相结合的方法，对于系统性风险采用区域性方法定损。但如果农户遭遇了特定的局部性灾害，如冰雹、局部大风、泥石流等，则采用传统农业保险的做法，对报案的农户进行逐户定损。这一做法可以看成是将区域产量保险与灾害补偿型保险组合成了一份保险。

北京市推广区域产量保险，可以开发一些局部性灾害的附加险，例如针对北京市比较严重的冰雹灾害，推出专门的冰雹灾害附加险，采用传统农业保险的理赔方式，供投保农户自愿选择。

## 参考文献

[1] Chambers, R. Cz. Insurability and Moral Hazard in Agricultural Insurance Market [J]. American Journal of Agricultural Economics, 1989, 71.

[2] Skees、J.R.and M.R.Reed. Rate-Making for Farm-level Corp Insurance：Implications for Adverse Selection [J]. American Journal of agricultural Economics,1986,68.

[3] Miranda M.J. "Area-Yield Crop Insurance Reconsidered [J]. American Journal of Agricultural Economics, 1991,73.

[4] Quiggin, J. A Note on the Viability of Rainfall Insurance [J]. Australian Journal of Agricultural Economics,1986,30.

[5] Quiggin, J., G. K. Aragiannis and J Stanton. Crop Insurance and Corp Production:An Empirical Study of Moral Hazard and Adverse Selection [J]. Austr.Econ.37,2,August 1993.

[6] Shaik、S. and J. Atwood. Demand for Optional Units in Corp Insurance [C].Paper presented at the AAEA annual meeting,Montreal,Canada,27-30 July 2003.

[7] Bardsley, P., A. Abey, and S. Davenport. The Economics of Insuring Crops Against Drought [J] Australian Journal of Agricultural Economics v. 28: 1, 14,1984.

[8] Miranda, M.J., and J.W. Glauber. Systemic Risk, Reinsurance, and the Failure of Crop Insurance Markets [J].American Journal of Agricultural Economics, 1997,79.

[9] Skees,J..Risk management challenges in rural financial markets:blending risk management innovations with rural finance [C].Presented at the International Conference:Paving the Way Forward for Rural Finance, Wansington DC,USA, June2~4,2003.

[10] Barnett,B. Agricultural index insurance products:strengths and limitations [C].Presented at Agriculture Outlook Forum, Washington,USA,USDA. February 19,2004.

[11] World Bank. agriculture index insurance producks: strengths and limitation [R].In Agriculture Investment Sourcebook Module 10,Available at World Bank webside, 2004.

[12] World Bank. Managing Agricultural Production Risk Innovations in Developing Countries. Available at World Bank webside, June 2005.

[13] Skees J R , Black J R , Barnett B J . Designing and Rating an Area Yield Crop Insurance Contracto[J] . American Journal of Agricultural Economics , 1997 ,79 .

[14] Mahul Olivier . Optimal Area Yield Crop Insurance[J] . American Journal of Agricultural Economics , 1999, 81.

[15] James A. Vercammen. Constrained Efficient Contracts for Area yield Crop Insurance[J] . Amer . J . Agr . Econ. 2000 ,82.

[16] Bourgeon Jean Marc and Chambers R G. Optimal Area Yield Crop Insurance Reconsideredo[J] . American Journal of Agricultural Economics , 2003 ,85.

[17] Ramaswami B. and Terry L. Roe. Aggregation in Area-Yeld crop insurance:The Linear Additive Model [J]. Amer. J. Agr. Econ., 86(2),May 2004.

[18] Turvey C G, Zhao C. Parametric and nonparametric crop yield distributions and their effects on all2risk crop insurance premiums[D] . Guelph :University of Guelph ,1993

[19] Barry K G,Alan P K. Nonparametric estimation of crop yield distributions :implications for rating group-risk croinsurance contracts[J] . Amer J Agr Econ ,1998 ,80 :139-153.

[20] Barry J. B, Y. Hu, J. Roy Black, J. R. Skees. Is Area Yield Insurance Competitive with Farm Yield Insurance? [J]. Journal of Agriculture and Resource Economics,30(2),2005.

[21] Just.R. and N. Bockstael, agricultural and Resource Policy in Agricultural Systems. New Publishers, 1990.

[22] Nelson, C. and Loehman, E. Further toward a theory of agricultural insurance [J]. American Journal of Agricultural Economics, 1987, 69(3).

[23] Ker, A.P. and B.K. Goodwin. Nonparametric Estimation of Crop Insurance Rates [J]. American Journal of Agricultural Economics , 2000,83.

[24] Harun Bulut,Keith Collins,Tom Zacharias,Frank Schnapp,NCIS. Why do producers choose individual or area insurance protection ? [J].Crop Insurance Today ,2011.2.

[25] Ozaki V.A., Ghosh S.K., Goodwin B.K., and Ricardo Shirota. Spatial-Temporal Modeling of Agricultural Yield Data with an Application to Pricing Crop Insurance Contracts [J].American Journal of agricultural Economics,2008,90.

[26] Smith V H , Chouinard H M , Baquet A E. Almost Ideal Area Yield Crop Insurance Contracts [J] . American Journal of Agricultural Economics. 1994 , 23.

[27] Alan P K,Barry K G. Nonparametric estimation of crop insurance rates revisited[J] . Amer J Agr Econ ,2000 ,83 .

[28] Skees J. R. and Collier B. The Potential of Weather Index Insurance for Spurring a

Green Revolution in Africa. The Watkins House, Lexington, KY. Available at www.Globalagrisk.com, 2008.
[29] Glauber,J.W. Crop Insurance Reconsidered [J].Amer.J.Agr.Econ.86(2004)。
[30] Tuo Guozhu, Wang Guojun. Research on China's agricultural insurance and rural social security system[M]. Beijing, Press of Capital University of Economics and Business, 2002
庹国柱，王国军.中国农业保险与农村社会保障制度研究[M].北京:首都经济贸易出版社，2002.
[31] Tuo Guozhu, Ding Shaoqun. Research on risk zoning and premium zoning of crop insurance[J]. Chinese Rural Economy,1994(8)
庹国柱,丁少群. 农作物保险风险分区和费率分区问题的探讨[J].中国农村经济.1994(8).
[32] Tuo Guozhu, Zhao Le, Zhu Junsheng. Research on the catastrophic risk management of government-supported agriculture insurance: in case of Beijing [M]. Beijing, Press of China's Finance and Economics, 2010
庹国柱,赵乐,朱俊生. 政策性农业保险巨灾风险管理研究——以北京市为例[M]. 中国财政经济出版社,2010.
Zhai Zhihong, Jiang Huifei, Ye Caihua,Liao Shuhua1, Li Nan. Hail risk distribution based on probability density model in Beijing region[J], Journal of China Agricultural University, 2008(6)
翟志宏，姜会飞，叶彩华，廖树华，李楠. 基于概率分布模型的北京地区冰雹灾害风险区划[J]. 中国农业大学学报, 2008(6).
[33] Zhang Yuehua. Area-based yield crop insurance and the development of China's agricultural insurance[J]. China Finance, 2005(6)
张跃华. 农业保险团体（区域）保险与中国农业保险发展[J]. 中国金融,2005(6).

[34] Zhu Junsheng. Literature Review on the Research of Crop Insurance[J]. Chongqing Social Sciences, 2009(9)
朱俊生. 农业保险问题研究综述[J].. 重庆社会科学.2009(9).
[35] Tuo Guozhu, Zhu Junsheng. Evaluation on the China's agricultural insurance: based on the public-private paticipation[J]. Chinese Rural Economy, 2009(3)
朱俊生、庹国柱. 中国农业保险制度模式运行评价——基于公私合作的理论视角. 中国农村经济. 2009(3).

# 区域产量保险的适用性及其合同设计初探

## ——以北京市农业保险为例

朱俊生[1]，赵 乐[2]，初 萌[3]

[1]劳动经济学院，首都经济贸易大学，北京，中国，100070
[2]发展规划处，北京市农委，北京，中国，100053
[3]金融学院，首都经济贸易大学，北京，中国，100070

**摘 要：**本文根据农业区域产量保险的运行机理及其发挥优势的前提条件，考察了北京市试验农业区域产量保险的意义、条件及其障碍，并结合国际上农业区域产量保险的运行状况，对合同作出初步的设计。

**关键词：**区域产量保险；合同设计；北京农业保险

# Analysis the Government Role of Insurance Funds Involved in the Affordable Housing Construction with Gains and Risk Adjusting

ZHANG Daijun, HOU Mengna

Institute of Finance, Zhejiang University of Finance and Economics, Hangzhou ,China 310018

**Abstract**: According to national statistics database, China Statistical Yearbook and Insurance Regulatory Commission and other sites, and visits relevant departments to understand the insurance funds to invest in commercial real estate and construction of affordable housing investment funds, To explore the new opportunities and risks that insurance companies invest in the affordable housing before and after the insurance companies involved in the housing construction. The two comparison analysis obtained before and after the earnings, the risk difference impacted by government financial support, the credit status of the insurance company, state tax revenue, interest rates, technology and information variables. According to these differences, clear central government and local government's role in policy support, legal support and marketing support three aspects.
**Keywords**: Insurance funds, affordable housing, risk, the role of government

## I. Analysis the use of insurance funds in China

### A. the use of insurance funds

Since the reform and opening up, China's insurance industry has been rapid development. In 2011, the insurance premium income is 1433.92512 billion RMB, the insurance industry total assets reached 6013.81032 billion RMB, at the end of October 2011, insurance funds use the balance of 5.37 trillion RMB, the average investment rate of return is 3.05%. Specific investment channels and the investment ratio are shown in Table 1 and Figure 1.

**Table 1. Investment channels and proportion**

| Project | Investment ratio (%) |
|---|---|
| Bank deposits | 31.35 |
| Bond | 46.91 |
| Securities Investment Fund | 5.73 |
| Stock | 7.7 |
| Long-term equity | 3.37 |
| Real estate | 0.52 |
| Others | 4.42 |

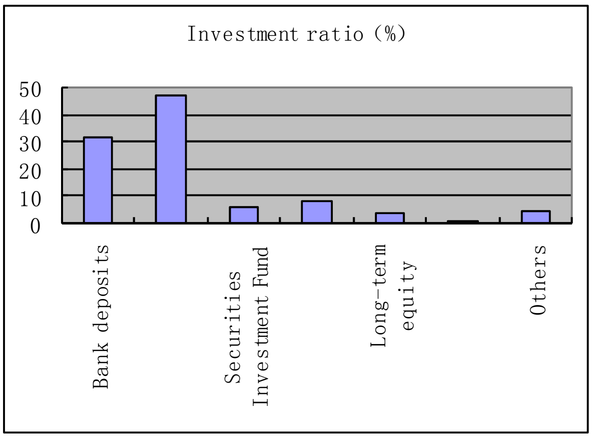



**Figure1 the use of insurance funds up to the end of October 2011**

However, the rapid growth of the scale compared with the Chinese insurance industry asset size and capital use, Use of insurance funds are still subject to many direct or indirect restrictions, relatively narrow investment channels, the efficiency of asset allocation is not high, the rate of return on investment is low. Which greatly reduced the competitiveness and development potential of the insurance industry, lead to the depletion of financial resources, and reduces the efficiency of the allocation of social resources.[1] On October 1, 2009,the implementation of the new Insurance Act to make new regulations on the use of insurance funds, widening the use of

[1] Liu Hongtao, Zhang Shuying. Investment of insurance funds [J]. Value engineering, 2006, (07)

insurance funds channels. Insurance funds are now not only can use in the capital market, but also be equity investments, can enter the field of real estate.[2]

### B. Affordable housing construction status and the feasibility of insurance funds involved in the affordable housing construction

Security policy formally come into effect on 7 August 2007, since 2008, the central government increase security live engineering construction force, namely make clear construction plan at the beginning of year, and construction scale up in successive years. In 2008, 2009 and 2010 respectively the central government plans to build affordable housing are 3.87, 0.63 and 5.8 million sets. 10 million sets of greatly increased in 2011, compared with 2010 growth of 72.4%.

**Table 2. The affordable housing completion situation in recent years (unit: million set)**

| Year | Construction plan | | | | | | | Actual working |
|---|---|---|---|---|---|---|---|---|
| | Transformation housing | low-renting public housing | Low-cost housing | price-fixed housing | economically affordable housing | Plan merger | Growth rate | |
| 2008 | | | | 63 | | 63 | | 100 |
| 2009 | 80 | 0 | 177 | 0 | 130 | 387 | | 330 |
| 2010 | 280 | 0 | 180 | 0 | 120 | 580 | 49.90% | 590 |
| 2011 | 400 | 230 | 170 | 80 | 110 | 1000 | 72.40% | |

Source: consolidation of the Chinese real estate dynamic policy design study group

During "the twelfth plan of five years" period, China will increase affordable housing construction force, plan 36 million sets, In 2011 and 2012, constructing 10 million every year, construcing 16 million sets from 2013 to 2015. After the completion of the target, the coverage rate will reach 20%, this will greatly ease housing pressure, especially solving these new to the work and the requirements of the college students' housing.[3]

[2] Chen jie. Channel expansion and risk prevention of insurance funds [J]. Shanghai Insurance, 2010, (6)

[3] Construction of affordable housing participation strategy [R]. Real estate topics, 2011, (8)

With the continuous strengthening of the protection of housing construction, it is not enough to rely solely on government financial support. In June 2010, seven ministries and commissions of the building housing ministry of Development and Reform Commission issued “guidance on accelerating the development of public rental housing”, proposed to support eligible enterprises to raise funds through issue of bonds and notes, etc., earmarked for the construction and operation of public rental housing, and explore the use of insurance funds, trust funds and real estate trust investment funds to expand the financing channels of public rental housing. Affordable housing construction financing method was first proposed, in particular, allow companies issuing bonds and notes, allow insurance funds and trust funds to enter the field of affordable housing construction, and will effectively alleviate the lack of the housing construction funds.

"We believe that the insurance funds invest in affordable housing is a good choice. Such as large-scale economic affordable housing, the pricing of this room is relatively low, sustainability is more suitable for rolling development in the insurance funds, also can help solve the problem of cities, local government, this is a very good idea, also in line with the principles of the insurance operation. " China Ping An Insurance Group, Chairman Mr. Ma had said. Not just Ma Mingzhe, more insurance companies have foreseen the future development prospects of affordable housing in China, begin to increase the insurance funds to participate in the construction of protection in an effort.

Insurance funds to enter policy residence which is led by the Government to safeguard the livelihood of the people for the purpose, this consideration is based on people's livelihood and the corporate social responsibility, on the other hand is based on the relative security and stability of investment income, people and business are both beneficial.

## II. Revenue analysis of insurance funds involved in the

## commercial real estate investment and insurance funds participate in the affordable housing construction

### A. Revenue analysis of insurance funds involved in the commercial real estate investment

#### 1) Under normal circumstances, land prices have trends that continue to add value

From the demand point of view, the growing demand of urban land space is expanding with the acceleration of urbanization and rural to urban mass transfer. From the supply analysis, land is fixed and limited, at the macro level it is a constant, can not be arbitrarily increased. Under conditions of normal development, commercial real estate demand is often greater than the supply, so that the commercial real estate prices in a rising trend.

#### 2) Commercial real estate investment can get multiple benefits, with higher profit margins

a) Commercial real estate rental income

b) Commercial real estate sales revenue. [4] The statistics show that over the past 20 years, the real estate rate of return of the Golden Group signed an agreement with Ping An of China in recent years to reach 10% -16% level. At the end of October 2011, the insurance funds invest in real estate 27.833 billion, an increase of 6.06 percent than the previous month, increased by 90.34% from the beginning of the year, accounting for 0.52% of the available balance of the insurance funds.

### B. Revenue analysis of insurance funds participate in the affordable housing construction

The insurance companies bear the obligations and responsibilities of shareholders and policyholders, it must create value by the sound operation and development for the shareholders and policyholders, to protect the stability of the entire economy and society.

In early March 2011, China Pacific Insurance breakthrough in insurance capital to get involved in the security room, had estimated that the general public rental yield is around 3%, insurance capital gains of 5% is in relatively good level. But in fact, the first single insurance funds from the China Pacific Insurance to affordable housing project, the scheduled annual yield of the insurance capital had stabilized above the bond interest rates and deposit rates of banks large agreement, and showed a tendency to enhance the above, has been infinitely close to 6% firmly. Affordable housing project that Ping An in Shanghai will also reach a firm yield of 6%. It can clearly be seen, rate of return insurance funds involved in the affordable housing construction is substantial.

## III. Risk Measurement of insurance funds involved in the commercial real estate investment and insurance funds participate in the affordable housing construction

### A. the methods of Risk Measurement

#### 1) Analysis of variance

Analysis of variance is a based method to measure risk, this approach take the expected rate of return of venture capital as a random variable, while the variance represents the degree of uncertainty or the degree of risk. The variance is a value to reflect the deviation from the random variables and their expectations.

a) For discrete random variables, its variance is calculated as follows:

$$D(X)=\sum_{K=1}^{\infty}\left[X_K-E(X)\right]^2\cdot P_K$$

Where: $P_K$ is the probability of $X_K$ random variable, $X_K$ is the possible values for K

[4] Xie qing. Real estate investment opportunities and risk analysis of insurance funds [J]. Chinese and foreign entrepreneurs, 2009, (24)

$$E(X)=\sum_{K=1}^{\infty} X_K \cdot P_K$$

b) For continuous random variable, its variance is calculated as follows:

$$D(X)=\int_{-\infty}^{+\infty}\left[X-E(X)\right]^2 \cdot f(X)\cdot d(X)$$

Where: $f(X)$ is the probability density function of random variable X

In the analysis of variance, measuring the risk of insurance funds invest in commercial real estate and the affordable housing is to be calculated according to the investment rate of return and the expected rate of return in a few years that insurance companies involved in commercial real estate and the affordable housing investment. The more data across the period, more accurate risk estimates.

### 2) Financial indicators analysis

Financial indicators analyze the solvency of the enterprise, operational capacity and profitability generally. Financial indicators, each indicator has a reasonable interval .Insurance funds involved in commercial real estate and housing construction, selecting the listing of Ping An Insurance Company nearly 10 years of financial data, especially concerned about those years financial that investing in commercial real estate and the affordable housing, analyze financial indicators to observe the financial impact of the insurance company that insurance funds involved in the affordable housing construction.

### 3) Altman's Z value of scoring models

Professor U.S. Edward.I.Altman collected the balance sheet and income statement information of 66 enterprise, and further collected 22 variables for evaluation, classify these variables in accordance with the five standard ratio of flow rate, yield, stability, ability to pay, the ratio of the activity. On the basis of observed variable to determine the prediction accuracy and the interdependence between the variables. Finally, got the following discriminant function of Altman model through a comprehensive analysis:

$$Z=0.012X_1+0.014X_2+0.033X_3+0.006X_4+0.999X_5$$

According to the result of the calculation, the conclusions of the Altman Z scoring model as shown below:

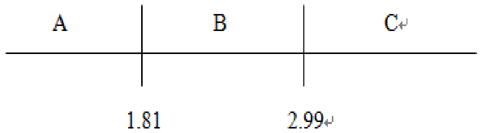



**Figure2.Judge zone of Z values scoring model**

In the three regions A ,B and C, A = Z-value score of less than 1.81 the area for the insolvency zone. Area C = Z scores greater than 2.99 of the area, non-bankruptcy zone. Area B = Z-value score between 1.81 and 2.99, easily lead to wrong classification, defined as the gray area. The data accuracy rates of one year and two years before the bankruptcy were 95% and 72%, the third year before the bankruptcy accuracy rate is 48 percent.[5]

This model results will be a direct response to the risk is relatively easy to use. Also have some reference for the metrics listed insurance companies' risk, insurance funds invest in commercial real estate and the affordable housing.

## B. Revenue impact analysis to determine the risk characteristics

### 1) The definition of the influencing factors

By constructing a simple model to determine the impact of income from each variable that insurance companies participate in investment before and after the affordable housing construction.

**Table 3. Influencing factors of gains that insurance companies involved in affordable housing construction**

| Influence factors | | Content and meaning |
|---|---|---|
| Insurance company | | credit status<br>costs of Investment guarantee room construction |
| Governments at all levels | The central government | Financial support, the national debt<br>Tax rate (investment tax rate of insurance company investment guarantee room )<br>Interest rates ( insurance company's interest rate subsidies), laws and regulations |
| | Local government | Local government bonds, provident fund |
| Market factors | | Technical level (the level of investment in technology support)<br>Information, human resources |

### 2) Character income Model

[5] Liang Junping, Yu Xuehua, Zhang Shuhua, Wu Xiubo, Leng Weiwei. Risk quantification model evaluation of risk investment projects [J]. Statistics and Consulting, 2006, (01)

When build the character income model before and after the insurance companies participate in the affordable housing construction, the revenue impact characteristics can be summarized as the characteristics of an insurance company, the characteristics of all levels of government and market characteristics, were corresponding to insurance company factors that affecting the income, all levels of government and market factors . The basic form of character income model that the insurance companies participate in the affordable housing construction:

$$R(z) = R(I, G, M) \quad (1)$$

Let n be the sample size of the model, the earnings impact of the insurance company factors include k kinds of insurance company characteristics, m all levels of government characteristics and r market characteristics. Where: R is the proceeds of one (n × 1) matrix, I is one (n × k) matrix, G is an (n × m) matrix, M is an (n ×r) matrix.

a) The linear function form of character income model:

$$R = \alpha + \beta I + \gamma G + \tau M + \varepsilon \quad (2)$$

b) The logarithmic form of character income model:

$$\ln R = \alpha + \beta \ln I + \gamma \ln G + \tau \ln M + \varepsilon \quad (3)$$

By estimating the parameters in the model, you can get character income of every feature (linear function form) or insurance company income for each character's elasticity (logarithmic function), thus we can explore the impact of income from various factors on the insurance companies before and after involved in the affordable housing construction.[6]

### 3) Empirical research idea

Samples as Shenzhen ,Shanghai ,Guangdong and Zhejiang provinces(cities), Shenzhen, Shanghai, Guangdong and Zhejiang the four provinces (cities) can say is the representative city of affordable housing construction, the data is much more and more transparency, have more reliable basis. Since August 7, 2007 security policy set full implementation of the housing, representative insurance company such as the Ping An and the peace of the Pacific nearly five years of the four cities, examine the insurance company credit status, characteristics of commercial real estate and the capital of the housing. The central government takes financial subsidies, investment tax provisions and interest rates subsidies to the four regions. Local government bonds issued in local government, the technical level of local investment and information professionals in the local market characteristics.

Insurance company credit status, input costs and the government financial subsidies, taxes, interest rate subsidies and local government bonds distribution can be obtained from relevant information, visiting the relevant departments, the technical level in market factors reflect local economic development level with GDP, information, personnel variables can be defined as dummy variables.

Finally, making correlation and regression analysis with earnings based on these variables around before and after these cities insurance funds invest in the affordable housing construction, then draw its impact size of each variable to its revenue.

# IV. The government role

Now determine their risk characteristics through those variables for the influence degree of the income. Clear all levels of government should play a role.

## A. The central government role

Government role which in insurance funds involved in the affordable housing construction should be to support and guide rather than pre-empt. Based on this, the author proposes the following specific role in venture capital.

### 1) Policy support

Government must construct a sound policy environment as the basis to improve the insurance

[6] Yan SIqi, Liu Hong, Hu Libing, Wu Qun. Quantitative research of residential land prices microeconomic impact factors - Case Study of Nanjing [J]. Technology Management of Land and Resources, 2011, (4)

funds to participate in the development conditions of affordable housing construction, promoting institutional innovation. It should improve the policy environment further, and establish a sound policy support system. Policy support embodied in:

a) Government financial aid. Provide economic assistance to insurance companies and other venture capital firms is a common practice in Western developed countries, the number of government financial aid funds are limited, but it play a significant role. At the same time, increase economic assistance to affordable housing is also an effective way to reduce the risk of insurance companies to invest. China's central government has continued to increase investment in housing support in recent years to ensure that the affordable housing work carried out smoothly (Table 4).

**Table 4.2009 to 2012, the central finance housing security spending (Unit: billion)**

| | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| Expenditure of the Central Government | 2.643 | 38.648 | 32.882 | 37.44 |
| Transfer payments to local | 52.413 | 73.925 | 139.181 | 174.315 |
| Total | 55.056 | 112.573 | 172.063 | 211.755 |

Source:"annual central and local budgets for the implementation", 2012 affordable housing expenditure data is the budget data, the People's Republic of China Ministry of Finance website

b) Tax concessions. Due to the size of the risk and the level investors profit is largely dependent on the capital gains tax. Therefore, providing tax incentives to insurance companies can still reduce the degree of risk involved in the affordable housing construction, to ensure insurance companies benefit. To encourage venture capital for high-tech industries, 1978, tax laws promulgated by the United States lowed venture capital funds rate from 49% to 28%, further reduced to 20% in 1981. These preferential tax policies made U.S. venture capitalists dramatic increase in the early 1980s about the magnitude of 46% per year.

c) The policy of the Government's credit guarantee and interest rate concessions. Central government credit guarantee of the security room can guarantee the rights of insurance companies and investment entities better, coupled with the Government discount the affordable housing loan interest rates so that more people can live in private housing, not only protect the interests of the people, and also protect the interests of the insurance companies involved in the affordable housing construction.

**2) Law support**

a) Establish a standard to actors qualifications who participate in the affordable housing construction. Making certain requirements on market access for insurance companies, investigate their size, financial condition and other issues, to ensure that there is a certain strength of the insurance companies involved in the affordable housing construction. China Pacific Insurance to participate in the affordable housing projects of Beijing in 2011, build-up 5 billion overweight insurance capital of the seven major insurance company's assets to enter the field of affordable housing, according to the actuaries projected annual rate of return will stand on 6%. Ping An of China in Shanghai to affordable housing project, will also be a firm yield of 6%. To ensure this rate of return, it is definitely impossible without certain amount of their own strength, only Ping An and CPIC such large insurance companies have the bargaining power of the yield.

b) Regulate the legal system of venture capital operation mechanism. Insurance funds involved in the protection of housing construction is a certain risk investment, it is different from traditional forms of bank deposits with high security. Therefore, the legislation is to do two things: First, making strict provisions on the insurance company nature of the investment affordable housing construction, operational objectives and investment. Second is clear rights and responsibilities of insurance companies on the housing.

**3) Market support**

a)Skill market. The Government should actively promote the development of the technology market, and promote the rational flow of scientific and technological resources, provide excellent investment vehicle for venture capital of insurance companies.

b) Service market. The government should organize the establishment of insurance company risk investment information network with efficient, convenient, and smooth flow characters, supply and demand sides keep abreast of the latest high-tech achievements and technical market and venture capital information. Also should step up the reform of higher education, enhance the integration of higher education and industry, Foster high-quality talent, achieve effective co-ordination of the country's education system between teaching existing knowledge and be creative potential.[7]

## B. The local government role

Affordable housing projects mainly promote the implementation from the perspective of social security by the central government. Central develop an overall plan, to clear the construction of affordable housing in the guiding ideology, basic principles and specific development goals. Require local government grasp the implementation under specific central unified policy, and eventually local governments directly address the problem of affordable housing construction.

**1) Policy support**

a) Fiscal policy. The local government makes financial support from insurance companies and the protection of housing, mainly in order to ensure the interests of insurance companies through ensure the affordable housing construction smoothly. For example, make items with rent, monetization of subsidies or financial support for low and middle-income families with housing difficulties. Issuing local government bonds is a good example. In 2011, Shanghai, Zhejiang, Guangdong, Shenzhen 4 provinces (cities) pilot to issue local government bonds, this year by local government debt issuing scope remain the same, is still the 4 provinces (cities), Only adjust varieties, added new 7 bonds varieties, first expand to 250 billion RMB, an increase of 50 billion RMB more than in 2011, the new part will strengthen security live project construction.

b) Tax policy. The local government should offer tax breaks to the local insurance company to encourage more insurance company involved in the construction affordable housing team.

**2) Law support**

a) Policies and regulations corresponding to the central government. The state has introduced a large number of provisions to support housing security system about the construction of affordable housing, such as “low-rent housing security funds” (Financial Comprehensive [2007] No. 64), “affordable housing management practices ”(built housing [2007] No. 258)and so on. However, local governments only through forwarded form to implement these systems, regulations established by the Central only reflect the country's overall situation, therefore, the local government should develop local supporting laws and regulations combined with the actual situation of the region and the central spirit of the document, So a complete national coverage affordable housing system of local government can be established in the true sense. [8]The other hand, local governments should be introduced local administrative rules and regulations to the insurance company for involved in the local housing construction.

b) Specific implementation details. The actual situation in the construction of affordable housing, many local governments have no reasonable planning of affordable housing types, what percentage each type should be constructed,

[7] Huan Yu. The Government's role in the venture capital[J]. Contemporary managers (in Xunkan), 2005 (05)

[8] He Hongjie . The role of local governments in building affordable housing system [J]. Science and Technology, 2011, (07)

and ultimately to achieve what goal did not get planning, constructing blindly. Local governments implement the policy of the central affordable housing, lacking matching specific implementation details, lacking policy objectives and should establish specific protection of housing construction implementation details as soon as possible.

**3) Market support**

a) Land, availability supply. In the housing supply of affordable housing, On one hand, local governments should supply social provision of housing to meet the housing needs of low and middle-income families with housing difficulties, do a good job on recycling work of the listings and guarantee the effective operation of the housing flow mechanism. On the other hand, the local government shall formulate preferential policies to encourage real estate development enterprise supply low-cost medium and purchased by the government to supply the availability of affordable housing. On the supply of land for the construction of affordable housing, local government is duty-bound to bear the responsibilities for the supply. Because under the current land management system, the local government gets a virtual monopoly of a market for urban land, in charge of affordable housing construction sites in the allocation power, local government responsibility for the housing supply is particularly important. Especially in the city of the high cost of land, the government should plan a good construction of affordable housing land to ensure the land of the social construction of the housing projects priority supply. Site should take into account the traffic convenience, low-income families to live, work, school, etc. needs.

b) Information supply. China's vast territory and large urban lead construction area per capita of urban residents , such initial endowments vary widely. By the central supply houses, it is not easy to achieve fair and effective of supply, also difficult to meet their families' heterogeneity of preferences. In contrast, the local government in the supply of housing has information superiority, is more supply efficiency.[9]

## C. The role of Game that central and local governments in the insurance funds involved in the affordable housing construction

**1) The existing problems**

The central government regard the harmony of the whole society, sustainable development as the ultimate goal, are more concerned about the housing fair of the whole society and stable development of the overall insurance industry. And local governments only consider the local economic benefits, Chinese fiscal decentralization and performance evaluation mechanism led to the formation of a developmental local government, weakening the effective supply of public goods including affordable housing, This is also the local government response is not positive, may not be implemented resulting in the housing supply shortage.

**2) Solutions**

a) Central government: establish incentive and restraint mechanisms to local government

Incentive mechanism .

First, the central government should take the material incentives. The central government should carry out effective transfer payments, and increase financial subsidies, and reduce the cost of local government building of affordable housing, in order to motivate local governments actively fulfill housing security responsibilities. From a practical point of view, the central government has taken note of the importance of incentives to increase the local construction of affordable housing subsidies since 2008, specific transfer payments can also be seen from Table 4.

Secondly, we should improve the political promotion of incentives, feasible, scientific and effective evaluation system should be set for the

[9] Jia Chunmei. Local government behavior regulation and effective supply of affordabla housing [J], Technology of Shanghai Lixin University, 2011, (6)

particularity of the housing security, focusing on both the two indicators of economic and social benefits. In addition to the economic indicators of GDP growth, tax revenue, investment, income growth, government officials and political promotion evaluation indicators should focus on social indicators more. Local governments should fulfill their security responsibilities in the housing circumstances, including the construction of affordable housing and the support of the principal investors, the satisfaction of the residents, government services and quality into the evaluation indicators, so as to promote local government actively fulfill its responsibility more.

Restraint mechanisms.

First of all, as soon as possible enact the “ Law on the Affordable Housing”, clear local government in the housing and the main body of investment funds, land, financial support, fiscal and tax concessions to the specific responsibilities in legal form, and specify the financial arrangements to what proportion of the funds for the housing construction. For local government did not complete the number and quality of protection of housing construction problems to what extent and nature of punishment respectively, constraint the quality and quantity of housing in the form of law.

Second, increase the proportion of responsible moderately, give local residents the power that monitor the government, participation in government decision-making and audit the financial budget and final accounts. Realize public scrutiny, increase the transparency of the housing construction and management, regularly published and updated in a timely manner in planning, land development approval, funds to implement, the progress of construction, distribution, allocation results. So that the whole process of public supervision and ensure the affordable housing falling into the hands of families in genuine need.

b) Local Government: enhance the awareness of policy implementation

Over the years, the local government focuses on GDP growth, economic construction emphasis on efficiency-oriented too much, and housing support of this public policy implementation awareness is quite weak, which highlights the social contradictions. [10] Adhere to the "people-oriented" as a starting point and goal of implementation by the government housing security, improve the production and supply of public services. Through a comprehensive understanding and accurate grasp of the substance and value orientation of the housing security, and enhance the initiative and consciousness of the policy execution, increase investment in the housing and related investment entities，meet a public need and convenience, improve the level of public housing, and ultimately reach the shift from a focus on efficiency to a focus on social equity.

# V. Conclusion

Insurance funds participate in affordable housing involved a lot and a wide range. From some of the world's successful countries in implementation of the housing security system, the government bears the important responsibility of the building housing security system and the various subjects involved in the housing construction. The current administrative system determines the central and local governments are playing important roles in build affordable housing system. All levels of government in the construction of affordable housing and to support the insurance sector to participate in the construction should take full account of the actual characteristics of the country and the region，achieve combining the level of protection and support capabilities. Should be truly continue to meet the housing needs of low-income residents as the government's governing priorities, maintain social fairness and justice, assist the insurance sector to participate in the affordable housing construction to maintain the economic stability of the whole society. Only the people life and the economy are stable, can the long-term development of China's construction in affordable

[10] Cai Bingfei.Game Analysis between local government and central government in construction of affordable housing, [J]. Social scientists, 2009, (12)

housing, long-term stability in our society be reach.

# Reference

[1] Liu Hongtao, Zhang Shuying. Investment of insurance funds [J]. Value engineering, 2006, (07)
[2] Chen jie. Channel expansion and risk prevention of insurance funds [J]. Shanghai Insurance, 2010, (6)
[3] Construction of affordable housing participation strategy [R]. Real estate topics, 2011, (8)
[4] Xie qing. Real estate investment opportunities and risk analysis of insurance funds [J]. Chinese and foreign entrepreneurs, 2009, (24)
[5] Liang Junping, Yu Xuehua, Zhang Shuhua, Wu Xiubo, Leng Weiwei. Risk quantification model evaluation of risk investment projects [J]. Statistics and Consulting, 2006, (01)
[6]Yan SIqi, Liu Hong, Hu Libing, Wu Qun. Quantitative research of residential land prices microeconomic impact factors - Case Study of Nanjing [J]. Technology Management of Land and Resources, 2011, (4)
[7] Huan Yu. The Government's role in the venture capital[J]. Contemporary managers (in Xunkan), 2005 (05)
[8] He Hongjie .The role of local governments in building affordable housing system [J]. Science and Technology, 2011, (07)
[9]Jia Chunmei. Local government behavior regulation and effective supply of affordabla housing [J], Technology of Shanghai Lixin University, 2011, (6)
[10]Cai Bingfei.Game Analysis between local government and central government in construction of affordable housing, [J]. Social scientists, 2009, (12)

# 浅析保险资金参与保障房建设收益与风险调整中政府应扮演的角色

张代军, 侯梦娜
金融学院，浙江财经学院，杭州，浙江，310018

**摘　要：**文章根据国家统计数据库、中国统计年鉴和保监会等网站，并且走访相关部门来了解保险资金投资商业地产和建设保障房所投入资金等情况，对保险公司参与保障房建设前后，保险公司投资保障房所面临的新的机遇和风险进行探讨。将二者进行对比，分析得出其前后收益、风险差异受政府财政支持、保险公司资信状况、国家税收、利率、技术和信息等变量影响。文章根据这些差异，明确中央政府和地方政府在政策支持、法律支持和市场支持三个方面应扮演的角色。

**关键词：**保险资金；保障房；风险；政府角色

# The Pension Option in Labor Insurance and Precautionary Savings: Evidence from Taiwan

**Hua Chen, Wenyen Hsu and Mary A. Weiss**

Hua Chen
Department of Risk, Insurance and Healthcare Management
Temple University
1801 Liacouras Walk, 625 Alter Hall
Philadelphia, PA 19122
Phone: (215) 204-5905
Fax: (215) 204-4712
Email: hchen@temple.edu

Wenyen Hsu (Corresponding Author)
Department of Risk Management and Insurance
Feng Chia University
100 Wen Hwa Road
Taichung City, 407, Taiwan
Phone: +886-6-24517250x4107
E-mail: wyhsu@fcu.edu.tw

Mary A. Weiss
Department of Risk, Insurance and Healthcare Management
Temple University
1801 Liacouras Walk, 624 Alter Hall
Philadelphia, PA 19122
Phone: (215) 204-1916
Fax: (215) 204-4712
Email: mweiss@temple.edu

**The Pension Option in Labor Insurance and Precautionary Savings:
Evidence from Taiwan**

**Abstract**

Starting in 2009, the Labor Insurance (LI) program in Taiwan has allowed workers to choose between pension old-age benefits and one-time old-age benefits. The introduction of the pension option not only mitigates longevity risk for workers but also provides a higher expected present value of old-age benefits to workers than the one-time benefit option (on average). Based on a lifecycle model with uncertain lifespan, we expect that workers will increase current consumption and reduce savings in response to this policy intervention. We use data from the Survey of Family Income and Expenditure (SFIE) in Taiwan to empirically test this prediction. In order to isolate other systematic structural changes or economic shocks from the true impact of the pension option on savings and consumption, we adopt a difference-in-differences (DID) approach in this study. Our results demonstrate that the implementation of pension benefits in LI lowers households' savings by 9.25% (NT$ 50,798) and raises consumption by 5.27% (NT$ 42,663) for LI workers. In addition, younger households tend to be more responsive to this policy in terms of increasing consumption, while some older households experience a significant decrease in savings.

**Key Words:** Pension Benefits, Precautionary Savings, Difference-in-Differences Estimator

## 1. Introduction

Precautionary savings occurs in response to future income uncertainty. Leland (1968) proves that for prudent individuals, the precautionary demand for savings exists even for small variations in future income.[1] Skinner (1988) points out that such precautionary savings could be substantial, accounting for as much as 56 percent of total lifecycle savings. Social insurance programs may lessen uncertainty arising from various sources and reduce the need for precautionary savings. Social insurance programs such as disability insurance (Kantor and Fishback 1996), unemployment insurance (Engen and Gruber 2001), Medicaid (Gruber and Yelowitz 1999) and health insurance (Chou et al. 2003) have been studied for their effects on precautionary savings. In this paper we examine the impact on precautionary savings and consumption of longevity risk reduction resulting from the Labor Insurance (LI) program in Taiwan providing old-age pension benefits.

More specifically, we use a natural experiment associated with a change in Taiwan's LI law to examine the effect on household savings and consumption of the introduction of a pension annuity for workers. Government employees have been offered annuitized pension benefits since 1959, and were not affected by the policy change in LI. Starting in 2009, workers

[1] Some researchers have focused on the effects of earning uncertainty on savings (e.g., Cantor 1985, Skinner 1988, Zeldes 1989, Kimball 1990, and Caballero 1991); other researchers have analyzed the effect on savings of uncertain medical expenses (e.g., Farley and Wilensky 1985, Kotlikoff 1989, Feenberg and Skinner 1994, Palumbo 1999, and Chou et al. 2003) or lifetime uncertainty (e.g., Yaari 1965, Davies 1981, Skinner 1985, Abel 1986, Hubbard and Judd 1987, Hurd 1989, and Engen 1992).

covered under LI can receive annuitized pension benefits as well.[2] The difference in timing of providing old-age pension benefits between these two programs enables us to identify its effect on precautionary savings and consumption for workers under LI. We adopt a 'difference in differences' (DID) approach in order to compare the change in precautionary savings or consumption of a treatment group (workers under LI) with the change of a control group (government employees). The change in savings or consumption for the government employee control group accounts for any systematic structural change while the LI worker treatment group's change reflects both the systematic structural change and the impact of the policy intervention.

The research most closely related to our study is that of Chou et al. (2003). The latter used the DID methodology to empirically test how National Health Insurance (NHI) in Taiwan affected precautionary savings and consumption. Chou et al. (2003) hypothesize that a reduction in uncertainty about future health expenses (the *risk effect*) discourages savings if households are prudent and that the risk effect would dominate an *income effect* in their case.[3] They find that the introduction of NHI in Taiwan reduced savings by an average of 8.6 to 13.7 percent and raised average consumption expenditure by 2.9 to 3.6 percent, with the largest impact on households with the lowest savings.

---

[2] The terms "annuitization option" and "pension option" are used interchangeably in this paper.

[3] Implementation of the NHI increases expected income net of medical expenses for households because they only need to pay 30 to 40 percent of the premium, resulting in an increase in both saving and consumption – the income effect. The income effect was hypothesized to be trivial because the partial contribution of premiums by employees only accounted for a small percentage of households' expenditures.

In this paper, we present a lifecycle model to demonstrate that the provision of pension benefits in LI can affect households' consumption/saving profile in two ways. The model setup is similar to Cantor (1985), Caballero (1991) and Santen (2011). First, annuitizing old-age benefits obviously reduces longevity risk of workers.[4] So we expect households to respond by raising current consumption and cutting savings due to the *risk effect*.[5] Second, we conduct a simple actuarial analysis which indicates that the pension option significantly increases households' expected old-age benefits on average.[6] An increase in future retirement income will boost permanent income; accordingly workers are encouraged to spend more and save less in the current period. Thus, unlike Chou et al. (2003), risk reduction and income-augmentation resulting from the pension option may actually reinforce the effects of each other, leading to a decrease in savings and an increase in consumption.

Our data is from the Survey of Family Income and Expenditure (SFIE) in Taiwan, a nationally representative survey that collects detailed information on income and consumption expenditures, demographics, and employment status for each member of the households that are surveyed. We use a large data sample (19,802 households) to ensure the applicability of our

[4] The literature investigating the role of uncertain lifespan on consumption/saving profiles can be traced back to Yaari (1965) and has grown extensively in recent years. Hubbard and Judd (1987) argue that substantial precautionary savings are likely to accompany longevity risk in the absence of annuities. Therefore, access to a fair annuity market could remove the influence of lifespan uncertainty on savings and consumption.
[5] Actually, workers may use all of part of the one-time benefit to purchase a private annuity. However, the annuity rate would not be known prior to retirement. In addition, private annuity rates are associated with loadings for underwriting and acquisition expenses. Also, due to longevity risk and investment risk, private annuity issuers would also include a loading for profit. These expenses/loadings are not incurred when the government provides the pension benefit.
[6] Our model does not involve the projection of future pension wealth (e.g., Guiso et al. 1992; Santen 2011) since assumptions in calculating potential pension benefits could introduce noise into the model.

results and the statistical power of our tests. The sample period is 2006 to 2010.[7] Over this sample period, no additional payroll tax for the pension option was levied. Thus, our estimates are free from potential depression of payroll tax on savings and consumption as shown in Hubbard and Judd (1987).[8]

Ordinary-least-squares (OLS) is used in conjunction with the DID methodology to determine the overall effect of the pension option on consumption and savings. Quantile regressions are performed as well to determine the welfare implication across the household-saving (or household-consumption) distribution. Following Kuan and Chen (2011), we also partition the sample into several age groups and investigate the effect of the pension option over the lifecycle.

The results indicate that offering old-age pension benefits through LI lowers overall households' savings by 9.25 percent (NT$ 50,798) and raises overall consumption by 5.27 percent (NT$ 42,663) for workers. The quantile regressions imply that the impact of annuitized pension benefits is larger on households that save less or consume less. We also find that younger households respond significantly in terms of the increase in consumption; and older households react by saving less. This result is intuitive as the motive for savings is not very important at the initial life stage, but it matters more for elder people.

[7] We exclude 2008 for reasons explained later.

[8] Hubbard and Judd (1987) point out that when Social Security is financed through a proportional payroll tax on current earnings the payroll taxes could depress consumption dollar for dollar when the individual faces a liquidity constraint and cannot borrow from the capital market. Thus the increase in individual welfare by introducing Social Security could be reduced or eliminated in the presence of the constraint.

This research has several important advantages over existing empirical work on the effect of pension plans on consumption and precautionary saving. First, we test the impact of offering the pension option in LI on precautionary savings and consumption for workers, not the decision to annuitize or not. Second the provision of pension benefits in LI is not means-tested. Therefore, we can directly test its effect on precautionary savings or consumption without any additional negative impact arising from means-testing. Third, this policy change and other unobservable events may occur simultaneously but independently, changing precautionary savings or consumption and thus leading to potentially biased regression estimates. The difference in timing of annuitizing the old-age benefit in Governmental Employment Insurance (GEI) and LI enables us to use the DID approach to modify the conventional pre-post comparison and provides for a more accurate assessment of the annuitization benefit under LI.

This research contributes to the existing literature as being the first paper to test the effect of LI pension reform in Taiwan on precautionary savings and consumption. Unlike most other papers investigating pension wealth uncertainty (see, e.g., Guiso et al. 2009), we focus on longevity risk reduction.[9] Our results support the theory that a precautionary saving motive from longevity risk is an important determinant of household saving/consumption behavior. The research can provide important insights to other countries or regions have aging populations

[9] Pension risk may exist because the pension benefit is designed as a defined contribution plan. Estimating pension risk may also involve subjective beliefs of respondents about future benefits. Thus, large uncertainty and substantial heterogeneity in expected benefits may exist in these studies (Guiso et al. 2009).

like Taiwan and can provide guidance in making new policies in pension programs. Particularly, our findings across the household-saving (or consumption) distribution and across age groups have significant implications to policymakers and can help them target policy intervention to specific groups.

The remainder of this paper is organized as follows. In Section 2, we provide background information on labor insurance in Taiwan. We conduct an actuarial analysis and consider a lifecycle model to illustrate the effect of the pension option in LI in Section 3. We describe the data and discuss our empirical methodology based on the DID approach in Sections 4 and 5, respectively. Empirical results are presented in Section 6. Section 7 concludes.

## 2. Background of Labor Insurance in Taiwan

Taiwan established its labor insurance program in March 1950, which was the first compulsory social insurance program in Taiwan. Subsequently, the Craft Workers' Insurance Program was initiated in 1951, and the Fishermen's Insurance Program was initiated in 1953. The Government promulgated the Labor Insurance Act in 1958 and it was made effective in 1960. When this program went into effect, the three previous, separate programs were nullified. The Act was amended many times for the purposes of expanding its coverage to more workers, offering better protection, and providing more generous benefits.[10]

[10] Since 1995, medical care for common accidents has been provided by the NHI Program.

In recent years, Taiwan's population and employment structure have experienced great changes with the result that Taiwan is becoming an increasingly aging society. In order to offer the insured person or insured person's dependents long-term living expenses, the government began to plan an old-age labor insurance pension system. After years of effort by the government and discussions among labor, ownership, and academic circles, a bill was passed on July 17, 2008, and the system went into effect on January 1, 2009. At the end of year 2010, approximately 9.4 million people were covered by LI, giving LI the widest coverage of all payment systems in Taiwan and making it the type of social insurance with the greatest number of insureds (General Condition of Labor Insurance from 1950, Bureau of Labor Insurance).

Under the old system, eligible workers could receive a one-time old-age benefit only.[11] In particular, for every full year of insurance coverage, workers could receive one month of the "average monthly insurance salary".[12] After fifteen years, two months of the "average monthly insurance salary" would accumulate for each additional year of insurance. The maximum amount is set at forty-five months of the "average monthly insurance salary". For those who continue to work over the age of sixty, a maximum of five years of insurance coverage can be granted for these years. The combined old-age payment was therefore limited to a maximum of fifty months.

[11] By "one time old age benefit" we mean a lump sum payment at retirement.
[12] The monthly insurance salary is determined by categorizing the worker's actual monthly salary into twenty-two levels, ranging from NT$ 17,280 to NT$ 43,900 in 2008. For example, if actual monthly salary is below NT$ 17,280, the monthly insurance salary is NT$ 17,280. If the actual monthly salary is between NT$ 17,281 to NT$ 17,400, the monthly insurance salary is NT$ 17,400. Likewise, if actual monthly salary is above NT$ 42,001, the monthly insurance salary is NT$ 43,900.

After the Labor Pension Act went into effect on January 1, 2009, workers who have LI insurance coverage before December 31, 2008 could select to have the one time old-age benefit or an old-age pension benefit.[13,14] A claim for the old-age pension benefit can be made by the following: (1) An insured person whose insurance coverage exceeds fifteen years, and who is at least sixty years of age and has resigned from work and withdrawn from insurance coverage; or (2) An insured person who has worked in dangerous, physical hard labor, or work of special character for more than fifteen years, and who is at least fifty-five years of age and has resigned from work and withdrawn from insurance coverage. The monthly payment of pension benefits is the maximum of two amounts: (1) Average Monthly Insurance Salary × Coverage Years × 0.775% + 3,000; (2) Average Monthly Insurance Salary × Coverage Years × 1.55%.[15]

## 3. Theoretic Framework

Providing pension benefits in LI can obviously reduce the risk that workers outlive their

---

[13] A one time old-age benefit is available only to the persons who have labor insurance coverage before December 31, 2008. Those who participate in LI for the first time after January 1, 2009 cannot select the one time old-age benefit.

[14] There is another old-age benefit option under the new system called the old-age lump sum benefit. It is clearly different from the pension benefit since it is provided to an insured person whose insurance coverage years are less than fifteen years and is at least sixty years of age and has resigned from work and withdrawn from insurance coverage. For every one full year of insurance coverage, one month of average monthly insurance salary would be paid. For insurance coverage after 60 years of age, five years would be the maximum to be included in the insurance coverage. Therefore, the lump sum benefit is also different from the one-time benefit, in the sense that the former does not set an upper limit while the latter has a maximum of 45 months or 50 months if the insured continues to work over age 60. To avoid complexity, we do not include the discussion of this lump sum benefit in this paper since we mainly focus on the effect of the old-age pension benefit on precautionary savings or consumption of workers.

[15] In the actuarial analysis in Section 3.1, we assume that laborers prefer amount (2) to amount (1) in order to normalize the "average monthly insurance salary" and compare the present value of old-age pension benefits with the value of the one-time old-age benefits. Note when the monthly insurance salary is NT$ 26,400 (the 11th among 22 levels), a minimum coverage year of 14.67 is required to satisfy this assumption. We also know laborers need at least 15 years coverage to qualify for the pension benefits. So qualified laborers whose monthly insurance salary is greater than NT$ 26,400 will automatically choose amount (2), and other qualified laborers may or may not choose amount (2) depending on their coverage year seniority. However, even for the lowest monthly insurance salary level (NT$ 17,280), the insured will choose amount (2) as long as the coverage year is greater than 22.4.

resources, i.e., longevity risk. Furthermore, it may affect the present value of old-age benefits that workers expect to receive upon retirement. Comparing the risk and retirement income between the one-time benefit option and the pension benefit option can shed light on how this policy change in LI affects precautionary savings and consumption behavior. In this section, we first calculate the actuarial present value of old-age benefits for these two options. We then use a lifecycle model to analyze the policy implications of offering pension benefits to workers.

### *3.1. Actuarial Analysis*

Driven by improving human health and prolonged life expectancy, the average retirement age in Taiwan has risen from 54.9 years in 2005 to 56.3 years in 2009, according to statistics compiled by the Directorate General of Budget, Accounting and Statistics (DGBAS).[16] Suppose a representative individual started working at the age of twenty-five and retired at the age of fifty-six.[17] Let $n$ denote the number of complete months from the individual's retirement until his/her death. Before 2009, the insured could only receive a one-time old-age benefit ($PV^{OT}$) from LI, which is equal to forty-five months of the "average monthly insurance salary". Normalizing the average monthly insurance salary to one, we have $PV^{OT} = 45$. Since 2009, eligible workers can choose between the one-time benefit and pension benefit with monthly payments ($MP$) that are equal to Average Monthly Insurance Salary × Coverage Years × 1.55%.

[16] The rising retirement age in Taiwan is also due to the revision of the Labor Standards Act in April 2008, delaying mandatory retirement to 65 from the former 60.

[17] The insured can wait until he/she reaches age 60 to claim the old-age benefit. If he/she wants to claim earlier than age 60, a deduction ratio will apply to the monthly payment. Considering this deduction does not change the conclusions of our analysis.

Normalizing the average monthly insurance salary to be one and assuming the worker has LI coverage for thirty-one years, we have

$$MP = 1.55\% \times 31 = 0.4805. \tag{1}$$

Suppose the level benefits are paid at the beginning of each month while the laborer survives. The present value of pension benefits ( $PV^{PB}$ ) at the time of retirement can be calculated as

$$PV^{PB} = MP \times \ddot{a}_{\overline{n}|\frac{i^{(m)}}{m}}, \tag{2}$$

where $\ddot{a}_{\overline{n}|i^{(m)}/m}$ is the present value of an annuity-due, payable $1 at the beginning of each period for $n$ periods, with the interest rate $i^{(m)}/m$. Here $i^{(m)}$ is the nominal interest rate compounded m-thly per year and $m = 12$.

In Figure 1, we plot the present value of pension benefits ( $PV^{PB}$ ) against the number of months until death ( $n$ ) using several nominal interest rate scenarios ( $i^{(m)} = 2\%$, 4% or 6%). Once the individual aged 56 at retirement survives another 126 months (10 years and 6 months), he /she receives more old-age benefits under the annuity option than he/she does under the one time option, when the nominal interest rate compounded monthly is 6%. As the interest rate gets lower, he/she needs less time to accumulate the equivalent benefits under the one time option. Living for another 10.5 years is not a dream for most Taiwanese: the life expectancy for an individual aged 56 in year 2009 is 26.46 years.[18] So clearly most insureds will prefer the pension benefit to

[18] Source: Department of Statistics in Taiwan http://sowf.moi.gov.tw/stat/english/elife/te98210.htm

the one-time benefit.[19]

[Insert Figure 1 Here]

Now we calculate the actuarial present value of pension benefits ( $APV^{PB}$ ),

$$APV^{PB} = m \times MP \times \ddot{a}_{56}^{(m)}, \tag{3}$$

where $\ddot{a}_x^{(m)}$ is the actuarial present value of a whole life annuity-due of \$1 per year, payable in installments of $\$1/m$ at the beginning of each *m*-th of the year, issued to an individual aged $x$. The calculation of $\ddot{a}_x^{(m)}$ can be found in any actuarial textbook. We include the formula in Appendix A for completeness. Based on the mortality table in Taiwan[20], $APV^{PB} = 71.97$ when $i^{(m)} = 6\%$ ; $APV^{PB} = 89.27$ when $i^{(m)} = 4\%$ ; and $APV^{PB} = 114.35$ when $i^{(m)} = 2\%$ . In each interest rate scenario, the expected present value of old-age benefits under the pension option is greater than that under the one-time benefit option. (Recall that $PV^{OT} = 45$.)

### *3.2. A Lifecycle Model*

In this subsection, we consider a simplified version of the lifecycle model presented by Santen (2011) to illustrate the effect of the pension option on precautionary savings and consumption. Santen (2011) takes into account both lifespan uncertainty and income uncertainty while we focus on lifetime uncertainty and the difference in the actuarial present value of old-age benefits between the two options in LI. We also assume a zero interest rate and zero discount rate

[19] Alternatively, the pension annuity benefit can be viewed as an additional retirement option for workers. If this option has no value, then we would expect to see no difference in savings or consumption for workers before and after the implementation of pension benefits in LI. Changes in savings and/or consumption, then, can provide evidence that the pension option, overall, has value to LI workers.
[20] Source: Human Mortality Database http://www.mortality.org/

for illustration purposes.

Assume a representative individual aged $x$ in the current period is endowed with some wealth, $A_{x-1}$, from the previous period.[21] His/her remaining lifetime is divided between the working stage and the retirement stage. The retirement age, $K$, is exogenous. The individual receives an exogenous income stream, $y_s$ $(x \le s \le K-1)$, before retirement. His/her retirement income is constant per period until death, i.e., $y_s = y_K$ for $s \ge K$. Survival until retirement is guaranteed; after retirement, the survival probability up to age $s$ is denoted by ${}_{s-K}p_K$ with ${}_0p_K = 1$. The maximum attainable age is denoted by $T$. We assume a constant-absolute-risk-aversion (CARA) utility function for each period, i.e.,

$$u(c) = -\frac{1}{\alpha}\exp(-\alpha c), \tag{4}$$

where $c$ is the consumption expenditure and $\alpha$ measures the degree of absolute risk aversion.

Under this model setup, the lifetime utility maximization problem can be written as

$$\begin{aligned} &\max_{c_s} -\frac{1}{\alpha}\sum_{s=x}^{K-1}\exp(-\alpha c_s) - \frac{1}{\alpha}E_x\sum_{s=K}^{T} {}_{s-K}p_K \exp(-\alpha c_s) \\ &\text{s.t. } \sum_{s=x}^{K-1} c_s + \sum_{s=K}^{T} c_s = A_{x-1} + \sum_{s=x}^{K-1} y_s + \sum_{s=K}^{T} y_K \end{aligned}, \tag{5}$$

where $c_s$ is consumption at age $s$ and $E_x$ is the expectation operator conditional on information up to age $x$.

The current period consumption, $c_x$, can be solved as[22]

[21] We use age instead of time as the subscript to avoid complexity of notation. It does not change the results.
[22] We refer interested readers to Santen (2011) for the complete derivation of the model. Basically, it can be solved in three steps. First, we focus on the retirement period and calculate the value of future utility streams given the

$$c_x = \frac{A_{x-1} + \sum_{s=x}^{K-1} y_s + (T-K+1)y_K}{T-x+1} - \frac{\sum_{s=K}^{T} \frac{1}{\alpha} \ln\left({}_{s-K}p_K\right)}{T-x+1}. \tag{6}$$

Equation (6) is economically intuitive. The first term is permanent income and the second term measures precautionary savings due to lifetime uncertainty. If the individual lives up to $T$ for certain, i.e., ${}_{s-K}p_K = 1$ for $K \le s \le T$, the second term goes to zero, which implies that the individual maximizes the lifetime utility by smoothing out his/her consumption path. With lifetime uncertainty, however, the second term does not go to zero. In this case, the individual consumes less and saves more in order to reduce risk, compared with the case of a certain lifetime horizon. The lower longevity risk the individual faces (i.e., smaller survival probabilities), the more current consumption and the less savings take place. In addition, an increase in income after retirement leads to an increase in current consumption and a decrease in savings.

Providing pension benefits in LI significantly reduces longevity risk for workers, thus discouraging precautionary savings and increasing current consumption from the risk effect. Pension benefits also bring more expected cash flows for the representative individual than the one-time benefit option, which increases current consumption and decreases savings further.[23] In the remaining parts of this paper, we will empirically test the impact of the pension option in LI

wealth available right before retirement, $A_{K-1}$. Second, we solve the problem for the working stage, and compute the value of utility streams as a function of $A_{K-1}$ as well. Third, we choose $A_{K-1}$ to maximize the lifetime utility.

[23] Some may argue the pension option can increase savings and consumption based on an income effect. However, the extra income from the pension benefit is only realized after retirement, so the increased retirement income raises consumption and cuts savings for the current period provided that the current period income remains unchanged.

on individuals' saving/consumption behavior to see if it is consistent with our prediction.

## 4. Data and Sample

We employ data from the Survey of Family Income and Expenditure (SFIE) conducted each year by the Directorate-General of Budget, Accounting and Statistics, Taiwan. The SFIE is conducted on a household basis. It includes information on demographic characteristics, income, educational background, social insurance status (GEI, LI, or others) and industrial sector of employment for each member in the sampled households.

Though the LI pension system was formally implemented in 2009, the passage of the bill on July 17, 2008 could have affected individuals' expectations and incentives for precautionary savings. To avoid potential biases, data for 2008 are excluded. We therefore use the 2006-2007, 2009-2010 data to compare the changes in precautionary savings and consumption between the pre- and post-annuitization periods. Since all samples are randomly drawn each year, we cannot track individual households longitudinally.[24]

Since GEI has provided the pension option in old-age benefits to insureds since 1959,

[24] The Directorate-General of Budget, Accounting and Statistics uses two methods to enhance the accuracy of the survey. In particular, "Both interviews and account-keeping are used to collect data in the survey. Households for interview are drawn from the population by the stratified random sampling method, and parts of the sampled households for interview are also selected to do account-keeping regularly. The sampled households are interviewed once a year for major items of income and expenditure of the year. Detailed categories are estimated on the basis of data recorded by account-keeping households. For households assigned to do account-keeping, they are required not only to receive an interview but to record actual income and expenditure every day. The enumerator shall review the account books and provide necessary advice in order to avoid mistakes, duplication, and omission. Data obtained in this way are more accurate than those derived from interviews." (Directorate-General of Budget, Accounting and Statistics Executive Yuan, 1994, p. 2). These data are used in many research studies, such as Deaton and Paxson (1994), Liu and Chen (2002), and Chou et al. (2003).

government employees are not affected by the policy change in LI. Hence we use government employees as a control group in this paper. Households without members insured in either GEI or LI are excluded. Households with members working in different sectors (one works for the public sector and is thus insured by GEI, and the other one works in the private sector and is insured by LI) are also excluded. Our control group includes households with at least one member covered by GEI (one with GEI and the other is not in the labor force or both covered by GEI). The treatment group includes households with at least one member covered by LI (one with LI and the other one is not in the labor force, or both are covered by LI).[25]

We restrict our sample to households whose head is married and between 20-65 years old. Since agricultural families and households with members serving in the army are insured in different annuity programs, they are excluded from the sample. Households reporting negative net saving or incomplete information are also excluded.[26] The final sample contains 19,802 households, among which 1,380 household heads are government employees and 18,422 are non-government employees.

[25] Since 2009 and 2010, the SFIE doesn't report individual income and consumption. We therefore cannot differentiate whether both the head and the spouse of the household head are in the same insurance program. However, we still can identify whether the household pays GEI premiums or LI premiums. Therefore, we exclude households reporting no GEI nor LI premiums, and those paying both GEI premiums and LI premiums. We cannot identify unemployment by premium.

[26] Chou et al. (2003, 2004) exclude households with negative savings in their empirical studies. Focusing on the same dataset, Kuan and Chen (2011) find that households with negative savings account for 18.9% of the entire sample. They argue that deleting such a large proportion of the sample causes a sample selection problem and may lead to biased results. In our data, the proportion of households with negative savings is 4.6% only. We obtain very similar empirical results when including them in our sample.

## 5. Empirical Methodology

A naïve approach for evaluating the effect of a treatment event on the treatment group is to simply compare the outcomes of the treatment group before and after the policy intervention, the so-called pre-post estimator. However, several other systematic structural changes might occur during the same time period as the treatment event. To separate the true effect of the treatment from other structural changes, we use the DID estimator in this paper through the use of a control group.

### *5.1. The DID Estimator: An Overview*

Suppose that we wish to evaluate the impact of a program or treatment on an outcome $y_i$ over a population of individuals. There are two groups indexed by treatment status $T = 0 \text{ or } 1$, where 0 indicates the group that does not receive treatment, i.e., the control group, and 1 indicates the group that receives treatment, i.e., the treatment group. We observe data in two periods, denoted by $t = 0 \text{ or } 1$, where 0 indicates a time period before the treatment group receives treatment, and 1 indicates the time period after that. In order to evaluate the effect of treatment on the treatment group, a simple pre-post estimator or a treatment-control estimator can be constructed. However, both the pre-post estimator and the treatment-control estimator are biased, given a time trend or a permanent difference between the two groups. Therefore, we adopt the DID estimator to measure the true effect of treatment.

The outcome $y_i$ can be modeled as follows:

$$y = \alpha + \beta T + \gamma t + \delta(t * T) + \varepsilon\,, \tag{7}$$

where $\alpha$ is a constant term, $\beta$ measures the treatment group specific effect (to account for average permanent differences between treatment and control groups in the pre-treatment period), $\gamma$ controls for a time trend common to the control and treatment groups, $\delta$ measures the true effect of treatment, and $\varepsilon$ is a random error term.

Let $\overline{y}_0^T$ and $\overline{y}_1^T$ be the average outcomes for the treatment group before and after treatment, respectively, and $\overline{y}_0^C$ and $\overline{y}_1^C$ be the corresponding average outcomes for the control group. Under these assumptions we can obtain expected values of these variables easily.

$$E\left[\overline{y}_0^T\right] = \alpha + \beta\,,\ E\left[\overline{y}_1^T\right] = \alpha + \beta + \gamma + \delta\,,\ E\left[\overline{y}_0^C\right] = \alpha\,,\ E\left[\overline{y}_1^C\right] = \alpha + \gamma\,. \tag{8}$$

The DID estimator is defined as the difference in average outcome in the treatment group before and after treatment minus the difference in average outcome in the control group before and after treatment, i.e.,

$$\hat{\delta}_{DD} = \overline{y}_1^T - \overline{y}_0^T - \left(\overline{y}_1^C - \overline{y}_0^C\right). \tag{9}$$

Note that the DID estimator is unbiased as

$$\begin{aligned} E[\hat{\delta}_{DD}] &= E[\overline{y}_1^T] - E[\overline{y}_0^T] - \left(E[\overline{y}_1^C] - E[\overline{y}_0^C]\right) \\ &= \alpha + \beta + \gamma + \delta - \left(\alpha + \beta\right) - \left(\alpha + \gamma - \alpha\right) \\ &= \delta \end{aligned} \tag{10}$$

### *5.2.1. The OLS Regression with DID*

In this paper, we investigate the effect of providing pension old-age benefits to households with LI on their consumption/savings profile. Recall that households with LI comprise the treatment group, while GEI households are the control group. We pool the samples of the control and treatment groups and estimate the following equation,

$$y_i = \alpha + \beta \times LI_i + \gamma \times Annuitization_i + \delta \times \left(LI_i \times Annuitization_i\right) + \lambda \times Z_i + \varepsilon_i \qquad (11)$$

where $y$ denotes the log of precautionary savings (or consumption) for the households in our sample; LI=1 for households with LI and 0 for those with GEI; Annuitization=1 if the data is from the post-annuitization period and 0 if it is from the pre-annuitization period; and $Z$ is a set of control variables described below plus a trend variable. This trend variable, Trend, is defined as the difference between the current year and 2006. Using the trend variable can control for time effects other than pre- and post-annuitization (Chou et al. 2004, Cohen et al. 2008). If $\delta$ is statistically significant, there exists a significant relationship between the change in precautionary savings (or consumption) and the provision of the pension option.

***5.2.2. Dependent and Independent Variables***

We use two dependent variables: household savings and household consumption expenditures. Household saving is defined as the difference between disposable income and consumption expenditure. All money figures are converted to 2006 NT dollars by using the all items Consumer Price Index.[27]

Since the demographic characteristics of household members affect saving and

[27] Let the CPI in 2006 be equal to 1. The CPI for each year in Taiwan was 1.0180 (1.0483, 1.0461) in 2007 (2009, 2010). The average exchange rate in 2006 was NT$32.53 (31.52, 33.05, 31.62) for an US dollar in 2006 (2007, 2009, 2010).

consumption behavior, we include the household head's gender, age, age squared, education dummies (6 category dummy variables), spousal education dummies (6 category dummy variables), the number of children under the age of 18 years, the number of elderly parents or grandparents, and the logged value of household permanent income.

According to the permanent income hypothesis, individuals' consumption in a given period is determined by his/her permanent income instead of income in that period (Friedman 1957). It is a common practice to control for permanent income in the saving/consumption functions; see, e.g., Guiso et al. (1992), Starr-McCluer (1996), Kazarosian (1997) and Chou et al. (2004). Thus, permanent income is included as an independent variable in our models. In this paper, we follow Guiso et al. (1992) to construct household permanent income. It is based on the observable characteristics of households. The details can be found in Appendix B.

A complete list of variable definitions is reported in Table 1.

[Insert Table 1 Here]

Table 2 presents summary statistics for the explanatory variables. The average savings of the sample is NT$ 516,898 and the average consumption is NT$ 826,585. The logged household permanent income is 14.2134.

[Insert Table 2 Here]

***5.3. Transformation Bias and Marginal Effects***

Recall that the dependent variable (savings or consumption) is transformed to log values in the OLS regression (11). However, the "real" marginal effect of annuitization should be assessed on the untransformed scale. So we are confronted with the problem of a retransformation effect, i.e., the logged dependent variable is unbiased but the marginal effect on the untransformed dependent variable might be biased. Duan (1983) proposes a nonparametric method, the smearing estimate, to measure an individual's expected response on the untransformed scale. Basically, we need to first estimate the error distribution by the empirical cumulative distribution function of the estimated regression residuals, and then take the desired expectation with respect to the estimated error distribution. This approach can be viewed as an application of the bootstrap principle in a broader context (Efron 1979).

Specifically, the marginal effect can be expressed either in the dollar amount change

$$E\left(y \mid t=1\right)-E\left(y \mid t=0\right), \tag{12}$$

or the percentage change

$$\frac{E\left(y \mid t=1\right)-E\left(y \mid t=0\right)}{E\left(y \mid t=0\right)}. \tag{13}$$

The general form of the retransformation for a log-linear model is given by

$$E\left(y\right)=\phi \exp\left(X\beta\right), \tag{14}$$

where $\phi = E[\exp(\varepsilon)]$ is the smearing factor.

### *5.4. Quantile Regressions*

While the OLS regression can answer the question "does the provision of pension benefits in LI significantly affect savings (or consumption) for households with LI?", it cannot address another important question: "does it affect savings (or consumption) differently for households with low savings (or consumption) than for those with high savings (or consumption)?" A more comprehensive picture of the impact on households' savings (or consumption) of the provision of pension benefits in LI can be obtained by using quantile regression. Quantile regression was introduced by Koenker and Bassett (1978) as a statistical technique intended to estimate, and conduct inference about, conditional quantile functions. The classical linear regression methods based on minimizing sums of squared residuals enable one to estimate models for conditional mean functions, while quantile regression methods offer a mechanism for estimating models for the full range of conditional quantile functions. Quantile regressions are estimated in this study.

***5.5. Age-varying Effects***

So far, we have assumed the effect of providing pension benefits in LI is constant over the life cycle. However, it is possible that the effect varies across age groups. Kimball (1990) argues that like risk aversion, prudence also declines with wealth. Given the fact that a household's wealth path is usually hump-shaped and peaks before the retirement age, decreasing absolute prudence implies that younger households are usually more sensitive to risk reduction and thus inclined to demonstrate a larger response than older households. In addition, households with a liquidity constraint might have a stronger precautionary saving incentive (Carroll, 1997).

Younger households are more likely to have a liquidity constraint and thus be more responsive to this policy change. On the other hand, older groups that are close to the retirement age usually face more urgent needs to plan retirement life, so they can be more sensitive to risk reduction resulting from the provision of the pension option in LI as well. Putting all this together, the response of different age groups to the provision of pension benefits in LI is not likely to be uniform. Caution has to be used to identify the welfare implication of this policy change.

In order to estimate the effect of annuitization on precautionary savings or consumption over the life cycle, we partition the data into eight age groups (age group 20-30, then 5-year age groups such as 30-35, 35-40, up to 60-65).[28] We estimate the groupwise treatment effects based on the following regression,

$$\begin{aligned} y_i = \alpha &+ \sum_{j=1}^{8} \beta_j \left(LI_i \times K_i(j)\right) + \sum_{j=1}^{8} \gamma_j \left(Annuitization \times K_i(j)\right) \\ &+ \sum_{j=1}^{8} \delta_j \left(LI_i \times Annuitization_i \times K_i(j)\right) + \lambda \times Z_i + \varepsilon_i \end{aligned} \tag{15}$$

where $K(j)$, $j = 1,2,...,8$, are the indicators of the eight age groups.

## 6. Empirical Results

### *6.1. Preliminary Results*

Table 3 compares the changes in household savings and consumption in the pre- versus post-annuitization periods according to insurance status. Savings and consumption in GEI

[28] There is no government employee aged 20-25 in our sample. So we have to pool the individuals aged 20-30.

households are higher than those in LI households. Both savings and consumption in LI households drop substantially after the year 2008: the average savings decreases by 0.0934 and the average consumption decreases by 0.0402. In contrast, savings in GEI households change in the opposite direction: their average savings increase by 0.0398. The average consumption in GEI households decreases by 0.0621. The DID indicator between LI households and GEI households is -0.1332 for savings and 0.0219 for consumption at the mean.[29] Other percentile statistics show a similar pattern. In other words, we observe clear evidence that the introduction of the pension option in LI discourages savings and raises consumption for LI workers, using the change in the savings/consumption profile of government employees as a benchmark.

[Insert Table 3 Here]

### *6.2. OLS Regression Results*

The OLS regression results with heteroscedasticity-consistent standard errors are reported in Table 4.

[Insert Table 4 Here]

The adjusted $R^2$ is 25.86% for the savings regression and 41.30% for the consumption regression, which indicates that the models fit the data well. Most explanatory variables have coefficients significant at the 1% level. They are also jointly significant as suggested by the F-statistics. In particular, the coefficient of the interaction term between Annuitization and LI is

[29] The change in savings or consumption is measured in log values in this paragraph.

statistically significant at the 1% level in both models. It is negative in the saving model and positive in the consumption model, which confirms our prediction that the implementation of the pension scheme decreases savings and increases consumption for households with LI.

### *6.3. Marginal Effect of Annuitization*

We now estimate the impact of annuitization on workers' saving and consumption levels. Since we use the logged value of savings or consumptions as the dependent variable in the OLS regression, but the true effect of the pension option needs to be evaluated on the untransformed variable scale, we have to take into account the potential transformation bias. Following Duan (1983) and Chou et al. (2003), we apply the "smearing" method to retransform the dependent variable to calculate the "real" marginal effect of the pension option on precautionary savings. We estimate the smearing factor as the sample average of the exponentiated least-squares residuals in the OLS regression (11). The smearing factor is 1.3066 for the saving model and 1.0492 for the consumption model. We then calculate the marginal effect of the pension option in LI based on equations (12), (13) and (14). Our results show that providing pension benefits decreases savings by 9.25% (NT$ 50,798) and increases consumption by 5.27% (NT$ 42,663) for households with LI.

### *6.4. Quantile Regression Results*

We are also interested in the effect of annuitization across households with different levels of savings (or consumption). A natural and relatively simple way to explore this difference is through the use of quantile regressions. To focus on the impact of annuitization on the treatment group, we only report $\delta$, the coefficient of the DID estimator, for the $10^{th}$, $25^{th}$, $50^{th}$, $75^{th}$ and $90^{th}$ percentiles in Table 5.

[Insert Table 5 Here]

All the DID coefficients are negative in the savings regression and positive in the consumption regressions, indicating a consistent pattern regarding the influence of annuitization on households with LI across varying levels of savings or consumption. Our empirical results show that its effect is insignificant for households at the top of the saving distribution (above $50^{th}$ percentile) or at the top of the consumption distribution (above $75^{th}$ percentile). At lower percentiles, the DID coefficients are statistically significant at the 5% level or better, indicating that the impact of annuitization is significant only for households that save less or consume less. We use the Wald F-statistics to test if the difference in the DID estimator is significant across the household-saving (or consumption) distribution. The test results reject the null hypothesis that the DID coefficients are equivalent in the saving and consumption models, which implies that its effect on savings and consumption for households with LI is significantly different across percentiles. From Table 5, the impact of annuitization on savings monotonically decreases at all percentiles levels. In addition, the Wald test indicates that the impact on the $10^{th}$ percentile is significantly greater than that on the $25^{th}$ percentile for savings. For households' consumption, the largest positive effect on consumption appears at the $25^{th}$ percentile. However, the difference between the $10^{th}$ and $25^{th}$ percentiles is insignificant. Its impact on the $25^{th}$ percentile is significantly greater than at the $50^{th}$ percentile. Our empirical evidence suggests that the provision of pension benefits has significantly greater impact on households that save less or consume less.

### *6.5. Age-Varying Effects of Annuitization*

To compare the treatment effects across age groups, we create eight dummy variables indicating different age groups and estimate model (15). To conserve space, we only report the DID estimators and their standard errors in Table 6; complete estimation results are available upon request.

[Insert Table 6 Here]

With respect to savings, the treatment effect is negative for all age groups except for the age group 30-35. The treatment effect on household consumption is almost always positive except for age groups 50-55 and 60-65. It is noteworthy that though the DID estimators in these age groups have an opposite sign to our prediction, they are not significant. The implementation of annuitized pension benefits in LI has a significantly negative impact on household savings for senior age groups (40-45 and 50-55) and it has a significantly positive impact on household consumption for younger age groups (20-30, 35-40, and 40-45).

Our results are consistent with the findings in Chou et al. (2004) and indicate a clear lifecycle pattern. On the one hand, younger households usually possess less wealth and thus are more prudent due to decreasing absolute prudence; this implies they would be more sensitive to risk reduction associated with the provision of pension benefits. Considering that they are at the initial life stage and the motive of saving for retirement is not very important, they react with a substantial increase in their consumption expenditures. On the other hand, elderly groups have retirement on the horizon, which presumably they have been saving for. So their reaction to risk reduction is mainly on the saving side. They would save less after the implementation of pension benefits in LI.

## 7. Conclusions

In this paper, we use the provision of pension benefits in the Labor Insurance program in Taiwan as a natural experiment to test its impact on households' precautionary savings and consumption. We choose households with at least one member covered by GEI as the control group since GEI has provided the pension option since 1959. Our treatment groups include households with at least one member covered by LI. We employ a DID approach to isolate "nuisance" factors from the true impact of annuitzation in LI.

Our OLS regression results indicate that the reduction of longevity risk/or the provision of the pension option have a significantly negative effect on precautionary savings and a significantly positive influence on consumption: it decreases savings by 9.25% (NT$ 50,798) and increases consumption by 5.27% (NT$ 42,663) for households with LI. These results are consistent with findings in Chou et al. (2003) and other papers that reducing future income uncertainty may discourage precautionary savings. In addition, the magnitude of its impact on savings (or consumption) is the largest at the bottom percentile in the household-saving (or household-consumption) distribution. We also investigate how its effect varies across age groups. Our empirical results show that younger households respond to the provision of the pension benefit by significantly increasing their consumption and older ones respond by significantly reducing their savings.

This research indicates that government policy can have a significant influence on consumption and savings patterns of the population. These effects vary by demographic characteristics (e.g., age distribution) in ways that are predictable given the life cycle hypothesis. Thus this research indicates that factors such as the age distribution must be taken into account when making governmental policy. Many countries and regions have an aging population, so these results could provide some useful guidance for other countries in making new policy, especially with respect to pension programs. Finally, this work is useful because it complements the work of previous studies concerning the impact of social security type programs on precautionary savings.

**References:**

Abel, A.B., (1986). Capital Accumulation and Uncertain Lifetimes with Adverse Selection, *Econometrica* 54: 1079-1097.

Cantor, R., (1985). The Consumption Function and the Precautionary Demand for Savings, *Economic Letters* 17(3): 207-210.

Caballero, R.J., (1991). Earnings uncertainty and aggregate wealth accumulation, *American Economic Review* 81 (4): 859–871.

Carroll, C.D. (1997). Buffer Stock Saving and the Life Cycle/Permanent Income Hypothesis, *Quarterly Journal of Economics*, CXII(1):1-57

Chou, S.Y., Liu, J.T., and Hammitt, J.K., (2003). National Health Insurance and Precautionary Saving: Evidence from Taiwan, *Journal of Public Economics* 87:1873-1894.

Chou, S.Y., Liu, J.T., and Huang, C.J., (2004). Health Insurance and Saving over the Life Cycle: A Semiparametric Smooth Coefficient Estimation, *Journal of Applied Econometrics* 19(3): 295-322.

Cohen, D.A., Dey, A., and Lys T.Z. (2008). Real and Accrual-Based Earnings Management in the Pre- and Post-Sarbanes-Oxley Periods, *The Accounting Review* 83(3): 757-787.

Deaton, A.S., Paxson, C.H., (1994). Intertemporal Choice and Inequality, *Journal of Political Economy* 102:437–467.

Davies, J., (1981). Uncertain Lifetime, Consumption and Dissaving in Retirement, *Journal of Political Economy* 89: 561-578.

Duan, N., (1983). Smearing Estimate: A Nonparametric Retransformation Method, *Journal of the American Statistical Association* 78(383): 605-610.

Efron, B., (1979). Bootstrap Methods: Another Look at the Jack-knife, *The Annals of Statistics* 7(1): 1-26.

Engen, E.M., (1992). Precautionary Saving, Consumption, and Taxation in a Life Cycle Model with Stochastic Earnings and Mortality Risk, Unpublished Ph.D. dissertation, University of Virginia.

Engen, E.M., Gruber, J., (2001). Unemployment Insurance and Precautionary Saving, *Journal of Monetary Economics* 47(3): 545–579.

Farley, P.J., Wilensky, G.R., (1985). Wealth and Health Insurance as Protection against Medical Risks. In: David, M., Smeeding, T. (Eds.), *Horizontal Equity, Uncertainty, and Economic*

*Well-being*. University of Chicago Press, Chicago.

Feenberg, D., Skinner, J., (1994). The Risk and Duration of Catastrophic Health Care Expenditures, *Review of Economic and Statistics* 76 (4): 633–647.

Friedman, M., (1957) A Theory of the Consumption Function. Princeton, NJ: Princeton University Press.

Gruber, J., and Yelowitz, A., (1999). Public Health Insurance and Private Savings, *Journal of Political Economy* 107: 1249-1274.

Guiso, L., Jappelli, T. and Terlizzese, D., (1992). Earning Uncertainty and Precautionary Saving, *Journal of Monetary Economics*, 30: 307-337.

Guiso, L., Jappelli, T. and Padula, M. (2009). Pension Risk, Retirement Saving and Insurance, working paper, European University Institute.

Hubbard, R.B. and Judd, K.L., (1987). Social Security and Individual Welfare: Precautionary Saving, Liquidity Constraints, and the Payroll Tax, *American Economic Review* 77: 630-646.

Hurd, M.D., (1989). Mortality Risk and Bequests, *Econometrica* 57: 779-814.

Kantor, S.E., Fishback, P.V., (1996). Precautionary Saving, Insurance, and the Origins of Workers Compensation, *Journal of Political Economy* 104 (2), 419–442.

Kazarosian, M. (1997). Precautionary Savings - A Panel Study, *Review of Economics and Statistics* 79: 241–247.

Kimball, M.S., (1990). Precautionary Saving in the Small and in the Large, *Econometrica* 58: 53-73.

Kotlikoff, L.J., (1989). Health Expenditures and Precautionary Savings. In: Kotlikoff, L.J. (Ed.), What Determines Savings. MIT Press, Cambridge, MA.

Koenker, R. and Bassett, G., (1978). Regression Quantiles, *Econometrica.* 46(1): 33–50.

Kuan, C.-M, and Chen, C.-L., (forthcoming). Effects of National Health Insurance on Precautionary Saving: New Evidence from Taiwan, *Empirical Economics*.

Leland, H.E., (1968). Saving and Uncertainty: The Precautionary Demand for Saving, *Quarterly Journal of Economics* 82: 465–473.

Liu, T.C., Chen, C.S., (2002). An Analysis of Private Health Insurance Purchasing Decisions with National Health Insurance in Taiwan, *Social Science & Medicine* 55: 755–774.

Palumbo, M.G., (1999). Uncertain Medical Expenses and Precautionary Saving: Near the End of the Life Cycle, *Review of Economic Studies* 66 (2): 395–422.

Santen, P.V. (2011). Lifecycle Savings when Pensions are at Risk: Theory and Microeconometric Evidence, University of Groningen, working paper.

Skinner, J., (1985). Variable Lifespan and the Intertemporal Elasticity of Consumption, *Review of Economics and Statistics* 67: 616-623.

Skinner, J., (1988). Risky Income, Life Cycle Consumption, and Precautionary Savings, *Journal of Monetary Economics* 22: 237-255.

Starr-McCluer, M. (1996). Health Insurance and Precautionary Savings, *American Economic Review* 86: 285–295.

Zeldes, S.P., (1989). Optimal Consumption with Stochastic Income: Deviations from Certainty Equivalence, *Quarterly Journal of Economics* 104(2): 275–298.

Yaari, M.E., (1965). Uncertain Lifetime, Life Insurance and the Theory of the Consumer, *Review of Economic Studies* 32(2): 137-150

## Appendix A: Calculate the APV of Pension Benefits

Notations:

$i^{(m)}$ : nominal interest rate compounded m-th ly per year.

$i = \left(1 + \frac{i^{(m)}}{m}\right)^m - 1$ : annual effective interest rate,.

$v = \frac{1}{1+i}$ : one year discount factor

$d = 1 - v$ : annual effective discount rate

$d^{(m)} = \frac{mi^{(m)}}{m + i^{(m)}}$ : nominal discount rate compounded m-th ly,

$\ddot{a}_x = \sum_{k=0}^{\infty} v^k \, {}_k p_x$ : APV of a whole life annuity-due of \$1 per year.

$\ddot{a}_x^{(m)} = \frac{1}{m} \sum_{k=0}^{\infty} v^{k/m} \, {}_{k/m} p_x$ : APV of a whole life annuity-due of \$1 per year, payable in installments of $\$1/m$ at the beginning of each m-th of the year while $(x)$ survives.

With these notations in mind, the actuarial present value of old-age pension benefits can be calculated as

$$APV^{PB} = m \times MP \times \ddot{a}_x^{(m)} = m \times MP \times \left(\alpha(m)\ddot{a}_x - \beta(m)\right), \tag{A.1}$$

where $\alpha(m) = \frac{i \times d}{i^{(m)} d^{(m)}}$ and $\beta(m) = \frac{i - i^{(m)}}{i^{(m)} d^{(m)}}$.

**Appendix B: Estimation of Permanent Income**

We follow Guiso et al. (1992) to construct the permanent household income. The permanent household income at age τ can be expressed as

$$Y(\tau) = Z\beta + \Phi(\tau), \tag{B.1}$$

where $Z$ is a vector of characteristics for the household head and $\Phi$ is a quadratic function of age for household heads. Assuming 65 years is the maximum age at which people work, the estimated permanent income at age $\tau_0$ is

$$Y_p(\tau_0) = (65 - \tau_0 + 1)^{-1} \sum_{\tau=\tau_0}^{65} [Zb + f(\tau)] \left( \frac{1+n}{1+r} \right)^{\tau-\tau_0}, \tag{B.2}$$

where $b$ and $f$ are the estimated coefficients of $\beta$ and $\Phi$, $r$ and $n$ are interest rate and the rate of growth of productivity. For simplicity, let $r$ equal $n$. The estimated permanent income can be calculated as

$$Y_p(\tau_0) = Zb + (65 - \tau_0 + 1)^{-1} \sum_{\tau=\tau_0}^{65} f(\tau). \tag{B.3}$$

Variables used to estimate $\beta$ and $\Phi$ include demographic characteristics, occupation for heads of a household and their spouses, family size, and the year trend. The estimation results are satisfactory. Most explanatory variables are significant at 1% level and adjusted $R^2$ is 42.14%. The estimated permanent household income is then used as a control variable in the saving/consumption equation.

**Table 1: Variable Descriptions**

| Variables | Definition |
|---|---|
| Log(Saving) | Log of the difference between total disposable household income and expenditures |
| Log(Consumption) | Log of consumption expenditure including food, beverage, tobacoo, closing, fuel, water, rent, future and family facilities, medical care and sanitation, transport and communication, recreation, education, culture, and other miscellaneous expenditures. |
| LI | Dummy variable = 1 if the household is insured by labor insurance |
| Annuitization | Dummy variable = 1 if the year is post-annuitization |
| *Characteristics of Household Head* | |
| Head Educational Dummies: Junior/Senior/College/University/ Graduate | Dummy variable = 1 if household head finished junior high school/ senior high school/ community college/ university/ gradual school (illiterate individuals are in the reference group) |
| Male | Dummy variable = 1 if household head is male |
| Age | Age of the household head in years |
| Age^2 | Squared age/100 |
| *Characteristics of Family Members* | |
| Spouse Educational Dummies: Junior/Senior/College/University/ Graduate | Dummy variable = 1 if spouse of household head finished junior high school/ senior high school/ community college/ university/ gradual school (Illiterate individuals are in the reference group) |
| # of children | # of children under age 18 |
| # of parents or grandparents | # of parents or grandparents |
| Log(Permanent Income) | Log of household permanent income |

## Table 2: Summary Statistics

| Variable | Mean | Std Dev | 25th percentile | 50th percentile | 75th percentile |
|---|---|---|---|---|---|
| Log (Saving) | 12.7836 | 0.9282 | 12.2561 | 12.8416 | 13.3913 |
| Log (Consumption) | 13.5462 | 0.3980 | 13.2979 | 13.5519 | 13.8031 |
| LI | 0.9303 | 0.2546 | 1.0000 | 1.0000 | 1.0000 |
| Annunitization | 0.4968 | 0.5000 | 0.0000 | 0.0000 | 1.0000 |
| Junior | 0.1673 | 0.3732 | 0.0000 | 0.0000 | 0.0000 |
| Senior | 0.3393 | 0.4735 | 0.0000 | 0.0000 | 1.0000 |
| College | 0.1663 | 0.3724 | 0.0000 | 0.0000 | 0.0000 |
| University | 0.1428 | 0.3499 | 0.0000 | 0.0000 | 0.0000 |
| Graduate | 0.0482 | 0.2143 | 0.0000 | 0.0000 | 0.0000 |
| Male | 0.8797 | 0.3254 | 1.0000 | 1.0000 | 1.0000 |
| Age | 46.2093 | 8.7731 | 39.0000 | 47.0000 | 53.0000 |
| Spouse Junior | 0.1695 | 0.3752 | 0.0000 | 0.0000 | 0.0000 |
| Spouse Senior | 0.3693 | 0.4826 | 0.0000 | 0.0000 | 1.0000 |
| Spouse College | 0.1479 | 0.3550 | 0.0000 | 0.0000 | 0.0000 |
| Spouse University | 0.1277 | 0.3338 | 0.0000 | 0.0000 | 0.0000 |
| Spouse Graduate | 0.0212 | 0.1441 | 0.0000 | 0.0000 | 0.0000 |
| # of children | 1.0214 | 1.0034 | 0.0000 | 1.0000 | 2.0000 |
| # of grandparents | 0.2244 | 0.5597 | 0.0000 | 0.0000 | 0.0000 |
| Log (Permanent Income) | 14.2134 | 0.3044 | 14.0177 | 14.1914 | 14.3962 |
| Trend | 1.9962 | 1.5907 | 0.0000 | 1.0000 | 4.0000 |

Note: The final sample contained 19,802 households of which 1,380 household heads are government employees and 18,422 are non-government employees. Log(Saving) is the logged difference between total disposable household income and expenditures. Log(Consumption) is the logged sum of consumption expenditures. LI is 1 if the household head is insured by labor insurance and 0 otherwise. Annuitization is 1 if the year is post-annuitization and 0 otherwise. Junior/Senior/College/University/Graduate are education dummy variables. Male is 1 if the household head is male, and 0 otherwise. Age is the age of the household head. # of children is the number of children under age 18. # of grandparents is the number of parents or grandparents. Log (Permanent Income) is the log of household permanent income. Trend is 0 (1, 2, 3, 4) for year 2006 (2007, 2008, 2009, 2010).

**Table 3: Comparison of saving/consumption for both groups in pre- versus post-annuitization**

| | | | Log (Saving) | | | | Log (Consumption) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | N | Mean | $25^{th}$ percentile | $50^{th}$ percentile | $75^{th}$ percentile | Mean | $25^{th}$ percentile | $50^{th}$ percentile | $75^{th}$ percentile |
| Households with LI | Pre | 9,219 | 12.7685 | 12.2611 | 12.8142 | 13.3523 | 13.5490 | 13.3053 | 13.5549 | 13.8043 |
| | Post | 9,203 | 12.6751 | 12.1679 | 12.7470 | 13.2737 | 13.5088 | 13.2542 | 13.5156 | 13.7631 |
| | *Pre - post* | | *-0.0934* | *-0.0932* | *-0.0672* | *-0.0786* | *-0.0402* | *-0.0511* | *-0.0393* | *-0.0412* |
| Households with GEI | Pre | 746 | 13.5898 | 13.1450 | 13.7016 | 14.0559 | 13.8045 | 13.5810 | 13.7968 | 14.0193 |
| | Post | 634 | 13.6296 | 13.2637 | 13.7348 | 14.0588 | 13.7424 | 13.4977 | 13.7128 | 13.9750 |
| | *Pre - Post* | | *0.0398* | *0.1187* | *0.0332* | *0.0029* | *-0.0621* | *-0.0833* | *-0.084* | *-0.0443* |
| *DID: LI versus GEI* | | | *-0.1332* | *-0.2119* | *-0.1004* | *-0.0815* | *0.0219* | *0.0322* | *0.0447* | *0.0031* |

Note: The final sample contained 19,802 households of which 1,380 household heads are government employees and 18,422 are non-government employees. Saving is the difference between total disposable household income and expenditures. Consumption is the sum of consumption expenditures.

## Table 4: The Effect of the Annuitization Option on Saving and Consumption

| Dependent variable | Log (Saving) | Log (Consumption) |
|---|---|---|
| Intercept | -7.1970*** | -1.9633*** |
| | (0.584) | (0.203) |
| LI | -0.3649*** | -0.0182 |
| | (0.026) | (0.012) |
| Annunitization | 0.0150 | -0.0724*** |
| | (0.048) | (0.021) |
| Annunitization * LI | -0.0971*** | 0.0514*** |
| | (0.035) | (0.018) |
| Junior | -0.0562** | 0.0040 |
| | (0.024) | (0.009) |
| Senior | -0.0836*** | -0.0112 |
| | (0.024) | (0.009) |
| College | -0.0903*** | -0.0570*** |
| | (0.029) | (0.011) |
| University | -0.0715** | -0.1294*** |
| | (0.033) | (0.013) |
| Graduate | -0.0669 | -0.1924*** |
| | (0.041) | (0.017) |
| Male | 0.0934*** | -0.0244*** |
| | (0.020) | (0.007) |
| Age | -0.0444*** | 0.0156*** |
| | (0.007) | (0.003) |
| Age^2 | 0.0481*** | -0.0176*** |
| | (0.007) | (0.003) |
| Spouse Junior | -0.1099*** | 0.0421*** |
| | (0.023) | (0.009) |
| Spouse Senior | -0.0888*** | 0.0313*** |
| | (0.023) | (0.009) |
| Spouse College | -0.0633** | -0.0242** |
| | (0.030) | (0.011) |
| Spouse University | -0.1025*** | -0.1001*** |
| | (0.034) | (0.013) |
| Spouse Graduate | -0.1653*** | -0.1892*** |
| | (0.051) | (0.023) |
| # of children | -0.2178*** | -0.0305*** |
| | (0.008) | (0.003) |
| # of grandparents | -0.0694*** | -0.0065 |
| | (0.011) | (0.004) |
| Log(Permanent Income) | 1.5205*** | 1.0749*** |
| | (0.043) | (0.015) |
| Trend | 0.0167 | 0.0134*** |
| | (0.011) | (0.004) |
| F Statistics | 346.39 | 697.71 |
| Adjusted $R^2$ | 25.86% | 41.30% |
| N | 19,802 | 19,802 |

Note: The final sample contained 19,802 households of which 1,380 household heads are government employees and 18,422 are non-government employees. Log (Saving) is the logged difference between total disposable household income and expenditures. Log (Consumption) is the logged sum of consumption expenditures. LI is 1 if the household head is insured by labor insurance and 0 otherwise. Annuitization is 1 if the year is post-annuitization and 0 otherwise. Junior/Senior/College/University/Graduate are education dummy variables. Male is 1 if the household head is male, and 0 otherwise. Age is the age of the household head. # of children is the number of children under age 18. # of grandparents is the number of parents or grandparents. Log(Permanent Income) is the log of household permanent income. Trend is 0 (1, 2, 3, 4) for year 2006 (2007, 2008, 2009, 2010). *** (**, *) indicates statistical significance at the 1% (5%, 10%) level. Heteroscedasticity-consistent standard errors are in parentheses.

**Table 5: Results of the Quantile Regression**

| Percentile | Quantile Regression | | | | | Wald Test F Statistics | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | $10^{th}$ | $25^{th}$ | $50^{th}$ | $75^{th}$ | $90^{th}$ | All equal | $10^{th}=25^{th}$ | $25^{th}=50^{th}$ | $50^{th}=75^{th}$ | $75^{th}=90^{th}$ |
| Log (Saving) | -0.2197*** (0.066) | -0.1022** (0.052) | -0.0462 (0.044) | -0.0391 (0.043) | -0.0316 (0.055) | 2.42** | 4.67** | 1.62 | 0.04 | 0.03 |
| Log (Consumption) | 0.0944*** (0.029) | 0.0986*** (0.021) | 0.0489** (0.022) | 0.0342 (0.024) | 0.0080 (0.037) | 2.33* | 0.03 | 6.67*** | 0.55 | 0.74 |

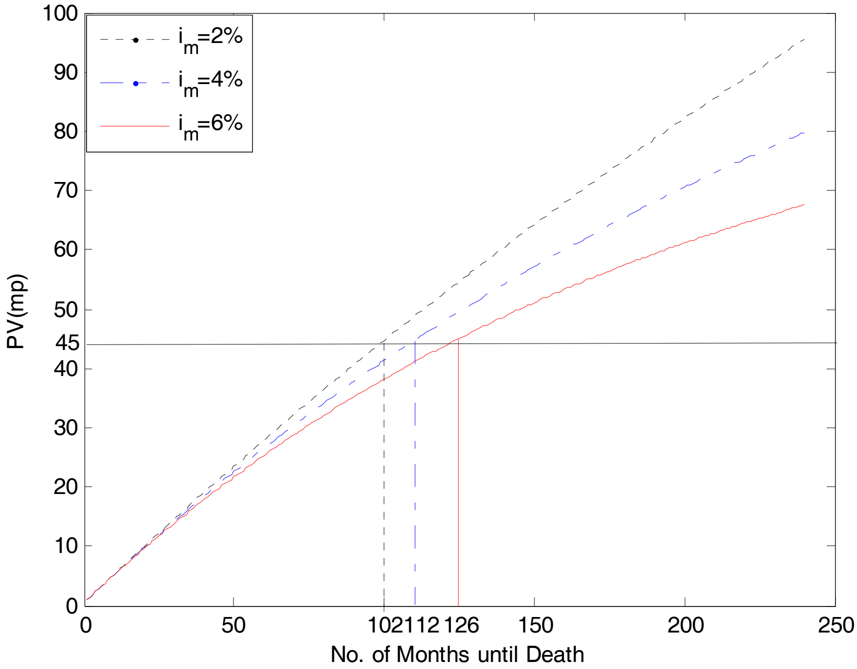
Note: The final sample contained 19,802 households of which 1,380 household heads are government employees and 18,422 are non-government employees. Log (Saving) is the logged difference between total disposable household income and expenditures. Log (Consumption) is the logged sum of consumption expenditures. *** (**, *) indicates statistically significance at the 1% (5%, 10%) level. Bootstrap standard errors are shown in parentheses. The model specification is the same as that in Table 4. The above reports the DID estimates only. All other control variables are not reported.

**Table 6: Results of the Groupwise Treatment Effects**

| Age Group | 20-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 |
|---|---|---|---|---|---|---|---|---|
| Log (Saving) | -0.2660 (0.3305) | 0.1555 (0.1130) | -0.0415 (0.0750) | -0.1240* (0.0645) | -0.1068 (0.0728) | -0.1987* (0.1040) | -0.0857 (0.1218) | -0.1859 (0.2337) |
| Log (Consumption) | 0.3662* (0.1919) | 0.0872 (0.0574) | 0.1378*** (0.0387) | 0.0692** (0.0347) | 0.0185 (0.0337) | -0.0052 (0.0491) | 0.0206 (0.0669) | -0.0814 (0.0956) |

Note: The final sample contained 19,802 households of which 1,380 household heads are government employees and 18,422 are non-government employees. We partition the sample into eight age groups and estimate the groupwise treatment effect. We report the DID estimators only. All other control variables are not reported. Log (Saving) is the logged difference between total disposable household income and expenditures. Log (Consumption) is the logged sum of consumption expenditures. *** (**, *) indicates statistically significance at the 1% (5%, 10%) level. Heteroscedasticity-consistent standard errors are in parentheses.

**Figure 1:** The present value of monthly benefits against the number of months until death




Note: The illustration is based on a representative individual covered by Labor Insurance who starts to work at the age of 25 and retires at the age of 56. Under the one-time benefit option, he will receive retirement benefits equal to 45 months of the "average monthly insurance salary". Under the pension benefit option, he will receive a monthly benefit until death that is the product of the "average monthly insurance salary", coverage years (31 in this example), and 1.55 percent. The horizontal line represents the present value of retirement benefits under the lump sum option. We also depict the present value of monthly benefits under the annuitization option against the number of months until death when the nominal interest rate is equal to 2%, 4% and 6%, respectively.

# Developing Environmental Pollution Liability Insurance: the Countermeasures

## ——A Case Study of Baoding, Hebei Province, China

Liu Congjun[1], Abdul Razak Bin Chik[2]

[1]College of Economics, Hebei University, Baoding, Hebei, China, 071002
[2]School of Economics, Finance and Banking, Universiti Utara Malaysia, Kedah, Malaysia, 06010

**Abstract:** Environmental liability insurance is an economic policy carried out to solve environmental problems through modern insurance system. Since 1960's, the environmental liability insurance has been put into practice in many western developed countries, however no big progress has been made in China until recent years. In April, 2011, the environmental liability insurance program was launched in Baoding which has been selected to be the only pilot city in Hebei province. On November 15$^{th}$, 2011, Baoding Branch of PICC Property and Casualty Company issued environmental pollution liability insurance policies to 15 enterprises in Baoding, which is a milestone for the environmental liability insurance development in Hebei province. By the end of 2011, 52 enterprises purchased environmental liability insurance. The experience accumulated in the course has great significance for extending this policy to other places in Hebei province. This study focuses on some hot issues rising when launching environmental pollution liability insurance in Baoding city, which include the role of the regulator, the attitude of the potential polluter, the preferred implementation mode and the risk evaluation standard. On base of the analysis and discussion, some suggestions are put forward on promoting environmental pollution liability insurance in Hebei province or even in China.

**Key words:** environmental pollution liability insurance; legal system; coverage; pricing

## Ⅰ. Introduction

Accidental environmental contamination has become a serious problem recent years in China. In 2011, liable parties paid CNY1.683 billion as compensation for the damage to the environment caused by Penglai 19-3-oil-field oil spill incident. Before this notorious accident, in 2010, the oil spill incident in Dalian Xingang and the contamination to Ting River also caused huge damage to the environment and the inhabitant.

Known as green insurance, environmental pollution liability insurance is a category of insurance that covers insured's environmental liability risks. Among many economic policies dealing with environmental pollution problems, environmental pollution liability insurance is deemed to be an effective method in relieving environmental problems through modern insurance system. It should be involved in pollution control owing to its ability to price environmental risk, encourage precautionary measures and generate funds for environmental cleanup (Richardson, 2002).

This study was sponsored by Education Department of Hebei Province (SZ2011501).

Since 1960's, the environmental pollution liability insurance has been put into practice in many western developed countries. In China, environmental pollution liability insurance was first introduced in the city of Dalian in 1991 and then in some other cities such as Changchun and Shenyang. However it developed rather slowly. From 1991 to 1994, only 15 firms purchased environmental pollution liability insurance in Dalian and in 1992, only one firm purchased such product in Changchun.

With increasing awareness of environmental issues and stronger government enforcement, the situation has improved in recent years. In 2007, China Environmental Protection Administration and the Insurance Regulatory Commission jointly issued "Environmental Pollution Liability Insurance Guidance" and proposed to establish environmental pollution liability insurance system during the "Eleventh Five-Year" period and extend it nationwide by 2015, which showed obviously the government's determination to promote environmental pollution liability insurance in China.

In 2009, Hebei Province issued Reducing Contaminant Discharge Regulations, which explicitly provided that environmental pollution liability insurance should be propelled among enterprises facing serious environmental pollution risks. As the first and sole pilot city, Baoding launched the project of developing environmental pollution liability insurance. In April, 2011, Baoding Environmental Protection Agency issued a notice on piloting environmental pollution liability insurance in Baoding and called for bids. Six insurance companies were chosen to compose the co-insurance body and by the end of 2011, 53 enterprises processing poisonous chemicals, discharging hazardous waste or related to heavy metals purchased environmental pollution liability insurance. Some helpful experience can be drawn from the practice of Baoding, however what can not be ignored is the problems exposed and remained during the process of developing environmental pollution liability insurance.

## Ⅱ. Method

This study used in-depth interview as the major method. Four parties have been involved in the project of implementing environmental pollution liability insurance in Baoding: environmental protection department of the government (regulator), insurer (product supplier), enterprises (product demander) and insurance brokerage company (intermediary). The interviews, conducted in May 2012, involved 6 interviewees. These interviewees are from the four parties involved in the developing environmental pollution liability insurance project in Baoding. They are numbered from 1 to 6. No.1 represents the government, Baoding Environmental Protection Agency. No.2 is from Baoding branch of an insurance company which provides environmental pollution liability insurance product. No.3 is from the insurance brokerage company which is involved in this project. No.4, 5 and 6 from three enterprises exposed to environmental liability risks. All of these interviewees have taken part in the project directly.

Topics discussed during interviews include:

1) Attitude of the insured to the environmental pollution liability insurance

2) Implementation mode

3) Risk evaluation

These topics are actually related to each other.

Before interviewing people from enterprises, relevant information were collected, which include the size, sources of risk and risk management level of the enterprises.

# Ⅲ.Findings

## A. Regulator's Necessary Role in Developing Environmental Pollution Liability Insurance

When talking about the decisive factor affecting the decision of purchasing such insurance product, all of the interviewees mentioned the intervention of the regulator.

It was very difficult to talk the enterprises at risk to purchase insurance, however it would be definitely impossible without the regulator's intervention. (No.2 and No.3)

Officials from Baoding Environmental Protection Agency said purchasing insurance can make subsequent inspection easier… (No.6)

It is important for us to keep a good relationship with the regulator… (No.4 & No.5)

Regulator's important role in developing environmental pollution liability insurance is not only reflected by persuading potential polluters to purchase environmental pollution liability insurance, but also by improving it.

We have asked the insurance company to improve the premium calculation method and suggested them provide more risk management service. We think the insurance company should pay more attention to its social management function. (No.1)

## B. Little Interest in Purchasing Environmental Pollution Liability Insurance

Interviewees from enterprises showed little interest in purchasing environmental pollution liability insurance, although they are aware of the environmental pollution liability risk to some extent, owing to the underestimate of the risk and unsatisfactory insurance product.

1) Underestimate of the liability risk

Although all of the interviewees are aware about the potential pollution risk to some extent, when it comes to the reality, they just shrug it off.

I know there would be a big loss if pollution accidents happened, but do you think it will really happen? I didn't see any accident for decades… (No.5)

They think the accidents won't happen. Actually, one serious accident did happen to a chemical factory when we tried to persuade it to purchase environmental pollution liability insurance. The boss hesitated too long time…It paid more than 2 million to the victim. If it had been covered by insurance… (No.1 & No.3)

What should be noticed is that not only small and medium size enterprises underestimate their risks, but big size enterprise also has this problem. Moreover, no interviewee from these enterprises mentioned anything about the famous underdeterrence problem caused by insolvency. It seems that they don't worry the potential pollution liability at all, so there is obviously no need to think about the possibility to go into insolvency because of pollution liability. It indicates that in China, potential polluters do not care too much about the environmental pollution liability risk not because they think the liability is too much for them to take, but because they didn't think the risk is serious at all.

2) Unsatisfactory product

Almost all the interviewees (except No. 2) mentioned the unsatisfactory product.

The most serious environmental pollution risk for a city like ours is in the middle of delivery. However this risk has been exempted from the environmental pollution liability insurance. (No.1)

I think the most important risk our company concern about is the liability coming from daily contaminant discharge. We have paid a lot for this. But I was told such loss won't be covered by insurance. (No.4)

It is obvious that a lot of complaints are about the limited coverage of environmental pollution liability insurance. In China nowadays, only a few insurance company provide relevant products in the area of environmental pollution liability which only cover accidental events caused in the boundaries of the insured's site. Risks during transportation are still uncovered.

Besides coverage, there are also complains about premium rate.

The premium rate is too high. Our company only makes a little profit. This is a big burden on us. (No.6)

I don't think we should pay so much for this. Why they charge us according to the size. Big size doesn't necessarily mean high risk… (No.4)

I don't know why we pay more than chemical factories… Obviously they face higher risks… (No. 4)

It seems strange that the risk adjustment coefficient for heavy metal industry is higher than that for chemical industry. (No.1 & No.3)

Basically speaking, premium rate should be set according to the loss probability. It is still very difficult for the insurer to get adequate information about it. Furthermore, even if the premium rate has been set at an appropriate level as a whole, the exposures differentiate from firm to firm. Compared to those facing serious problems, enterprises with low-level risks would not like to purchase such an insurance product if risk control level was not taken into consideration when setting the specific premium rate.

### C. Compulsory Insurance Preferred

Environmental pollution liability insurance nowadays is still voluntary insurance. However the interviewee from government expressed his strong desire for implementing it by force.

Our work would be much easier if it was a compulsory insurance. (No.1)

This opinion was agreed by interviewees from insurance company and the brokerage company.

### D. Risk Evaluation Standard

Every interviewee expressed his concern about risk evaluation. Some opinions have been mentioned in 3.2. Insurance company explained as following:

We know more work should be done about risk evaluation. There is almost no ready standard can be used. It will cost us too much to set the risk evaluation standard by ourselves. Besides, we are in lack of technicians in this area… (No.2)

## Ⅳ.Discussion and Suggestion

The studies reported in this paper were limited in scope and used small purposive sampling. However, some conclusions can be drawn and on base of it some suggestions can be made.

### A. Setting Risk Evaluation Standard

Risk evaluation is the basis for premium rates differentiation, which is important for avoid adverse selection. Considering the current situation, it is unrealistic to rely solely on the insurance company. This is a new and highly technical field and the insurance company is lack of motivation since the prospect of its development is still uncertain. If the result was like that in the nineties of last century, from the insurance company's standpoint, it would not be deserved to do it. Moreover, there is possibility of "free riders". The appropriate approach to solve this problem is government's taking the leading role, convening relevant experts and insurance companies to set the standard. Experience from some other cities such as Dalian and Chongqing can be learnt from.

### B. Implementation mode selection

Although compulsory mode will make the implementation easier, we must be clear that compulsory mode has both advantages and disadvantages. The advantages are increased expected utility, information problems and insolvency (Faure, 2002). However some conditions should be met before implementing compulsory environmental pollution liability insurance. Faure mentioned three: information problems, externalities and insolvency of the potential injurer which may lead to underdeterrence. Shavell (2000) argued that the proper justification for required liability insurance is whether it will improve incentives to reduce risk. Furthermore, if cost and probability of risk has been underestimated by potential injurers, compulsory insurance should be implemented (Faure, 2006). Zhang Lei (2007) deemed that the conditions for implementing insurance by force are huge loss and insufficient capacity for compensation. However, all the conditions for implementing compulsory insurance should be verified in practice.

## C. Improving Incentives for Pollution control

Although the main purpose of insurance is for loss compensation, its function of providing risk reduction incentives should not be ignored. The major approach an insurance company can resort to is the premium rate differentiation which depends heavily on the risk evaluation techniques. That is another reason that setting risk evaluation standard should be put at the first place.

## D. Enhancing Coordination and Cooperation

Coordination and cooperation is crucial for developing environmental pollution liability insurance in China. For example, environmental pollution liability risk rising from hazardous chemicals in delivery, which accounts for large proportion of environmental pollution losses, is not covered by current environmental pollution liability insurance product, because traditionally it is under supervision of traffic management department other than environment protection department.

## Acknowledgement

This study was carried out when the author worked along with other experts for promoting environmental pollution liability insurance in Baoding, Hebei province. We would like to thank the people who participated in this study, Baoding Changcheng Brokerage Company as well as Baoding Environment Protection Bureau that has assist this study.

## References

[1] Carol L. Press & Albert G. Bixler (2002). Environmental insurance can address liability problems, if businesses lay the groundwork. *Adhesives & Sealants Industry, 13,* 20-22.

[2] Kenn Anderson & Arthur Harrington (2006). Environmental insurance can reduce liability risk at brownfield sites. *Hazardous Waste Consultant, 24(4),* 1.1-1.5.

[3] Liu Jun (2006). The importance and possibility of developing environmental pollution liability insurance in China. *Ecological Economy*, 5,145-147.

[4] Luo ming & Wu Shaokai (2008). Analysis on present situation of environmental pollution liability insurance in China and the prospects of its system. *Journal of Insurance Professional College (Bimonthly), 22 (2),* 10-14.

[5] Michael G. Faure (2002). Environmental damage insurance in theory and practice. in Timothy Swanson (ed.), *Research in Law and Economic* (Vol. 20, 283-328). Emerald Group Publishing Limited.

[6] Michael G. Faure (2006). Economic criteria for compulsory insurance. The Geneva Papers, 31, 149 – 168.

[7] Shavell, S. (1984). Liability for harm vs. regulation of safety. Journal of Legal Studies, 13, 357 – 374.

[8] Shavell, S. (1986). The judgement proof problem. International Review of Law and Economics, 6, 43 – 58.

[9] Steven Shavell (2000). On the social function and the regulation of liability insurance. The Geneva Paper on Risk and Insurance, 25(2), 166-179.

[10] Steven Shavell (2005). Minimum asset requirements

and compulsory liability insurance as solutions to the judgment-proof problem. RAND Journal of Economics, 36(1), 63-77.

[11] Teng Jing (2010). Probe into new measures for environmental economic policy, responsibility insurance system on environmental pollution. *China Environmental Protection Industry, 5,* 10-13.

[12] Timothy Cuddihy (2000). Environmental liability risk management for the 21st century. *The Geneva Papers on Risk and Insurance, 25(1),* 128-135.

[13] Zhang Lei (2007). "A Study on Compulsory Liability Insurance in China", Doctoral Dissertation, XiaMen University.

# Product Market Competition and Corporate Demand for Insurance[1]

LIU Zhiyong[1], Hae Won Jung[2]

1. Scott College of Business, Indiana State University, Terre Haute, IN, 47809.

2. Robinson College of Business, Georgia State University, PO Box 4036, Atlanta, GA, 30302

**Abstract**

This article shows through a simple model that there is a monotonic relation between the competitiveness of the product market and firms' demand for insurance. The more competitive the product market is, the more likely firms competing in the market will acquire insurance or purchase full coverage. This holds true no matter whether firms exhibit risk aversion or not in their preferences. Investment in risk management prior to competition is used as a strategic commitment device in the product market competition. Firms optimize their risk management investment by balancing the strategic commitment benefit and the cost of insurance. Therefore, the "outside the box factors" such as the industry characteristics, the market environment and the competitive pressure are important ones shaping firms' risk management strategies. This provides clear empirical implications for corporate investment in risk management and its relation to the product market environment.By focusing on primary insurers' reinsurance purchases, we provide strong empirical support forthe theoretical predictions.

**Key Words***Corporate Demand for Insurance, Risk Management, Product Market Competition, Strategic Commitment*

**JEL***G22 L13L22*

[1]Email: John.Liu@indstate.edu; hennyjung@gmail.com. We are grateful for the helpful comments from Marty Grace, Bob Hoyt, Ping Lin, Rich Phillips, Chengzhong Qin, Harris Schlesinger, and participants to the 2011 Annual Meeting of the American Risk and Insurance Association, 2011 Annual Meeting of the Southern Risk and Insurance Association, 2011 Annual Meeting of the Asian Law and Economics Association, and the Sixth Conference on Industrial Economics and Economic Theory at Shandong University.HyeonSeong Yun provided excellent research assistance. The usual disclaimer applies.

## 1. Introduction

Every year corporations spend billions of dollars in insurance premiums to obtain property and casualty coverage. According to Davidson, Cross and Thornton (1992, p.61), “in 1989, businesses paid property and casualty premiums of $112 billion, compared to dividend payments of approximately $85 billion.” Also, according to Mayers and Smith (1982, p.281), “business insurance accounted for approximately 54.2 percent of the $79,032,923,000 in direct property and liability insurance premiums written in the United States in 1978.”[2]Why do corporations purchase a significant amount of insurance?Researchers have argued that firms purchase insurance to reduce tax liability (Main, 1983), to avoid or reduce the cost of financial distress (MacMinn, 1987; Mayers and Smith, 1982), to mitigate agency conflicts (MacMinn and Han, 1990; Mayers and Smith, 1987), to signal private information (Grace and Rebello, 1993; Thakor, 1982), or to fulfill creditors’ requirements (Cheyne and Nini, 2010). Recently, Seog (2006) provides an interesting analysis of firms’ insurance demand out of strategic motives in competitive environments. He shows that corporate insurance leads to more aggressive competition in the product market, while the optimal insurance coverage is determined by a tradeoff between the strategic effect of insurance and the cost of insurance.

An unanswered question following this line of explanation for corporate insurance demand is how the degree of product market rivalry affects firms’ insurance demand. Seog (2006) analyzes firms’ strategic demand for insurance in a *given* competitive environment. In this article, we willshow using a simple conjectural variations model how a*change in the competitive market environment* influences firms’ strategic demand for insurance. The main result is that a more competitive product market environment induces firms to purchase insurance in order to reduce their risk exposures, and furthermore, induces them to fully insure their losses given that they do purchase insurance. Importantly, we show that the monotonic relation between the competitiveness of the product market and firms’ risk management investment holds true no matter whether firms exhibit risk aversion or not in their preferences. These results provide a clear empirical prediction for firms’ investment in risk management and its connection to their product market environment.

Studying corporate insurance demand in a strategic product market competition framework provides an interesting path to analyze corporate risk management strategies. The recent wave of financial crisis and collapses of some famous institutions such as Lehman Brothers stimulate strong incentives for corporations to emphasize risk management along a broad range of their business activities. However, what most companies do in risk management is to determine optimal financial hedging portfolios, largely ignoring the effects of risk management activities on product market competition through their rivals’ strategic feedback. This paper demonstrates that those “outside the box factors” such as the industry characteristics, the market environment and the competitive pressure are important ones shaping firms’ risk management strategies. Investment in risk management prior to competition is used as a strategic commitment device in the product market competition. Firms optimize their risk management investment by balancing the strategic commitment benefit and the cost of insurance, and it turns out that this tradeoff exhibits monotonic characteristics.

To empirically test the predictions of the model, we use the data from the property-liability insurance industry. We mainlyinvestigate the relation between reinsurance purchases by primary insurers and the competitiveness of insurance markets in which the primary insurersdo business. We compute firm-specific measures of market competitiveness (via firm-specific weighted averages of concentration ratios and Herfindahl-Herschman indexes across insurance markets segmented by lines of businessand states in which insurers operate), and associate these measures with reinsurance purchases by the insurers. The regression results provide strong support for the

[2] A survey by Tillinghast-Towers Perrin and Risk and Insurance Management Society (1995) finds that direct property-casualty insurance costs for most North American business organizations typically average around 0.4% of revenues. See footnote 1 of MacMinn and Garven (2000).

theoretical prediction that corporate demand for insurance is monotonically increasing with the competitiveness of the product market in which firms do business.

In the next section weoutline the setup. In Section 3 we study the equilibrium when firms have risk averse preferences. Then we investigate the case of no risk aversion in Section 4. In Section 5 we test the empirical predictions of the model using the data from the insurance industry. Finally weconclude in Section 6.

## 2. The Model

There are $n$ firms competing in the product market, indexed by $i = 1, 2, \ldots, n$. The insurance market is competitive and characterized by free entry and zero equilibrium profit. The premium could be actuarially unfair with a premium loading factor, $\lambda \geq 0$.

There are two periods in the model. Firms choose insurance coverage in the first period before they determine the output levels in the second period.Payoffs are not discounted.Firms purchase insurance coverage in the first period to reduce their second-period risk exposures in the competitive market. Here the firms' strategic insurance purchase before production can be interpreted as risk management strategies in a more general sense. The essential feature is that firms invest in risk management before the market competition. For instance, before launching a new product, firms in the final round may commit resources in pre-market research to evaluate more thoroughly the risk of the productand consequentially may invest in further product improvement if from the research they found it to be necessary. All these are for the purpose of reducing the potential post-sale operational risk. The question is how much resources they should commit to such research. There is a tradeoff between the cost of research and the expected benefit of research in reducing the risk exposure in the competitive market. Therefore our paper may also shed some light on how the competitiveness of the expected market environment in which firms compete affects these tradeoffs in more generalized settings.

Firm $i$'s output level is $q_i$, and for simplicity the marginal cost of production is normalized to zero. The (inverse) market demand is $P = a - bQ = a - b\sum_{i=1}^{n} q_i$, where $a, b \in \mathbb{R}_{++}$ are constant, and $Q$ is the aggregate output.Each firm faces a potential loss that is random and depending on its output level. For example, we can think of the loss as one caused by product problems that would potentially trigger a recall, whose costs would be proportional to sales; or we can think of the loss as operational risks such as environmental harms caused by production and the consequential litigation risks, costs of which would be related to the production levels. Denote firm $i$ 's random loss by $L(q_i) \equiv kq_i\theta$,where $k > 0$ is a constant representing the sensitivity of the risk to the production scale, and $\theta$ is normally distributed: $\theta \sim N(\mu, \sigma^2)$, $\mu \in \mathbb{R}_+, \sigma \in \mathbb{R}_{++}$. The risk exposure in our model best mimics the risks of commercial liability, product liability, professional liability, and business disruption insurance, etc. Firm $i$ chooses an insurance coverage, $\alpha_i \in [0,1]$,of its potential lossbefore its production decision.Before studying the case of no risk aversion in the next section, we assume in this section that firms(more precisely, firms' agents or decision-makers who decide output choices and risk management strategies) have CARA utility functions[3] with risk aversion parameter $\gamma \geq 0$. Then given the insurance coverage, $\alpha_i$, chosen at period 1, we can write firm $i$'s expected payoff in the second period as

$$U_i(q_i, q_j) \equiv \mathbb{E}_\theta\left[-exp\left\{-\gamma\left[\begin{matrix}\left(a - b\sum_{i=1}^{2} q_i\right)q_i \\ -(1-\alpha_i)kq_i\theta\end{matrix}\right]\right\}\right]. (1)$$

Inside the square brackets of the exponential function, the first item is the gross profit, and the second item is the uncovered loss.

The firm's ex ante expected payoff net of the insurance premium in the first period is

[3] The sources of firms' risk aversion could be the convexity of taxes, costs of bankruptcy or financial distress, or risk aversion of shareholders or managers (in this sense we are using a reduced-form model here in which the compensation of the firms' agents or decision makers is positively correlated with firms' net income), etc.

$$w_i(\alpha_i, \alpha_j) \equiv \mathbb{E}_\theta \left[ -exp \left\{ -\gamma \begin{bmatrix} (a - b\sum_{i=1}^{2} q_i^*) q_i^* \\ -(1-\alpha_i) k q_i^* \theta \\ -(1+\lambda)\alpha_i k q_i^* \mu \end{bmatrix} \right\} \right], (2)$$

where $q_i^*$ is firm $i$'s optimal output choice in the second period given its first period selection of insurance coverage. The last term inside the square brackets of the exponential function above is the (actuarially unfair) insurance premium payment.

## 3. Competitiveness of the Product Market and Corporate Demand for Insurance: The Case of Risk Averse Firms

***The Equilibrium***

We work backwards to solve for the equilibrium. In the second period, given the insurance coverage, $\alpha_i$, chosen at period 1, firm $i$ chooses its output level to maximize its expected payoff

$$Max_{q_i} U_i(q_i, q_j) = \mathbb{E}_\theta \left[ -exp \left\{ -\gamma \begin{bmatrix} \left( a - b \sum_{i=1}^{2} q_i \right) q_i \\ -(1-\alpha_i) k q_i \theta \end{bmatrix} \right\} \right]$$

$$= -exp \left\{ -\gamma \begin{bmatrix} \left( a - b \sum_{i=1}^{2} q_i \right) q_i - (1-\alpha_i) k q_i \mu \\ -\frac{1}{2} \gamma (1-\alpha_i)^2 k^2 {q_i}^2 \sigma^2 \end{bmatrix} \right\}.$$

For ease of notations, we denote

$$\varphi_i(q_i, q_j, \alpha_i) \equiv \begin{bmatrix} (a - b\sum_{i=1}^{2} q_i) q_i - (1-\alpha_i) k q_i \mu \\ -\frac{1}{2} \gamma (1-\alpha_i)^2 k^2 {q_i}^2 \sigma^2 \end{bmatrix}. (3)$$

Therefore,

$$U_i(q_i, q_j) = -exp\{-\gamma \varphi_i(q_i, q_j, \alpha_i)\}.$$

The first-order condition (FOC) entails:

$$\partial \varphi_i / \partial q_i = \begin{bmatrix} a - (1-\alpha_i) k \mu \\ -[2b + \gamma k^2 \sigma^2 (1-\alpha_i)^2] q_i \\ -b q_j - b v q_i \end{bmatrix} = 0, (4)$$

wherewe denote by $v \equiv dq_j/dq_i$ the *conjectural variations* parameter, which indicates firm $i$'s conjecture of firm $j$'s response to a unit changein its own output level. The conjectural variations (CV) model captures a broad range of market environments.Therefore, it is typically used to study the impact of market competitiveness (see Bresnahan, 1981; Perry, 1982; Kamien and Schwartz, 1983). For example, in our current model if for the moment abstracting from the random loss part, the first-order condition becomes $a - 2bq_i - bq_j - bq_i v = 0$. When $v = 0$, CV model characterizesthe Cournot model as a special case.When $v$ approaches $-1$, each firm expects its output expansion is almost exactly absorbed by a corresponding output reduction by the other firm. This implies that each firm is a price-taker, and the market isperfectly competitive with price equal to the marginal cost. When $v$ approaches 1, the market is collusive in that firms behave so as to maximize their joint profits. Therefore, we let $v \in (-1,1)$represent the competitiveness of the market, and investigate in this paper how the degree of market competitiveness affects firms' strategic demand for insurance. Seog (2006) shows that corporate insurance coveragemakes firms more aggressive in the product market competition. Wewill study, in a reverse path, how different degrees of rivalry in the market environment influence corporate insurance demand.

We make the following assumptions:

**A1**$v \in (-1,1)$.

**A2**$a > k\mu$.

As we see from the discussion above, the support of $v$ from assumption A1 covers all competitive market environments thatwe observe in real life and are interested to study. Assumption A2 is made to ensure that the market size ($a$ as a proxy) is not too small to cover the expected lossrelated to one unit of output. Otherwise, there would be no entry into this market.

A similar first-order condition for firm $j$'s output choice in the second period entails

$$\partial \varphi_j / \partial q_j = \begin{bmatrix} a - (1-\alpha_j) k \mu \\ -\left[ 2b + \gamma k^2 \sigma^2 (1-\alpha_j)^2 \right] q_j \\ -b q_i - b v q_j \end{bmatrix} = 0, (5)$$

wherewe implicitly assume that firms hold symmetric conjectural variations (which is typical in CV models and is reasonable since firms are ex ante identical): $dq_j/dq_i = dq_i/dq_j = v$.

For ease of notations, we denote

$$A \equiv a - (1-\alpha_i)k\mu;$$

$$B \equiv (2+v)b + \gamma(1-\alpha_i)^2k^2\sigma^2;$$

$$C \equiv (2+v)b + \gamma\left(1-\alpha_j\right)^2k^2\sigma^2;$$

and $$D \equiv a - \left(1-\alpha_j\right)k\mu. \quad (6)$$

The equilibrium output levels as the solution to the equations (4) and (5) are given by

$$q_i^*\left(\alpha_i, \alpha_j, v\right) = \max\left(\frac{AC - bD}{BC - b^2}, 0\right);$$

$$q_j^*\left(\alpha_i, \alpha_j, v\right) = \max\left(\frac{BD-bA}{BC-b^2}, 0\right). \quad (7)$$

**Lemma 1***Given the insurance coverage firms purchased in the first period,*

(a)$\partial q_i^*/\partial\alpha_i \geq 0; \partial q_i^*/\partial\alpha_j \leq 0$.

(b) $\partial q_i^*/\partial\gamma < 0$*if and only if*$C(1-\alpha_i)^2 q_i^* > b\left(1-\alpha_j\right)^2 q_j^*$;

(c) $\partial q_i^*/\partial v < 0$*if and only if*$Cq_i^* > bq_j^*$;

(d) *For the symmetric case where* $\alpha_i = \alpha_j = \alpha, \partial Q^*/\partial\alpha > 0, \partial Q^*/\partial\gamma \leq 0, \partial Q^*/\partial k \leq 0$, *and* $\partial Q^*/\partial v < 0$. *Moreover,* $\partial Q^*/\partial\alpha$ *is strictly decreasing in* $v$.

*Proof*: See Appendix A.□

From Lemma 1 we observe that, as found in Seog (2006), insurance coverage or more generally pre-competition risk management leads to more aggressive competition in the product market.[4]Also, Lemma 1 states that a higher degree of risk aversion, a higher sensitivity of risk exposures to the production scale, or a less competitive market environment leads to reduced output levels in the symmetric equilibrium. Moreover, the strategic effect of insurance under the symmetric equilibrium is strictly increasing in the competitiveness of the product market. For given asymmetric insurance coverage selections, the effect of risk aversion and/or the competitiveness of the market environment on the output choices depends on firms' relative market shares, insurance coverage selections, risk exposures and the competitive pressure.

In the followings, when appropriate, we may drop the arguments of the optimal output functions, and simply write as $q_i^*$ and $q_j^*$.In the first period, firm $i$ selects insurance coverage $\alpha_i$ to maximize its expected payoff

$$Max_{\alpha_i} w_i\left(\alpha_i, \alpha_j\right) = \mathbb{E}_\theta\left[-exp\left\{-\gamma\left[\left(a - b\sum_{i=1}^{2} q_i^*\right)q_i^* - (1-\alpha_i)kq_i^*\theta - (1+\lambda)\alpha_i k q_i^*\mu\right]\right\}\right]$$

$$= -exp\left\{-\gamma\left[\varphi_i\left(q_i^*, q_j^*, \alpha_i\right) - (1+\lambda)\alpha_i k q_i^*\mu\right]\right\}.$$

The first-order condition[5]entails

$$\frac{\partial\varphi_i}{\partial q_j}\frac{\partial q_j^*}{\partial\alpha_i} + \frac{\partial\varphi_i}{\partial\alpha_i} - (1+\lambda)k\mu q_i^* - (1+\lambda)\alpha_i k\mu\frac{\partial q_i^*}{\partial\alpha_i} = 0, \quad (8)$$

where we omit a term $\frac{\partial\varphi_i}{\partial q_i}\frac{\partial q_i^*}{\partial\alpha_i}$ since $\frac{\partial\varphi_i(q_i^*, q_j^*)}{\partial q_i} = 0$ by equation (4).

From the definition of $\varphi_i\left(q_i, q_j, \alpha_i\right)$ given in equation (3), the definitions of $A, B, C$ and $D$ given in equations (6), and the definitions of$q_i^*$ and $q_j^*$ given in equations (7), we have

[4]Also, this is, in spirit, related to Brander and Lewis (1986) which shows that higher financial leverage can be used by firms as a commitment device to compete aggressively in the product market.

[5]We omitted a similar first-order condition for firm $j$'s optimal insurance selection.

$$\frac{\partial \varphi_i}{\partial q_j}\frac{\partial q_j^*}{\partial \alpha_i} = -bq_i^* \frac{-(BC-b^2)[2\gamma k^2\sigma^2(1-\alpha_i)D + bk\mu] + 2(BD-bA)\gamma k^2\sigma^2(1-\alpha_i)C}{(BC-b^2)^2}$$

$$= \frac{bq_i^*}{(BC-b^2)^2}[bk\mu(BC-b^2) + 2b\gamma k^2\sigma^2(1-\alpha_i)(AC - bD)]$$

$$= \frac{b^2 q_i^*}{BC-b^2}[k\mu + 2\gamma k^2\sigma^2(1-\alpha_i)q_i^*].$$

$$\frac{\partial \varphi_i}{\partial \alpha_i} = k\mu q_i^* + \gamma k^2\sigma^2(1-\alpha_i)q_i^{*2}.$$

$$\partial q_i^*/\partial \alpha_i = \frac{(BC-b^2)k\mu C + 2(AC-bD)\gamma k^2\sigma^2(1-\alpha_i)C}{(BC-b^2)^2} = \frac{C}{BC-b^2}[k\mu + 2\gamma k^2\sigma^2(1-\alpha_i)q_i^*].$$

Therefore, from equation (8) we have:

$$\begin{bmatrix} \frac{b^2 q_i^*}{BC-b^2}[k\mu + 2\gamma k^2\sigma^2(1-\alpha_i)q_i^*] \\ +k\mu q_i^* + \gamma k^2\sigma^2(1-\alpha_i)q_i^{*2} \end{bmatrix} - (1+\lambda)\begin{bmatrix} kq_i^*\mu \\ +\frac{\alpha_i k\mu C}{BC-b^2}[k\mu + 2\gamma k^2\sigma^2(1-\alpha_i)q_i^*] \end{bmatrix} = 0,$$

which is simplified to

$$k\mu\left[(1+\lambda)\begin{bmatrix} b^2 q_i^* - \alpha_i k\mu C \\ -2\gamma k^2\sigma^2\alpha_i(1-\alpha_i)q_i^* C \end{bmatrix} - \lambda BC q_i^*\right] + \gamma k^2\sigma^2(1-\alpha_i)q_i^{*2}(BC+b^2) = 0. \quad (9)$$

Since firms are ex ante identical, we will focus on symmetric equilibrium, where

$$\alpha_i = \alpha_j = \alpha; A = D = a - (1-\alpha)k\mu \equiv \tilde{A}; B = C = (2+v)b + \gamma(1-\alpha)^2k^2\sigma^2 \equiv \tilde{B}. \quad (10)$$

We have $q_i^* = q_j^* = q^*(\alpha, v) = \frac{\tilde{A}}{\tilde{B}+b}$.

Applying symmetry, from equation (9) the first-order condition becomes:

$$k\mu\left[(1+\lambda)\begin{bmatrix} b^2\frac{\tilde{A}}{\tilde{B}+b} - \alpha k\mu\tilde{B} \\ -2\gamma k^2\sigma^2\alpha(1-\alpha)\frac{\tilde{A}\tilde{B}}{\tilde{B}+b} \end{bmatrix} - \lambda\frac{\tilde{A}\tilde{B}^2}{\tilde{B}+b}\right] + \gamma k^2\sigma^2(1-\alpha)(\frac{\tilde{A}}{\tilde{B}+b})^2(\tilde{B}^2+b^2) = 0. \quad (11)$$

Equation (11) can be rewritten as

$$k\mu(\tilde{B}+b)\left[(1+\lambda)\begin{bmatrix} b^2\tilde{A} - \alpha k\mu\tilde{B}(\tilde{B}+b) \\ -2\gamma k^2\sigma^2\alpha(1-\alpha)\tilde{A}\tilde{B} \end{bmatrix} - \lambda\tilde{A}\tilde{B}^2\right] + \gamma k^2\sigma^2(1-\alpha)\tilde{A}^2(\tilde{B}^2+b^2) = 0. \quad (11')$$

In order to analyze whether firms will purchase insurance, we would like to investigate the behavior of FOC (11') at $\alpha = 0$. With respect to equations (10), we denote

$$\tilde{A}_0 \equiv \tilde{A}\big|_{\alpha=0} = a - k\mu,$$

and $$\tilde{B}_0 \equiv \tilde{B}\big|_{\alpha=0} = (2+v)b + \gamma k^2\sigma^2. \quad (12)$$

From the FOC(11') we have

$$FOC|_{\alpha=0} = [\frac{\partial \varphi_i}{\partial q_j}\frac{\partial q_j^*}{\partial \alpha_i} + \frac{\partial \varphi_i}{\partial \alpha_i} - kq_i^*\mu - \alpha_i k\mu\frac{\partial q_i^*}{\partial \alpha_i}]\Big|_{\alpha_i=\alpha_j=\alpha=0}$$

$$= \left[k\mu\tilde{A}(\tilde{B}+b)[(1+\lambda)b^2 - \lambda\tilde{B}^2] + \gamma k^2\sigma^2\tilde{A}^2(\tilde{B}^2+b^2)]\right|_{\alpha=0}$$

$$= k\mu\tilde{A}_0(\tilde{B}_0+b)\left[(1+\lambda)b^2 - \lambda{\tilde{B}_0}^2\right] + \gamma k^2\sigma^2{\tilde{A}_0}^2({\tilde{B}_0}^2+b^2)$$

$$= k\mu\tilde{A}_0(\tilde{B}_0+b)\left[\frac{\gamma k^2\sigma^2\tilde{A}_0({\tilde{B}_0}^2+b^2)}{k\mu(\tilde{B}_0+b)} + b^2 - \lambda({\tilde{B}_0}^2 - b^2)\right]$$

$$= k\mu(a-k\mu)[(3+v)b + \gamma k^2\sigma^2]\{[(2+v)b + \gamma k^2\sigma^2]^2 - b^2\}\left[\bar{\lambda}(v) - \lambda\right], \quad (13)$$

where

$$\bar{\lambda}(v) \equiv \frac{\gamma k\sigma^2(a-k\mu)[(2+v)b+\gamma k^2\sigma^2]^2+b^2[(3+v)b\mu+a\gamma k\sigma^2]}{\mu[(3+v)b+\gamma k^2\sigma^2]\{[(2+v)b+\gamma k^2\sigma^2]^2-b^2\}}. \quad (14)$$

Obviously, $\bar{\lambda}(v) > 0$.Fromequations (13) and (14), we know that if $\lambda > \bar{\lambda}(v), FOC|_{\alpha=0} < 0$,which implies that firms will not purchase insurance at all. When $\lambda \leq \bar{\lambda}(v)$, firms will purchase insurance.Therefore, $\bar{\lambda}(v)$ is the cutoff level of insurance costs that determines whether firms will choose to invest in risk management prior to product market competition. This cutoff level of insurance costs is a function of the degree of the competitiveness of the product market environment.

Now assuming that $\lambda \leq \bar{\lambda}(v)$, therefore firms will choose to insure their potential losses, we would like to analyze whether firms will select full coverage in the risk management phase. This requires us to investigate the behavior of FOC (11') at $\alpha = 1$. Fromequations(10) we know

$$\tilde{A}\big|_{\alpha=1} = a, \text{and} \tilde{B}\big|_{\alpha=1} = (2+v)b.$$

Hence, from FOC (11') we have

$$FOC|_{\alpha=1} = [\frac{\partial\varphi_i}{\partial q_j}\frac{\partial q_j^*}{\partial\alpha_i} + \frac{\partial\varphi_i}{\partial\alpha_i} - kq_i^*\mu - \alpha_i k\mu\frac{\partial q_i^*}{\partial\alpha_i}]\bigg|_{\alpha_i=\alpha_j=\alpha=1}$$

$$= k\mu(\tilde{B}+b)\big[(1+\lambda)[b^2\tilde{A} - k\mu\tilde{B}(\tilde{B}+b)] - \lambda\tilde{A}\tilde{B}^2\big]\big|_{\alpha=1}$$

$$= b^3k\mu(3+v)[(1+\lambda)[a-k\mu(2+v)(3+v)] - \lambda a(2+v)^2]$$

$$= b^3k\mu(3+v)^2[a(1+v)+k\mu(2+v)][\underline{\lambda}(v)-\lambda], \quad (15)$$

where

$$\underline{\lambda}(v) \equiv \frac{a-k\mu(2+v)(3+v)}{(3+v)[a(1+v)+k\mu(2+v)]}. \quad (16)$$

From equation (15) we know that the sign of $FOC|_{\alpha=1}$ is the same as the sign of $\underline{\lambda}(v)-\lambda$. If $\underline{\lambda}(v)-\lambda < 0$, we have $FOC|_{\alpha=1} < 0$, which implies that firms will choose less-than-full coverage. If $\underline{\lambda}(v)-\lambda \geq 0$, we have $FOC|_{\alpha=1} \geq 0$, which implies that firms will choose to fully insure their potential losses.

Denote$f(v) \equiv (3+v)(2+v)$.Solving for $v^*$ such that $f(v^*) = a/k\mu$,we have

$$v^* = \frac{\sqrt{1+4(a/k\mu)}-5}{2}. \quad (17)$$

You can see an illustration of $f(v)$ and $v^*$ in Figure 1. If $v > v^*$, from equation (16) we have $\underline{\lambda}(v) < 0$, which implies that $FOC|_{\alpha=1} < 0$, so firms will only select partial, if not none, insurance coverage of their potential losses. If $v \leq v^*$,from equation (16) we have $\underline{\lambda}(v) \geq 0$. In this case the equilibrium insurance coverage firms purchase depends on the competitiveness of the product market and the cost of insurance. Given $v \leq v^*$, when $\lambda > \underline{\lambda}(v)$, firms select partial insurancesince $FOC|_{\alpha=1} < 0$ ; when $\lambda \leq \underline{\lambda}(v)$, we have $FOC|_{\alpha=1} \geq 0$, which implies that firms will select full insurance. We summarize the results discussed above in Proposition 1.

**Proposition 1** (a) *If $\lambda > \bar{\lambda}(v)$,firms do not purchase insurance at all.Only when $\lambda \leq \bar{\lambda}(v)$, do firms purchase insurance;*

(b) *Given $\lambda \leq \bar{\lambda}(v)$, when $v > v^*$, firms choose to only partially insure their potential losses. If $v \leq v^*$, then the equilibrium insurance coverage that firms purchase depends on the competitiveness of the product market and the cost of insurance: when $\lambda > \underline{\lambda}(v)$,firms select partial insurance; when $\lambda \leq \underline{\lambda}(v)$,firms select full insurance.*

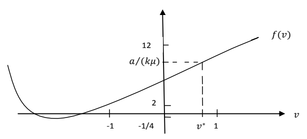



**Figure 1** Critical Value $v^*$ for Insurance Coverage Choice

Proposition 1 states that the cost of insurance and the competitiveness of the product market environment jointly shape firms' insurance decisions. Obviously, the higher the insurance costs, the less insurance firms purchase. When the insurance is too costly, firms choose not to insure at all. When insurance is not too costly, there exists a critical value of the competitiveness of the product market, which determines whether firms choose to acquire full or partial insurance.When the product market where firms compete is not so competitive[6] ($v > v^*$),even if the cost of insurance is below the insurance purchase threshold ($\bar{\lambda}(v)$), the firms will only select partial coverage. When the product market is quite competitive ($v \leq v^*$), firms may still choose to partially insure if the cost of insurance is not low ($\lambda > \underline{\lambda}(v)$); only whenthe product market is competitive and the cost of insurance is low, do firms choose full insurance for the potential losses.

As you can see from Figure 1, $f(v)$ is strictly increasing for any $v \in (-1,1)$,the interval of possible conjectural variations we assumed that covers all market environments which we are interested to study. From equations (16) and (17), we can see how changes in $a$ affect the threshold levels ----$v^*$ and$\underline{\lambda}(v)$.When$a \in [2k\mu, 12k\mu], v^*$ falls within $(-1,1)$. If $a < 2k\mu$, we have $v^* < -1$; and $\underline{\lambda}(v) < 0, \forall v \in (-1,1)$. In this case Proposition 1 implies that firms never purchase full insurance. If $a > 12k\mu$,we have $v^* > 1$; and $\underline{\lambda}(v) > 0, \forall v \in (-1,1)$. In this case, according to Proposition 1, firms may purchase full coverage when insurance costs fall below $\underline{\lambda}(v)$. We summarize this in the following corollary:

**Corollary 1***If $a < 2k\mu$, firms never acquire full insurance. If $a > 12k\mu$, firms may purchase full coveragewhenthe insurance costs are low--- $\lambda \leq \underline{\lambda}(v)$. If$a \in [2k\mu, 12k\mu]$, firms' insurance decisions are described by Proposition 1, depending on $v$ and $\lambda$.*

When the market size is small, the equilibrium production scale accordingly will not be large. This implies that the risk exposure in the product competition is limited since the risk exposure is proportional to the production scale. Therefore, it never pays off for firms to fully insure in a small market. By the same token, in a large market, when facing high competitive pressure and a not-so-expensive insurance supply, firms may purchase full coverage since firms will produce large scale output in a large market, subjecting themselves to a high degree of risk exposure.

We would like to further investigate the impact of the competitiveness of the product market on the cutoff levels characterizing firms' risk management strategies. From equation (14), we have:

[6] Remember that a lower $v$ represents a more competitive market environment.

$$\bar{\lambda}'(v) = \frac{\mu(\tilde{B}_0 + b)(\tilde{B}_0{}^2 - b^2)(2\gamma k\sigma^2\tilde{A}_0\tilde{B}_0 b + b^3\mu) - \begin{bmatrix} \gamma k\sigma^2\tilde{A}_0\tilde{B}_0{}^2 \\ +(3+v)b^3\mu + ab^2\gamma k\sigma^2 \end{bmatrix}\begin{bmatrix} b\mu\left(\tilde{B}_0{}^2 - b^2\right) \\ +2\mu(\tilde{B}_0 + b)\tilde{B}_0 b \end{bmatrix}}{\left[\mu(\tilde{B}_0 + b)(\tilde{B}_0{}^2 - b^2)\right]^2}$$

$$= \frac{b\mu(\tilde{B}_0 + b)\left\{(\tilde{B}_0{}^2 - b^2)(2\gamma k\sigma^2\tilde{A}_0\tilde{B}_0 + b^2\mu) - \begin{bmatrix} \gamma k\sigma^2\tilde{A}_0\tilde{B}_0{}^2 \\ +(3+v)b^3\mu + ab^2\gamma k\sigma^2 \end{bmatrix}\begin{bmatrix} (\tilde{B}_0 - b) \\ +2\tilde{B}_0 \end{bmatrix}\right\}}{\left[\mu(\tilde{B}_0 + b)(\tilde{B}_0{}^2 - b^2)\right]^2}$$

$$= \frac{b\left\{\begin{matrix} (\tilde{B}_0 - b)\left[2\gamma k\sigma^2\tilde{A}_0\tilde{B}_0{}^2 + b^2\mu\tilde{B}_0 + 2\gamma k\sigma^2\tilde{A}_0\tilde{B}_0 b + b^3\mu - \gamma k\sigma^2\tilde{A}_0\tilde{B}_0{}^2 - (3+v)b^3\mu - ab^2\gamma k\sigma^2\right] \\ -2\tilde{B}_0\left[\gamma k\sigma^2\tilde{A}_0\tilde{B}_0{}^2 + (3+v)b^3\mu + ab^2\gamma k\sigma^2\right] \end{matrix}\right\}}{\mu(\tilde{B}_0 + b)(\tilde{B}_0{}^2 - b^2)^2}$$

$$= \frac{b\left\{(\tilde{B}_0 - b)\begin{bmatrix} \gamma k\sigma^2\tilde{A}_0\tilde{B}_0{}^2 + 2\gamma k\sigma^2\tilde{A}_0\tilde{B}_0 b \\ -ab^2\gamma k\sigma^2 + b^2\mu(\tilde{B}_0 - (2+v)b) \end{bmatrix} - 2\tilde{B}_0\begin{bmatrix} \gamma k\sigma^2\tilde{A}_0\tilde{B}_0{}^2 \\ +(3+v)b^3\mu + ab^2\gamma k\sigma^2 \end{bmatrix}\right\}}{\mu(\tilde{B}_0 + b)(\tilde{B}_0{}^2 - b^2)^2}$$

$$= \frac{b\left\{(\tilde{B}_0 - b)\gamma k\sigma^2\left(\tilde{A}_0\tilde{B}_0{}^2 + 2\tilde{A}_0\tilde{B}_0 b - ab^2 + b^2\mu k\right) - 2\tilde{B}_0\left[\gamma k\sigma^2\tilde{A}_0\tilde{B}_0{}^2 + (3+v)b^3\mu + ab^2\gamma k\sigma^2\right]\right\}}{\mu(\tilde{B}_0 + b)(\tilde{B}_0{}^2 - b^2)^2}$$

$$= \frac{b\left\{\gamma k\sigma^2(\tilde{B}_0 - b)\left(\tilde{A}_0\tilde{B}_0{}^2 + 2\tilde{A}_0\tilde{B}_0 b - b^2\tilde{A}_0\right) - 2\tilde{B}_0\left[\gamma k\sigma^2\tilde{A}_0\tilde{B}_0{}^2 + (3+v)b^3\mu + ab^2\gamma k\sigma^2\right]\right\}}{\mu(\tilde{B}_0 + b)(\tilde{B}_0{}^2 - b^2)^2}$$

$$= \frac{b\left\{\gamma k\sigma^2\left[(\tilde{B}_0 - b)\tilde{A}_0\left(\tilde{B}_0{}^2 + 2\tilde{B}_0 b - b^2\right) - 2\tilde{A}_0\tilde{B}_0{}^3 - 2ab^2\tilde{B}_0\right] - 2\tilde{B}_0(3+v)b^3\mu\right\}}{\mu(\tilde{B}_0 + b)(\tilde{B}_0{}^2 - b^2)^2}$$

$$= \frac{b\left\{\gamma k\sigma^2\left[-(\tilde{B}_0 - b)\tilde{A}_0(\tilde{B}_0{}^2 + b^2) - 2b^2\tilde{B}_0(\tilde{A}_0 + a)\right] - 2\tilde{B}_0(3+v)b^3\mu\right\}}{\mu(\tilde{B}_0 + b)(\tilde{B}_0{}^2 - b^2)^2} < 0. \qquad (18)$$

We obtain the inequality by the assumptions A1 and A2,and the fact that $\tilde{A}_0, \tilde{B}_0, \tilde{B}_0 - b, \tilde{B}_0 + b$,and $3 + v$are all positive.

Similarly, from equation (16), we have

$$\underline{\lambda}'(v) = \frac{-(3+v)[a(1+v) + k\mu(2+v)]k\mu(5+2v) - [a - k\mu(2+v)(3+v)]\begin{bmatrix} a(1+v) + k\mu(2+v) \\ +(3+v)(a+k\mu) \end{bmatrix}}{\{(3+v)[a(1+v) + k\mu(2+v)]\}^2}$$

$$= \frac{-(3+v)[a(1+v) + k\mu(2+v)]k\mu(5+2v) - [a - k\mu(2+v)(3+v)][2a(2+v) + k\mu(5+2v)]}{\{(3+v)[a(1+v) + k\mu(2+v)]\}^2}$$

$$= \frac{-k\mu(5+2v)[a(1+v)(3+v) + k\mu(2+v)(3+v) + a - k\mu(2+v)(3+v)] - 2a(2+v)[a - k\mu(2+v)(3+v)]}{\{(3+v)[a(1+v) + k\mu(2+v)]\}^2}$$

$$= \frac{-ak\mu(5+2v)(2+v)^2 - 2a(2+v)[a - k\mu(2+v)(3+v)]}{\{(3+v)[a(1+v) + k\mu(2+v)]\}^2}$$

$< 0$when$v < v^*$. (19)

We obtain the inequality because, first, the denominator is positive;and second, in the numerator, the first term is negative, and the second term is also negativewhen $v < v^*$.

Since $\bar{\lambda}(v)$ is the cost-of-insurance threshold characterizing firms' decision whether to acquire insurance, and $\underline{\lambda}(v)$ is the cost-of-insurance threshold characterizing firms' decision whether to select full coverage, we have the following proposition from inequalities (18) and (19):

**Proposition 2***The more competitive the product market is, the more likely firms choose to insure their potential losses.Furthermore, when $v < v^*$, the morecompetitive the product market is, the more likely firms select full coverage.*

Proof of Proposition 2 follows from the inequalities (18) and (19), and Proposition 1. By inequality (18), a lower $v$, which represents a more competitive product market environment, leads to a higher $\bar{\lambda}$, thus a higher likelihood of satisfying $\lambda < \bar{\lambda}$, which triggers insurance purchase according to Proposition 1. Similarly, by inequality (19), given $v < v^*$,a lower $v$ leads to a higher $\underline{\lambda}$, thus a higher likelihood of satisfying $\lambda < \underline{\lambda}$, which triggers full coverage selection according to Proposition 1.Proposition 2 illustrates that higher competitive pressure drives more strategic demand for insurance.

***Discussion: The Case of $\gamma \to 0$***

It would be interesting to examine how firms' insurance decisions are influenced by purely strategic factors characterized in the product market competition, absent any risk version considerations. Here I first discuss the case of the risk aversion parameter $\gamma$ approaching zero.

In the three critical values characterizing firms' optimal insurance decisions, both $v^*$ and $\underline{\lambda}(v)$ are independent of $\gamma$.According to Proposition 1, this implies that given firms will acquire insurance, whether they will select partial or full coverage does not depend on risk version at all, but only depends on the insurance costs and the competitiveness of the product market ---- a pretty counter-intuitive result implied from our analysis.

From equation (14), we know that $lim_{\gamma \to 0} \bar{\lambda}(v) = \frac{1}{(1+v)(3+v)} > \frac{1}{8}, \forall v \in (-1,1)$. This implies that firms will always purchase insurance if $\lambda \leq 1/8$, according to Proposition 1. Moreover, $lim_{\gamma \to 0} \bar{\lambda}(v)$ is decreasing in $v$, which implies that the more competitive the product market is, the more likely firms will acquire insurance, by Proposition 1. We summarize the results in the following corollary.

**Corollary 2** (a) *Given that firms will acquire insurance, whether they will select partial or full coverage does not depend on the risk aversion parameter, but only on the cost of insurance and the competitiveness of the product market;*

(b) *When $\gamma \to 0$, firms' likelihood of purchasing insurance is increasing in the competitiveness of the product market environment, and they will always purchase insurance if $\lambda \leq 1/8$.*

## 4. The Case of No Risk Aversion

In this section, in order to focus on the pure strategic effect of corporate insurance on the product market competition, filtering any risk version considerations, we study the case of no risk aversion in a simplified version of the model where the risk ($\sigma$) itself does not affect firms' insurance selection per se.

The framework is basically the same as before, except that given the insurance coverage, $\alpha_i$, chosen at period 1, firm $i$ 's expected payoff in the second period is

$V_i(q_i, q_j, \alpha_i) \equiv \left(a - b\sum_{i=1}^{2} q_i\right)q_i - (1 - \alpha_i)kq_i\mu$.(20)

Accordingly, the firm's expected payoff net of the insurance premium in the first period is

$\pi_i(\alpha_i, \alpha_j) \equiv \left(a - b\sum_{i=1}^{2} q_i^*\right)q_i^* - (1 - \alpha_i)kq_i^*\mu - (1 + \lambda)\alpha_i k q_i^* \mu$.(21)

In the second period, firm $i$ chooses its output level to maximize its expected payoff

$$Max_{q_i} V_i(q_i, q_j, \alpha_i).$$

The first-order condition (FOC) entails:

$\partial V_i / \partial q_i = a - (1 - \alpha_i)k\mu - (2 + v)bq_i - bq_j = 0,$ (22)

where, again, $v$ is the conjectural variationsparameter.

A similar first-order condition for firm $j$'s output choice in the second period entails

$\partial V_i/\partial q_j = a - \left(1-\alpha_j\right)k\mu - (2+v)bq_j - bq_i = 0.$ (23)

The equilibrium output levels as the solution to the equations (22) and (23) are given by

$$q_i^*(\alpha_i,\alpha_j,v) = \max\left(\frac{(2+v)[a-(1-\alpha_i)k\mu] - \left[a-\left(1-\alpha_j\right)k\mu\right]}{b(3+v)(1+v)},0\right) = \max\left(\frac{(2+v)A-D}{b(3+v)(1+v)},0\right);$$

$$q_j^*\left(\alpha_i,\alpha_j,v\right) = \max\left(\frac{(2+v)\left[a-\left(1-\alpha_j\right)k\mu\right]-\left[a-\left(1-\alpha_i\right)k\mu\right]}{b(3+v)(1+v)},0\right) = \max\left(\frac{(2+v)D-A}{b(3+v)(1+v)},0\right).\quad(24)$$

For the symmetric case where $\alpha_i = \alpha_j = \alpha$, we have

$$q^*(\alpha,v) = \frac{a-(1-\alpha)k\mu}{b(3+v)};\ \text{and}\ Q^* = \frac{2[a-(1-\alpha)k\mu]}{b(3+v)}.\quad(25)$$

We have the following lemma:

**Lemma 2** *In the case of no risk aversion, given the insurance coverage firms purchased in the first period,*

(a) $\partial q_i^*/\partial\alpha_i \geq 0; \partial q_i^*/\partial\alpha_j \leq 0.$ *In particular, if* $\alpha_i > (2+v)\alpha_j + (1+v)\frac{a-k\mu}{k\mu}, q_j^* = 0,$ *and* $q_i^* = \frac{(2+v)A-D}{b(3+v)(1+v)} > 0.$ *In other words, a firm with an insurance coverage sufficiently higher than the one selected by its rival may effectively drive out the rival and achieve monopoly;*

(b) $\partial q_i^*/\partial\alpha_i$ *is decreasing in* $v$; $\partial q_i^*/\partial\alpha_j$ *is increasing in* $v$;

(c) $\partial q_i^*/\partial v < 0$ *if and only if* $\frac{a-(1-\alpha_i)k\mu}{a-\left(1-\alpha_j\right)k\mu} > \frac{2(2+v)}{(2+v)^2+1}$; *i.e., if and only if the relative insurance commitment effect is greater than the competitive pressure effect. In particular,* $\partial q_i^*/\partial v < 0$ *when* $\alpha_i > \alpha_j$;

(d) *For the symmetric case where* $\alpha_i = \alpha_j = \alpha, \partial Q^*/\partial\alpha > 0, \partial Q^*/\partial k \leq 0,$ *and* $\partial Q^*/\partial v < 0.$

*Proof*: See Appendix B.□

Lemma 2(a) confirms the strategic effect of corporate insurance in the product market competition in the case of no risk aversion. Especially, when the asymmetric commitment advantage through insurance is sufficiently great, a firm may successfully drive out its rival and attain monopoly. This implies that investment in risk management may be used as an exclusionary deviceby incumbent firms to prevent entry or induce exit of rivals if firms in the market are subject to differential liquidity constraints such as that supposed in the "long-purse" (or "deep-pockets") theory in industrial organization (see, for example, Tirole (1988), Benoit (1986), and Telser (1966)). Lemma 2(b) tells us that the strategic commitment effect of insurance is monotonically increasing in the competitiveness of the product market environment. A fiercer product market competition makes the strategic commitment effect of corporate insurance more salient. Lemma 2(d) states that a higher sensitivity of risk exposures to the production scale, or a less competitive market environment leads to reduced output levels in the symmetric equilibrium. According to Lemma 2(c), for given asymmetric insurance coverage selections, the effect of competitiveness of the product market environment on the output choices depends on firms' relative insurance coverage selections, and the competitiveness of the product market. In particular, a firm with relatively higher insurance coverage will be more aggressive as the product market environment becomes more competitive.

In the first period, firm $i$ selects insurance coverage $\alpha_i$ to maximize its expected payoff

$$Max_{\alpha_i}\pi_i\left(\alpha_i,\alpha_j\right) = V_i\left(q_i^*,q_j^*,\alpha_i\right) - (1+\lambda)\alpha_i k q_i^*\mu.$$

The first-order condition entails

$$\frac{\partial V_i}{\partial q_j}\frac{\partial q_j^*}{\partial\alpha_i} + \frac{\partial V_i}{\partial\alpha_i} - (1+\lambda)k\mu q_i^* - (1+\lambda)\alpha_i k\mu\frac{\partial q_i^*}{\partial\alpha_i} = 0,\quad(26)$$

where we omitted a term $\frac{\partial V_i}{\partial q_i}\frac{\partial q_i^*}{\partial\alpha_i}$ since $\frac{\partial V_i(q_i^*,q_j^*,\alpha_i)}{\partial q_i} = 0$ by equation (22).

Using the definition of $V_i\left(q_i,q_j,\alpha_i\right)$ given in equation (20), and the definitions of $q_i^*$ and $q_j^*$ given in equations (24), we can simplify equation (26) as

$bq_i^* - b\lambda(3+v)(1+v)q_i^* - (1+\lambda)(2+v)k\mu\alpha_i = 0$.(27)

Again, we will focus on symmetric equilibrium. Therefore, $\alpha_i = \alpha_j = \alpha$, and $q_i^* = q_j^* = q^*(\alpha, v) = \frac{a-(1-\alpha)k\mu}{b(3+v)}$. Substituting these into equation (27), we have

$\alpha^* = \min\left(\max\left(\frac{1-\lambda(3+v)(1+v)}{v^2+5v+5+\lambda(3+v)(3+2v)}\frac{a-k\mu}{k\mu}, 0\right), 1\right)$.(28)

Denote

$g(v) \equiv \frac{1}{(3+v)(1+v)}$; (29)

and

$\overline{v}(\lambda) \equiv \sqrt{1+\frac{1}{\lambda}} - 2$, when $\lambda > 0$. (30)

Then we have the following proposition:

**Proposition 3** *In the case of no risk aversion,*

(a) *given the competitiveness of the product market as represented by* $v$, *firms will acquire insurance when* $\lambda < g(v)$, *i.e., when the cost of insurance is low compared to its strategic commitment effect; given the cost of insurance as represented by* $\lambda > 0$, *firms will acquire insurance when* $v < \overline{v}(\lambda)$, *i.e., when the product market is more competitive than represented by* $\overline{v}(\lambda)$.
(b) *The more competitive the product market is, the more likely firms will purchase insurance. Furthermore, the insurance coverage firms select is increasing in the competitiveness of the product market.*
(c) *Given firms will purchase insurance, the coverage they select is increasing in the market size, and is decreasing in the sensitiveness of risk to the production scale.*
*Proof:* See Appendix C.□

Proposition 3 states that even when there is no risk aversion in the utility function, firms may still acquire insurance, for the strategic effect in the product market. Similarly, the cost of insurance and the competitiveness of the product market environment jointly shape firms' insurance decisions. When the cost of insurance is less than the strategic benefit of insurance, or when the product market is quite competitive, firms will purchase coverage for their risk exposures. Both the likelihood and the coverage selected are monotonically increasing in the competitiveness of the product market. Moreover, the equilibrium insurance coverage is increasing in the market size, but decreasing in the sensitiveness of risk to the production scale. The latter is because the equilibrium production level is decreasing in the risk sensitiveness.

## 5. Empirical Test

From the theoretical results, we have and will test the following hypotheses:

**Hypothesis 1:** Given the cost of insurance, more intense product market competition faced by firms induces them to purchase a higher level of insurance coverage.

**Hypothesis 2:** Given the cost of insurance, firms will choose a higher level of insurance coverage as the size of product market in which they operate increases.

**Hypothesis 3:** Provided that product market characteristics remain unchanged, as the cost of insurance increases, the amount of insurance demanded by firms will decrease.

### 5.1. Data and Empirical Methodology

In order to test the implications of our theoretical model empirically, we examine the demand for reinsurance by U.S. primary insurers. Although it would provide a more general test on corporate demand for insurance to utilize data on insurance purchases by general firms as in recent studies such as Zou, Adams, and Buckle (2003,using Chinese data), Regan and Hur (2007, using Korean data), and Michel-kerjan, Raschky, and Kunreuther (2009, using U.S. catastrophe insurance data), we will focus on the property-liability insurance industry due to data limitations, as in most empirical studies on this subject (Mayers and Smith, 1990; Garven and Lamm-Tennant, 2003; Cole and McCullough, 2006; Powell and Sommer, 2007). However, it should be emphasized that, to our knowledge, our empirical analysis is the first study that incorporates product market environment factors - the competitiveness and size of the market in which firms operate - and the costs of reinsurance that are defined as firm-specific based on detailed information about reinsurance transactions of primary insurers and their affiliated groups if they belong to any.

As in previous studies that utilize the insurance industry to test corporate demand for insurance, our dependent variable, *REINS*, measures how much portion of the total premiums of an insurer, which is the sum of its direct premiums written and reinsurance assumed, is ceded either to affiliates or to external companies. We also estimate the same equation with the ratio of reinsurance premiums ceded only to external companies, *EXT_REINS,* because insurers might have different incentives to purchase external reinsurance from those to transfer premiums to affiliates as concretely examined in Powell and Sommer (2007).

In our study, independent variables of main interest are product market related variables. Given that there are significant differences between different lines of business and states, we define a product market in which primary insurers operate as a market segmented by lines of business and states and compute its market size and concentration measures, such as the Herfindahl-Hirschman index (HHI), the four-firm and ten-firm concentration ratios ($CR_4$ and $CR_{10}$). More specifically, market size that represents the density of consumers in a market is measured by taking the sum of direct premiums written for firms operating in a given market. Market concentration measures enumerated above have been widely used to measureproduct market competitivenessin many studies. The underlying idea behind these measures is that lower concentration reflects a higher degree of market competition among firms in the market. After obtaining market size and concentration variables for each market, we construct firm-specific market related variables by computing the weighted averages of these variables over all the markets in which an insurer is doing business. Here, the weight for each market is the portion of direct premiums written in that particular market for the insurer. We thus obtain firm-specific market size and concentration ratios and label them as *MKTSIZE, CONC_HHI, CONC_CR4, CONC_CR10*, respectively, where *MKTSIZE* is log transformed because of itsskewness to the right. Given that most primary insurers tend to diversify their business for the purpose of risk pooling,[7] the firm-specific variables above are expected to capture the overall level of market demand size and market competitiveness for each insurer. Based on the results of our theoretical model, we expect a positive relation between *MKTSIZE* and reinsurance demand and a negative relation between either of market concentration variables and reinsurance demand.

We now describe how to measure reinsurance supply side variables that captures the cost of reinsurance and the financial status of reinsurers in our analysis. Cole and McCullough (2006) show the importance of incorporating reinsurance industry factors in the equation for reinsurance demand by primary insurers. However, in contrast with their study utilizing reinsurance industry average factors that are identically applied to all primary insurers, we consider differences across firms in terms of the source of reinsurance supply. Each firm may cede its premiums either to its affiliates or to U.S. or non-U.S. unaffiliated insurers. If the financial status of its affiliates or its reinsurance partners outside of its group changes, the insurer will take into account that situation when it decide the amount of reinsurance ceded. Since the status of affiliates or that of reinsurance partners varies across insurers, we can capture firm-specific reinsurance supply-side changes that may affect their demand for reinsurance. To do so, we use the combined ratio and the development of loss reserves as in Cole and McCullough (2006). The combined ratio of a firm, which includes both underwriting expenses and loss ratios, is negatively associated with the price of insurance provided by the firm (Cole and McCullough, 2006).[8] Thus, we expect to capture the cost of reinsurance by measuring the overall levels of combined ratios of affiliates and those of unaffiliated reinsurance partners. The loss development (the 2-year loss development in our analysis) shows whether or not the firm successfully anticipates and prepares for claim payments. Note that a positive (negative) value indicates

[7]In our sample, the average number of lines of business for which a primary insurer is operating is 6 and that of states is 14.

[8] A more standard measure would be the economic premium ratio that is often used in the literature (e.g., Winter, 1994; Cummins and Danzon, 1997; Cole and McCullough, 2006) because it reflects the present value of expected loss cash flows whose patterns vary with lines of business. However, our regression results show that the measures based on the combined ratio are enough to show the implications of the cost of reinsurance.

that the firm has been under-reserving (over-reserving). As in Cole and McCullough (2006), this loss development variable is used not only as a firm-specific control variable influencing the demand for reinsurance by primary insurers, but also as anindication of a reinsurer's financial status. The former is because insurers under-reserving are expected to demand more reinsurance to complement reserving errors, whereas the latter is suggested by prior studies (e.g., Petroni, 1992) that show that financially troubled insurers are more likely to understate loss reserves.

To obtain the group level variables, we identify which firms engage in reinsurance transactions within the group more heavily using the variable of reinsurance assumed from affiliates and then compute the weighted averages of combined ratio and loss reserve developmentso as to reflect the status of those firms assuming more reinsurance from affiliates with higher weights. These group status variables are denoted by$GROUP_COMB$ and $GROUP\_LOSS\_DEV$ and included in the regression after being multiplied by group dummy variable, $G\_DUMMY$, which is one only if the firm belongs to a group and zero otherwise.

In addition to reinsurance pooling and transactions with affiliates, many of reinsurance transactions of primary insurers occur with U.S. unaffiliated insurers, which are a professional reinsurer or another primary insurer.[9] Based on the data on reinsurance transactions in Schedule F (Part 3) of the NAIC database, we identify to whom and how much a primary insurer transfers its premiums among U.S. unaffiliated insurers. We then compute the weighted averages of combined ratios and loss development of those unaffiliated reinsurance partners with which the primary insurer transacts by placing a higher weight on a firm assuming more reinsurance. The first variable, *US_UNAFF_COMB,* is used to capture the firm-specific cost of reinsurance that the primary insurer faces for ceding its premiums to those U.S. unaffiliated insurers, whereas the second variable, *US_UNAFF_LOSS_DEV,* may reflect the financial quality of its reinsurance partners. The last source of reinsurance supply to be considered in our analysis is non-U.S. reinsurers. Due to data limitations, we are only able to measure the average combined ratios of non-U.S. reinsurers among the top 100-150 reinsurers around the world, $NONUS\_COMB$, and include this variable multiplied by $NONUS_DUMMY$in the regression that is one only if the primary insurer purchases reinsurance from a non-U.S. reinsurer and zero otherwise.

Our empirical approach to examine the demand for reinsurance by primary insurers is presented by the following equations that are estimated by ordinary least squares (OLS) regression with standard errors that are robust to clustering at the firm level. The dependent variable, $REINS_{it}$, represents the overall reinsurance ratio for insurer *i* in year *t*. As mentioned earlier, we also test the demand for external reinsurance, $EXT\_REINS_{it}$ , with the same set of independent variables.

$$REINS_{it} = \beta_0 + \beta_1 CONC_{it} + \beta_2 MKTSIZE_{it} + \beta_3 G\_DUMMY_{it} * GROUP\_COMB_{jt} + \beta_4 G\_DUMMY_{it} * GROUP\_LOSS\_DEV_{jt} + \beta_5 US\_UNAFF\_DUMMY_{it} * US\_UNAFF\_COMB_{it} + \beta_6 US\_UNAFF\_DUMMY_{it} * US\_UNAFF\_LOSS\_DEV_{it} + \beta_7 NONUS\_DUMMY_{it} * NONUS\_COMB_t + \gamma' X_{it} + \delta_t + \varepsilon_{it} \quad (31)$$

Based on the discussion above, our main independent variables are explicitly specified in the equation. Note that the variables of market concentration and size are firm-specific and that we expect to see a negative impact of the former and a positive impact of the latter on reinsurance demand. The next five variables attempt to capture the cost of reinsurance offered by reinsurance partners, proxiedby the negative of the combined ratio, and their financial status, measured by theloss development, especially by distinguishing three channels of reinsurance supply. Both our model and prior studies predict a negative impact of reinsurance cost variable, that is, positive signs of $\beta_3, \beta_5$, and $\beta_7$. If ceding companies care about the financial soundness of affiliates and unaffiliated reinsurance partners and the loss development is negatively associated with a firm's financial quality, the demand for reinsurance through that channel will decrease,

[9] Of reinsurance transactions with U.S. unaffiliated insurers, 30-40 percent occur among primary insurers based on the NAIC or A.M. Best definition of professional reinsurers.

thereby negative signs of $\beta_4$ and $\beta_6$.

$X_{it}$ is a vector of other firm-specific factors that are known to affect reinsurance activity from prior studies, such as a firm'ssize, ROA, leverage, tax-exempt investment, loss development, catastrophe exposure, line of business and geographic Herfindahl indexes, group affiliation, organizational form, and line of business controls. Finally, $\delta_t$ represents year fixed effects, and $\varepsilon_{it}$ is a random error term.[10]

Our sample used in the empirical analysis is obtained from the National Association of Insurance Commissioners (NAIC) database for the years 1995 through 2008. The data on the combined ratios of non-U.S. reinsurers that are the top 100-150 reinsurers around the world are obtained from Standard and Poor's *Global Reinsurance Highlights* (1998-2009 editions). We remove consolidated financial data for insurance groups and observations with non-positive assets, surplus, and premiums earned. Since our analysis intends to look at reinsurance decisions by primary insurers, professional reinsurers, which are identified by the NAIC definition or the A.M. Best definition,[11] are excluded from the sample. To avoid the effects of extraordinary operating behaviors, we also exclude insurers with non-positive direct premiums written, those whose status is identified as inactive, and those with reinsurance ratios that are not between zero and one. We then winsorize several firm-specific variables to remove the potential effects of outliers, including assets, premiums earned, surplus, ROA, 2-year loss development, leverage, combined ratio, at the 2 percent and 98 percent levels for each year. The final sample consists of 2,996 U.S. primary insurers and 26,668 firm-year observations from 1995 to 2008.

### 5.2. Empirical Results

Table 2 provides the summary statistics for the variables used in the regression analysis. First, our dependent variables are shown in the top of the table. The average ratio of reinsurance ceded either to affiliates or to external insurers is 0.3796, whereas that of reinsurance ceded only to external insurers is 0.1715. Independent variables are classified into three categories – insurance market related variables, reinsurance supply side variables, and other firm-specific controls. The first four variables alternatively measure the weighted average of market concentration where the weights are the proportions of direct premiums written in specific markets for each firm. Accordingly, these variables are expected to capture the overall level of market competition that an insurer operating in different states for several lines of business faces. Given that a HHI index below 0.15 or a four-firm concentration ratio below 0.5 largely indicates low market concentration, primary insurers, on average, confront intense market competition. Of the entire observations, 63 percent are those of affiliated firms that engage in internal reinsurance activity, 72 percent cede premiums to U.S. unaffiliated insurers, and 51 percent transactwith a non U.S. reinsurer. The weighted average group combined ratio is 1.06, whereas that of U.S. unaffiliated reinsurance partners is 1.18 and the average combined ratio of non-U.S. reinsurers is 1.02. Contrary to Cole and McCullough (2006), the difference in the average combined ratio between non-U.S. reinsurers and U.S. unaffiliated insurers assuming reinsurance is negative. The reason might be different sample periods or that the latter combined ratio is not simply an average of all the U.S. reinsurers, but the weighted average combined ratio of firm-specific reinsurance partners. Using the 2-year loss development variable, we can say that affiliated groups and U.S. unaffiliated reinsurance partners, on average, over reserved during the sample period, which implies the overall sound financial performance of the reinsurance supply-side even though there might be some fluctuation over time. The statistics for other firm-specific controls are similar to those in other studies (Cole and McCullough, 2006; Powell and Sommer, 2007).

[10] To control for potential endogeneity, we use lagged independent variables as suggested by prior studies (e.g., Cole and McCullough, 2006). However, our main results still hold with non-lagged independent variables.

[11] Cole and McCullough (2008) summarize and compare different definitions of professional reinsurers from prior studies, including the NAIC definition – any firm in which reinsurance assumed from non-affiliates is more than 75 percent of reinsurance assumed from non-affiliates plus direct business written – and the A.M. Best definition – any firm in which reinsurance assumed from non-affiliates is more than 75 percent of reinsurance assumed from affiliates plus direct business written.

Results for the regression equation (31) in which the dependent variable is the total reinsurance ratio, *REINS*, are shown in Table 3. Note that the three regressions are distinguished by the alternative market concentration variables and that the results are very similar in these specifications. To begin with, we find that firm-specific control variables, which are included based on prior studies, show fairly consistent results. The significant coefficients on size and leverage are consistent with those of prior studies that test the hypothesis that insurers with higher default risk tend to purchase more reinsurance. Consistent with the results of prior studies, insurers with higher catastrophe exposures and lower concentration in terms of business mix, geographically less concentrated insurers, those under-reserving more, stock insurers, and those affiliated demand more reinsurance. Only the effects of return on assets and tax-exempt investments are different from those found in the literature.[12]

As noted earlier, ourmaininterest concerns insurance market related variables that are defined as firm-specific. The results provide strong support for our predictions from the model regarding the intensity of market competition and market size. As predicted by our theory, the coefficient of the firm-specific level of market concentration is significantly negativeat the 10% level, whereas the coefficient of market size variable is positive and significantat the 10% level. Thus, these estimates suggest that greater market competition and greater market size lead to greater reinsurance demand. In addition, it should be emphasized that reinsurance supply side variables are largely found to significantly affect reinsurance demand by primary insurers. First, the coefficients of *GROUP_COMB* and *US_UNAFF_COMB* are significantly positive at the 5% and 1% level, respectively, thereby implying that regardless of whether affiliates or U.S. unaffiliated insurers provide reinsurance, the demand for reinsurance decreases as the cost of reinsurance increases. However, the price of a reinsurance contractoffered by non-U.S. reinsurers does not significantly affect the overall demand for reinsurance.

The variables capturing the financial status of reinsurance partners, *GROUP_LOSS_DEV* and *US_UNAFF_LOSS_DEV,* are found to be significantly positive and negative (at the 10% and 5% level, respectively). As discussed earlier, higher loss development implies poor financial status of reinsurance partners, which may, in turn, decrease the demand for reinsurance. However, there might be a substitution effect between reinsurance transactions through affiliates and those with U.S. unaffiliated insurers because our dependent variable combines both internal and external reinsurance in the regressions in Table 3. That is, for example, if affiliates undergo financial difficulties, insurers may not only reduce internal reinsurance, but also increase external reinsurance at the same time. The combined effect for transactions within the group turns out to be positive, that is, the substitution effect is dominant, whereas the combined effect for reinsurance purchases through U.S. unaffiliated insurers appears to be negative, that is, the increase in the demand for internal reinsurance does not dominate the reduction in the demand for external reinsurance when U.S. unaffiliated reinsurance partners have some financial difficulties.

Furthermore, the estimated effects of these main variables are also economically significant.[13] From the coefficients in

[12] The return on assets, which is included based on the underinvestment hypothesis that reinsurance is used to reduce the likelihood of rejecting positive net present value projects (Cole and McCullough, 2006), is significantly positive in contrast with the prediction. As Cole and McCullough (2006) point out, it could be because of the inclusion of both return on assets and leverage. Dropping *ROA* does not change the results except for the effect of tax-exempt investment. In our results, tax effect turns out to be significantly negative. The theory of Garven and Lamm-Tennant (2003) predicts higher demand for reinsurance by insurers with greater tax favored assets, thereby a positive association between reinsurance demand and tax favored assets. However,they and Cole and McCullough (2006) do not find evidence to support the hypothesis. Powell and Sommer (2007) find a significantly positive tax effect only for internal reinsurance. Our negative effect might be the interaction between *ROA* and tax-exempt investments, as the significance of tax-exempt investments disappears in the regression that drops *ROA*.

[13] The economic effect of an independent variable is measured as the estimated coefficient

specification (1), a one standard deviation increase in the index of market competition faced by a primary insurer, captured by the negative of *CONC_HHI*, is associated with a 2.3% of one standard deviation increase in reinsurance demand. A one standard deviation increase in market size (log-transformed), *MKTSIZE*, increases the reinsurance ratio by 6.8%. The coefficients on *GROUP_COMB* and *US_UNAFF_COMB* can be interpreted as an 8.8% and 7.8% reduction in reinsurance demand when the cost of reinsurance offered by affiliates and U.S. unaffiliated insurers, respectively, increases by one standard deviation. A one standard deviation deterioration in the overall financial status of affiliates, measured by *GROUP_LOSS_DEV,* increase the reinsurance ratio by 2.3%, whereas that of U.S. unaffiliated reinsurance partners, captured by *US_UNAFF_LOSS_DEV,* lowers it by 3.7%. Given that the economic effects of the loss-developmentand catastrophe exposure are 4.9% and 3.7%, it can be argued that the firm-specific market related variables and reinsurance supply side variables also have considerable explanatory power even compared to other control variables suggested by prior studies.

The next set of regressions in Table 4 analyzes the demand for external reinsurance for the purpose of comparison. First, market competition shows both significantly and economically greater impact on external reinsurance than it does on total reinsurance including both external and internal reinsurance, whereas the significance and the size of economic effect of market size is reduced compared to the results in Table 3. Second, comparing the coefficients of reinsurance cost variables in Table 3 and Table 4, one can see the opposite sign of the coefficient on *GROUP_COMB*. If reinsurance can be obtained through affiliates at a cheaper price, that is, higher *GROUP_COMB*, the demand for external reinsurance is found to decrease. The cost of reinsurance provided by U.S. unaffiliated insurers have greater economic effect (17.7%), which is grater than the economic effect of size, -13.5% (the largest effect among other firm-specific controls). Moreover, the cost of reinsurancethat is incurred in the contract with non-U.S. reinsurers, *NONUS_COMB,* shows significant (at the 1% level) and economic impact of 2.9% on external reinsurance. The financial status of affiliates loses explanatory power for external reinsurance, but the sign change of the coefficients in specification (2) and (3) in Table 3 and 4 may imply that insurers alternatively use external reinsurance when their affiliates have financial difficulties. Changes in the estimates of other firm-specific controls are consistent with the results of Powell and Sommer (2007) that estimate external reinsurance demand separately. Taken together, the empirical results provide strong evidence for the predictions of our theory regarding the effects of market competition and market size as well as those of reinsurance cost. Furthermore, we complement prior empirical studies that examine reinsurance demand by taking into account the variables related to primary insurance markets (product markets) and reinsurance supply side variables that reflect differences across firms.

multiplied by the ratio of the standard deviation of the independent variable to the standard deviation of the dependent variable.

## 6. Conclusion

We show in this article through a simple conjectural variations model that the external product market environment plays an important role in firms' insurance decisions. Interestingly, there exists a monotonic relation between firms' insurance coverage selections and the competitiveness of the product market environment where firms compete. A more competitive product market induces firms to transfer more of their risk exposures to the insurance companies. The interaction of the strategic effect of insurance, the cost of insurance and the competitiveness of the product market leads to this clear prediction of the influence of the product market environment on firms' risk management strategies. The monotonic relation holds true no matter whether firms exhibit risk aversion or not in their preferences. This empirical prediction would be convenient for analyzing corporate risk management in a broader framework that is not restricted to financial hedging as considered in most of the literature. Our empirical tests using the data from the insurance industry provide strong support of the theoretical predictions.

## References

Ashby, S.G. and S.R. Diacon. 1998. "The Corporate Demand for Insurance: A Strategic Perspective," *Geneva Papers on Risk and Insurance*, 23:34-51.

Benoit, J-P. 1984. "Financially Constrained Entry in a Game with Incomplete Information," *Rand Journal of Economics*, 15:490-99.

Brander, J.A. and T.R. Lewis. 1986. “Oligopoly and Financial Structure: The Limited Liability Effect,” *American Economic Review*, 76(5):956-970.

Bresnahan, T. 1981. “Duopoly Models with Consistent Conjectures,” *American Economic Review*, 71:934-945.

Caillaud, B., G. Dionne and B. Jullien. 2000. “Corporate insurance with optimal financial contracting,” *Economic Theory*, 16:77–105.

Cheyne, B. and G. Nini. 2010. “Creditor Mandated Purchases of Corporate Insurance,” mimeo, Wharton School, University of Pennsylvania.

Cole, C.R.and K.A. McCullough. 2006.“A Reexamination of the Corporate Demand for Reinsurance,”*Journal of Risk and Insurance*, 73 (1): 169-192.

Cole, C.R.and K.A. McCullough. 2008.“A Comparative Analysis of U.S. Property and Casualty Reinsurers and Insurers,”*Risk Management and Insurance* Review, 11 (1): 179-207.

Cummins, J.D. and P.M. Danzon. 1997.“Price, Financial Quality, and Capital Flows in Insurance Markets,”*Journal of Financial Intermediation*, 6: 3-38.

Garven, J.R. and J. Lamm-Tennant. 2003.“The Demand for Reinsurance: Theory and Empirical Tests,”*Assurances*, 71: 217-238.

Garven, J. and R. Macminn. 1993. “The underinvestment problem, bond covenants, and insurance,” *Journal of Risk and Insurance,* 60: 635-646.

Garven, J. and R. Macminn. 2000. “On Corporate Insurance,” in: Dionne, G. (Ed.), *Handbook of Insurance*. Kluwer Academic Publishers, 541-564.

Grace, M. and M. Rebello. 1993. “Financing and the Demand for Corporate Insurance,” *Geneva Papers on Risk and Insurance Theory*, 18(2):147-172.

Han, L-M. 1996. “Managerial Compensation and Corporate Demand for Insurance,” *Journal of Risk and Insurance*, 63(3):381-404.

Hoyt, R. and H. Khang. 2000. “On the Demand for Corporate Property Insurance,” *The Journal of Risk and Insurance*, 67(1): 91-107.

Kamien, M. and N. Schwartz. 1983. “Conjectural Variations,” *Canadian Journal of Economics*, 16(2):191-211.

MacMinn, R. 1987. “Insurance and Corporate Risk Management,” *Journal of Risk and Insurance*, 54:658-677.

MacMinn, R. and J. Garven. 2000. “On Corporate Insurance,” *Handbook of Insurance*, G. Dionne (ed.), Springer.

MacMinn, R. and L-M. Han. 1990. “Limited Liability, Corporate Value, and the Demand for Liability Insurance,” *Journal of Risk and Insurance*, 57:581-607.

Main, B. 1983. “Corporate Insurance Purchases and Taxes,” *Journal of Risk and Insurance*, 50:197-223.

Mayers, D. and C. Smith, Jr. 1982.“On the Corporate Demand for Insurance,” *Journal of Business*, 52:281-296.

Mayers, D. and C. Smith, 1987.“Corporate insurance and the underinvestment problem,” *Journal of Risk and Insurance,* 54:45-54.

Mayers, D. and C. W. Smith. 1990.“On the Corporate Demand for Insurance: Evidence from the Reinsurance Market,”*Journal of Business*, 63: 19-40.

Michel-Kerjan, E., P.A. Raschky, and H.C. Kunreuther. 2009.“Corporate Demand for Insurance: An Empirical Analysis of the U.S. Market for Catastrophe and Non-Catastrophe Risks,” Working Paper.

Perry, M. 1982. “Oligopoly and Consistent Conjectural Variations,” *Rand Journal of Economics*, 13(1):197-205.

Petroni, K.R. 1992.“Optimistic Reporting in the Property-Casualty Insurance Industry,”*Journal of Accounting and Economics*, 15: 485-508.

Powell, L.S. and D.W. Sommer. 2007.“Internal Versus External Capital Markets in the Insurance Industry: The Role of Reinsurance,”*Journal of Financial Services Research,* 31: 173-188.

Regan, L. and Y. Hur. 2007.“On the Corporate Demand for Insurance: The Case of Korean Nonfinancial Firms,”*Journal of Risk and Insurance*, 74(4): 829-850.

Schnabel, J. and E. Roumi. 1989. “Corporate Insurance and the Underinvestment Problem: An Extension,” *The Journal of Risk and Insurance*, 56(1): 155-159.

Seog, S. H. 2006. “Strategic Demand for Insurance,” *Journal of Risk and Insurance,* 73(2):279-295.

Seog, S. H. 2006. “The Strategic Role of Insurance: The Warranty Case,” *Journal of Insurance Issues,*.

Sung, J. 1997. “Corporate Insurance and Managerial Incentives,” *Journal of Economic Theory*, 74(2):297-332.

Telser, L.G. 1966. "Cutthroat Competition and the Long Purse," *Journal of Law and Economics*, 9:259-277.

Thakor, A. 1982.“An Exploration of Competitive SignallingEquilibria with ‘Third Party’ Information Production: The Case of Debt Insurance,” *Journal of Finance*, 37:717-739.

Tillinghast-Towers Perrin, and Risk and Insurance Management Society. 1995. *1995 Cost of Risk Survey*. Tillinghast-Towers Perrin Risk Management Publications, Stamford, CT.

Tirole, J. 1988. *The Theory of Industrial Organization*, Cambridge: MIT Press.

Weiss, M.A., and J. Chung. 2004.“U.S. Reinsurance Prices, Financial Quality, and Global Capacity,”*Journal of Risk and Insurance*, 71: 437-467.

Winter, R.1994.“The dynamics of competitive insurance markets,”*Journal of Financial Intermediation*, 3: 379-415.

Zou, H., M. B. Adams, and M. J. Buckle. 2003.“Corporate Risks and Property Insurance: Evidence From the People’s Republic of China,”*Journal of Risk and Insurance,* 70 (2): 289-314.

## Appendix

### Table 1 Variable Definitions

| Variables |
| --- |
| **(Dependent Variables)** |
| ***REINS***: Premiums ceded/(direct premiums written and reinsurance assumed)<br>***EXT_REINS***: Premiums ceded to affiliates/(direct premiums written and reinsurance assumed) |
| **(Insurance Market Related Variables)** |
| ***CONC_HHI***: $\sum_i w_i HHI_{i,}$ where $i$represents each specific market segmented by states and lines of business, $w_i$is the portion of direct premiums written of the insurer in the specific market, and $HHI_{i,}$ is the Herfindahl index of the specific market |
| ***CONC_CR4***: $\sum_i w_i CR4_{i,}$where $CR4_i$ is the four-firm concentration ratio of market *i*. |
| ***CONC_CR10***: $\sum_i w_i CR10_{i,}$ where $CR10_i$ is the ten-firm concentration ratio of each market *i*.<br>***MKTSIZE***: $\sum_i w_i MKTSIZE_{i,}$ where $MKTSIZE_i$ is the sum of direct premiums written of all insurers operating in market *i*. |
| **(Reinsurance Supply Side Variables)**<br>***GROUP_COMB***: $\sum_j w_j COMB_{j,}$ where *j* represents each firm assuming premiums of other affiliates within the group in which the insurer belongs to, $w_j$ is the ratio of firm *j*'s assumed premiums from affiliates to the sum of premiums from affiliates for all the firms within the group, and $COMB_j$ is the combined ratio of firm *j*<br>**GROUP_LOSS_DEV**: $\sum_j w_j LOSS\_DEV_{j,}$ where $LOSS\_DEV_j$ is the 2-year loss development of firm *j* belonging to the same group as the insurer<br>***US_UNAFF_COMB***: $\sum_k w_k COMB_{k,}$ where *k* represents each U.S. unaffiliated firm to which the insurer cedes its premiums, $w_k$ is the ratio of the insurer's premiums ceded to firm *k* to the insurer's total premiums ceded to U.S. unaffiliated firms, and $COMB_k$ is the combined ratio of firm *k*<br>***US_UNAFF_LOSS_DEV***: $\sum_k w_k LOSS\_DEV_{k,}$ where $LOSS\_DEV_k$ is the 2-year loss development of firm *k*, whichis the insurer's reinsurance partner that is not affiliated to the same group as the insurer |
| ***NONUS_COMB***: Average combined ratio of non-U.S. reinsurers that are the top 100-150 reinsurers around the world |
| ***US_UNAFF_DUMMY***: Dummy variable equals to one if the insurer is contracting with any U.S. unaffiliated insurers<br>***NONUS_DUMMY***: Dummy variable equals to one if the insurer is contracting with any non-U.S. reinsurers |
| **(Other Firm-specific Controls)** |
| ***SIZE***: Natural logarithm of admitted assets |
| ***ROA***: Net income/admitted assets |
| ***LEV***: Direct business written/surplus |
| ***TAX-EXEMPT***: Tax-exempt investment income ( = bond interest exempt from federal taxes plus 70% of dividends received for common and preferred stock)/total investment income<br>***LOSS_DEV***: The development in estimated losses and loss expense incurred 2 years before the current year and prior year scaled by surplus<br>***CAT_EXPOSURE***: The percentage of direct premiums written by the insurer in Gulf Coast and Atlantic Coast states (TX, LA, MS, AL, FL, GA, SC, NC, and VA) in several related property lines (fire, multiple peril crop, farmowners, homeowners, and commercial multiple peril, ocean marine, and auto physical damage) plus the percentage of premiums in earthquake insurance |
| ***LB_HERF***: Line-of-business Herfindahl index |
| ***G_HERF***: Geographic Herfindahl index |
| ***G_DUMMY***: Dummy variable equal to one if the insurer is affiliated to a group |
| ***STOCK_DUMMY***: Dummy variable equal to one if the insurer is a stock company<br>***LINE1-LINE26***: Fire, Allied lines, Farmowners, Homeowners, Commercial, Mortgage guaranty, Ocean marine, Inland marine, Financial guaranty, Medical malpractice, Earthquake, Group A&H, Credit A&H, Other A&H, Workers' compensation, Other liability, Products liability, Auto liability, Auto physical damage, Aircraft, Fidelity, Surety, Glass, Burglary and theft, Boiler and machinery, Credit |

## Table 2 Summary Statistics(Sample period: 1995-2008)

Table 2 provides summary statistics of the main variables used in the regressions. The definitions of the variables are in Table 1.

| Variables | N | Mean | Std. Dev. | Minimum | Maximum |
|---|---|---|---|---|---|
| **(Dependent Variables)** | | | | | |
| REINS | 26,668 | 0.3796 | 0.3000 | 0 | 1 |
| EXT_REINS | 26,668 | 0.1715 | 0.2190 | 0 | 1 |
| **(Insurance Market Related Variables)** | | | | | |
| CONC_HHI | 26,668 | 0.0354 | 0.0563 | 0.0004 | 0.9840 |
| CONC_CR4 | 26,668 | 0.1866 | 0.1911 | 0.0034 | 1 |
| CONC_CR10 | 26,668 | 0.2689 | 0.2576 | 0.0065 | 1 |
| MKTSIZE | 26,668 | 19.3093 | 1.8376 | 12.5641 | 23.3325 |
| **(Reinsurance Supply-Side Variables)** | | | | | |
| GROUP_COMB | 14,297 | 1.0577 | 0.7470 | -50.2053 | 19.7756 |
| GROUP_LOSS_DEV | 14,291 | -0.0029 | 0.1626 | -0.7544 | 4.7025 |
| US_UNAFF_COMB | 19,121 | 1.1773 | 1.2607 | -0.3181 | 25.6847 |
| US_UNAFF_LOSS_DEV | 18,668 | -0.0264 | 0.1851 | -0.7544 | 0.8356 |
| NONUS_COMB | 26,668 | 1.0227 | 0.0964 | 0.8902 | 1.2204 |
| US_UNAFF_DUMMY | 26,668 | 0.7170 | 0.4505 | 0 | 1 |
| NONUS_DUMMY | 26,668 | 0.5107 | 0.4999 | 0 | 1 |
| **(Other Firm-specific Controls)** | | | | | |
| SIZE | 26,668 | 17.8323 | 1.9522 | 13.6165 | 22.4525 |
| ROA | 26,668 | 0.0231 | 0.0536 | -0.1886 | 0.2014 |
| LEV | 26,668 | 1.8186 | 1.9606 | 0 | 10.2238 |
| TAX-EXEMPT | 26,496 | 0.2457 | 0.2620 | 0 | 0.9971 |
| LOSS_DEV | 25,651 | -0.0234 | 0.1843 | -0.7544 | 0.8356 |
| CAT_EXPOSURE | 26,668 | 0.0996 | 0.2244 | 0 | 1 |
| LB_HERF | 26,668 | 0.5774 | 0.2981 | 0.0964 | 1 |
| G_HERF | 26,668 | 0.6066 | 0.3848 | 0.0304 | 1 |
| G_DUMMY | 26,668 | 0.6336 | 0.4818 | 0 | 1 |
| STOCK_DUMMY | 26,668 | 0.6557 | 0.4751 | 0 | 1 |

**Table 3 Regression Results (Dependent variable: total reinsurance ratio)**

| | REINS (1) | | REINS (2) | | REINS (3) | |
|---|---|---|---|---|---|---|
| **Variables** | **Coeff.** | **Std. Err.** | **Coeff.** | **Std. Err.** | **Coeff.** | **Std. Err.** |
| **(Insurance Market Related Variables)** | | | | | | |
| CONC_HHI | -0.125* | 0.072 | | | | |
| CONC_CR4 | | | -0.058* | 0.031 | | |
| CONC_CR10 | | | | | -0.047* | 0.025 |
| MKTSIZE | 0.011** | 0.005 | 0.011** | 0.005 | 0.012** | 0.005 |
| **(Reinsurance Supply-Side Variables)** | | | | | | |
| GROUP_COMB | 0.035** | 0.016 | 0.035** | 0.016 | 0.035** | 0.016 |
| GROUP_LOSS_DEV | 0.042* | 0.024 | 0.043* | 0.024 | 0.042* | 0.024 |
| US_UNAFF_COMB | 0.019*** | 0.003 | 0.019*** | 0.003 | 0.019*** | 0.003 |
| US_UNAFF_LOSS_DEV | -0.060** | 0.026 | -0.060** | 0.026 | -0.059** | 0.026 |
| NONUS_COMB | -0.006 | 0.007 | -0.006 | 0.007 | -0.006 | 0.007 |
| **(Other Firm-specific Controls)** | | | | | | |
| SIZE | -0.036*** | 0.003 | -0.036*** | 0.003 | -0.036*** | 0.003 |
| ROA | 0.145*** | 0.050 | 0.145*** | 0.050 | 0.146*** | 0.050 |
| LEV | 0.057*** | 0.002 | 0.057*** | 0.002 | 0.057*** | 0.002 |
| TAX-EXEMPT | -0.024* | 0.014 | -0.024* | 0.014 | -0.024* | 0.014 |
| LOSS_DEV | 0.079*** | 0.025 | 0.079*** | 0.025 | 0.079*** | 0.025 |
| CAT_EXPOSURE | 0.049** | 0.021 | 0.050** | 0.021 | 0.049** | 0.021 |
| LB_HERF | -0.112*** | 0.017 | -0.113*** | 0.017 | -0.113*** | 0.017 |
| G_HERF | -0.144*** | 0.020 | -0.133*** | 0.021 | -0.131*** | 0.021 |
| G_DUMMY | 0.118*** | 0.015 | 0.118*** | 0.015 | 0.118*** | 0.015 |
| STOCK_DUMMY | 0.028*** | 0.010 | 0.028*** | 0.010 | 0.028*** | 0.010 |
| YEAR DUMMIES | YES | | YES | | YES | |
| LINE 1-LINE 26 | YES | | YES | | YES | |
| CONSTANT | 0.758*** | 0.178 | 0.760*** | 0.179 | 0.761*** | 0.180 |
| NUM of OBS. | 25,519 | | 25,519 | | 25,519 | |
| $R^2$ | 0.2951 | | 0.2952 | | 0.2952 | |

note: ***p<0.01, **p<0.05, *p<0.1

**Table 4 Regression Results (Dependent Variable: external reinsurance ratio)**

| Variables | EXT_REINS (1) Coeff. | EXT_REINS (1) Std. Err. | EXT_REINS (2) Coeff. | EXT_REINS (2) Std. Err. | EXT_REINS (3) Coeff. | EXT_REINS (3) Std. Err. |
|---|---|---|---|---|---|---|
| **(Insurance Market Related Variables)** | | | | | | |
| CONC_HHI | -0.206*** | 0.055 | | | | |
| CONC_CR4 | | | -0.053** | 0.024 | | |
| CONC_CR10 | | | | | -0.046** | 0.019 |
| MKTSIZE | 0.006* | 0.003 | 0.007* | 0.004 | 0.007* | 0.004 |
| **(Reinsurance Supply-Side Variables)** | | | | | | |
| GROUP_COMB | -0.014** | 0.006 | -0.014** | 0.006 | -0.014** | 0.006 |
| GROUP_LOSS_DEV | -0.00003 | 0.016 | 0.00014 | 0.016 | 0.00014 | 0.016 |
| US_UNAFF_COMB | 0.031*** | 0.003 | 0.031*** | 0.003 | 0.031*** | 0.003 |
| US_UNAFF_LOSS_DEV | -0.036** | 0.018 | -0.036** | 0.018 | -0.036* | 0.018 |
| NONUS_COMB | 0.067*** | 0.005 | 0.067*** | 0.005 | 0.067*** | 0.005 |
| **(Other Firm-specific Controls)** | | | | | | |
| SIZE | -0.015*** | 0.002 | -0.016*** | 0.002 | -0.016*** | 0.002 |
| ROA | -0.007 | 0.044 | -0.007 | 0.045 | -0.006 | 0.044 |
| LEV | 0.015*** | 0.002 | 0.015*** | 0.002 | 0.015*** | 0.002 |
| TAX-EXEMPT | -0.017* | 0.010 | -0.017* | 0.010 | -0.016* | 0.010 |
| LOSS_DEV | 0.058*** | 0.016 | 0.058*** | 0.016 | 0.058*** | 0.016 |
| CAT_EXPOSURE | 0.114*** | 0.018 | 0.113*** | 0.018 | 0.113*** | 0.018 |
| LB_HERF | 0.004 | 0.014 | 0.003 | 0.014 | 0.003 | 0.014 |
| G_HERF | -0.013 | 0.015 | -0.010 | 0.016 | -0.006 | 0.016 |
| G_DUMMY | -0.084*** | 0.009 | -0.084*** | 0.009 | -0.084*** | 0.009 |
| STOCK_DUMMY | -0.009 | 0.008 | -0.008 | 0.008 | -0.008 | 0.008 |
| YEAR DUMMIES | YES | | YES | | YES | |
| LINE 1-LINE 26 | YES | | YES | | YES | |
| CONSTANT | 0.328* | 0.170 | 0.329* | 0.171 | 0.331* | 0.172 |
| NUM of OBS. | 25,519 | | 25,519 | | 25,519 | |
| $R^2$ | 0.2193 | | 0.2185 | | 0.2186 | |

note: *** p<0.01, ** p<0.05, * p<0.1

**Proof of Lemma 1**

*Proof*: Given the assumptions and the support of parameter values, it is straightforward to verify that $A, B, C$ raightforward to verify that and $D$ are all positive. Also it is st

$$BC - b^2 = [(2+v)^2 - 1]b^2 + \gamma k^2\sigma^2 \begin{bmatrix} (2+v)b\left[(1-\alpha_i)^2 + (1-\alpha_j)^2\right] \\ +\gamma k^2\sigma^2(1-\alpha_i)^2(1-\alpha_j)^2 \end{bmatrix} > 0.$$

$$AC - bD = \gamma k^2\sigma^2(1-\alpha_j)^2[a - (1-\alpha_i)k\mu] + b\begin{bmatrix} (1+v)[a-(1-\alpha_i)k\mu] \\ +(\alpha_i - \alpha_j)k\mu \end{bmatrix};$$

$$BD - bA = \gamma k^2\sigma^2(1-\alpha_i)^2[a - (1-\alpha_j)k\mu] + b\begin{bmatrix} (1+v)[a-(1-\alpha_j)k\mu] \\ +(\alpha_j - \alpha_i)k\mu \end{bmatrix};$$

$$\partial q_i^*/\partial\alpha_i = \begin{cases} \dfrac{(BC-b^2)k\mu C + 2(AC-bD)\gamma k^2\sigma^2(1-\alpha_i)C}{(BC-b^2)^2} > 0 \text{ when } AC - bD > 0 \\ 0 \text{ when } AC - bD \le 0 \end{cases};$$

When $AC - bD \le 0, \partial q_i^*/\partial\alpha_j = 0$; otherwise

$$\partial q_i^*/\partial\alpha_j = \frac{-(BC-b^2)[2\gamma k^2\sigma^2(1-\alpha_j)A + bk\mu] + 2(AC-bD)\gamma k^2\sigma^2(1-\alpha_j)B}{(BC-b^2)^2}$$

$$= -\frac{2b\gamma k^2\sigma^2(1-\alpha_j)(BD-bA) + bk\mu(BC-b^2)}{(BC-b^2)^2}$$

$$= -\frac{1}{(BC-b^2)}[2b\gamma k^2\sigma^2(1-\alpha_j)q_j^* + bk\mu] < 0.$$

$$\partial q_i^*/\partial\gamma = \frac{k^2\sigma^2}{(BC-b^2)^2}\begin{Bmatrix} (BC-b^2)A(1-\alpha_j)^2 \\ -(AC-bD)\begin{bmatrix} B(1-\alpha_j)^2 \\ +C(1-\alpha_i)^2 \end{bmatrix} \end{Bmatrix} = \frac{k^2\sigma^2}{BC-b^2}\left\{b(1-\alpha_j)^2 q_j^* - C(1-\alpha_i)^2 q_i^*\right\}.$$

$$\partial q_i^*/\partial v = \frac{b}{BC-b^2}[A - (B+C)q_i^*] = \frac{b}{BC-b^2}(bq_j^* - Cq_i^*).$$

In the symmetric case, $\alpha_i = \alpha_j = \alpha; A = D = a - (1-\alpha)k\mu \equiv \tilde{A}$; and $B = C = (2+v)b + \gamma(1-\alpha)^2k^2\sigma^2 \equiv \tilde{B}$.We have $q_i^* = q_j^* = q^* = \frac{\tilde{A}}{\tilde{B}+b}; Q^* = 2q^*;\ \partial Q^*/\partial\alpha = \frac{2k\mu(\tilde{B}+b)+4\gamma k^2\sigma^2(1-\alpha)\tilde{A}}{(\tilde{B}+b)^2} > 0; \partial Q^*/\partial\gamma = \frac{-2k^2\sigma^2(1-\alpha)^2\tilde{A}}{(\tilde{B}+b)^2} \le 0; \partial Q^*/\partial k = -\frac{2(1-\alpha)(\tilde{B}+b)\mu + 4\gamma(1-\alpha)^2k\sigma^2\tilde{A}}{(\tilde{B}+b)^2} \le 0$; and $\partial Q^*/\partial v = -\frac{2b\tilde{A}}{(\tilde{B}+b)^2} < 0$.

Moreover, $\frac{\partial(\partial Q^*/\partial\alpha)}{\partial v} = \frac{2bk\mu(\tilde{B}+b)^2 - 2b(\tilde{B}+b)[2k\mu(\tilde{B}+b)+4\gamma k^2\sigma^2(1-\alpha)\tilde{A}]}{(\tilde{B}+b)^4} < 0.$□

**Proof of Lemma 2**

*Proof*: (a) Using equations (24), it is straightforward to verify that $\partial q_i^*/\partial\alpha_i \ge 0$; and $\partial q_i^*/\partial\alpha_j \le 0$. In particular, $\alpha_i > (2+v)\alpha_j + (1+v)\frac{a-k\mu}{k\mu} \Rightarrow (2+v)\left[a - (1-\alpha_j)k\mu\right] < a - (1-\alpha_i)k\mu \Rightarrow q_j^* = 0$ by the equations (24). Moreover, since $v \in (-1,1)$, considering assumption A1, we have $a - (1-\alpha_j)k\mu < (2+v)\left[a - (1-\alpha_j)k\mu\right]$, and $a - (1-\alpha_i)k\mu < (2+v)[a - (1-\alpha_i)k\mu]$. Therefore, $\alpha_i >$

$(2+v)\alpha_j + (1+v)\frac{a-k\mu}{k\mu} \Rightarrow a - (1-\alpha_j)k\mu < (2+v)[a-(1-\alpha_j)k\mu] < a - (1-\alpha_i)k\mu < (2+v)[a-(1-\alpha_i)k\mu] \Rightarrow q_i^* > 0$ by the equations (24).

(b) By equations (24), $\partial q_i^*/\partial\alpha_i = \frac{(2+v)k\mu}{b(3+v)(1+v)}$; $\partial q_i^*/\partial\alpha_j = -\frac{k\mu}{b(3+v)(1+v)}$. Therefore, $\frac{\partial(\partial q_i^*/\partial\alpha_i)}{\partial v} = \frac{(3+v)(1+v)-2(2+v)^2}{b(3+v)^2(1+v)^2}k\mu < 0$; and $\frac{\partial(\partial q_i^*/\partial\alpha_j)}{\partial v} = \frac{2(2+v)}{b(3+v)^2(1+v)^2}k\mu > 0$.

(c) By equation (24), $\partial q_i^*/\partial v = \frac{2(2+v)[a-(1-\alpha_j)k\mu]-[(2+v)^2+1][a-(1-\alpha_i)k\mu]}{b(3+v)^2(1+v)^2}$. Therefore, $\partial q_i^*/\partial v < 0 \Leftrightarrow \frac{a-(1-\alpha_i)k\mu}{a-(1-\alpha_j)k\mu} > \frac{2(2+v)}{(2+v)^2+1}$.In particular, denote $h(v) \equiv \frac{2(2+v)}{(2+v)^2+1}$.It is straightforward to check that $h'(v) < 0, \forall v \in (-1,1)$. Therefore, $h(v) < h(-1) = 1, \forall v \in (-1,1)$. When $\alpha_i > \alpha_j$, we have $\frac{a-(1-\alpha_i)k\mu}{a-(1-\alpha_j)k\mu} > 1 > h(v), \forall v \in (-1,1)$.

(d)Under the symmetric equilibrium characterized by equations (25), we have $\partial Q/\partial\alpha = \frac{2k\mu}{b(3+v)} > 0$; $\partial Q/\partial k = -\frac{2(1-\alpha)\mu}{b(3+v)} \leq 0$; and $\partial Q/\partial v = -\frac{2[a-(1-\alpha)k\mu]}{b(3+v)^2} < 0$.□

**Proof of Proposition 3**

*Proof:* (a) When $\lambda < g(v)$ for a given $v$, or equivalently, when $v < \bar{v}(\lambda)$ given $\lambda > 0$, we have $\frac{1-\lambda(3+v)(1+v)}{v^2+5v+5+\lambda(3+v)(3+2v)}\frac{a-k\mu}{k\mu} > 0$, which implies that $\alpha^* > 0$ by equation (28).

(b) By equation (29), $g'(v) < 0$. This implies that a lower $v$ (a more competitive product market) leads to a higher $g(v)$. Thus, more likely that $\lambda < g(v)$ will be satisfied, which implies that more likely firms will purchase insurance, according to Proposition 3(a). Moreover, $\alpha^{*\prime}(v) < 0$, by equation (28).

(c)Given $\alpha^* > 0$, we have $\alpha^{*\prime}(a) > 0$, and $\alpha^{*\prime}(k) < 0$, by equation (28). □

# Thinking caused by Way-oriented Theory in Construction of Insurance Institutions

ZHANG Daijun

Institute of Finance, Zhejiang University of Finance and Economics, Hangzhou, China 310018

**Abstract**： Elaborating the correlation of insurance team building and changes of demand for insurance .Giving a brief analysis of the essence of Way-oriented Theory that put forward by the domestic scholar-Qi Shanhong .Emphasizing the importance of innovation theory which integrates this theory inherited from Confucianism, Buddhism and Taoism culture and Western corporate culture and its enlightenments on organization perfect ,team members' subjectivity and management goal aimed to team members in insurance institutions team building. Though the perspective of "five-Z one-line"--a systematic understanding of insurance undertakings operation and management ,I conduct a tentative probe of specific application of Way-oriented Theory about how to build philosophy ,form the team system and organization ,conform the mechanism and configuration and the line of team development.

**Keywords**： Way-oriented Theory, insurance team-building, application

## I. Background

Social development is ultimately a human development. The key of insurance agencies' survival and development is to develop and utilize insurance human resources. The domestic insurance industry's growing up is basically accompanied by the process of traditional economic transformation. After more than 30 years of development, although the size and structure of the insurance market has made a great development, its human resources of insurance agency or employees' overall quality did not upgrade to the industry and society general recognition, which will undoubtedly restrict the development of the insurance industry. Generally, the development fruits of the whole society benefits from the contribution of all walks of life and the social and economic slowdown or stagnation also stems from the constraints of the various industries .Many observers believe that coupled with the stabilization of the domestic economy, including the insurance industry, the industry will face the adjustment of the management model and its mode of growth, while the expectations of the objective aspect of this adjustment is also their subjective needs.

With the continuous improvement of civilization in domestic insurance market, as well as the insurance needs diversification, multi-level hierarchy of needs, demands for product diversification, the ability of various aspects, such as operation and management, bound to change correspondingly. Relying on the sea tactics or wholesale staff training has been unable to adapt to future market highlighting the characteristics of personalized insurance needs. "Team is comprised of a small number of people with complementary skills, and they are willing to work for a common purpose, performance goals and methods and mutual responsibility." [1] The western team-building observers generally believe that without team, people will not be able to meet future challenges, and can not do all the work from providing clients comprehensive and high-quality service to innovating. Compared with other industries, the contradiction in the area of insurance between limitation of personal effort and knowledge system and structure and the marginality and complexity of its knowledge is more prominent .Therefore insurance undertakings rely solely on personal ability is difficult to improve or ensure the service quality to customer satisfaction.

Team as a special organization of the insurance institutions can take advantage of the complementary nature of the team members' comparative advantages, making it have a

[1] Huang Lingxiang. Development law of independent innovative team and constructional strategy [J].Business Times,2007,(31),Page 64-66.

complete characteristic that individual members do not have.[2] In recent years, the discussion of team building is fierce. The topic discussed focuses on efficient or innovative team building in the organizational system and mainly studies the path and experience of team building(Zhe Guichang, Yang Xujun,Huang, Ling Xiang).Surely, after many scholars' discussion, a series of questions has been further cleared, including the corporate team-building concept, system and mechanism construction, organization and staffing and its construction path. And many other problems --including the significance of team building, the status and role of team in the enterprise organizational system and etc.--has been widespread consensus. However, discussion--based on particularity of insurance management--on insurance team-building is relatively few. The reason can be summarized as the following points: First, here is a huge insurance market to develop in the process of economic transition, and the insurance operational objectives can be easily achieved by means of sea tactics or rough type of business. So the philosophy of dedicating to insurance market through insurance team is difficult to get due attention of insurance managers. Second, compared with foreign mature insurance market, domestic insurance market is lack of the necessary stage of development. There are numerous defects in the growth of domestic insurance industry. Some basic problems--insurance business integrity issues, the homogenization of insurance product and service, development of insurance intermediary market, construction of policies and regulations--concerned with the development of insurance market has not yet been resolved. Therefore, experts and scholars pay more attention to the above problems. Thirdly, in reality, insurance team-building mainly lies in the field of insurance marketing. Relatively, the organizational characteristics of this area's business development are trend to a certain degree, labor-intensive. Compared to the field of underwriting, claim, actuary, marketing is short of professional skills and core team members who can truly control the team, so the effect of insurance team-building is unsatisfactory. Hence, I conduct a research of insurance institutions' team-building, based on Way-oriented Theory and many domestic and international research production of team-building.

## II. The spirit and essence of Way-oriented Theory

This theory with Chinese cultural characteristic is an innovative management theory, put forward by Qi Shanhong as a representative of management scholars. It is given a systematic exposition in the book--Essential Management of Tao: the essence of management and mode of operation--written by Qi Shan Hong. In his writings, he deeply studies the managerial hypothesis of matterism, godism, capitalism and humanism and its evolution with an objective and strict scientific attitude. It reveals the cognitional changes of the past mainstream management theory, including human nature and their position and function in social development. It also reveals the limitation of practical application of management theory affected by the traditional human nature hypothesis. And it expounds the core and characteristic of Tao believed by themselves with perspectives of integration of Chinese and Western management philosophy [3] and on this basis the Management coming from Way-oriented Theory is derived. The main ideas of this theory are as follows:

### A.Human is the starting and destination point of management

This theory makes more explicit the fact that human lies in the main position of management

[2] Li Weian.A beneficial exploration of Chinese characteristic management theory--"Management of Way-oriented Theory: the essence of management and operational model" Review [J].The Nan Kai Management Review,2008,(4),Page 111-112.

[3] Qi Shanhong,Wang Jianzhon,Song Junqing. From organizational management to self-management--the subjective perspective of management paradigm evolution trend [J].Technology Management Research,2008,(8).Page 272-275.

activities. After analyzing the evolution of human nature in management theory, we believe that the best realm of management and great breakthrough in efficiency is on the condition of promotion of human nature[4] .We also point out that the concept of "people-oriented" to a certain extent leads to reflection and correction about human alienation tendency existed in the past managerial theory and confirm that the focus of modern management has transformed from "objects" to people. The theory shows that management activities are human activities, management core is people management and management goal is human's development.

### B. People should respect the laws of nature, laws of people in harmony with nature, laws of human nature, laws of human development, rather than make themselves beyond the objective and natural laws

This theory shows in a perspective of construction of social system that human is just one of the thousands of species in the world and is not the master of the world. Respecting and following laws is manager's eternal pursuit. Anyone who is pursuing his own development goals needs to be balanced in harmony with other concomitant natural species or objective things. As to construction of policies and regulations, administrators can not only reflect their own will and ignore the stakeholders common intention. Consequently, we should focus on the discovery of the objective laws for organization and team-building, and prevent the negative tendencies of self-righteous and ignoring the objectives.

### C. Fully reflecting the subjectivity of the people in the management of the organization or team management and focusing on laws rather than subjecting to human's bounded rationality

This theory in use of Renne's idea of human subjectivity[5] believes that people is different from animals because of human subjectivity. This is qualitative provision. These essential attributes include independency, self-behavior, creativity and transcendency. The formation and development of human subjectivity which is studied by the historical evolution of management paradigm reveals the evolvement of management paradigm.

The core of the theory is to focus on the evolution of the human spirit, the existence of the human spirit, and it is the premise of existence and development of human subjectivity. The limitations of previous management precisely lie in the aspect of neglect of human spirit forces and intentional or unintentional constraints on human subjectivity. Way-oriented Theory taps people's spiritual values naturally existed and subjectivity, developing rather than designing out the basic logic of management through the grasp of the universal law[6].

## III. Enlightenments of this theory to insurance institutions team-building

The cultural essence of Confucianism, Buddhism and Tao--"afford to take and put it down, be optimistic"--attaches great importance to creating the soft power of the contemporary Chinese and foreign social organization. From the concept of government administration, corporate values to personal attitude towards life and the formation of ideals and goals are all flashing the cultural highlights of "Confucianism, Buddhism and Taoism". The cultural connotation of Way-oriented Theory is a kind of cultural heritage of "Confucianism, Buddhism, Taoism", and is also a integration of the cultural essence of

---

[4] Zhe Guichang,Yang Xujun. Strategy research of coupling path of mental model in modern enterprise innovation team [J].Contemporary Economic,2009,(8).Page 117-119.

[5] Qi Shanhong,Cao Zhenjie. Management of Way-oriented Theory: the combined perspective of Chinese and western management philosophy [J].Management Journal,2009,(10).Page 1279-1290

[6] Zhang Daijun. The problem of "insurance three-state"--analysis of its dislocation and position in the perspective of "five-Z one-line" [J].Zhejiang Financial,2010,(11).Page 58-61.

"Confucianism, Buddhism, Taoism" and the contemporary civilization of organization and management. This theory proposed by Chinese scholars is a systematic management thought, and it will undoubtedly become a model of contemporary Chinese and Western corporate cultural integration. At least, this theory has some inspiration to insurance team-building in the following three aspects:

### A.Insurance agency team-building is an inevitable choice for the insurance organizational system tends to be sound

Survival and development of anything is inherently the ins and outs, or in other words, the real state of things all the time can be regarded as a causal relationship between the sum of the carriers. The organizational form of insurance institutions is an objective requirement that the insurance agent should meet the running of insurance market. In the 21st century, compared with the past, the insurance industry as a special industry, specializes in centralizing and decentralizing risk and provides financial security for the socio-economic entities. The enhancement of risk management capabilities and development of financial markets lead to profound changes of insurance supply and demand. Expansion of insurance coverage and the use of funds will be able to further enhance the function of insurance safeguard and investment management. With insurance clients to accept the modern concept of insurance services, the request to provide systematic, pluralistic and composite insurance safeguard and financial services will become the a trend for the insurance market in the new era that can not be ignored. The formation of the modern economic and social relationship between supply and demand, may be in the form of individual to individual, or individual to group ,or group to individual. In fact, more is in the performance of system to system, or in other words, outward manifestation of group to group. Therefore, in the future development of insurance market, if let people approach the insurance, understand it,own it and benefit from it, relying solely on personal ability of the insurance practitioners cannot meet the insurance needs highlighting the above personality. The publicity and display of individual employees' ability can often be seen in the contact with clients or in the insurance market game, but the fact behind it is the existence of an insurance team's support.

### B. Insurance team-building should respect the subjectivity of the team members

The team of insurance agencies is generally comprised of outstanding members with a certain specialty in area of management or business. They are models of insurance institutions' human resources because of their professional knowledge, business experience and skills. In reality, if someone wants to become a veritable insurance professional, he needs to possess some professional training and experience, and expertise in his own area. It is hard to substitute for each other between different members. Aiming at the member's characteristic of knowledge and technique in insurance team, we can conclude by the Herzberg two-factors theory that the factor is the specific content of their work and the work itself that can really produce an incentive effect to this group of people. Therefore, in general, as an insurance practitioner, he should have enough loyalty and behavioral self-regulation in his occupation. From the perspective of Maslow's hierarchy of needs theory, insurance core team members are basic in the needs of emotion and belonging, respecting, and self-fulfilling stage of life. Compared with other areas of crowd, their autonomy, self-behavior, creative and transcendence tend to be more obvious.

### C. The construction of insurance team focuses on team-members' development

In the process of insurance team-building and work, anyone in the team should enhance their professionalism and ability along with the path of personal development, and constantly enrich their spiritual and material wealth .Among them, the accumulation of material wealth is not their ultimate goal ,but a product of team-members personal development. Therefore, deal with team members at different stages of development correctly. On one hand, we need to respect their psychological changes in the process of development, and to create necessary material conditions, providing good services to help them achieve their development goal of life, on the other hand, team members need to pay attention to close cooperation and support each other, keep the team always in the optimized state providing them the best services, enhance the contribution of insurance institutions as much as possible to overall development of team members' future life.

At this point, we do not deny the existence of differences between personal interests and the interests of the organization or team. Corporate exists in the theory of marginal substitution, while insurance agencies constitute an independent stakeholder as a whole. And from the view of social system, team members, after all, s a social subject with an independent personality. However, from the view of organization and personal relations, to achieve and maintain the interests of the insurance agencies, they should follow the rule of insurance operation and management, and to reach the insurance agency or team goals, like-minded people engaging in insurance occupation is needed. Team and individuals of their own interests exist to seek common ground while reserving differences. Development of team-members as the destination point also means development of like-minded people in the team as the destination point. Based on the assumption that humanity can be civilized, managers are responsible for the physical and mental development of team-members.

## IV. Application of Way-oriented Theory in the main construction session of insurance team.

A systematic understanding of the mode of operation of the insurance team could refer to "five-Z one-line"[7] --an insurance agency business management. "Five-Z one-line "contains insurance team concept(banner, and qi zhi in Chinese),institution(ti zhi),organization(zu zhi),mechanism(ji zhi),configuration(pei zhi) and route, and then we could get a systematic understanding of insurance team. These aspects are obviously important parts of insurance team-building that cannot be ignored. Based on the perspective of "five-Z one-line" or the important parts of insurance beam-building, I explore the application of Way-oriented Theory in the construction of insurance team.

### A.Understanding of team-building conception

Insurance team-building conception is the basic knowledge of insurance team-building, the core of insurance team culture, and the banner of leading to team construction. Establishing a correct concept of team-building is necessary to proceed from the following aspects:

Firstly, the necessity is fully understand the laws of insurance operation and follow them. The insurance operational laws is to do insurance underwriting ,claim ,actuary ,and investment. It is the objective requirements and standards followed by the managerial activities. It is the basic trend reflecting insurance health running. It is a method, means and core of varieties of insurance behavior. It is the core of the survival and development of insurance institutions. If insurance team-building deviates from insurance development law, it will inevitably lead to the insurance line of "leftist" or "rightist". If we leave it alone and do not rectify it timely and effectively, insurance agencies are always doomed to failure.

Secondly, having a correct understanding of the social role of insurance industry in the running of social system. Like other subject of social behavior, insurance agency is a component of the entire social system, and the basic premise of their survival and development is their ability to integrate into the social running system. Insurance

[7] Zhang Daijun. Management of insurance agency [M].Lixin Accounting Press,2011,(11).Page 33-38.

agency should follow the operational laws in the process of realizing its business objectives. They need to make the most of their abilities and are always in the correct direction of insurance organizational development, so as to perform duties of risk-sharing, financial compensation and auxiliary social management.

Thirdly, put insurance team in the right position in insurance organizational system. The formation and operation of the insurance team that is based on a new topic and requirement of social operation system for insurance agencies' business managers, which makes insurance supply activities accord with the objective requirement of social development system formed to insurance. Therefore, in deal with the relationship between insurance team and general organization of insurance agency, we need to recognize that insurance team is a kind of reconstruction based on the original resources of insurance agency and that is a kind of integration in line with the objective requirement of insurance development. We should neither regard insurance team as a kind of fashion, nor drift with the current to build a team against the objective law. Insurance team and insurance traditional organizations often co-exist in the system of insurance agencies, and they are interdependent, mutually-supportive, mutual-encouragement and share the same goals, rather than mutually-contradictory.

And lastly, correctly deal with insurance team in insurance activities. The insurance team is based on the development of insurance market segmentation and personality of insurance demands. The insurance team is a kind of insurance organization which is to promote insurance services effectively to meet its market demands. It is the inevitable choice of modern insurance to enhance the quality of insurance services. But due to the variation of management philosophy, system and mechanism development stage and development route in different insurance agencies, the specific requirement to build a insurance team is different. Maybe in some areas, with the help of traditional organizational model, insurance agencies or some organizations can support their operation. Therefore, in the team-building of insurance institutions, we neither made it rigidly uniform, nor set the dogmatic assessment standards to evaluate all insurance team-building. We should neither overestimated(or blindly respect)the effect of insurance team and the contribution of insurance business management or underestimate(or ignore)them, nor neglect the vitality of the general insurance organization.

## B. Construction of system and mechanism

The insurance team is a system model that define the relationship between team-members and their organization, staff and personnel. It is a core problem of system construction of insurance team to make sure of responsibilities concerned to members of insurance team and managerial duties of insurance activity. The system cannot only consider the management intention of some subjects concerned with insurance team. We should follow the rule of insurance operation and fully respect the domestic right of stakeholders of insurance team in the formation of the system, and extensively solicit views or recommendations from all parties. The system we built help team-members to display their talents, to emancipate team-members' mind to the maximum and is in line with the requirements of the law of insurance practitioners in mental models.

Mechanism construction is to mobilize insurance resources, such as the human resources of insurance team, operational expense, hardware facilities and venues and management skills and so on. With the inherent internal relation, create an effective mechanism in accordance with team activities, and whereby to promote the smooth development of insurance activities. The insurance team-building needs to respect the objective and to explore the internal mechanism of the insurance factors. Take the construction of incentive mechanism in insurance team as an example. Managers need a solid understanding of the interrelations of the four basic elements of team-members in insurance activities: demand, motivation, behavior and goal and seek the mechanism of combination of the four factors to match the objective needs of the incentive effects of insurance team management with the theory of incentive.

With the managerial philosophy of being a passive person and dong things rationally, we should maintain the vitality of an insurance team in the construction of system and mechanism and also pay attention to the long-term development of insurance team. Management of Way-oriented Theory focuses on people's development and emphasizes the people's subjectivity. It is not unconstrained supervision to team-members, but a return of people to explore and follow the path of insurance development. For cognitive rules of insurance managers, necessary correct mechanism is also needed to deal with their cognitive limitations and moral hazard.

## C. Structure of team members and its adjustment

Theory of same factor and different structure reveals the same elements via effective combinations can enhance or optimize the organizational structure. Echelon state of the insurance team-members should highlight the reasonable and sustainable structure of the members. The diversity of people's interest in learning may lead to differences in knowledge construction, and different knowledge construction would affect people's ability structure. The ability structure of insurance practitioners can be reflected by the personnel of insurance team. Because the insurance team needs the support of insurance overall capacities, it is difficult to support the role played in modern insurance team and the organizational function solely relying on team's local structure force.

The insurance team leader who is the core and soul of the team, with the dual role of insurance practitioners and pioneers, should be equipped with rich experience and innovation in insurance industry and high theoretical level and good organization and coordination capacity. Insurance team members are usually formed on the basis of long-term cooperation. They are an executive or professional collective, and has i reasonable knowledge, ability, gender and age structure.

Generally, in order to facilitate the communication between the insurance team members, maintain contact between them and coagulate the team power, the number of team-member should not be too much and usually 7 or so is appropriate. Team leader should create a nice environment and opportunity for the members. The relationship between the team members becomes more and more harmonious, from unfamiliar to familiar, from cautious to open, from turbulent to stable, from exclusion to embrace, from suspicion to trust. The more solid and trusting the relationship is, the smaller the organizational internal friction is and the more obvious the consistency of the team insurance activity is. The role of members in the team and the tasks to be undertaken should continue to make timely adjustments with the enhancement of business level and management capability, accomplishment of periodic tasks, and the replacement of old an new members. In other words, we need to try to keep the teaching team in the benign state of normalization.

## D. The choice of the insurance team-building approach

The choice of the insurance team-building a approach(or called development path) is the result of impact caused by factors of internal and external incentive and restraint in insurance team. Of these factors, regardless of the subjective ones or objective ones, the expected effect is to promote the insurance team to carry out activities along with the way suitable for its development. In practice, an insurance team running route is a specific form of insurance development laws. The law of insurance development is objective. To explore it, wisdom of managers or management team is needed. And ultimately, we need to follow people's cognitive laws to realize it.

I will further elaborate the understanding of the laws of insurance team development. The real state of any insurance organization may be a state with their own expectations, or a management state with the expectations of all insurance agencies stakeholders--insurance regulatory agencies, insurers, creditors and employees. Or it may be a real state that the above requirements don't meet. However, whatever state it is, there is always a path to achieve the state of the insurance activities in real life. Arriving here, we can reflect whether the reality objective path is the desired? The usual answer is always more or less regretful. There is a optimal path among the alternative development paths to get the insurance service state that we all expect. So compared with other paths, this path is a better one to follow the laws of insurance team's survival and development.

Confirm the fact that whether the approach of team-building meets the laws of team development, the practice test is needed. And so does the people's reflection to the past insurance experience. Correctly treating the price paid by "deviation" and "correction", modifying the relationship between perfectionism and realism. Accept the activities that meet the objective requirements, while adjusting or improving them which are unqualified. And all insurance activities need to follow people's cognitive laws, respect the subjectivity of insurance team managers and team-members. The supervision of insurance agencies and other departments should provide supports and services that they can for the development of the team members.

# V. Conclusion

As an innovative theory in the managerial theory system, Way-oriented Theory is in a process of continuous improvement. Due to the abstract feature, the effective application in practice remains to be further explored. In term of reality, the use of the theory is not entirely excluding the control and constraint of insurance team members. Respect for the comprehensive development of insurance team members is based on the compatibility and consistency of their comprehensive development and law of insurance operation. The philosophy of doing well one's own job is in line with the cognitive laws of team-members' comprehensive development and also a true portrayal of following the insurance operational laws. Excellent insurance team requires a process of development. The phenomenon that the team members deviate from the path of comprehensive development will occur in different stage. Therefore, insurance administration agency or director is needed to execute the duties of regulation and restraint in the construction and development of insurance team. Equally, due respect for members' capacity of self-correction is needed. And finally the insurance team management is in a ideal situation of beyond perfection.

# Reference

[1] Huang Lingxiang. Development law of independent innovative team and constructional strategy [J].Business Times,2007,(31),Page 64-66.
[2] Li Weian.A beneficial exploration of Chinese characteristic management theory--"Management of Way-oriented Theory: the essence of management and operational model" Review [J].The Nan Kai Management Review,2008,(4),Page 111-112.
[3] Qi Shanhong,Wang Jianzhon,Song Junqing. From organizational management to self-management--the subjective perspective of management paradigm evolution trend [J].Technology Management Research,2008,(8).Page 272-275.
[4] Zhe Guichang,Yang Xujun. Strategy research of coupling path of mental model in modern enterprise innovation team [J].Contemporary Economic,2009,(8).Page 117-119.
[5] Qi Shanhong,Cao Zhenjie. Management of Way-oriented Theory:the combined perspective of Chinese and western management philosophy [J].Management Journal,2009,(10).Page 1279-1290
[6] Zhang Daijun. The problem of "insurance three-state"--analysis of its dislocation and position in the perspective of "five-Z one-line" [J].Zhejiang Financial,2010,(11).Page 58-61.
[7] Zhang Daijun. Management of insurance agency [M].Lixin Accounting Press,2011,(11).Page 33-38.

AUTHOR: Zhang Daijun, master's supervisor, who is born in September, 1961, is financial professor of Zhejiang University of Finance and Economics and director of insurance research institute. His main research areas are capital markets and insurance theory. His main teaching courses are insurance, the use of insurance funds, insurance management, security investment, financial engineering and so on. He has completed 9 provincial or ministerial and lateral researches, complied 9 course books and published more than 50 academic articles in domestic and foreign authoritative journals.
Email:zdj0303@126.com；
Tele：13750815909

# 由道本理论引发的对保险机构团队建设的思考

张代军
金融学院，浙江财经学院，杭州，中国，310018

**摘　要：**阐述保险需求变化与保险团队建设相关性，对国内学者齐善鸿提出的道本理论精髓给予简要分析，强调其作为“儒、释、道”文化的传承与西方企业文化融合的创新理论对保险机构团队建设在组织机构完善、团队成员主体性与成员发展为管理归宿点等方面启示，并借助保险经营机构经营管理系统性的认识视角——“五 Z 一线”，就道本理论如何在保险团队建设理念、团队体制与组织的形成、机制与配置的确认以及团队发展路线选择等环节的具体应用进行尝试性探讨。

**关键词：**道本理论；保险团队建设；运用

# A Study on the Mechanism of the Boosting and Stabilizing Function from Insurance Consumption to Economic Growth

PU Chengyi Pan Xiaojun

School of Economics, Southwest University for Nationalities, ChengDu City,610041

**Abstract:** Demand suffers because Chinese consumers facing Low levels of insurance coverage and lacking a robust social security system save up as insurance against illness,unemployment and other uncertainty,and drive high savings rates and reduced consumption-- key factors in economic growth. The effect of consumer demand driving economic growth is paied more attention to all over the world after global financial crisis.Insurance policy is regarded as common consumption goods in this paper. With the method of specialization labour division and inframarginal analysis, an endogenous economic growth dynamic model with a generalized capital containing insurance consumption goods is built up, and the dynamic effect that the mechanism of the safeguard function of insurance consumption promoting economics is very complex,is analysed by the empirical test with VAR and VEC model, and impulse response function and variance decomposition on China`s case. The results show that insurance either gets into production areas in enterprise production consumption form, or enters in the consumer fields in a family personal and government service consumption form, to disperse risk from residents family, enterprise organizations and government agencies, involves in social economic system reproduction cycle with a small part of the embedding investment forming materialized labor and living labor cost. The article argued that the contribution of human capital Embedded insurance consumption to the growth of the economy (1.743) is much higher than that of the production consumption Embedded insurance does (1.222).

**Key Words**：Insurance Consumption；Economic Growth；Dynamic Effect；VAR anr VEC Model

## 一、引言

金融危机后的世界经济大衰退至今还未完全恢复，消费需求不足的阴影依然弥漫全球。投资和出口拉动的传统经济增长方式受到普遍质疑，各国迫切希望重整经济活力，恢复经济增长，消费的经济驱动功效受到重视。同样，金融危机后，我国出口受挫和投资乏力的双重拖累下，经济近 30 年一直保持着年均 9.5% 的增长率开始持续下滑，年均降幅超过 0.4%。而且，我国居民消费率长期以来持续下滑的趋势（1981-2000 间年均下降约 0.8%）在最近 10 年来呈加速下降态势（年均降幅超过 1.5%），长期高速增长的居民储蓄率不断攀升，年均增幅超过 25%。这种困境既不利于社会成员生活质量的提高，也难以实现共同分享经济发展的成果，也同经济发展初衷相背离，并有可能影响经济持续健康发展。

然而，保险消费在经济社会发展中的独特作用机制，长期以来未被我们正确认识，其特有的经济助推与稳定功能也未被真正重视。其实，消费需求受到对未来预防性（增加了储蓄动机）的制约，保险有助于减少对未来的预防性。因此，保险消费有撬动储蓄、间接促使消费和民间投资的功能。保险消费能够补充社会保障体系的不健全，也能弥补养老金支付的巨额缺口，也能减弱延迟退休政策提案正悄悄地啃噬着居民消费信心，也能改变消费意愿低迷而畸高的储蓄率，更能阻止经济增长下滑的态势。

保险消费与经济增长关系的研究始于 1895 年德国综合保险学派的兴起，经济学家 Lexis，法学家 Ehreberg 和数学家 Boblmann 等首次将保险与经济结合在一起研究[1]，以及 1970 年代美国总体保险学派和 1973 年瑞

士的国际保险经济学研究会的推动，将保险与经济、社会、政治和自然环境等结合起来分析，拓展了保险研究的深度和广度（Skipper，1992[2]；Harold，1998）[3]。不过，在Patrick（1966）[4]和Gold Smith（1969）[5]对金融发展和经济增长关系的实证分析后，保险和经济增长关系也有了深入研究，文献比较丰富。**首先，理论分析认为，**经济决定保险，保险服务并反作用于经济（Borch，1962[6]；刘茂山，1991[7]；栾存存，2004[8]；徐为山，2006[9]；郑伟，2007[10]）。**其次，实证也发现，**保险是经济发展的产物，依赖“实业引领，保险跟随”的需求跟进型路径对经济发展具有促进作用，但不同法制和文化环境的国家或地区的不同发展阶段的作用差异较大（Hak Hong Soo，1996[11]；Webb etal.[12]；Arena，2006[13]；Kris hna，2008[14]；Ward et al.，2000[15]；周海珍，2008[16]），甚至还认为其线性作用并不明显（曹乾，2006[17]；赵尚梅，2009[18]；胡宏兵，2010[19]），而其非线性效应显著（吴洪和赵桂芹，2010[20]）。另外，在强调保险对经济增长的正面效应时，也关注保险产业系统迅速扩张和发展对经济增长的负面效应，重视把保险对经济增长的正面效应和负面效应结合起来，准确权衡不同经济水平下保险发展的适宜水平，选择恰当的政府监管策略和产业引导政策（刘茂山，2003[21]；郝演苏，2004[22]；江生忠，2005[23]；卓志，2011[24]）。

**另外，保险功能视角的研究**推动了保险保障功能、金融功能和社会管理功能的融合，强化了保险服务活动对经济社会行为的影响（魏华林，2003[25]；吴定富，2004[26]；李扬，2004[27]；林宝清，2008[28]）。**保险消费视角的分析认为，**保险消费既受GDP与可支配收入的影响，还受法制和社会文化心理环境等因素综合影响，不仅对经济增长做出贡献，而且对非保险部门有溢出效应（郝演苏，2002[29]；Beck and Webb，2003[30]；刘茂山，2010[31]；赵进文，2010[32]），甚至对普通消费增长的促进作用也很明显（张风科，2011[33]）。

**综上所述，**虽然现有文献肯定了经济对保险的决定作用，也认可并强调保险对经济增长的促进作用。但是，仍有不少文献认为保险对经济增长没有作用，或其线性作用并不明显，或其非线性效应显著，甚至与处于不同经济发展水平的地区或国家，以及其不同阶段的经济增长呈完全不同的反向关系。显然，现有文献多从宏观结果的视角考察单因子保险与经济增长的关系，没有考虑到保险促进经济增长的微观机理，忽略了现代社会经济中被认为具有“助推器和稳定器功能”的保险是通过具体的保险消费活动来体现其作用功效的，才导致结论不一，甚至相反，以及不能清楚解释保险对经济的助推和稳定作用机制。

本文认为保险与经济的关系取决于保险在经济活动中的特殊功效和独特的作用机理，保险作用于经济的微观机理和宏观效应必须得到解释和实证，唯有如此才能让人们正确认识保险，重视保险消费在经济社会发展中独特的助推作用和经济社会波动中的稳定烫平功效。基于此目的，本文在理论分析基础上，以1980-2011年中国保险消费、经济增长的资本和劳动要素投入的实际数据，构建VAR和VEC模型，以及脉冲响应函数与方差分解，检验了嵌入保险消费的广义资本推动经济增长的动态效应；第四部分是研究结论与政策启示。

## 二、保险消费对经济增长的助推和稳定作用机理分析

保险消费对经济具有“助推和稳定”作用表现在它是一个社会经济系统中的动力系统与均衡系统。本文将保险作为生产和人们生活的安全需要纳入一般消费范畴，将保险消费分为生产消费保险和生活消费保险，前者以生产要素形式进入生产领域，既作为资本和劳动投入要素的嵌入性生产成本推动经济增长，还对经济活动在遭遇突发性风险冲击时因大起大落的波动提供保障。后者以生活消费品形式进入消费领域，弥补了社会保障的不足，满足了人的心理需求，增强了生活安全感，提高了幸福指数，提振了消费信心，内需旺盛，经济增长不息。

**（一）保险消费推动经济增长的静态模型**

假设生产要素是生产函数的必要条件，不保险时物质资本可作风险后备，保险后备则不需过多物质后备，保险赔偿金（或有索取权）就是一种以四两拨千斤的市场化事前准备。因此，物质资本与保险消费具有替代性。令$K(t)$为资本存量，$C(t)$为一般商品消费，$E(t)$为特殊的保险商品消费，其中，$E_R(t)$为进入生活的保险商品消费，$E_P(t)$为进入生产的保险商品消费。假设生产函数$Y(K,L,E_p)$严格凹的、一阶齐次和二阶连续可微。由于短期内人口变化不大，可假设劳动力 L 是一定的。那么，生产函数应为物质资本 K 和进入生产的保险消费（计为成本）的函数，计为$Y(K,E_P)$。而且，$F(0,E_p)=F(K,0)=0$，$F_{KE_p}=F_{E_pK}>0$。如果随着资本（或劳动）趋向于零，资本（或劳动）的边际产品趋向于无穷大，随着资本（或劳动)趋向于无穷大，资本（或劳动）的边际产品趋向于零，则稻田条件（Inada Condition）成立。

即有$\lim\limits_{k\to 0}F_K=+\infty$，$\lim\limits_{K\to+\infty}F_K=0$，$\lim\limits_{E_p\to 0}F_{E_p}=+\infty$，$\lim\limits_{E_p\to+\infty}F_{E_p}=0$　（1）

则可得状态方程：$\dot{K}=F(K,E_p)-C-\delta K$　（2）

式中：$\delta$为非货币资产折旧率（货币资产折旧率为 0）。消费分为普通消费和特殊保险消费两类。此外，定义消费函数$U(C,E_R):R_+\to R_+$为非降的、边际效用递减的二阶连续可微函数。同理，如果 Inada 条件成立，即有$\lim\limits_{C\to 0}U_C=+\infty$，$\lim\limits_{C\to+\infty}U_C=0$，$\lim\limits_{E_R\to 0}U_{E_R}=+\infty$，

$\lim\limits_{E_R\to+\infty}U_{E_R}=0$　（3）

另外，一定时期内进入生产消费的保险与进入生活消费的保险共同构成的总保险消费$\overline{E}$保持不变，则有：$E_R+E_P=\overline{E}$　（4）

设$\rho$为贴现率，则有效用函数：$\int_0^\infty U(C,E_R)e^{-\rho t}dt$

则以上问题变为求解以下动态优化问题：

$$\max\int_0^\infty U\left(C,\ \overline{E}-E_P\right)e^{-\rho t}dt$$

（5）

$$\text{s.t.}\quad \dot{K}=F(K,E_P)-C-\delta K$$

假设给定$K(0)=K_0>0$，$C>0,\ E_P\geq 0$。则有以下 Hamilton 方程：

$$H=U(C,\overline{E}-E_P)+\lambda[F(K,E_P)-C-\delta K]$$

（6）

式中：$\lambda$为财富资本的影子价格，其最优路径的充分必要条件为：

$$\lambda=U_C(C,\overline{E}-E_P)$$

（7）

$$U_{E_R}(C,\overline{E}-E_P)=\lambda F_{E_P}(K,E_P)$$

（8）

$$\dot{\lambda}=\lambda[\rho+\delta-F_K(E,E_P)]$$

（9）

$$\lim_{t\to\infty}\lambda K e^{-\rho t}=0$$

（10）

由式（7）、（8）可得：$U_{E_R}=U_C F_{E_P}$，即用于生活消费的保险商品边际效用必须等于普通消费边际效用与生产消费的保险商品边际产量的乘积。

为了进行稳定状态研究，令$\dot{K}=\dot{\lambda}=0$，由（5）有：

$$\dot{K}=0=F\left(K^*,\ E_P^*\right)-C^*-\delta K^*$$

（11）

$$\dot{\lambda}=0=\lambda^*[\rho+\delta-F_K\left(K^*,E_P^*\right)]$$

（12）

式中：*表示该变量的稳定状态值，即特解。

由式（12）知：当$\lambda^*>0$时，$\rho+\delta=F_K\left(K^*,E_P^*\right)$。定义隐函数$K\left(E_P^*\right)$，应用隐函数定理，可得：$dK/dE_P=-F_{KE_P}/F_{KK}>0$。将$K^*$代入式（11）可得：

$C=F[K\left(E_P^*\right),E_P^*]-\delta K\left(E_P^*\right)$，利用式（7），将式（8）重写为：

$$U_C F\left\{[K\left(E_P^*\right),E_P^*]-\delta K\left(E_P^*\right),\bar{E}-E_P^*\right\}F_{E_P}[K\left(E_P^*\right),E_P^*]$$
$$=U_{E_P}\left\{F[K\left(E_P^*\right),E_P^*]-\delta K\left(E_P^*\right),\bar{E}-E_P^*\right\}$$

（13）

式中，左边表示总保险消费的边际生产率$\left(VMP_{E_P}\right)$，右边表示生产消费保险商品的边际成本$\left(MC_{E_P}\right)$。对其求导可得：

$$\frac{dMC_{E_P}}{dE_P}=U_{E_R}C\left[\left(F_K-\delta\right)\frac{dK}{dE_P}+F_{E_P}\right]-U_{E_RE_R}>0$$

（14）

$$\frac{dVMP_{E_P}}{dE_P}=U_{CC}F_{E_P}\left[\left(F_K-\delta\right)\frac{dK}{dE_P}+F_{E_P}\right]-U_{CE_R}F_{E_P}+U_C\left(F_{E_PE_P}-\frac{F_{KE_P}^2}{F_{KK}}\right)<0$$

（15）

由于生产函数为严格凹的，故在稳定状态时，$F_K-\delta=\rho$为正，且$U_{CE_P}>0$。在区间$\left[0,\bar{E}\right]$内，$MC_{E_P}$为单调递增函数，而$VMP_{E_P}$为单调递减函数。

**（二）保险消费推动经济增长的状态—协状态相位关系分析**

为了研究$(K,\lambda)$的状态——协状态相位关系，由式（7）－（9）得：$\left(C,E_P\right)=\left[C(K,\lambda),E_P(K,\lambda)\right]$。利用隐函数定理可得以下一组线性方程：

$$\begin{bmatrix}U_{CC} & -U_{CE_R}\\ -U_{CE_R} & \lambda F_{E_PE}+U_{E_RE_R}\end{bmatrix}\begin{bmatrix}\partial C/\partial K & \partial C/\partial\lambda\\ \partial E_P/\partial K & \partial E_P/\partial\lambda\end{bmatrix}=\begin{bmatrix}0 & 1\\ -\lambda F_{E_P} & F_{E_P}\end{bmatrix} \quad (16)$$

由克莱姆法则可得：

$$\frac{\partial C}{\partial K}=-\frac{\lambda}{\Delta}F_{E_PK}U_{CE_P}<0 \quad (17)$$

$$\frac{\partial C}{\partial \lambda}=\frac{1}{\Delta}\left(\lambda F_{E_pE_p}+U_{E_pE_p}-U_{CE_p}F_{E_p}\right)<0 \tag{18}$$

$$\frac{\partial E_P}{\partial K}=-\frac{\lambda}{\Delta}F_{E_pK}U_{CC}<0 \tag{19}$$

$$\frac{\partial E_P}{\partial \lambda}=\frac{1}{\Delta}\left(-U_{CC}F_{E_p}+U_{CE_p}\right)>0 \tag{20}$$

式中：$\Delta=\lambda U_{CC}F_{E_pE_p}+U_{CC}U_{E_RE_R}-U_{CE_R}^2>0$

（21）

由式（17）和（19），当财富资本存量递增，则财富资本的边际生产力递减，边际生产力则一定小于$\rho+\delta$。由（12）可知$F_{KE_p}>0$，因此，生产消费的保险是递增的。而且，生产消费保险与生活消费保险存在此消彼涨的替代关系（企业年金与个人商业性养老保险间是存在替代关系的），而由于$U_{CE_p}>0$，所以消费的边际效用是递减的。由式（9）可知，当财富资本存量发生变化时，消费品的影子价格是常数。为使式（9）成立，同时，由于$U''(\cdot)<0$，则当消费减小时，必须有$U_C$递增。

由式（1）、（9）的雅可比矩阵，以及$C=C(K,\lambda)$、$E_P=E_P(K,\lambda)$和（17）-（20）可得：

$$\frac{\partial \dot{K}}{\partial K}=F_K-\delta+F_{E_p}\frac{\partial E_P}{\partial K}-\frac{\partial C}{\partial K}>0 \tag{22}$$

$$\frac{\partial \dot{K}}{\partial \lambda}=F_{E_p}\frac{\partial E_P}{\partial \lambda}-\frac{\partial C}{\partial \lambda}>0 \tag{23}$$

$$\frac{\partial \dot{\lambda}}{\partial K}=-\lambda\left(F_{KK}+F_{KE_P}\frac{\partial E_P}{\partial K}\right)>0 \tag{24}$$

$$\frac{\partial \dot{\lambda}}{\partial \lambda}=-\lambda F_{KE_P}\frac{\partial E_P}{\partial \lambda}<0 \tag{25}$$

由式（22）-（25）可得：$\det J=\frac{\partial \dot{K}}{\partial K}\frac{\partial \dot{\lambda}}{\partial \lambda}-\frac{\partial \dot{K}}{\partial \lambda}\frac{\partial \dot{\lambda}}{\partial K}<0$ （26）

因此，由式（1）和（9）组成微分方程为鞍点均衡，并且具有惟一的均衡点$(K^*,\lambda^*)$。

应用隐函数定理，两条等斜线$\dot{K}=0$和$\dot{\lambda}=0$的斜率正负性判断如下：

$$\left.\frac{d\lambda}{dK}\right|_{\dot{K}=0}=-\frac{\partial \dot{K}}{\partial K}\Big/\frac{\partial \dot{K}}{\partial \lambda}<0 \tag{27}$$

$$\left.\frac{d\lambda}{dK}\right|_{\dot{\lambda}=0}=-\frac{\partial \dot{\lambda}}{\partial K}\Big/\frac{\partial \dot{\lambda}}{\partial \lambda}>0 \tag{28}$$

通过（K，λ）相位图可知，具有较低的与消费品价格相对应的影子价格的财富资本存量，将会较大可能地导致较低的消费水平，而在高财富资本存量的情形下，任何资本的额外效用几乎没有任何意义。当时间足够大时，财富资本 K 与其影子价格$\lambda$单调趋向其均衡值。

**（三）保险消费推动经济增长的稳定状态的敏感性分析**

在稳定状态时$\dot{K}=\dot{\lambda}=0$，就$K,\lambda,\delta,\rho$间的关系进行讨论。由式（7）-（9），并令$(C,E_P)=[C(K,\lambda),E_P(K,\lambda)]$，则可进行参数变动对状态变量和协状态变量的影响分析。再由式（19）-（22）分析参数变动对控制变量的影响。利用隐函数定理，对式（1）和（12）组成的微分动力系统进行计算可得：

$$\begin{bmatrix} \frac{\partial \dot{K}}{\partial K} & \frac{\partial \dot{K}}{\partial \lambda} \\ \frac{\partial \dot{\lambda}}{\lambda * \partial K} & \frac{\partial \dot{\lambda}}{\lambda * \partial \lambda} \end{bmatrix} \begin{bmatrix} \frac{\partial K *}{\partial \delta} & \frac{\partial K *}{\partial \rho} \\ \frac{\partial \lambda *}{\partial \delta} & \frac{\partial \lambda *}{\partial \rho} \end{bmatrix} = \begin{bmatrix} K * & 0 \\ -1 & -1 \end{bmatrix} \tag{29}$$

由克莱姆法则可得：由（26）式有 $\det J = \frac{1}{\lambda^*}\left[\frac{\partial \dot{K}}{\partial K}\frac{\partial \dot{\lambda}}{\partial \lambda} - \frac{\partial \dot{K}}{\partial \lambda}\frac{\partial \dot{\lambda}}{\partial K}\right] < 0$

$$\frac{\partial K *}{\partial \delta} = \frac{\lambda *}{\det J}\left(\frac{K *}{\lambda *}\frac{\partial \lambda}{\partial \lambda} + \frac{\partial K}{\partial \lambda}\right)\begin{Bmatrix} > \\ = \\ < \end{Bmatrix} 0 \tag{30}$$

由（23）式有 $\frac{\partial K *}{\partial \rho} = \frac{\lambda *}{\det J}\frac{\partial \dot{K}}{\partial \lambda} < 0$ （31）

$$\frac{\partial \lambda *}{\partial \delta} = -\frac{\lambda *}{\det J}\left(\frac{\partial \dot{K}}{\partial K} + \frac{K *}{\lambda *}\frac{\partial \dot{\lambda}}{\partial K}\right) > 0 \tag{32}$$

$$\frac{\partial \lambda *}{\partial \rho} = -\frac{\lambda *}{\det J}\frac{\partial \dot{K}}{\partial K} > 0 \tag{33}$$

式中 $\partial \dot{K}/\partial K$ ，$\partial \dot{K}/\partial \lambda$ ，$\partial \dot{\lambda}/\partial K$ ，$\partial \dot{\lambda}/\partial \lambda$ 的正负性已由式（22）-（25）给出。

$$\frac{\partial C *}{\partial \rho} = \frac{\partial C}{\partial K}\frac{\partial K *}{\partial \rho} + \frac{\partial C}{\partial \lambda}\frac{\partial \lambda *}{\partial \rho} = \frac{\lambda *}{\det J}\left[-\frac{\partial C *}{\partial \lambda}(F_K - \rho) - F_{E_p}\left(\frac{-\lambda F_{E_p}}{\Delta}\right)\right] < 0 \tag{34}$$

以上可知，险险消费推动经济增长的稳定状态时，非货币性固定资产折旧率对资本存量的影响难以判断，对消费品价格则具有正向影响。其次，贴现率提高将对稳定状态的资本存量具有负向影响，但是，对消费品价格确有正向影响。另外，时间偏好率的增加将导致稳定状态时生产消费的保险提高，而导致用于生活消费的保险商品下降。

**（四）保险消费推动经济增长的动态模型**

从长期来看，人口会发生增减，一定时期内劳动力 L 是不确定的。如果假设人口 $N$ 是增长的，增长率为 $\pi$，则在稳定状态下的人均生产消费保险和普通消费要保持一定的增长率就不成立，则假设生产函数和效用函数都为 CD 型。设 $c = C/N$，$e_r = E_R/N$，效应函数为：

$U(c,e) = c^a e_r^b, a+b<1, a,b \in$（0，1）。当在一个物质文明与精神文明高度发达的社会时期，整个社会和个人都富了，反而生活消费保险将会很少，即 $e_r \to 0$ 时，用于生活消费的保险商品的效用为无穷小。社会总效用函数可表示为 $\int_o^\infty e^{-rt} N c^a e_r^b dt$ ，它又可表示为 $\int_o^\infty e^{-rt} C^a E_r^b dt$ ，设 $\rho$ 表示贴现率，$N(0)=1$，$r = \rho - \pi(1-a-b)$ 。如果生产函数规模收益不变，则生产函数为：

$F(K, E_p, N^e) = AK^\alpha E_p^\beta (N^e)^\gamma$

其中，$N^e$ 为社会有效劳动，$\alpha+\beta+\gamma=1$，社会生产技术水平 A 为一常数，一个正常劳动者在一定时期内的工作时间为 $u$ 、提供的有效劳动为 $h$ ，则 $N^e = uhN, 1-u$ 为通过学习而导致的人力资本的累积。由 Lucas（1988）模型，对人力资本累积，设人力资本的最大增长率为：$\dot{h} = h\tau(1-\mu), \tau > 0$ 。因此，以上问题可变为以下的动态优化问题：

$$\max_{C,E_p,U} \int_\circ^\infty C^a(\bar{E} - E_p)^b e^{-rt} dt \tag{35}$$

$$s.t. \dot{K} = AK^\alpha E_p^\beta (uhN)^\gamma - C - \delta K, K(0) = K_0 \tag{36}$$

$$\dot{h} = h\tau(1-u), h(0) = h_0 \tag{37}$$

则 $Hamilton$ 方程为：

$$H = C^{a}(\overline{E} - E_p)^b + \lambda_1[AK^{\alpha}E_p^{\beta}(uhN)^{\gamma} - C - \delta K] + \lambda_2[h\tau(1-u)] \quad (38)$$

其中：$\lambda_1, \lambda_2$ 分别为物质财富资本和人力资本的影子价格。

其充分必要条件为：$\lambda_1 = a(\overline{E} - E_p)^b / C^{1-a}$ （39）

式（39）给出了将保险消费合理地分离为边际生产消费保险和边际生活消费保险的最优值条件。从边际角度看，保险商品必须在消费和资本积累过程中具有相同的价值功效。

又 $\lambda_1 \beta AK^{\alpha}E_p^{\beta-1}(uhN)^{\gamma} = bC^{a}/(\overline{E} - E_p)^{1-b}$ （40）

式（40）表明，保险总消费必须在生活消费保险和生产消费保险中具有相同的价值功效。

$$\lambda_2 \tau h = \lambda_1 \gamma AK^{\alpha}E_p^{\beta}u^{\gamma-1}(hN)^{\gamma} \quad (41)$$

式（41）表明，用于生产和用于人力资本积累的时间具有相同的价值。

$$\dot{\lambda}_1 = \lambda_1[r + \delta - \alpha AK^{\alpha-1}E_p^{\beta}(uhN)] \quad (42)$$

$$\dot{\lambda}_2 = r\lambda_1 \gamma AK^{\alpha}E_p^{\beta}h^{\gamma-1}(uN)^{\gamma} - \lambda_2 \tau(1-u) \quad (43)$$

则边界条件是：$\lim\limits_{x\to\infty}\lambda_1 Ke^{-rt} = 0, \lim\limits_{x\to\infty}\lambda_2 he^{-rt} = 0$ （44）

令 d 为消费增长率 $\dot{C}/C$ 。由式（39）可得：

$\dot{\lambda}_1/\lambda_1 = -(1-a)d$ ，其中 $1-a>0$ 为边际效用的弹性系数。

再根据式（42）可得：$\alpha AK^{\alpha-1}E_p^{\beta}(uhN)^{\gamma} = r + \delta + (1-a)d$ （45）

因此，沿着经济社会的均衡增长路径，资本的边际产出等于其机会成本 $\gamma + \delta + (1-a)d$ 。对于 $CD$ 函数，资本的边际产出等于 $\alpha$ 与资本的平均产出之积。

由式（45）可得：$\dot{K}/K + \dot{C}/C = [\gamma + \delta + (1-a)d]/\alpha$ （46）

由于在经济社会的均衡路径上 $\dot{K}/K$ 为常数，故式（46）表明 $\dot{C}/K$ 为常数。

两边对时间求导，可得：$\dot{K}/K = \dot{C}/C = d$ ，即资本和消费具有相同的增长率 d。 （47）

为进一步分析增长率，式（45）两边对时间求导，可得：$d = \gamma(v+\pi)/(\gamma+\beta)$ （48）

式中 $v$ 表示人力资本的增长率。此式表明，保险总消费的弹性系数 $\beta$ 增加，将导致资本和普通消费的增长率下降，结果会导致经济增长率的下降，说明在经济社会的长期均衡中，保险保障消费应该有个适度区间，否则，保险保障消费过度，将会导致社会整体财富资本过量用于保障消费，整体社会经济效率下降。这也是目前欧洲高福利保障国家普遍面临的问题。

将（47）式代入（48）可得：$\frac{\dot{K}}{K} = \frac{\dot{C}}{C} = \frac{\gamma v + \pi\beta}{\gamma + \beta} = \frac{\gamma v + (1-\alpha-\beta)\pi}{\gamma+\beta}$ （49）

因此，$\frac{\gamma v + (1-\alpha-\beta)\pi}{\gamma+\beta} > 0$ 就是人均消费递增的充分必要条件。

为进一步求出人力资本的增长率，式（41）两边对时间求导，并置换出 $\dot{\lambda}_1, \lambda_1$，可得：

$$\dot{\lambda}_2/\lambda_2 = [\alpha - (1-\alpha)]d - (1-\gamma)v + \gamma\pi \quad (50)$$

联立（41）和（43）式可得：$\dot{\lambda}_2/\lambda_2 = r - \tau$ （51）

由式（48）、（50）和（51）可得人力资本的增长率为：

$$v=[(\gamma+\beta)(\tau-r)+a\gamma\pi]/[\gamma(1-a)+\beta]$$
$$=\{(\gamma+\beta)(\tau-\rho)+\pi[\gamma(1-b)+\beta(1-a-b)]\}/[\gamma(1-a)+\beta] \quad (52)$$

此计算结果显然小于不考虑外部效用的 $Lucas$ 模型中的相关增长率。这意味着，尽管某些要素会降低经济系统的潜在生产力，但这并不影响经济系统获得均衡增长。其次，如保险保障消费沿着积累过程保持不变条件下，CD 函数中的技术规模收益递减，那么，该模型建立的均衡增长与规模收益递减是一致的。另外，必须建立保证目标函数收敛到一特定值的相关条件。在经济的均衡路径上，消费增长率以 d 递增，用于生活消费保险量一定。那么，为保持系统的收敛，则必须要求：

$r-ad>0$ 即 $-r+[a\gamma(v+\pi)/(\gamma+\beta)]<0$ 成立，或写为 $v<[(\gamma+\beta)r/a\gamma]-\pi$ 。

由上述条件可知：$\beta/\lambda<v<[(\gamma+\beta)r/\alpha\gamma]-\pi$ （53）

可将（53）式写为关于参数 $\tau$ 的不等式，即教育的生产率形式。又由式（52）可得

$$\rho+[[\beta^2+\gamma^2]/\gamma(\gamma+\beta)+b]\pi<\tau<\rho\{(\gamma+\beta)-[\gamma(1-b)+\beta(1-a-b)]\pi\}\alpha\gamma \quad (54)$$

因此，在式（54）存在一正的非空区间条件下，必然存在一非空的保证系统均衡增长的集合。

将（39）代入（40）有 $[a(\overline{E}-E_p)^b/C^{1-a}]\beta AK^\alpha E_p^{\beta-1}(uhN)^\gamma=bc^a/(\overline{E}-E_p)^{1-b}$ （55）

其中 $E_R=\overline{E}-E_p$ 。又据（21）中的定义，由于满足存在一个解 $E_p$ ，$E_p\in(0,\ \overline{E})$ ，则可认为，保险商品消费是不可能全部用于生产消费的，用于生活消费保险不可能为零。这个结论是很符合现实情况的。

由式（55）、（47）可得：$Kd=AK^\alpha E_p^\beta(uhN)^\gamma-(b/a)(\overline{E}-E_p)\beta AK^\alpha E_p^{\beta-1}(uhN)^\gamma-\delta K$ （56）

整理得：$d=AK^{\alpha-1}E_p^\beta(uhN)^\gamma(\dfrac{\alpha\beta+b}{b}-\dfrac{\alpha\beta\overline{E}}{bE_p})-\delta$ （57）

用式（45）可得：$E_p=\alpha\beta/[\alpha\beta+b(1-\phi)]\overline{E}$ （58）

$E_R=b(1-\phi)/[\alpha\beta+b(1-\phi)]\overline{E}$ （59）

式中 $\phi=\alpha(\delta+d)/[r+\delta+(1-a)d]<1$

同理，由式（37）和（52）可求出 $u$ 的最优解。经计算可知，在满足式（53）的条件下，该值为一小于 1 的正数。表明生产消费保险是社会再生过程中物化劳动与活劳动投入中很小的一部分嵌入性投入，而且，拥有生活消费保险的劳动力对经济增长的贡献大于生产消费保险对经济增长的贡献。

**（五）保险消费推动经济增长动态模型的比较状态分析**

由式（58）可得：$\dfrac{\partial E_p}{\partial b}=-\alpha\beta[(1-\phi)-b\dfrac{\partial\phi}{\partial b}]/[\alpha\beta+b(1-\phi)]^2<0$ （60）

式中 $\dfrac{\partial\phi}{\partial b}=-\alpha\pi[\dfrac{\gamma(1+a\delta)}{\gamma(1-a)+\beta}+\delta+d]/[r+\delta+(1-a)d]^2<0$ 。由于 $\partial E_p/\partial a$ 的正负性难以判断，则用式（58）可得：

$$\frac{\partial E_p}{\partial q}=\frac{\partial \phi}{\partial q}\frac{ab\beta \bar{E}}{[a\beta+b(1-\phi)]^2} \tag{61}$$

式（61）中$q$为集合$T=(\rho,\pi,\tau,\delta)$中的一个元素，因此，$\partial E_p/\partial q$的正负性可由$\partial\phi/\partial q$决定。先求出$\partial E_p/\partial q$，再反解$\partial\phi/\partial q$便可。

$$\frac{\partial \phi}{\partial \rho}=-\frac{\frac{\alpha\gamma(r+a\delta)}{\gamma(1-a)+\beta}+\alpha(\delta+d)}{[r+\delta+(1-a)d]^2}<0 \tag{62}$$

$$\frac{\partial \phi}{\partial \pi}=\frac{\alpha(1-a-b)[\frac{\gamma(r+\delta)}{\gamma(1-a)+\beta}+\delta+d])}{[r+\delta+(1-a)d]^2}>0 \tag{63}$$

$$\frac{\partial \phi}{\partial \tau}=\frac{\alpha\gamma(r+a\delta)}{[\gamma(1-a)+\beta][r+\delta+(1-a)d]^2}>0 \tag{64}$$

$$\frac{\partial \phi}{\partial \delta}=\frac{\alpha(r-ad)}{[r+\delta+(1-a)d]^2}>0 \tag{65}$$

为保证式（65）为正，则要求$-r+ad=-r+a\gamma\left(v+\pi\right)/\left(\gamma+\beta\right)<0$，这与保证目标函数收敛的条件是一致的。

由式（36）、（39）-（43），可知：

$$\frac{\mathrm{a}\left(\bar{\mathrm{E}}-\mathrm{E_P}\right)^{\mathrm{b}}}{\mathrm{C}^{1-\mathrm{a}}}\beta\mathrm{AK}^{\mathrm{a}}\mathrm{E_P}^{\beta-1}\left(\mathrm{uhN}\right)^{\mathrm{r}}=\frac{\mathrm{bC}^{\mathrm{a}}}{\left(\mathrm{E}-\mathrm{E_p}\right)^{1-\mathrm{b}}}\text{，即（55）式} \tag{66}$$

$$\mathrm{aAK}^{\mathrm{a}-1}\mathrm{E_p}^{\beta}(\mathrm{uhN})^{\mathrm{r}}=\mathrm{r}+\delta+(1-\mathrm{a})\mathrm{d}\text{，即（45）式} \tag{67}$$

由式（39）、（41）可得：

$$\frac{a\left(\bar{E}-E_P\right)^b}{C^{1-a}}\gamma AK^{\alpha}E_P^{\beta-1}\left(uh\right)^{\gamma-1}N^{\gamma}=\lambda_2\tau \tag{68}$$

在（式66）到（式68）中，b值的提高，即生活消费用保险商品的边际效用的弹性减少，在生产要素一定的条件下，必然会对生产消费用保险具有直接和间接的正向影响。同时，b 值提高，同样提高了生产用保险和物质资本的边际成本，其结果必然是引起生产用保险商品需求的下降。同时，分析结果表明，以上两个影响的净值是负的。

## 三、保险消费推动经济增长的实证分析

### （一）模型设定与变量选择

综上所述，可以建立一个含有保险消费的广义资本新兴古典经济增长模型为：

$$y_t=\beta_0+\beta_1x_{1t}+\beta_2x_{2t}+\beta_3x_{3t}+\mu_t$$

其中，$\beta_0,\mu_t$分别为模型的常数项和随机扰动项，$\beta_1,\beta_2,\beta_3,y_t$分别为人力资本ADE、保险消费PI、物质资本WT、经济增长GDP。

**保险消费PI**：用保费总收入PI来反映经济发展中的保险消费。由于现实中没有生产消费保险与生活消费保险分开的数据，本文仍然采用汇总数据。

**物质资本投入WT**：用固定资产投资价格指数调整后得到各年度不变价（1980年价）资本形成总额（是常住单位在一定时期内获得减去处置的固定资产和存货的净额，包括固定资本形成总额和存货两部分的增加，是用支出法计算的当年国内生产总值的一部分）来反映经济发展中的物质资本投入WT。

**人力资本投入 ADE**：在教育程度越高，风险意识与保险意识越强的假设条件下，用在业人口平均受教育年限表示人力资本质量ADE，来反映经济发展的人力资本投入。根据

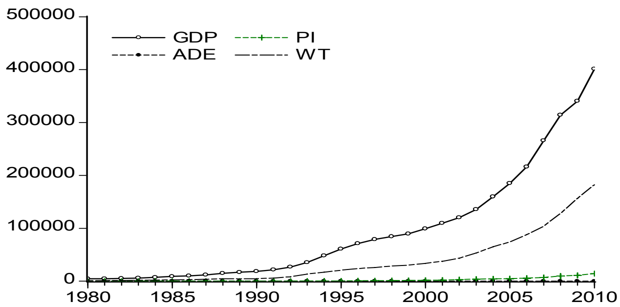
我国的教育体系，按教育程度分为 5 组：大专及以上、高中、初中、小学和文盲半文盲。考虑到资料的易获得性，将博硕研究生、本科和大专生合并为一组，忽略其彼此间的差异。另外，通过设定各类人员受教育年数来区分组间差异：文盲半文盲为 1、小学为 6、初中为 9、高中为 12、大专及以上为 16，通过加权求和得到人均受教育年限。

**经济增长 GDP**：用零售物价指数对 GDP 总值调整后得到的不变价 GDP（1980 年价）来反映经济增长。

根据 1980-2011 年间的中国《统计年鉴》、《劳动年鉴》和《保险年鉴》的数据整理得到以上指标。

**（二）平稳性检验**

首先，绘制变量 GDP、PI、ADE、WT 的时序图检查其截距项和趋势项，由图 1 可知所选序列存在一定的时间趋势但无截距项，由图 2 可知 LnGDP、LnPI、LnADE、LnWT 的时序图存在一定的时间趋势和截距项。然后，采用 ADF 单位根检验对数据进行平稳性检验，发现无论数据本身还是取对数都不平稳，而取对数的一阶差分后则平稳（表 1），表明变量均为一阶单整时间序列 I(1)，说明序列可进行协整分析。



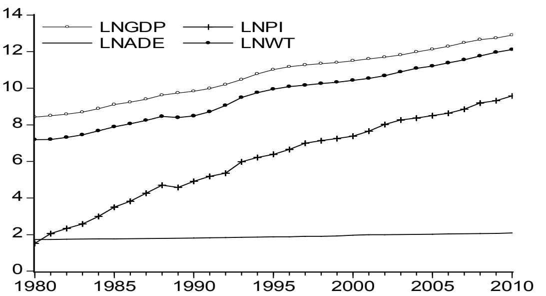




Fig.1 Graph of Time Series Variance

Fig.2 Graph of Log Time Series Variance

表 1 变量平稳性检验结果

| 变量 | 检验类型（C，T，L） | 临界值 5% | 临界值 10% | ADF 值 | 平稳性（5%） |
|---|---|---|---|---|---|
| GDP | (0，1，0) | -1.956 | -1.608 | 3.205 | 非平稳 |
| ADE | (0，1，0) | -2.963 | -2.621 | 1.876 | 非平稳 |
| PI | (0，1，0) | -2.981 | -2.629 | 9.512 | 非平稳 |
| WT | (0，1，0) | -1.952 | -1.610 | 2.758 | 非平稳 |
| LnGDP | (1，1，0) | -2.981 | -2.629 | -0.656 | 非平稳 |
| LnADE | (1，1，0) | -2.963 | -2.621 | 1.228 | 非平稳 |
| LnPI | (1，1，0) | -2.963 | -2.621 | -2.679 | 非平稳 |
| LnWT | (1，1，0) | -2.967 | -2.623 | -0.756 | 非平稳 |
| D(LnGDP) | (1，1，0) | -2.981 | -2.629 | -3.364 | 平稳 |
| D(LnADE) | (1，1，0) | -2.967 | -2.623 | -4.414 | 平稳 |
| D(LnPI) | (1，1，0) | -2.967 | -2.623 | -5.309 | 平稳 |
| *D(LnWT)* | (1，1，0) | -2.971 | -2.625 | -3.878 | 平稳 |

注：C、T、L 分别表示序列的截距项、趋势项和滞后项；*D* 为一次差分。

### （三）协整检验

采用 Johansen 协整检验对序列 LnGDP、LnADE、LnPI、LnWT 进行长期影响关系分析。首先建立 VAR 长期均衡模型为：

$$\begin{bmatrix}\ln gdp\\ \ln ade\\ \ln pi\\ \ln wt\end{bmatrix}=\begin{bmatrix}0.183\\ 0.216\\ -5.689\\ -4.85\end{bmatrix}+\begin{bmatrix}1.012 & 0.564 & 0.118 & 0.575\\ 0.093 & 0.805 & 0.014 & 0.047\\ 0.684 & 2.060 & 0.439 & 0.433\\ 0.664 & -0.089 & 0..281 & 1.449\end{bmatrix}\begin{bmatrix}\ln gdp\\ \ln ade\\ \ln pi\\ \ln wt\end{bmatrix}_{t-1}$$

$$+\begin{bmatrix}0.103 & 0.243 & 0.137 & 0.560\\ 0.091 & 0.001 & 0.009 & -0.022\\ 0.302 & -0.286 & 0.277 & -1.087\\ 0.382 & 1.828 & 0.166 & -1.371\end{bmatrix}\begin{bmatrix}\ln gdp\\ \ln ade\\ \ln pi\\ \ln wt\end{bmatrix}_{t-2}+\begin{bmatrix}\hat\varepsilon_0\\ \hat\varepsilon_1\\ \hat\varepsilon_2\\ \hat\varepsilon_3\end{bmatrix}_{t-1}$$

则可得滞后 1 期和滞后 2 期含有保险消费的广义资本对经济增长影响效应的 VAR 方程为：

$$\ln(gdp_t)=\underset{(0.2238)}{0.183}+\underset{(0.14875)}{1.012}\ln(gdp_{t-1})+\underset{(0.18745)}{0.564}\ln(ade_{t-1})+\underset{(0.07060)}{0.118}\ln(pi_{t-1})+\underset{(0.14687)}{0.5751}\ln(wt_{t-1})$$

$$+\underset{(0.017626)}{0.103}\ln(gdp_{t-2})+\underset{(0.08867)}{0.243}\ln(ade_{t-2})+\underset{(0.05975)}{0.137}\ln\left(pi_{t-2}\right)+\underset{(0.14928)}{0.560}\ln\left(wt_{t-2}\right)+\hat\varepsilon_t$$

$R^2$=0.9994　$\overline{R}^2$=0.9991　F =4367.644

由 VAR 长期均衡模型得到的滞后 1 期和滞后 2 期含有保险消费的广义资本和 GDP 对经济增长的影响效应方程可知，平均来说，每 1 个百分点的滞后 1 期保险消费可推动 0.118 个百分点的当期经济增长，每 1 个百分点滞后 1 期的平均受教育年限可推动 0.564 个百分点的当期经济增长，每 1 个百分点的滞后 1 期物资资本投入可推动 0.575 个百分点的当期经济增长，每 1 个百分点的滞后 1 期 GDP 可推动 0.575 个百分点的当期经济增长。**另外**，每 1 个百分点的滞后 2 期保险消费可推动 0.137 个百分点的当期经济增长，每 1 个百分点滞后 2 期的平均受教育年限可推动 0.243 个百分点的当期经济增长，每 1 个百分点的滞后 2 期物资资本投入可推动 0.560 个百分点的当期经济增长，每 1 个百分点的滞后 2 期 GDP 可推动 0.103 个百分点的当期经济增长。**由此可知**，含有保险消费的广义资本对经济增长有促进作用，回归系数都通过了显著性检验（括号内为标准差）。**同理**，由 VAR 长期均衡模型也得到的滞后 1 期和滞后 2 期的 GDP 对保险消费的影响效应方程可知，GDP 对保险消费也有正的影响效应，其影响力度超过前者。

表2　Johansen协整检验结果

| 特征值 | 协整方程个数 | 迹统计量 | 5 % 临界值 | P 值 | 协整方程个数 | 最大特征值统计量 | 5 % 临界值 | P 值 |
|---|---|---|---|---|---|---|---|---|
| 0.719528 | 没有 | 77.52065 | 47.85613 | 0.0000 | 没　有 | 35.59583 | 27.58434 | 0.0038 |
| 0.620173 | 最多1个 | 41.92482 | 29.79707 | 0.0013 | 最多1个 | 27.10510 | 21.13162 | 0.0064 |
| 0.292686 | 最多2个 | 14.81972 | 15.49471 | 0.0630 | 最多2个 | 9.695840 | 14.26460 | 0.2327 |
| *0.167228* | 最多3个 | 5.123876 | 3.841466 | 0.0236 | 最多3个 | 5.123876 | 3.841466 | 0.0236 |

表3 标准化协整系数（一个协整方程）

| LnGDP | LnADE | LnPI | LnWT |
|---|---|---|---|
| *1.000000* | -0.798772(0.24809) | -0.085891 (0.01944) | -0.826772(0.03682) |

然后，基于 VAR 模型进行 Johansen 协整检验，从检验结果（表 2）可知，迹统计量可以得到国内生产总值，保险消费，平均受教育年限，物资资本投入之间确实存在多个长期均衡关系。其次，最大特征值统计量也表明，国内生产总值，保险消费，平均受教育年限，物资资本投入间存在唯一的长期均衡关系，此实证结论与前面理论模型分析结论一致。因此，从上述 Johansen 协整检验结果可以看出，无论是迹统计量还是最大特征值统计量都表明，含有保险消费的广义资本和经济增长在 5 %显著性水平上的确存在长期协整关系，最大特征值统计量显示存在 1 个协整关系。因此，选择包含 4 个变量的协整方程，标准化协整系数如表 3 所示。

标准化协整向量为 ：(1, -0.798772, -0.085891, -0.826772)

协整方程为（括号中为标准差）：LnGDP=0.798772 LnADE+0.085891 LnPI+0.826772 LnWT

(0.24809) (0.01944) (0.03682)

协整方程表明，方程影响因子效应的差异较大，以保险消费的影响力最小，是符合前面理论结论（保险消费是社会再生过程中物化劳动与活劳动投入中很小的一部分嵌入性投入，影响力有限，而且，拥有生活消费保险的劳动力对经济增长的贡献大于生产消费保险对经济增长的贡献）。

**（四）Granger 因果检验**

基于 VAR 模型 Granger 因果关系检验如表 4 所示。结果表明，（1）无论滞后 2 期还是滞后 3 期，LnPI 与 LnGDP 与 LnADE、LnGDP 都存在双向因果关系；（2）滞后 2 期时，LnWT 与 LnGDP 存在双向因果关系；（3）滞后 3 期时，存在从 LnWT 对 LnGDP 的单向因果关系，而不存在 LnGDP 对 LnWT 的单向因果关系。

表4 基于VAR模型多个滞后长度的Granger 因果关系检验的结果

| 检验的原假设 | 滞后长度 | F检验统计量 | F统计量的概率值 | 对原假设的判断 |
|---|---|---|---|---|
| LnGDP $\nrightarrow$ LnADE | 2 | 4.32463 | 0.02489 | 拒绝原假设 |
| LnADE $\nrightarrow$ LnGDP | 2 | 3.98512 | 0.02863 | 拒绝原假设 |
| LnGDP $\nrightarrow$ LnADE | 3 | 3.59329 | 0.03070 | 拒绝原假设 |
| LnADE $\nrightarrow$ LnGDP | 3 | 3.74629 | 0.03657 | 拒绝原假设 |
| LnGDP $\nrightarrow$ LnPI | 2 | 5.47832 | 0.02042 | 拒绝原假设 |
| LnPI $\nrightarrow$ LnGDP | 2 | 19.9844 | 7.8E-6 | 拒绝原假设 |
| LnGDP $\nrightarrow$ LnPI | 3 | 3.45730 | 0.03342 | 拒绝原假设 |
| LnPI $\nrightarrow$ LnGDP | 3 | 12.2663 | 7.5E-5 | 拒绝原假设 |
| LnWT $\nrightarrow$ LnGDP | 2 | 8.83673 | 0.00133 | 拒绝原假设 |
| LnGDP $\nrightarrow$ LnWT | 2 | 3.76311 | 0.03789 | 拒绝原假设 |
| LnWT $\nrightarrow$ LnGDP | 3 | 3.87310 | 0.02381 | 拒绝原假设 |
| *LnGDP $\nrightarrow$ LnWT* | 3 | 1.86699 | 0.16614 | 不能拒绝原假设 |

**（五）VEC 模型**

尽管前述的 VAR 模型只刻画了含有保险消费的广义资本投入与 GDP 间的长期均衡关系，但是，并不能反映其彼此间关系的实时动态变化机理，需要进一步借助 VEC 模型考察短期波动的影响。

由 VEC 模型及得到的滞后 1 期和滞后 2 期含有保险消费的广义资本对经济增长影响效应的 VEC 方程可知，**在其它条件不变的条件下，**每 1 个百分点的滞后 1 期保险消费可**平均推动** 0.112 个百分点的当期经济增长，每 1 个百分点滞后 1 期的平均受教育年限可**平均推动** 0.193 个百分点的当期经济增长，每 1 个百分点的滞后 1 期物资资本投入可**平均推**

动 0.39 个百分点的当期经济增长，每 1 个百分点的滞后 1 期 GDP 可**平均**推动 0.388 个百分点的当期经济增长。**另外，在其它条件不变的条件下，**每 1 个百分点的滞后 2 期保险消费可**平均**推动 0.063 个百分点的当期经济增长，每 1 个百分点滞后 2 期的平均受教育年限可**平均**推动 1.08 个百分点的当期经济增长，每 1 个百分点的滞后 2 期物资资本投入可**平均**推动 0.054 个百分点的当期经济增长，每 1 个百分点的滞后 2 期 GDP 可**平均**推动 0.189 个百分点的当期经济增长。

由 VEC 模型检验结果可知，含有保险消费的广义资本对经济增长有促进作用，回归系数都通过了显著性检验（括号内为标准差）。**同理，**由 VEC 模型也得到的滞后 1 期和滞后 2 期 GDP 对保险消费的影响效应方程可知，GDP 对保险消费也有正的影响效应，其影响力度超过前者。

$$\Delta \ln Y_t = \begin{bmatrix} 0.128 \\ 0.031 \\ 0.194 \\ 0.079 \end{bmatrix} + \begin{bmatrix} 0.388 & 0.193 & 0.112 & 0.391 \\ -0.101 & -0.110 & 0.059 & 0.016 \\ -0.061 & 1.743 & 0.155 & 0.366 \\ -0.275 & -2.322 & -0.037 & 1.222 \end{bmatrix} \Delta Y_{t-1}$$

$$+ \begin{bmatrix} 0.189 & 1.081 & 0.063 & 0.054 \\ 0.356 & -0.300 & -0.025 & 0.020 \\ 0.602 & 2.406 & -0.029 & -0.366 \\ -0.302 & -2.129 & 0.049 & 1.188 \end{bmatrix} \Delta Y_{t-2} + \begin{bmatrix} -0.223 \\ 0.021 \\ -0.366 \\ 1.188 \end{bmatrix} VECM_{t-1} + \hat{\varepsilon}_t$$

$R^2$=0.9564　$\overline{R}^2$ =0.9661　F =4253.64

其中，向量误差修正项

$$\mathrm{VECM_{t-1}} = LnGDP_t - 0.799 LnADE_t - 0.085 LnPI_t \text{ - } 0.8267\mathrm{LnWT_t} - 3.742$$

$$LnY_t = (LnGDP_t, LnADE_t, LnPI_t, LnWT_t)'$$

由上面总的模型可知，含有保险消费的广义资本投入与 GDP 间的 VEC 动态机理模型表明，含有保险消费的广义资本投入与 GDP 有明显互为因果的协整关系，则一定存在描述 GDP 动态增长机理的率由短期波动向长期均衡调整的误差修正模型（括号中为标准差）：

$$\Delta(\ln gdp_t) = \underset{(0.04146)}{0.128} + \underset{(0.27615)}{0.388}\,\Delta\ln(gdp_{t-1}) + \underset{(1.07527)}{0.193}\,\Delta\ln(ade_{t-1}) + \underset{(0.08788)}{0.112}\,\Delta\ln(pi_{t-1}) + \underset{(0.17669)}{0.391}\,\Delta(\ln wt_{t-1})$$

$$+ \underset{(0.24819)}{0.189}\,\Delta\ln(gdp_{t-2}) + \underset{(1.08867)}{1.081}\,\Delta\ln(ade_{t-2}) + \underset{(0.06557)}{0.063}\,\Delta(\ln pi_{t-2}) + \underset{(0.23917)}{0.054}\,\Delta(\ln wt_{t-2}) - \underset{(0.29099)}{0.223}\,ecm_{t-1}$$

$R^2$=0.9564　$\overline{R}^2$ =0.9661　F =4253.64　DW=2.103

从误差修正模型看，向量误差修正项 $\mathrm{VECM_{t-1}}$ 的误差修正项系数为-0.223，表明 VEC 模型的自我动态修正机制能针对冲击后发生偏离的自我调整能力较强，误差修正项均具有较强反向调整能力，存在短期到长期的动态调整过程。

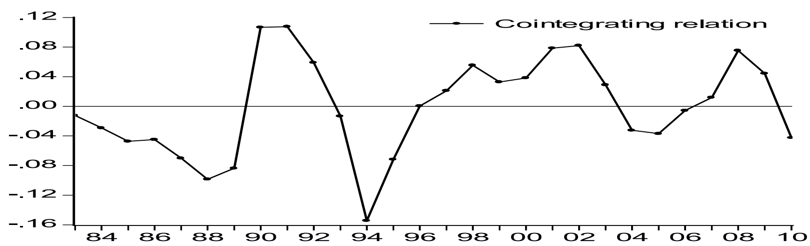



Fig.3　Curve of the EC Part in VECM

另外，在估计 VEC 模型后，还需要对模型估计结果做 VEC 模型的误差修正项曲线图，以便直观反映长期动态变化趋势。图 3 中的零均值线代表了变量间长期均衡的稳定关系，VEC 模型的误差修正项曲线是含有保险消费的广义资本投入与 GDP 间的动态变化趋势，曲线在 1994 年左右出现严重的短期波动，偏离长期均衡关系，而且，反映在模型中的误差修正项的绝对值也较大验证了这种冲击效应，经过大约 2 年的调整又重新回到长期均衡稳定状态（1996 年），曲线的短期波动以后的偏离长期均衡关系的幅度比较小，反映在模型中的误差修正项的数值也逐渐趋小，验证了这种冲击的消退过程。

### （六）脉冲响应分析及方差分解

脉冲响应函数刻画的是在 VEC 扰动项上施加一个单位标准差大小的新息( Innovation) 对内生变量的当前值和未来值的影响。因此，基于 VEC 模型，还需要进行脉冲响应分析来检验模型中每个内生变量对其自身以及其他内生变量的扰动所作出的反应，来了解 VEC 模型的动态特征。

图 4、5、6、7 分别描述了一个标准差的 LnGDP、LnADE、LnPI、LnWT 的扰动对 LnGDP 的影响（20 期），结果表明（表 6），LnGDP 自身的冲击对 LnGDP 影响的反映最快，数值最大，波幅较宽，持续时间最长，大约在 16 期后趋于稳定（图 4）。LnPI 对 LnGDP 影响的响应速度、数值大小和影响持续时间都要次之，但波幅最宽，大约在 13 期后趋于稳定（图 6），而 LnGDP 对 LnPI 影响的响应速度（0.07）、数值大小（0.088）、波幅宽窄都要远远超过 LnPI 对 LnGDP 的影响程度，但影响持续时间稍短，在 11 期后趋于稳定。LnADE 对 LnGDP 的冲击力度较弱，响应较慢，还有延迟，要在大约第 4 期才反映出来，波幅较窄，持续时间较短，大约在 10 期后趋于稳定（图 5）。LnWT 对 LnGDP 的冲击力度最弱，反映较慢，波幅较窄，持续最较短，大约在 5 期后趋于 0，然后窄幅上下振荡，大约 12 期后趋于稳定（图 7）。

另外，由于变量间既存在长期协整关系，又有 VECM 的动态结构效应，用方差分解分析法（给定一个不同时期的解释变量的波动，可对 VECM 中其他变量相应时期对方差的贡献进行分解）则可进一步找到经济增长受到自身，以及保险消费、人力资本和物质资本大约 20 期的影响效应（表 5）。

表 5　一个标准差的 LnGDP、LnADE、LnPI、LnWT 对 LnGDP 脉冲响应

| 冲击 \ LnGDP | 反映快慢 | 起始值 | 最大值 | 波幅宽窄 | 持续时间 | T 期后趋于稳定 |
|---|---|---|---|---|---|---|
| LnGDP | 最快 | 0.06 | 0.081 | 最宽 | 最长 | 16 |
| LnPI | 较快 | 0.04 | 0.084 | 窄 | 较长 | 13 |
| LnADE | 延迟 3 期 | 0 | 0.032 | 较宽 | 短 | 10 |
| *LnWT* | 较慢 | 0 | 0.031 | 较窄 | 很短 | 12 |

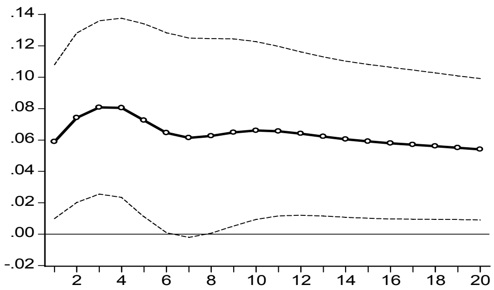



Fig4 Response of LnGDP to Cholesky One S.D. LnGDP Innovation

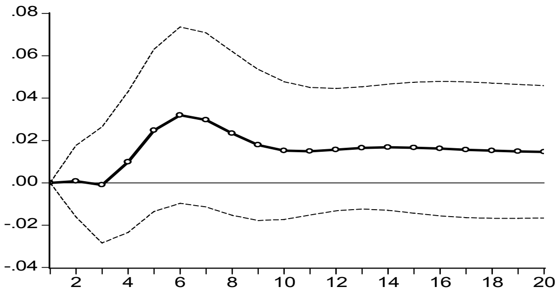



Fig.5 Response of LnGDP to Cholesky One S.D. LnADE Innovation

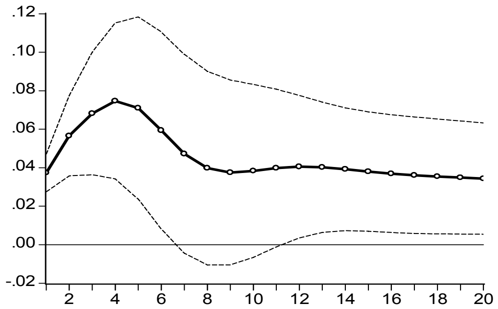



Fig.6 Response of LnGDP to Cholesky One S.D. LnPI Innovation

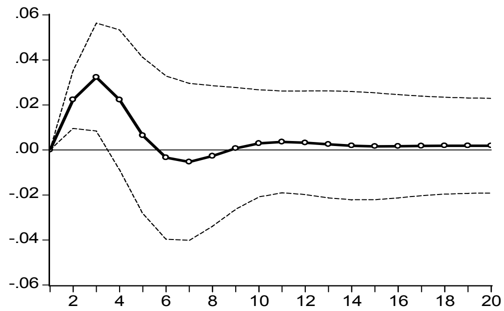



Fig.7 Response of LnGDP to Cholesky One S.D. LnWT Innovation

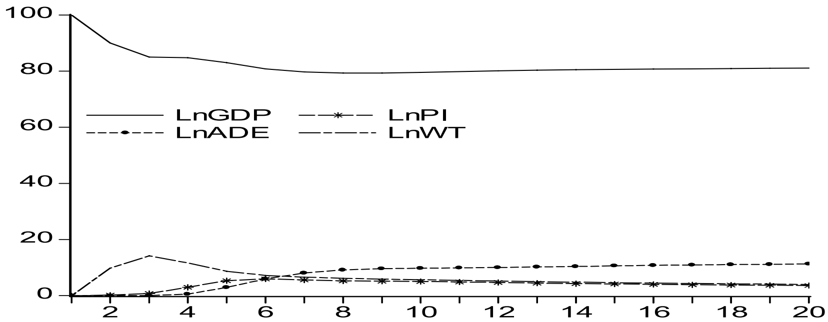



Fig.8 Variance Decompositon of LnGDP

从表 6 可知，经济增长本身是最主要的影响因素，这也与脉冲响应函数得到的结论一致，但贡献力度在逐期下降，直到 5 期后稳定在 80%左右，而嵌入保险消费广义资本对经济增长的贡献在逐期上升，6 年后分别稳定在 6%-7%左右。但是，实证表明，嵌入保险消费的广义资本对经济增长的影响机理复杂。其中，保险消费对经济增长的影响缓慢而持续时间较长，轨迹呈倒 U 状的钟罩型；物质资本影响反应快，迅速上升转而缓慢下降，具有长尾特性；人力资本的影响具有延迟性特征，要到冲击后的 5 期才开始缓慢出现影响，但此影响却不断上升，而且持续增长。同时，从表 7 中可以看出，在第 6 期预测中，LnGDP 的 S.E. 为 0.170143，其 80.2588%是由 LnGDP 自身的扰动所引起的，但还有部分是由其它引起的，其中，5.97069%由 LnADE 引起，5.974705%是由 LnPI 引起，7.228727%是由 LnWT 引起。而且，随着时间的推移，由 LnGDP 以外的部分扰动所引起的部分逐渐增加，而由 LnGDP 自身扰动所引起的比例则不断下降。另外，从变量 LnGDP 方差分解的合成图（图 8）也可以看出这种趋势。

表 6 LnGDP 的方差分解

| Period | Variance Decomposition of LnGDP | | | | |
|---|---|---|---|---|---|
| | S.E. | LnGDP | LnADE | LnPI | LnWT |
| 1 | 0.037338 | 100.0000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 0.071457 | 89.98782 | 0.011652 | 0.201870 | 9.798662 |
| 3 | 0.104295 | 84.98121 | 0.015114 | 0.799044 | 14.20463 |
| 4 | 0.132245 | 84.75734 | 0.557103 | 3.021937 | 11.66362 |
| 5 | 0.154710 | 83.00868 | 2.967933 | 5.329632 | 8.693755 |
| 6 | 0.170143 | 80.82588 | 5.970690 | 5.974705 | 7.228727 |
| 7 | 0.179350 | 79.68317 | 8.111536 | 5.611395 | 6.593903 |
| 8 | 0.185218 | 79.32858 | 9.192060 | 5.274948 | 6.204409 |
| 9 | 0.189967 | 79.31877 | 9.621276 | 5.160612 | 5.899340 |
| 10 | 0.194559 | 79.50777 | 9.781078 | 5.064946 | 5.646206 |
| 11 | 0.199250 | 79.80404 | 9.882796 | 4.897972 | 5.415195 |
| 12 | 0.203980 | 80.09632 | 10.01834 | 4.694315 | 5.191029 |
| 13 | 0.208580 | 80.32226 | 10.20363 | 4.495788 | 4.978321 |
| 14 | 0.212912 | 80.48204 | 10.41347 | 4.318914 | 4.785575 |
| 15 | 0.216928 | 80.60168 | 10.61618 | 4.166545 | 4.615601 |
| 16 | 0.220656 | 80.70401 | 10.79353 | 4.036102 | 4.466361 |
| 17 | 0.224152 | 80.80080 | 10.94268 | 3.922365 | 4.334161 |
| 18 | 0.227464 | 80.89500 | 11.06942 | 3.820118 | 4.215459 |
| 19 | 0.230621 | 80.98515 | 11.18131 | 3.726023 | 4.107523 |
| *20* | 0.233637 | 81.06888 | 11.28390 | 3.638671 | 4.008553 |

## 四、研究结论与政策启示

### （一）理论分析结论及政策启示

被现代社会公认为地方经济发展、社会稳定和人民生活安定做出重要贡献，起到经济“助推器”和社会“稳定器”的保险是通过具体的保险消费活动来体现其功能作用的。本文将保险作为人们的安全需要纳入一般消费范畴，将保险消费分为生产消费保险和生活消费保险，前者以生产要素形式进入生产函数，后者以生活要素形式进入效用函数。**首先，**在人口规模保持不变的条件下，经济系统存在惟一的鞍点均衡值。保险消费最优分配的**必要条件是：**生产用保险消费的边际生产力等于其边际成本。保险消费最优分配的均衡状态值为正的**充分条件是：**保险消费偏好在生产消费用保险和生活消费用保险的选择与数量决策时具有决定性作用。而且，通过比较状态分析可知，**如果贴现率 $\rho$ 提高（人口保持不变），**将既导致物质资本的边际成本的增加以及就业水平的下降，也导致生产消费保险商品量和保险总消费的边际生产率的下降，既导致保险消费商品总供给量的减少，也导致生产消费和生活消费保险商品的减少，引起保险商品总需求下降，既导致对保险资源的开发减少和对保险产业资源的利用率的下降，也会阻碍保险业的良好发展。**因此，**随着生活消费保险边际效用弹性的下降，生产消费保险的最优量将下降。消费保险边际效用的弹性越低，消费保险商品的需求越强。如果消费者视生活消费保险为生活必需品，即当消费用保险商品为零时的生产用保险商品的边际成本为无穷小，这个结论保证了保险商品不可能全部进入生产消费，必然有一部分进入人们的生活消费内容中。

**其次，在人口变动情况下，**含有保险消费的广义资本内生最优经济增长模型分析表明，基于一定的生产消费保险和生活消费用保险间分配基础上的人均总消费递增的经济增长是可以实现的（式 68）。而且，通过比较状态分析可知，**如果贴现率 $\rho$ 提高（人口增长率 $\pi$ 为正时），一方面，**生产消费保险的边际生产能力增加及其边际成本减少，将导致生产消费保险需求数量增加。**另一方面，**由于物质资本边际成本的提高将降低保险消费

的边际价值，也将导致生产用保险消费商品需求增加。两方面的合力迫使保险商品价格上涨，必然引起保险服务供给总量提高和保险资源开发利用率增多，将推动经济更健康稳定增长。**如果贴现率$\rho$降低，**保险消费需求上升，迫使保险商品价格上涨，必然引起保险服务供给总量提高，保险资源开发利用的增多，保险产业资源利用率高效，将导致保险业发展得更好。

**另外，**人力资本最大增长率$\tau$增加（教育活动的生产力提高），与人口增长率$\pi$提高所导致的保险消费需求的正效应是一样的，其正效应高于由于人力资本最大增长率$\tau$的增加所导致的物质资本和有效人力资本的提高所引起的负效应。显然，在考虑人力资本的经济系统，贴现率对经济增长具有决定性作用。同时，非货币资产折旧率$\delta$的变动与由于教育活动的生产力的变动具有相同的效应。

**（二）实证分析结论及政策启示**

基于中国数据构建的 VAR 和 VECM 模型，以及脉冲响应函数与方差分解，对嵌入保险消费的广义资本促进经济增长的动态效应进行的实证分析表明，我国嵌入保险消费的广义资本投入与经济增长间存在协整关系。在彼此动态关系机制的形成中，促进经济增长本身的效果比调节嵌入保险消费的广义资本可能要来得显著，却不能持续（5 期后平稳），而尽管调节嵌入保险消费的广义资本可能要来得缓慢，但作用效果却能逐渐上升并长期持续（16 期后才平稳）。特别是在有保险消费的人力资本下，平均受教育程度越高，风险意识与保险意识越强，对保险消费的贡献率越高，嵌入活劳动的保险消费对经济增长的贡献（1.743）要大于嵌入物化劳动的保险消费和物质资本对经济增长的贡献（1.222）。因此，保险消费在广义资本投入中，无论是生产领域，还是生活领域，数量不大，但作用很大，其功能作用类似化学催化剂。这为商业保险参与社会保障体系的完善和年金产品的推广提供了科学依据，为保险推动和稳定社会经济健康持续运行提供理论支持。

因此，需要把消费主导作为经济转型的主要目标，重视保险消费在经济活动中的助推和稳定作用，有助于保险成为社会保障不足的重要补充，成为支持出口、保障投资和服务民生的重要措施，成为优化金融结构和提高金融市场资源配置效率的重要力量，成为促进社会公共服务管理创新和提高政府行政能力效能的重要手段，成为提振消费信心，化解储蓄率畸高的长期扭曲困境的重要举措，成为扩大内需和推动经济持续健康发展的有力保障。

**参考文献**

[1] 魏华林,林宝清.保险学[M].高等教育出版社,1999,P.6-38
[2] Skipper.(1992),国际风险与保险－环境管理分析[M].1999 译,机械工业出版社,P.8-126
[3] Harold.(1998),International Risks and Insurance：An Environmental Managerial Approach[M].Irwin,P.3-15
[4] Patrick H.(1966),Financial Development & Economic Growth in Underdeveloped Countries[J].Economic Development and Cultural Change,(14):174-189
[5] Raymond William Goldsmith.(1969),Financial structure & development,New Haven,Yale University Press.
[6] Borch,Karl H.(1962),Equilibrium in reinsurance market.Econometrica,30,424-444
[7] 刘茂山.保险经济学[M].南开大学出版社,1991.7,P.1-164
[8] 栾存存.我国保险业增长分析[J].经济研究,2004(1),P.25-32
[9] 徐为山,吴坚隽.经济增长对保险需求的引致效应[J].财经研究,2006（2）,p.127-137
[10] 郑伟,刘永东.中国保险业中长期增长潜力分析[J].北京大学学报（社）,2007（5）,p.105-114
[11]Hak Hong Soo.(1996),Life insurance and economic growth: theoretical and empirical investigation.Dissertation for PH.D.Nebraska University.P.1-164
[12] Webb I.P.,Grace MF,Skipper H.D.(2002),The Effect of Banking and Insurance on the Growth of Capital And output, Center for Risk Management and Insurance Working Paper,No.02-1.
[13] Marco Arena(2006),Does Insurance Market Activity Promote Economic Growth?Across-country Study for Industrialized and Developing Countries,World Bank Policy Reseach Working Paper 4098:1-21.

[14] Kris hna(2008),Does Insurance Promote Economic Development? Empi rical Evidence from India, Journal of Applied Economic Research, 2(1):43-86
[15] Ward D,Zurburegg R.(2000),Does Insurance Promote Economic Growth? Evidence from OECD Countries. Journal of Risk and Insurance,67(4),489-506
[16] 周海珍.保险业发展与拉动经济增长的关系研究[J].管理世界,2008（11）,p.170-185
[17] 曹乾,何建敏.保险增长与经济增长的互动关系：理论假说与实证研究[J].上海金融,2006(3),p.14-16
[18] 赵尚梅,李勇、庞玉锋.保险业对经济增长贡献的理论模型与实证检验[J].保险研究,2009（1）,p.51-56
[19] 胡宏兵,郭金龙.中国保险发展与经济增长关系检验[J].宏观经济研究,2010（2）,p.41-47
[20] 吴洪,赵桂芹.保险发展、金融协同和经济增长[J].经济科学,2010(3),p.P.61-72
[21] 刘茂山.论保险业的最大风险——兼论保险的本质及其回归[J].南开经济研究,2003（06）,p.63-67
[22] 郝演苏.中国保险:40%的泡沫源于错误产业方向[J].中国新闻周刊,2004（40）, p.44-46
[23] 江生忠.中国保险产业组织优化研究[D].2001年南开大学博士学位论文,2001.6,P.1-152
[24] 卓志.保险监管的政治经济理论及其启示[J].金融研究,2001（5）,P.111-118
[25] 魏华林,李金辉.论充分发挥保险的社会管理功能[J].保险研究,2003(11),p.35-38
[26] 吴定富.发挥保险的社会管理功能,不断完善社会主义市场经济体制[J].中国金融,2004(4),p.8-10
[27] 李扬.保险业的社会管理功能[J].中国金融,2004(4),p.13-16
[28] 林宝清.对保险的资金融通功能与社会管理功能的再批判——对卢爽同学质疑的答疑[J].海南金融,2008(6),p.50-51
[29] 郝演苏.发展保险启动消费加速经济发展[J].保险研究,2002（5）,p.7-10
[30] Beck,T.and Webb.Consumption across Economic Countries.Demographic and Institutional Determinants of Life Insurance. World Bank Economic Review,2003
[31] 刘茂山.从保险消费观视角分析我国保险业的发展[J].保险研究,2010,(08),p.53-59
[32] 赵进文,邢天才,熊磊.我国保险消费的经济增长效应[J].经济研究,2010（S1 期）,p.21-26
[33] 张风科.中国保险业发展与消费增长的关系研究[J].保险研究,2011（12）,P.51-56

# 保险消费对经济增长的助推和稳定作用机理分析*

蒲成毅 潘小军
西南民族大学经济学院，成都，610041

**摘要：**全球金融危机后，各国对经济增长动力的倚重发生改变，消费需求的经济驱动功效倍受关注。目前，我国社会保障体系还不健全，预防性储蓄动机强烈，高储蓄与低消费的畸形已成经济持续增长的制约。本文将保险纳入一般消费范畴，理论分析发现，保险要么以企业生产成本形式进入生产领域，要么以家庭个人和政府机构的服务消费形式进入消费领域，构成社会经济系统再生产循环中物化劳动与活劳动消耗的一小部分嵌入性投入，保险消费对经济具有“助推和稳定”作用机理非常复杂。另外，以 1980-2011 年的中国数据构建 VAR 和 VEC 模型，以及脉冲响应函数与方差分解，检验了嵌入保险消费的广义资本投入促进经济增长的动态效应，发现平均受教育程度越高，风险意识与保险意识越强，对保险消费的贡献率越高，将导致嵌入活劳动的保险消费对经济增长的贡献（1.743）要大于嵌入物化劳动的保险消费和物质资本对经济增长的贡献（1.222），保险消费促进经济增长的整体效果虽然表现缓慢，但逐渐上升并持续时间较长（16 期后才平稳）。

**关键词：**保险消费；经济增长；动态效应；VAR 和 VEC 模型

---

*本文为国家社科基金（12XJL012）、教育部一般规划（11YJA850016）、四川省科技厅软科学（2012ZR0025）、中央高校专项（11SZYTH12）等的资助成果。
**蒲成毅**（1966-），男，经济学博士，博士生导师，教授，中国保险学会理事，主要从事金融保险学教学科研。
**潘小军**（1969-），女，经济学硕士，讲师，主要从事金融保险学教学科研。
**通讯作者：蒲成毅**
**通讯地址：四川省成都市一环路南四段 16 号，西南民族大学经济学院，邮编：610041**
**联系电话：**18908212316
**电子邮箱：**Pucy2011@126.com

# Analysis on Risk Factors and It`s Sequential Chain Structure

PU Chengyi　PAN Xiaojun
Southwest University for Nationalities，　Chengdu City，　610041

**Abstract:** The theory on traditional risk factors and their structure are described as "risk factors,risk events,risk loss" based on the view of insurance, while it is " risk source,risk carrier,prevention and reduction disaster " based on the scientific project perspective, and it can't really reflect the complexity,variety and diversity of the process of development and happen of risks, is also hard to keep up with the development of the risk management techniques,with the global climate changing and the crustal moving, the relief of extreme disasters occuing frequently is very rare,the connotation extension of traditional risks need to be revised, risk factors and sequential chain structure should be renewed. A new theory is put out that the order of the elements of "risk factors,risk environment,risk carrier,risk events,risk loss,risk undertaker ", and the sequential inertia chain structure are in turn, and a case is analyzed in this paper, it is helpful to the accuracy and reliability of the identification, the forecasting on the frequency, the degree and range of the loss of risk.
**Keywords:** Risk factors; Risk structure；chain-like Sequential inertia

## 一、引言

工业革命以来大量碳基化石能源的使用引发了全球温室效应、环境恶化和生态系统的持续退化，严重威胁到人类的生存和发展。工业化与城市化推动了人类活动领域的扩展，也加剧了人类生命财产的集中，这既是自然系统的客观运动现象，也是人类活动扰动影响与自然运动的叠加产物。因为，远离生命财产的荒漠中的自然活动是谈不上灾害的。如果没有相应的致灾环境，风险因子也不可能发育到损害风险载体的程度；如果承载体的脆弱性很高，足以抵挡一定风险环境下致灾因子突变的损害，也未必会发生风险事件；由于风险载体足够强大，即使发生风险事件了，也未必有严重的风险损失；如果没有风险主体承担损失的后果，则整个风险各要素顺序推进的结果只能说是自然运动现象，不能说成是灾害或损失。因此，说到灾害一定是与人的社会经济系统相关的又导致了生命财产损害的各种自然活动。

人类社会有史以来就有自然灾害及其对策的记载和研究，但系统科学地研究始于20 世纪 30 年代 Gilbert White（1936）对美国洪水灾害的探索。1963 年美国成立世界上首个“灾害研究中心”，推动了以科学工程学主导的灾害研究，1975 年 Gilbert White 与 J.Eugene Haas 主持的美国第一次自然灾害评估则开启了灾害的经济社会和政治影响的社会科学研究，为灾害学的综合研究奠定了基础。1980 年后，尽管许多新理论（系统论、突变论、混沌和分形等）与新技术（RS、GPS、GIS、神经网络和遗传算法）被广泛运用（Brabb Earl E.,1986；Gupta R P.,1990），以及灾害的动态模拟仿真和数字减灾系统（DDRS）的实现（Trevorj Davis & C.Peter Kelle,1997），极大提升了灾害研究能力和防减救灾效率，但是，近年全球巨灾频发与生态环境恶化的趋势，才真正推动了抢险救灾向防灾减灾转变，促进了全球灾害预警体系的建立，推动了灾害的政治经济学思考（Eugene Gurenko,2004）和风险社会来临的判断（Ulrich Beck,1992），推动了巨灾风险分散的全球化（SkipperH.D,1998;SwissRe,2011），开辟风险融资渠道的多元化（Kenneth A.Froot,1999;SwissRe,2011），而财政转移支付和资助方案的灾害综合风险管理框架的建立（Michael R.Powers,2009;SwissRe,2011）则进一步拓宽了灾害学的综合研究视野。

国内对灾害学的研究比较早，竺可桢

《中国之雨量及风暴说》(1916)与翁文灏考察海原 8.5 级地震后《中国地质构造对地震区分布之影响》(1921)开启了我国现代灾害学研究。邓云特《中国救荒史》(1937)是现代最早的灾害分区与防灾减灾政策研究。1949-1979 年，仍然有竺可桢《历史时代世界气候的波动》(1961)和《中国近五千年来气候变迁的初步研究》(1972)等重大成果，以及区域性防灾减灾史料研究（王嘉荫,1963；中央气象局,1975；四川省气象局,1978)。1980 年后，随着全国自然灾害普查与治理，许多新理论和新技术被大量运用（闫嘉祺与杨梅忠,1986；秦大河,丁一汇,陈国阶,1993)，各种灾害监测台网和群测群防网络初具规模，为灾害的动态模拟仿真和数字减灾系统（DDRS）的实现提供了新途径（史培军,黄润秋, 2003)。

另外，防减救灾措施与制度演变的社会学和政治经济学思考（李登弟,1982；马宗晋和郑功成,1998；孙绍骋,2004)，基于保险的巨灾风险分散保障体系建立（魏华林,1994；赵苑达,1999；栾存存,2003；许飞琼,2002；孙祈祥,2004；田玲,2010；卓志,2011)，风险融资渠道开辟和政府干预的探索（曾立新,2010)，促进了传统的事后抢险救灾向事前区域综合灾害风险管理的防减救灾转变（史培军,2011)，推动了区域特色的防灾减灾研究（黄崇福,夏建新,郑长德,黄润秋,陈国阶,2008;徐玖平,2011)。因此，我国传统防灾减灾研究已从自然科学和工程学拓展到经济政治、文化宗教和社会心理等诸多领域（谢晓非,2003)。

综上可见，国内外学者对灾害种类、成灾机理和经济社会影响，以及文化宗教和社会心理的冲击进行了深入研究，对防灾减灾实现的技术可能性和具体措施等也给予了广泛探索。但是，各国地理气候差异，经济社会和历史文化不同，通用性防灾减灾对策较少，普遍重救轻防，防灾减灾没有受到应有的关注高度。其次，因受灾变过程不确定性与数据获取困难，灾害的预测技术精度仍然不高，灾害各学科间的研究缺乏贯通，基于保险的风险要素及其结构与基于科学工程的表述很不一致。

基于保险视角的风险要素及其结构被描述为“风险因素——风险事件——风险损失”，基于灾害科学工程角度则为“风险源——风险载体——防灾减灾”，前者是基于保险的风险管理，只简单关注损失数量，后者是基于科学工程的风险管理，直接关注救灾效果。两者的表述既单一也不统一，不能真实反映风险发育过程与风险涌现突变的复杂性、多变性和多样性的实际，也难以跟上风险管理技术发展的要求。比如，很难解释智利地震（2010.2.27 发生于大城市，8.8 级，497 人死亡，782 人伤）与汶川地震(2008.5.12 发生于山区小县城，8.0 级，69226 人死亡、失踪 17923 人）在生命财产损失和群体心理损害的巨大差异。特别是，在全球气候变化加剧和地壳运动活跃下，极端性灾害频发和并发，损害之大和救灾之难极为罕见，不但风险的内涵外延要调整，而且风险发育与风险涌现突变过程的复杂性、多变性和多样性等问题也需关注，才能确保风险识别、发生频率预测、成灾范围测定和损失程度计量等精度和可靠性，才能保证综合风险管理技术的与时俱进。

因此，本文通过 2000-2011 年西南某地烤烟雹灾风险发育与发生的案例与样本数据，分析并改进传统风险要素及其链式结构，以期从理论上有所贡献，并在实践中能获得比较可靠而精准的损失频度与损失额度，以及较理想的风险管理技术效果，并希望为保险公司在实际承保雹灾险种设计中合理费率的厘定和灾后赔付标准的制定提供科学依据，为进一步的衍生品设计提供基础数据，也为保险监管以及灾后政府补贴的合适额度和应灾方案制定提供重要参考。

## 二、风险要素及其链式结构

### （一）致灾环境

渝东南烤烟种植区地处武陵山脉西翼，东与湖南省湘西土家族苗族自治州、湖北省恩施土家族苗族自治州接壤，南与贵州省铜仁地区毗邻，是渝、黔、湘、鄂四省（市）结合部，包括重庆市石柱、彭水、酉阳、秀山民族自治县，以及按民族地方自治对待的黔江区等“一区四县”，幅员面积 1.69 万平方公里，占重庆市总面积的 20.5%，总人口

295 万人，其中土家族、苗族等少数民族人口 183 万人，占重庆市少数民族人口的 92.72%，既是少数民族聚居区，又是国家级贫困地区。

该区地质环境和气候条件特别，山地坡度大，地势陡峭，坡耕地和宜林地为主，土层薄的旱坡地较多，其中坡耕地占耕地 74.3%，坡耕地中土层厚度低于 30cm 的占 37.9%，人均耕地较少（0.92 亩），低于全国平均水平（2010 年全国人均耕地 1.38 亩），平均垦殖指数高达 23%。该区平均海拔 800-1400 米，年平均气温 18.8℃，年降雨量 969.5-1293.8 毫米，5-9 月份总日照时数平均 666.93 小时，平均气温 23℃。因此，夏季气温高，雨量充沛，湿度大，河谷深切，气流上下运动频繁，强对流天气变化异常，经常出现冰雹、大风、暴雨等灾害，并引发洪涝，崩塌、滑坡和泥石流等次生灾害。尽管该区粮食作物栽培耕作困难，却非常适合耐旱耐瘠的烤烟栽培耕作，并逐渐形成了栽培历史比较悠久的单一烟草种植的特色农业。

### （二）风险载体

烤烟的主要收获物为烟叶。一般从 2 月份开始播种（温室苗床），4 月初大田移栽，9 月份采收完毕，这期间分为四个时期：苗期从 2 月中旬至 5 月初，长出烟叶 7-8 片；团棵期从烟叶移栽到大田起至 6 月 10 日左右，叶片长到 10-14 叶，而且叶片不断展开变大，这期间属于烟叶营养生长期，肥料投入与初期田间管理都在这期间；旺长期从 6 月 10 日左右至 7 月 10 日，大约一个月时间，这期间烟叶拔节长高，叶片最后在 20-25 叶左右。采收期从 7 月中旬至 9 月底，烟叶逐渐落黄，从下面叶片向上开始分期采收，每株大约产成熟鲜叶 18-22 片。显然，烟叶的叶片全面生长展开期（6、7、8 月）与收获期（7、8、9 月）因冰雹打断烟茎、打断叶柄或叶片孔洞造成的损失是主要损失，其中又以叶片损害为主（图 1、图 2）。因此，中后期烤烟的**叶片是主要承灾体**。

图 1：雹灾前烤烟地情景

图 2：雹灾后烤烟地情景

### （三）致灾因子发育及成灾时间分布

从烟叶种植过程可以看出，苗期是在温室大棚的苗床上渡过，集中统一管理，没有什么损失。大田早期由于苗矮，遇上风灾也不会产生什么损失，而河谷风不会造成烟叶和茎杆刮断或连根拨起造成的损失。团棵期（营养生长期），除了泥石流、山体滑坡之类的毁灭性损失外，也不会遭受冰雹之类的灾害，偶尔在移栽大田的早期，会因遭遇霜冻所致烟苗死亡。团棵期之后生长基本定型，叶片进入合成展开期，这段时期和采收期恰好是冰雹、大风和暴雨天气集中期，经常会造成因冰雹打断烟茎、打断叶柄或叶片孔洞造成的损失。当然，由于山洪冲击或河水泛滥浸淹烟田，致使烟苗冲走、埋没或浸淹所造成的损失，以及因崩塌、滑坡和泥石流冲毁、掩埋烟苗所造成的损失大，发生的概率很小。此外，旱灾发生概率较小，还因为干旱一大片，洪水走一线，旱灾损失巨大，以及自然灾害外的市场风险、技术风险、投资风险和政策风险等经营中意外的社会经济风险也时有发生，损失也非常巨大，但保险公司一般将其列入除外责任。因此，渝东南民族地区烤烟种植期间影响烤烟产量和质量的主要致灾因子是冰雹。

另外，烤烟种植区域的成灾时间分布

（受雹灾影响的主要时期）大致集中在 6-9 月份的旺长期和采收期。其中，旺长期系指烟草生长到拔节至现花蕾之间的时期，叶片在 12 片以上。采收期系指烟草生长到打尖至采收完成之间的时期。

**（四）成灾事件勘察**

承上，此区域烤烟种植期间影响烤烟生物产量和商品质量的主要致灾因子是冰雹，而且其可保性好，相比其它风险，保险公司愿意承保雹灾。这是因为烤烟雹灾保险的风险单位遵从独立同分布，近似服从正态分布，满足保险经营要求的大数定律。并且，雹灾发生概率大，损失程度大，农户的投保动机强烈。但是，其它灾害（大旱、洪水、崩塌、滑坡和泥石流）的风险单位不遵从独立同分布，近似服从泊松分布，甚至伯努利分布，难以满足保险经营要求的大数定律，其风险的可保性弱，保险公司一般拒绝承保。

由于叶片是雹灾的主要承灾体，那么叶片遭受雹灾侵害到什么程度才计算损失？首先，烟草有效叶片基数和每亩烟草株数在约定中事先注明。一般烟草种植行距 3.2-3.5 尺，窝距 1.7-1.8 尺，每亩大约 1000-1100 株，被采收的叶片数等于叶痕数减 3（脚叶数），每株净产叶片 20 片左右。其次，保险双方事前约定损失系数：当烟叶被冰雹击打出 3（含）至 5（含）个洞，损失系数为 0.25；当烟叶被冰雹击打出 6（含）至 8（含）个洞，损失系数为 0.6；当烟叶被冰雹击打出 9（含）个洞以上，损失系数为 1。在具体计损时，根据损失原始记录和损失清单，采取抽样的方式以叶折株计算被抽样区域损失率，不同损失系数情况下的损失率分别计算，最后合计数为抽样区域内的损失率。

**（五）损失度量**

**1.损失率与损失额计算。**一般实务中以种植成本计算烤烟雹灾风险损失额。烤烟种植在施肥上与其他作物不同，在移栽到大田前的 3 月初到 4 月底，不会有肥料上的成本损失。一般在移载进大田一个月内（至 5 月底）肥料基本施完，在 5-9 月份间主要是田间管理与采收的人工费用和农药成本，因此，无论什么时候受灾，物化损失比较固定。一般烟草种植成本主要由三部分构成：一是烟叶种子、农药、技术咨询成本在 15 元/亩；二是肥料成本在 285 元/亩，其中行业及当地政府补贴 100 元/亩；三是劳动力投入按照 20 个人工/亩计，合人民币 200 元/亩。总成本合计 400 元/亩。当然，这里不考虑少数地方和年份里其它补贴。

**损失率=[抽样区域内损失叶片数/（抽样区域内单株叶片数×抽样区域内总株数）]×损失系数**

另外，受损面积以实际丈量的方式确定，然后结合平均损失率和面积系数求得实际损失面积。

即实际损失面积=平均损失率×面积系数×受损面积

面积系数=（投保面积/实际种植面积）*100%，（面积系数≤1）

如果投保面积小于实际种植面积时，构成不足额保险，则按比例折算修正损失面积。如无法区分未保险面积部分，则按保险面积与实际种植面积的比例计算赔偿责任金额。保险面积大于或等于实际种植面积时，按实际损失面积计算赔偿责任金额。如果保险烤烟区域在遭受保险责任范围内损失时，同时遭受非保险责任灾害损失，对非保险责任灾害造成的损失，应从总损失中扣除。

因此，实际责任损失额的计算为：**责任损失额=平均损失率×面积系数×受损面积×赔偿限额**

运用上述计算责任损失额的方法，经实地勘灾，计算出 2000-2011 年渝东南烤烟种植区分地区雹灾平均责任损失额（表 1），以及 2000-2011 年渝东南烤烟种植区分年度的雹灾平均责任损失额（表 2）。不过，有时也会出现极端情况。如 05 年 7 月中旬和 8 月初渝东南民族地区烤烟种植区域的万州、巫山、巫溪、奉节、彭水、黔江、石柱等地两次大面积冰雹和暴风灾害，报灾面积近 8 万亩，涉及到 120 个乡镇，450 个村组和 15000 户烟农。06 年 6 月奉节县的冰雹灾害，报案面积 1.5 万亩，涉及 50 个乡镇，140 个村社和 4000 户烟农。

由表 1 和表 2 可以看出，2000-2011 年渝东南烤烟种植区分地区雹灾影响面平均达到总面积的 10%，绝收面积达 1.98%。其中，

损失最严重的 2004 年达到总面积的 20%。另外，按每亩烟叶 400 元的成本计算，区域内光绝收造成的损失达到 480 -1240 万元，每年总的责任损失额在 540 -1950 万元之间。

表 1　2000-2011 年渝东南烤烟种植区分地区雹灾平均责任损失额

| 序号 | 地区 | 种植面积（万亩） | 受灾面积（万亩） | 绝收面积（万亩） | 按成本计绝收损失（万元） | 平均责任损失额（万元） |
|---|---|---|---|---|---|---|
| 1 | 綦江 | 0.9 | 0.09 | 0.018 | 7.2 | 21 |
| 2 | 黔江 | 7.2 | 0.72 | 0.144 | 57.6 | 150 |
| 3 | 秀山 | 2.3 | 0.23 | 0.046 | 18.4 | 49 |
| 4 | 酉阳 | 9.25 | 0.925 | 0.185 | 74 | 192 |
| 5 | 彭水 | 12.9 | 1.29 | 0.258 | 103.2 | 268 |
| 6 | 石柱 | 6.95 | 0.695 | 0.139 | 55.6 | 147 |
| 7 | 涪陵 | 0.9 | 0.09 | 0.018 | 7.2 | 21 |
| 8 | 武隆 | 7.87 | 0.787 | 0.157 | 62.8 | 164 |
| 9 | 丰都 | 2.3 | 0.23 | 0.046 | 18.4 | 46 |
| 10 | 南川 | 1.85 | 0.185 | 0.037 | 14.8 | 40 |
| 11 | 巫山 | 5.78 | 0.578 | 0.106 | 42.4 | 111 |
| 12 | 奉节 | 0.9 | 0.09 | 0.018 | 7.2 | 19 |
| 13 | 巫溪 | 0.9 | 0.09 | 0.018 | 7.2 | 22 |
| 合计 | | 60 | 6 | 1.19 | 476 | 1250 |

资料来源：实地勘察，并结合重庆烟草公司、重庆市政府农业办的历年统计数据整理。
注：每亩赔偿限额为烤烟种植成本 400 元。

表 2　2000-2011 年渝东南烤烟种植区分年度的雹灾平均责任损失额

| 年份 | 受灾面积（万亩） | 绝收面积（万亩） | 雹灾导致损失总额（万元） |
|---|---|---|---|
| 2000 | 5 | 1.2 | 860 |
| 2001 | 3 | 0.8 | 540 |
| 2002 | 6 | 1.2 | 960 |
| 2003 | 5 | 2 | 1100 |
| 2004 | 12 | 2.5 | 1950 |
| 2005 | 10 | 3.1 | 1930 |
| 2006 | 9.6 | 2.4 | 1680 |
| 2007 | 7 | 1.6 | 1180 |
| 2008 | 5 | 1.3 | 890 |
| 2009 | 7.9 | 2.1 | 1420 |
| 2010 | 6.1 | 1.7 | 1130 |
| 2011 | 7.3 | 2.0 | 1350 |

数据来源：实地勘察，并结合重庆市烟草公司、中华联合保险重庆分公司的历年统计数据整理。
注：数据为渝东南烤烟种植区（13 个县市）汇总，并经过修匀剔除了旱灾损失。

**2.损失经验分布函数**

利用 2000-2011 年烤烟区自然灾害直接经济损失的样本数据(直接采用 10 年历史数据，不考虑价格因素的影响）作为损失随机变量，构造烤烟风险损失的经验分布函数，并拟合其损失分布。

由表 3 中的累积频率可得经验分布函数与累积频率分布图（图 3)，观察值的经验分布曲线是由左下向右上逐渐抬升。将观测值做对数变换后的概率密度分布曲线中各点具有一定对称性，因而可以考虑用对数正态分布来拟合。利用 2000-2011 年的责任损失额的样本序列，对样本值分别取对数，得到样本值的对数序列。首先，在 EViews5 中进行

J-B 检验，得到 P 值为 0.8347，故可认为此序列服从正态分布，即责任损失额服从对数正态分布。其次，在 SPSS13.0 中对责任损失额样本值取对数后的序列进行单样本 K-S 检验，结果表明样本服从正态分布，即责任损失额的样本值服从对数正态分布。显然，两种检验的结果都表明责任损失额的样本观测值对数序列服从正态分布。

**3. 损失频度拟合**

根据区域内各年度责任损失额的勘察数据，计算出该样本的描述性统计变量如下：

一阶原点距：$\bar{x}=\frac{\sum_{i=1}^{n}x_i}{n}=\frac{860+540+960+1100+1950+1930+1680+1180+890+1420}{10}=1251$

二阶原点距：

$$\overline{x^2}=\frac{\sum_{i=1}^{n}x_i^2}{n}=\frac{860^2+540^2+960^2+1100^2+1950^2+1930^2+1680^2+1180^2+890^2+1420^2}{10}=1771350$$

由于对数正态分布的 E（x）= exp（u+$\frac{1}{2}\sigma^2$），E（$x^2$）= exp [ 2（u+$\sigma^2$）]

由此建立矩方程组为：$\begin{cases}\exp(u+\frac{1}{2}\sigma^2)=1251\\ \exp[2(u+\sigma^2)]=1771350\end{cases}$ 得 $\begin{cases}u=7.0698\\ \sigma^2=0.1239\end{cases}$ 即

$$\begin{cases}u=7.0698\\ \sigma=0.352\end{cases}$$

即 Ln（x）～$N$（7.0698，$0.352^2$）

然后，在 Matlab7 中编程进行模拟，得到对数正态分布拟合的理论频数如表 4 所示，模拟损失频度如图 4 所示。因此，可利用对数分布函数曲线估计经验分布函数值，进而计算出可能以多大的概率保证在某个区间包含责任损失金额。

表 3　2000-2011 年渝东南烤烟种植区受灾损失频数、频率分布表

| 损失额度（万元） | 频数 | 频率 | 累计频率 | 频率密度 |
|---|---|---|---|---|
| 0-750 | 1 | 0. 1 | 0. 1 | 0. 00013 |
| 750-1090 | 3 | 0. 3 | 0. 4 | 0. 00088 |
| 1090-1460 | 5 | 0. 3 | 0. 7 | 0. 00081 |
| 1460-1930 | 2 | 0. 2 | 0. 9 | 0. 00042 |
| >1930 | 1 | 0. 1 | 1 | 0. 00005 |

数据来源：由表 2 数据得出

$$F(x)=\begin{cases}0.1 & x=750\\ 0.4 & x=1090\\ 0.7 & x=1460\\ 0.9 & x=1930\\ 1 & x>1930\end{cases}$$

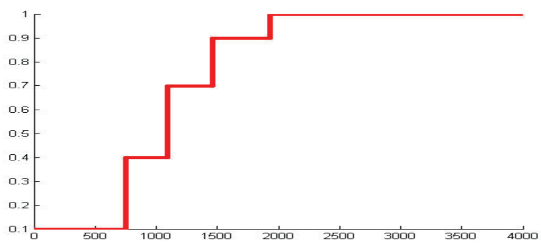



图 3：责任损失额的累积频率分布

表 4　　经对数正态分布拟合的理论损失频数

| 损失额度（万元） | 实际频数 | 用对数正态分布拟合的理论频数 | 拟合的理论频数取整 |
|---|---|---|---|
| 0-750 | 1 | 1.00 | 1 |
| 750-1090 | 3 | 3.15 | 3 |
| 1090-1460 | 5 | 3.15 | 3 |
| 1460-1930 | 2 | 1.90 | 2 |
| >1930 | 1 | 0.80 | 1 |

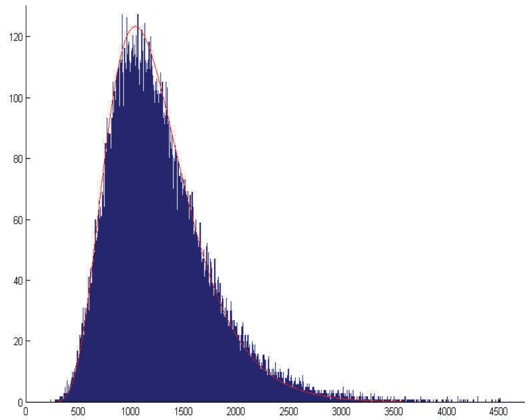



图 4：Matlab7 模拟的责任损失频度

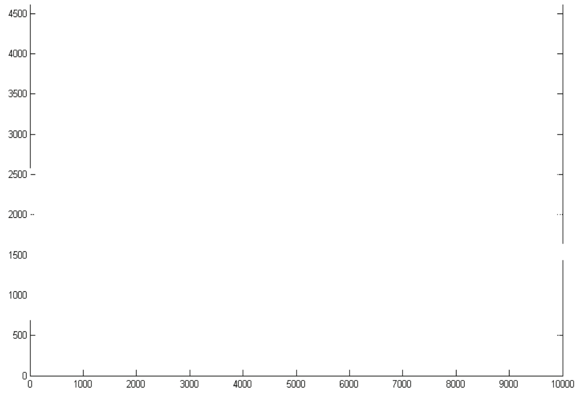



图 5： Matlab7 模拟的责任损失程度

**4.损失程度拟合**

根据拟合的对数正态概率分布 Ln（x）~ $N$（7.0698，0.352$^2$），假定某一年雹灾损失总额超过 K 万元的概率为 P（x>k），则有

$$P(x>K)=1-P(x\le K) \qquad =1-\int_{-\infty}^{\ln K}\frac{1}{\sqrt{2\pi\sigma^2}}\exp(\frac{-(t-u)^2}{2\sigma^2})dt \qquad =1-\int_0^K\frac{1}{\sqrt{2\pi}\,\sigma x}e^{-\frac{1}{2}(\frac{\ln x-u}{\sigma})^2}dx$$

当风险准备金为

$\exp(u+2\sigma)=\exp(7.0698+2\times0.352)=2377.5$

万元时，实际责任损失额不超过此金额的概率为 97.8%。当风险准备金为

$\exp(u+3\sigma)=\exp(7.0698+3\times0.352)=3380.6$

万元时，实际责任损失额不超过此金额的概率为 99.865%。

然后编写一个 Matlab7 的 M 文件，运行命令 lognrnd（7.0698，0.352， 1， 10000），模拟得到 10000 个服从该对数正态分布的随机数，获得其中大于或等于 K 的随机数的频数 m，则可近似认为 P（x>k）= m/10000。损失程度的模拟结果可由图 5 来描述。试验结果表明模拟损失额不超过3380.6万元的频数为 9987，故其频率为 9987/10000=99.87%。而且，在 10000 次模拟中，平均约有 13 次会发生责任损失额超过 3380.6 万元的情况，其平均值约为 3739.9 万元。显然，由实际田野勘察数据与试验模拟的结果一致。表明通过实际雹灾损失的田野现场勘察数据的模拟方法是可行和可信的，拟合的责任损失额是可靠的。因此，运用理论拟合和精算实验模拟相结合的方法，利用风险损失的实际损失样本数据，获得比较真实可靠又精准的损失额度和损失频度，为保险公司险种的合理费率的厘定和灾后责任赔付标准的制定提供基础数据，为在资本市场发售相关金融衍生品的融资额度设计提供科学依据，为保险监管提供合理的价格指导区间，为政府灾后补贴的合适额度和方案制定提供重要参考。

**（六）承灾主体**

目前，渝东南民族地区是我国最大的烤烟种植区域，此区是国家烟草专卖局确认的优质烤烟生产基地，产量和品质位居全国前茅，烤烟已成地方财政收入的重要来源，是农民增收致富的主要门路，是当地经济社会发展的支柱产业。自 1987 年以来烟草税收一直居于全国第一位。渝东南烤烟种植区农民种植烟叶年收入 7 亿元左右，向地方财政上缴农业特产税 1.4 亿元，烟叶税占了部分区县财政收入的 50%以上，烟草产业作为支柱产业和优势产业在重庆市具有重要地位。特别是在国家退耕还林还草政策落实后，烤烟重庆三峡库区的山区农民致富的主要经济作物，逐渐形成了联系紧密的“公司－农户－基地”产业链，已经有黔江区、彭水县、石柱县、酉阳县、秀山县、武隆县、丰都县、

南川市、涪陵区、巫山县、奉节县、巫溪县、綦江县等 13 个区县（市），222 个乡，1411 个村，4583 个组，种烟农户 94436 户参与的种植规模。该区最高年份（1997）种植面积达 150 万亩，收取烟叶 280 多万担。98 年后由于严格执行国家烟草总局"双控"政策（控制收购总量，控制种植面积），生产规模趋于稳定，年种植面积 60 万亩左右，年产烟叶 130 万担（6500 万公斤）左右，平均收购价 10 元/公斤。由于当地特殊的地质和气候条件，烤烟经常在旺长期和采收期遭受雹灾侵害，严重影响到烤烟的生物产量和商品质量。因此，烤烟种植区域的雹灾严重影响了当地支柱产业的发展和农户的增收，以及相关利益体的成本收益状况和经济行为的差异。

近年来尽管烤烟雹灾借助商业保险市场化风险处置机制的成效显著，而且探索创新了"政府财政补贴+龙头企业反哺+公司市场运作+农户积极参与"雹灾风险处置模式。但是，由于农业风险的区域差异性、成灾的复杂性和系统性，以及开展保险的时间短暂，能用于精算定价的统计数据非常不足，常常不是出现前期签订保险合同时保险公司对损失频度与损失程度的高估而出现高费率，就是在后期风险发生后的实际勘察定损与理赔业务中对实际损失额和承担责任部分的低估而出现惜赔，导致各方对勘察定损和赔付不满，甚至引发保险合同争议纠纷。其中，农户更愿采用其它风险管理方法而不是花钱买保险，参与保险纯粹是为了得到政府的补贴和龙头企业的反哺。烟草公司如果不是苦于自己没有专业能力准确估损，则更愿意直接向自己交售烟叶的农户发善心让利，而给予农户遭受损失额相当的帮护，而不是额外花钱请保险公司做精准高效的赔付。保险公司如果没有政府给予承保烤烟雹灾风险的各种补贴和税收优惠，则更愿承保其它利润高的风险项目。政府也在补贴救济直接到农户之手还是借助保险公司进行转移支付来解决"三农"问题而犹豫不决。显然，政府、烟草企业、保险公司和农户等参与主体因农业风险的系统性与复杂性，根本搞不清真实的损失程度与损失频度到底多少而有吃亏感觉，各方认识上的偏差与追求目标的错位，因烤烟雹灾保险业务萎缩而出现市场失灵。

## 三、研究结论与启示

随着全球气候变化加剧和地壳运动活跃，极端性灾害频发和并发，损害之大和救灾之难极为罕见，传统风险内涵外延发生变化，基于保险视角和基于科学工程角度的传统风险要素及其结构理论，都不能真实反映风险发育与发生过程的复杂性、多变性和多样性的实际，也难以跟上风险管理技术发展的要求，前者抓住了风险损失频度与风险损失程度两个基本要素，偏重风险损失结果，后者抓住了风险载体的脆弱性与风险风险环境对致灾因子发育影响两个基本要素，偏重防灾减灾和救灾。本文综合两者优点，将风险要素及其结构修改为"风险因素——风险环境——风险载体——风险事件——风险损失——风险主体"等要素组成的顺序推进的序惯性链式结构，并以烤烟雹灾为例，运用田野雹灾损失的现场勘察数据，拟合雹灾的理论分布和损失程度与损失频度，再通过 Matlab 模拟试验获得了与现场勘察的实际数据模拟结果一致的结论，分析证明此改进有助于风险的识别、发生频率的预测、成灾范围的测定和损失程度的计量等的精度和可靠性提高，在实践中能获得比较可靠而精准的损失频度与损失额度，为保险公司在实际承保雹灾险种设计中合理费率的厘定和灾后赔付标准的制定提供科学依据，为进一步的衍生品设计提供基础数据，也为保险监管以及灾后政府补贴的合适额度和应灾方案制定提供重要参考。

## 参考文献

[1] Bundorfa, MK.And Pauly,MV.(2006),Is Health Insurance Affordable for the Uninsured? Journal of Health Economics 25(4): 650-673

[2] Jin-Zhen Li,Shu Li*,Wen-Zhong,Wang, Li-Lin Rao and Huan Liu(2009), Are People Always More Risk Averse after Disasters? Surveys after a Heavy Snow-hit and a Major Earthquake in China in 2008，Applied Cognitive Psychology，Published online in Wilet interscience

[3] Kunreuther,H.&Pauly,M.(2006),InsuranceDecision Making and Market Behavior (Foundations & Trends in Microeconomics). Now Publishers Inc.

[4] Kramer, R. Federal Crop Insurance:1938-1982.Agricultural History 1983(57):181-200

[5] Kunreuther, H. and Pauly, M.(2006), Insurance

Decision Making and Market Behavior (Foundations and Trends in Microeconomics). Now Publishers Inc.
[6] Laury et al.(2009), Insurance Decision for Low-Probability Losses. Journal of Risk and Uncertainty, 39:17-44
[7] George L.Priest..（1996）The Government, the Market, and the Problem of Catastrophic Loss.Journal of Risk and Uncertainty.Vol.12.No.2/3.219-237
[8] Alial-Nowaihi and Sanjit Dhami(2010). The Behavioral Economics of Insurance, Working Papers in Economics, Department of Economics, University of Leicester, revised Apr 2010
[9] Schwarcz, D.(2010). Regulating Consumer Demand in Insurance Markets. Erasmus Law Review, 3(1):23-45
[10] Slovic, P., ML Finucane, E Peters and DG. MacGregor(2007), The Affect Heuristic, European Journal of Operational Research, 177(3): 1333-1352
[11] Swissre(2010), European Life Insurance Report 2010: Customers for life, www.swissre.com
[12] 黄崇福.综合风险评估的一个基本模式[J].应用基础与工程科学学报,2008（03）
[13] 史培军.论综合灾害风险防范模式,寻求全球变化影响的适应性对策[J].地学前缘,2007（06）
[14] 何小伟、高进，巨灾保险为什么失灵？—个研究综述[J].保险职业学院学报,2010(2),10-13
[15] 金晓霞.基层救灾的困境[J].中国减灾，2010（13）
[16] 夏建新.自然灾害胁迫下少数民族地区可持续发展评估模型[J].中央民族大学学报,2008（4）
[17] 王稳等，小概率高损失事件的忽略——对中国发展巨灾保险的意义[J].保险研究，2009(12)，15-20
[18] 徐玖平等.自然灾害灾后重建技术及实践的研究进展[J].灾害学,2010（01）
[19] 张庆洪等，巨灾保险市场失灵原因及巨灾的公共管理模式分析[J].保险研究，2008(5)，13-16
[20] 赵苑达，我国自然灾害损失保险补偿率过低的原因与对策[J].管理世界，1999(6)，59-65
[21] 卓志等，巨灾保险需求分析：理论与工具[J].（清华）保险与风险管理研究动态，2010（9），34-43
[22] [美]特瑞斯.普雷切特等.孙祈祥等译.风险管理与保险原理[M].第 8 版，北京：中国社会科学出版社，1998
[23] [美]乔治.E.瑞达.申曙光译.风险管理与保险原理[M].第 8 版，北京：中国人民大学出版社，2006
[24] 刘茂山、江生忠.保险学原理[M].天津：南开大学出版社，2000
[25] 孙祈祥，著，保险学[M].第 3 版，北京：北京大学出版社，2005
[26] 魏华林、林宝清.保险学[M].第 8 版，北京：高等教育出版社，2006
[27] 江生忠.风险管理与保险[M]. 北京：高等教育出版社，2007
[28] 中国保监会保险教材编写组.风险管理与保险[M].天津：南开大学出版社，2008

# 风险要素及其序惯性链式结构分析：以烤烟雹灾为例[①]

蒲成毅　　潘小军
（西南民族大学经济学院，成都，610041）

**摘要：**传统风险要素及其结构基于保险视角的描述为“风险因素——风险事件——风险损失”，基于科学工程角度为“风险源——风险载体——防灾减灾”。随着全球气候变化加剧和地壳运动活跃，极端性灾害频发和并发，损害之大和救灾之难极为罕见，传统风险内涵外延发生变化，传统风险要素及其结构不能真实反映风险发育与发生过程的复杂性、多变性和多样性的实际，也难以跟上风险管理技术发展的要求。本文改进其为“风险因素——风险环境——风险载体——风险事件——风险损失——风险主体”等要素组成的顺序推进的序惯性链式结构，并以烤烟雹灾为例，分析验证了此改进有助于风险的识别、发生频率的预测、成灾范围的测定和损失程度的计量等的精度和可靠性提高。

**关键词：风险要素；风险结构；链式序惯性**

[①]本文为国家社科基金（12XJL012）、教育部一般规划（11YJA850016）、四川省科技厅软科学（2012ZR0025）、中央高校专项（11SZYTH12）等项目的资助成果。
**蒲成毅（1966-）**，男，经济学博士，博士生导师，教授，中国保险学会理事，主要从事金融保险学教学科研。
**潘小军（1969-）**，女，经济学硕士，讲师，主要从事金融保险学教学科研。
**通讯地址：四川省成都市一环路南四段 16 号，西南民族大学经济学院，邮编：610041**
**联系电话：18908212316**
**电子邮箱：Pucy2011@126.com**

# Research on the Construction of the public credibility in China's insurance industry

WANG Xujin
Insurance Department, Beijing Technology and Business University, Beijing, China, 100048

Abstract: The public credibility will put far-reaching impact on china's insurance industry. This paper has made a beneficial discussion on the meaning and characteristics of the public credibility in china's insurance industry, simultaneously, it also discusses how to construct the public credibility of insurance industry. The paper is divided into three parts: part I discusses the meaning of public credibility from the aspects of insurance basic functions and business process; partⅡdiscusses the basic characteristics of the public credibility in china's insurance industry; part III puts forward some recommendations on how to construct the public credibility in china's insurance industry, including the system construction, technology development, organization construction, personnel training and mechanism design.
**Keywords:** the public credibility of insurance industry, construction

保险公信力对中国保险业的发展影响深远。如何理解保险公信力的含义与特征,其实现路径如何，本文据此作以下探讨。

一、保险业公信力的内涵

公信力是使公众信任的力量，也可以说是公众对某一个行业信任的力度。源于英文词 Accountability，意指为某一件事进行报告、解释和辩护的责任；为自己的行为负责任，并接受质询。到目前为止最主要的是用到政府部门、司法部门比较多。但就此用做公众对某一行业的信任度而言，对保险业来说，这方面也很值得我们研究，它意味着公众对保险业信任的力度。保险公信力可在保险基本职能、经营环节和社会责任几个方面得以体现。

就基本职能而言，保险的基本职能是经济补偿、保险金给付。经济补偿是在发生保险事故时，保险人赔偿的保险金正好弥补被保险人因保险事故所造成的保险金额范围内的损失；人身保险的保险金则是因保险事故发生根据保险合同的保险金额进行给付的。保险在这两方面职能的发挥，则是检验保险公信力的体现。

从保险环节来说，从展业、承保、再保险、防灾防损、理赔，再到资金运用各经营环节。在这些环节中集中体现的诚信展业、及时按约理赔和保险经营效益的提高。

从承保效益而言，尽管紧近年我国保险经营效益有较大提高，但相对来说，还有很大改善空间。例如，与 2006 年比较，2008 年产险业的综合成本率为 106.7%，比 2006 年的 102.7%上升了一些，简单赔付率从 52.75%上升到 60.7%，给消费者更多的实惠；营业费用率也从 2006 年的 44.45％降为 2008 年 40.5%。 但与国际比较，差距仍然很大，美国赔付率是 78.7%加上保单持有人红利率 1.1%,则达到 79.8%，营业费用率只有 26.4%；加拿大的赔付率 73.3％，营业费用率是 29.8%；英国的赔付率是 73%，营业费用率是 31.2%；日本的赔付率是 61.2%，营业费用率是 38.1%1。这说明我国承保方面如果改善的话，还可以降低营业费用率、增加公司盈利

[1] 日本的为１９９５年到２００４年，其余各国为１９９４年到２００４年的数据。

能力，同时，在理赔方面使保险消费者得到更多实惠。再如，我国 2006 年产险公司简单赔付率是 52.75%，车险保费占产险比重 73.4%，车险骗赔率是 20%，骗赔 20%带来的赔付率是 7.74%；若骗赔 25%，则带来的赔付率是 9.68%，说明我们的经营过程还有很多改善的空间。

从投资收益而言，我国保险投资收益这几年是波澜不惊的，2006 年的投资收益是 995.3 亿元，2007 年为 2791.73 亿元，2008 年为 583.56 亿元，2009 年为 2141.7 亿元，2010 年 2041.98 亿元。就国际保险业发展的一般规律而言，通过投资盈利弥补承保的亏损，最后，便综合盈利。从有关资料可以看出，我国保险业 2008 年的保险投资是比较惨烈的，投资收益率从 2007 年的 12.17%降到了 1.91%，2009 年的投资收益好,为 6.41%[2]，实现保险资金的保值增值；2010 年的投资收益总额比 2009 年差不了多少，但收益率差很远，从 2009 年的 6.41%降为 2010 年的 4.91%，由于资本市场的低迷，2011 年也只有 3.6%。投资没做好的话就靠承保盈利了，在营业费用一定的情况下，理赔上就会有些惜赔了。因此，公司盈利不是万能的，但公司没盈利是万万不能的。而公司的盈利也必须是在合法守信前提下的盈利，是双赢下的可持续的盈利，这就涉及到诚信与盈利的关系而言，从长期而言，是一致的。当然，这里也涉及到社会责任问题，公司的社会责任应分为基本责任和派生责任，基本责任是对股东、员工、对客户、对政府负责，对股东的责任是实现公司稳健经营、获得利润；对员工的责任是使员工收入稳步上升；对客户是服务到位、履行承诺；对政府负责是保证依法纳税。派生责任是建立在基本责任上的：即公益活动。只有在履行基本责任基础上做公益活动，这才有社会责任赶；如果一个企业第一层责任没做好去追求第二层责任，这便是不负责任。

当然，行业的公信力与行业自律和保险监管密切联系，保险行业自律主要是通过市场行为的约束来影响；保险监管宗旨是依法保护保护保险消费者的利益，保险监管部门是保险消费者最信赖的部门。由企业内控、行业自律和保险监管来实现保险业的公信力。

二、保险公信力的特征

保险业公信力的特征是由保险产品的特点决定的，其特征概括为无形性、射悻性、长期性和广泛性。无形性是指保险产品是无形产品；射悻性是指非寿险产品支付保险的确定性、获得保险金的不确定性，即支付少量的保险费，若保险事故发生时则可获得百倍甚至万倍的保险金，若不发生保险事故，则该被保险人的得不到一分的保险金；长期性是指寿险合同是长期合同，少则几年十几年，多则几十年；广泛性是指保险业务涉及千家万户，十分广泛。这就要求保险业务必诚信，保险业务必具有很强的公信力。

三、铸造我国保险公信力的路径

保险公信力的实现路径，主要有几个方面：

第一，制度是保障。保险制度包括公司制度、行业制度和监管制度，制度是保险公司经营、行业自律和保险监管的依据和准绳，一个坏的制度能使好人变坏，一个好的制度能使坏人变好；一部善法可以使魔鬼变天使，一部恶法则逼着天使变魔鬼。因此保险制度的完善是提高保险也公信力的保障。

第二，技术是基础。保险公司具备了技术力量，也能为公司的诚信经营提供条件，如信息技术、保险经营技术、监管技术。

第三，组织是前提，铸造保险业的公信力要有制度保障，同时，必须要有组织，才能落实，没有组织落实是很困难。

第四，人才是关键。人才问题是行业最关键的问题，人才是第一生产力。人才的核心体现一是理念，一是技术。完善市场经济制度建设的保险业发展，需要专业技术的支撑。现在我国保险业在很多方面还没跟上，最主要的是我国保险专业人才的培养没有跟上我国保险业快速发展的步伐，保险人才的培养在一定程度上影响着从业人员的理念与技术。我们讲道与术，道应该优先。但道与术在大多数情况下是一致的，没有好的道，

[2]除投资收益比 2008 年的好以外，与会计准则的改革也有一定关系。

再好的术也很难有好的效果；同样，没有术，再好的道也无法实现。我国保险从业人员已近 400 多万人，保险营销支队伍规模一直在扩大，现在保险营销员已经有 300 多万人，已经积累了一定的人才基础，外加制度保障，为铸造保险业的公信力创造了一定条件；但由于我国保险业恢复也就 30 多年，保险公司的数量增长较快，保险专业人才依然严重供不应求，有待加速培养。我国保费规模 2009 年是第七位，在 2010 年达到第六位，已成为一个保险大国，但要成为一个保险强国，则还有一段艰辛的距离，要达到这个目标。则人才是关键。

第五，机制是保证。一是公司治理为核心的企业内容；二是行业自律；三是政府监管，政府监管这方面已经做了很多工作。只有这三者功能的有效发挥，才能保证保险公信实现。

总之，铸造中国保险业的公信力，是促进保险业长期稳定发展的重要条件，　是从保险大国向保险强国发展的重要条件。只有当一个行业成为全社会最具信任的行业、该行业的产品成为全社会千家万户的必需品时，这个行业便可能成为最具竞争力的强大行业，从事这个行业的职业也就便可成为人们最尊敬、最向往职业。

参考文献：

1.王绪瑾主编：《保险学》，第5版，北京，高等教育出版社，2011年。
2.王绪瑾：《财产保险》，北京，北京大学出版社，2011 年。
3.王绪瑾、席友、龙云飞：《中国寿险市场的特征、矛盾和对策研究》，保险研究，2011.12。
4.王绪瑾：《中国财产保险市场研究》，保险研究，2009.1。

# 论中国保险业公信力的铸造

王绪瑾

摘要: 保险公信力对中国保险业的发展影响深远。如何理解保险公信力的含义与特征,其实现路径如何，本文据此作了有益探讨。本文分成三部分:第一部分从保险的基本职能和经营环节论文了保险业公信力的含义；第二部分论述了保险业公信力的基本特征；第三部分提出了铸造我国保险业公信力的建议，包括制度保障、技术基础、组织前提、人才培养和机制保证。
关键词：保险业公信力，铸造

作者信息：
王绪瑾
单位：北京工商大学
职位：北京工商大学保险学系主任、教授；北京工商大学保险研究中心主任。
电话：8610-82572451；8610-82572744 传真：8610-82572744
手机：13611282321
E-mail：wangxuin@foxmail.com
联系地址：100037 北京海淀区阜成路 33 号北京工商大学保险学系

# Analysis of Regulation Determination and Economic Factors Influencing Life Insurance Development in China

XU Jingshu, WU Yao
Central University of Finance and Economics, Beijing, China, 100081

**Abstract:** In November 2010, CBRC published a notice about risk management of commercial banks selling insurance policies that regulated insurers' personnel should not be allowed to sell insurance products in commercial bank branches. This policy has significant negative impact on life insurance demand due to the important position of bancassurance in life insurance selling channels. Based on the characteristics of bancassurance, this paper divides and analyzes five stages of slowdown in the development process of life insurance industry. Then, combined with domestic and international economic situation and institutional changes, this paper concludes that national economy slowdown, rises in deposit interest rates, strong inflation expectation, capital market downturn as well as the introduction of bancassurance new policy are all economic and institutional reasons of slowdown in life insurance development currently. Finally, this paper raises possible advices in order to achieve a smooth transition to sustainable growth stage of China's life insurance industry.

Keywords: Life insurance, Development Speed, Bancassurance new policy, Influencing Economic Factors

## 一、 引言

自 1995 年兴起以来，银行保险业务已逐渐成为拉动寿险保费收入的主力军，银行保险保费收入在寿险保费中的占比已从 2000 年的 0.7%增长到 2009 年的 44.50%(见表 1)。经过十余年的实务检验，科学合理的开展银保业务可以使银保双方获取利益双赢。一方面，保险公司借助银行的销售平台和客户资源推进业务，节约大量人力成本，并能够在短期内实现期缴业务的快速增长；另一方面，银行开辟了新的业务渠道，保险代理手续费已成为银行中间业务重要的盈利来源。

表 1　2000-2009 年寿险产品结构变化

| 项目 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| 寿险保费收入/亿元 | 981.3 | 1288.2 | 2072.8 | 2668.3 | 2839.8 | 3246.9 | 3585.4 | 4463.4 | 6512.4 | 7186.2 |
| 新型寿险产品保费收入/亿元 | 30.6 | 419.5 | 1225.1 | 1762.0 | 1846.3 | 2286.7 | 2586.6 | 3460.7 | 5687.9 | 6365.1 |
| 新型寿险产品保费收入占比% | 3.1% | 32.6% | 59.1% | 66.0% | 65.0% | 70.4% | 72.1% | 77.5% | 87.3% | 88.6% |
| 银行代理保费收入 | 7.0 | 47.0 | 467.9 | 764.91 | 764.87 | 803.3 | 987.6 | 1410.2 | 2912.5 | 3039.0 |
| 银行代理保费收入占比% | 0.7% | 3.6% | 22.6% | 28.7% | 26.9% | 24.7% | 27.5% | 31.6% | 44.7% | 42.3% |

资料来源：　根据各年度《中国保险年鉴》数据整理而得

然而，银行保险也是一把双刃剑。我国当前的银保产品主要以投资连接和分红型寿险产品为主。这些新型寿险产品区别于传统寿险产品的重要特点是保障性并不强，突出投资功能。这就决定了银行保险业务的发展与宏观经济环境的好坏及资本市场的兴衰密切相关。相比于传统寿险而言，其收益率和业务规模有更大的波动性，对公司的经营稳定性以及偿付能力提出了更高的要求。同时，2010 年 11 月银监会下发《关于进一步加强商业银行代理保险业务合规销售与风险管理的通知》(下文简称“银保新规”)，出台多项规定规范银保市场秩序，其中最为重要的一条是要求商业银行不得允许保险公司人员派

驻银行网点销售保险产品。自 2008 年以来，超过 40%的寿险保费收入来源于银保渠道，其中以新型寿险产品为主。可以预见，该通知的出台很可能在短期内急剧抑制寿险产品需求和销售。

因此，在我国寿险消费投资导向日趋明显的情况下，研究主要经济因素包括投资驱动以及银保新规对我国寿险需求的影响，具有重要的理论及现实意义。对保险公司而言，可以及时按照消费者的需求调整产品的设计、结构和销售渠道，在微观层面上实现公司的良性运转；对保险监管者而言，可以有效评估银保政策在短期和长期内对寿险业的影响，监测市场运行状况、及时调整监管政策，在宏观层面上保证保险业的可持续健康发展。

## 二．文献综述

国外对寿险需求的研究大致分为两类，一是理论模型研究，以微观经济学效用理论为基础，分析微观经济主体(个人或家庭)购买人寿保险的最优消费行为；二是实证检验研究，以微观的家庭调查数据或者宏观的国家统计数据为基础，采用回归分析等统计方法对各方面的影响因素进行分析和检验，进而得出现实结论。

在理论研究方面，Yaari(1965)将寿命的不确定性引入消费决策的最优化分析，对传统的确定性生命周期模型予以修正。在 Yaari 的理论基础上，很多学者不断丰富完善寿险需求理论的框架。如 Fischer(1973)用储蓄中定期寿险保费支出比例代表寿险需求，在考虑保险、债券、股票等资产组合的情况下，用效应理论求解最优寿险需求，得出寿险需求与死亡率、遗产动机和未来预期收入正相关的结论。Bernheim(1991)评价了遗赠动机对寿险需求的显著性影响程度，并特别分析了商业寿险与社会保险项目之间的配合与替代关系。Lewis (1989)从受益人的角度研究寿险需求，指出受益人的预期效用和风险厌恶程度同样是重要的影响因素。

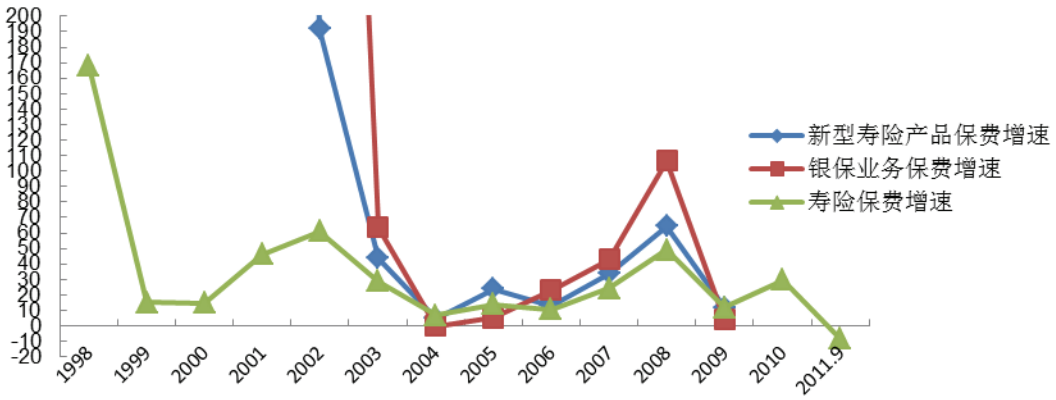
在寿险需求理论研究的基础上，国内外专家学者进行了大量的实证研究。研究方法多为建立寿险需求与相关影响因素间的多元线性回归模型；而差异性主要集中在变量的选取和结果分析上。在梳理国内外相关文献后，可以将影响寿险需求的因素大体上分为三类：一是经济因素，如收入、经济发展水平、金融发展水平、价格、利率以及市场结构等；二是人口因素，如抚养率、死亡率、教育水平、宗教信仰等；三是制度因素，如制度发展和制度改革等。

纵观国内外的实证研究成果，在研究角度上，大多着力分析消费者的支付能力和保障动机，从投资角度对寿险需求的理解都比较片面，大多仅仅停留在利率的影响上，而且没有一致性的结论。同时，由于我国寿险业发展历史短、单项政策影响力有限，少有文献涉及制度因素对寿险需求的影响。因此，本文从影响寿险需求的经济和制度因素出发，一是重点分析寿险需求的投资性和保障性，二是辨识银保新规的制度影响，力争准确评价我国寿险市场的发展动因。另外，在研究方法上，对我国寿险市场的实证研究通常局限于各省(市)的横截面比较或者全国各年度的纵向比较。横向比较的研究期限一般较短，无法准确衡量利率和通货膨胀等因素的长期影响；而纵向比较多采用年度数据，在计量分析中的自由度不够充分，使检验结果的精确性受到很大影响。为弥补这一不足，本文采用月度数据进行实证研究，力图更为准确的测算 2010 年 11 月银保新规颁布后的制度影响。

## 三．基于银保角度细分我国寿险业增速放缓的五个阶段

由于改革开放政策和国民经济的快速发展，我国寿险业务自 1982 年全面恢复办理以来保持了高速的增长态势，这种持续快速增长的势头一直延续到 20 世纪 90 年代末期。本文按照寿险保费收入增长率作为划分标准，得出 1998 年至今我国寿险业共经历了五次增速放缓的阶段。

图1 1998年—2011年9月寿险保费收入增长率




### （一）1998 年—2000 年（传统寿险产品“利差损”现象突出）

1999 年前后由于国家七次下调利率，传统寿险产品在连续降息的情况下产生了大量利差损。由于受到 2.5%预定利率的限制，传统寿险产品的吸引力下降，寿险公司面临老业务利差损风险和开拓新业务难度大的双重压力。数据显示，多次降息导致寿险业保费增速从 1998 年的 168%下降到 1999 年、2000 年的 15%和 14.5%。在这种形势下，以投资连接、万能和分红为代表的新型寿险产品应运而生，并快速发展成为中国寿险业务增长的主要动力。也是从 1999 年开始，国内各大银行和保险公司普遍加强了合作，在银行总行与保险公司总部及各自分支机构之间，签署了以保险代理、资金结算、资金融通和电子商务等业务合作为主要内容的全面合作协议。在这一阶段，银行保险的形式只处于简单的产品代销模式。

### （二）2002 年—2004 年（银保销售误导抬头）

2002 年股市进入低迷期，与资本市场联动性较强的投连险等新型寿险产品收益率不断下跌。在此之前，银保业务处于高速增长阶段，一些保险营销员在销售时夸大或承诺投资回报，把风险极高的投连险卖给了不具备相应风险承受能力的投资者，导致了 2002—2003 年期间的投连险集中退保风波。除了新型寿险产品创新带来的增长动力不足之外，保险业体制改革、保险机构公开上市、增设新市场主体、资金运用渠道放宽等对行业发展所产生的新增长动力还没有完全形成，寿险业务的增速不断下降，甚至在 2004 年 1 季度出现了负增长。

### （三）2005 年—2006 年（小幅震荡调整）

受业务调整和体制转换的影响，2006 年寿险保费收入增长率较 2005 年下降了 3 个百分点。银保业务仍保持一定幅度的增长，呈现出年初“高企”、年中“低走”的增长态势[1]。原因是，年初国有商业银行进行业务结构调整，大力发展中间业务，推动了银保业务在一季度的高速增长。七月保监会出台了《银行、邮政代理保险业务自律公约》，加大了对银行保险市场手续费恶性竞争的监管力度；同时，基金等理财产品的热销和央行加息，进一步导致银行保险业务下滑。相比于 2005 年的增长态势，2006 年的保费收入增长速度虽有小幅下降但各季度保费收入更为平稳，业务质量和结构更为合理。

### （四）2008 年—2009 年（全球金融危机蔓延）

从经济环境来看，2008 年全球金融危机的蔓延至 2009 年开始在国内金融市场显现。

[1]吴定富主编,《中国保险年鉴 2007》,中国:中国保险编辑出版社,2007 年,第 27 页.

友邦母公司的财务危机、平安投资富通失败增添了寿险投资者的恐慌情绪；股市持续下跌的走势再次重挫投连险，投资账户出现净值大幅缩水的现象；央行大幅度降息直接冲击万能险的投资收益水平，保险资金的投资收益率持续走低。再加上销售误导现象频出，部分地区投连险产品出现了继 2002 年之后的二次退保风波。国内外经济形势的利空使得寿险保费收入增长率从 2008 年的 49.2%降为 2009 年的 12%。

### （五）2010 年至今（整体经济、制度因素利空）

2011 年前三个季度的保费收入同比增长率分别为-2.5%,-10.8%及-15.1%。从目前的市场形势来看，今年保费收入负增长的态势确定无疑。2011 年寿险增速放缓主要与整体经济环境相关，资本市场的不景气以及不断上调的银行 5 年定存利率都在挑战寿险公司的投资收益底线。此外，2010 年 10 月银监会出台《关于进一步加强商业银行代理保险业务合规销售与风险管理的通知》，规定保险公司销售人员不得在银行网点驻点销售，使保险公司的银保业务遭遇急刹车。根据 2011 年一季度保险中介市场报告，一季度银行代理保费收入 1269.73 亿元，同比下降 15.33%，实现佣金收入 51.49 亿元，同比下降 3.2%。[2]虽然银保新规从长期来看将促使银行代理保险业务朝着更加规范健康的方向发展，但无疑在短期内，由于银保业务较前几年高速增长有较大幅度的回落，寿险保费收入的增速可能放缓。无论是经济环境还是政策导向，都决定了短期内我国寿险业发展速度放缓的基本趋势。

从我国寿险业发展速度的角度出发，我们可以得出以下结论：随着传统寿险产品在整个寿险行业中的占比不断萎缩，以分红保险为主导的新型寿险产品可谓决定了寿险业的发展态势。一方面，由于新型寿险产品与资本及货币市场联动紧密，经济环境的好坏直接影响这类产品的投资收益以及保费收入；而银行保险作为销售新型寿险产品的重要渠道，监管部门相关政策的出台将在很大程度上影响新型寿险产品的销售乃至寿险业的发展。因此，在研究现阶段寿险需求的影响因素中加入银保新规的制度因素将十分必要。

[2]仝春建:《一季度银行代理保费收入 1269.73 亿同比下降 15%》,2011 年 6 月 13 日《中国保险报》,第 1 版.

## 四、 影响我国寿险需求的宏观经济因素与实证分析

### （一）变量选择

#### 1、被解释变量

使用的被解释变量为寿险保费收入，按照消费者价格指数(CPI)统一调整为 2005 年末的货币单位。本文的研究对象局限于寿险业务，能够有效地解决以往研究中将人身险总保费收入作为被解释变量普遍存在的险种差异性问题。

#### 2、宏观经济的解释变量

除了银保政策变动的制度因素外，本文将选取以下四个宏观经济影响因素，作为模型的解释变量。

（1）国内经济发展水平

GDP 是衡量一国经济发展水平的重要标志。国内生产总值的增长将带来国民收入的增加；随着收入的增加人们对寿险的需求也增加。我国的寿险业的增长是“经济增长带动型”，因此预计其系数为正。

（2）银行存款利率

银行利率变化对寿险保障型产品、储蓄型产品、新型产品的需求会产生不同的影响。首先，保障型寿险产品的给付金额并不取决于保费积累达何种程度，而是由死亡率和不确定的意外因素决定，几乎不受利率波动影响。而储蓄型寿险产品需要事先在一定利率条件下积累本息以满足未来给付，对存款利率变化敏感。当利率上升时，一方面银行存款、债券、股票等金融产品的总体收益率上升；另一方面因寿险保单预定利率的调整具有延迟性，投保人损失投资其他金融产品的机会成本。再说新型寿险产品与利率的关系。由于这类寿险产品突出投资功能，而债市作为目前寿险公司投资的主要渠道，从理论上讲，利率提高时其投资收益率也会水涨船高，进而刺激寿险需求。因此，利率对不同类型寿险产品需求的影响方向不一致，其系数符号并不能确定。

（3）通货膨胀

就持续的通货膨胀和通胀预期而言，它

会降低寿险产品的实际保障水平，从而使寿险“贬值”，减少寿险需求。其抑制作用主要表现在价格效应、收入效应和替代效应等方面[3]。从价格效应来说，人们通过支付货币获得保障，缴费在前、给付在后，通货膨胀将使实际得到的保险给付金额减少。从收入效应来说，通货膨胀情况下实际收入增长率低于名义收入增长率，因此消费者实际收入水平的下降会引起寿险需求的减少。从替代效应来说，通货膨胀通过影响其它金融资产的收益率而对寿险需求产生影响。如果通货膨胀引起其它金融资产收益率水平的相对上升，寿险需求将减少，这主要是针对利率敏感性寿险产品而言。然而，一些研究和实例表明，适度的温和的通货膨胀能够刺激经济增长、增加居民收入，从而增加寿险需求。因此，尚不能判断通货膨胀对寿险需求的影响方向。

（4）资本市场的发展程度

投资型寿险产品作为兼具保险保障和投资功能的新型寿险产品，是保险产品向资本市场的渗透，也是保险市场和资本市场相互融和的产物。寿险公司将来源于这些产品的资金以更大的比例投资于风险性和收益性都较高的金融资产，从而使投保人在承担一定风险的同时可以获得比传统寿险产品更高的投资回报率。目前，我国新型寿险保费收入已占全部寿险保费收入的 85%以上，分红保险更是一险独大，2009 年的市场份额已达73%。这说明，投资型产品的收益率高低越来越成为决定寿险需求乃至行业发展的重要因素之一。

从国际经验来看，资本市场环境是影响寿险投资收益率最为关键的因素。因此，本文将资本市场发展程度作为解释变量之一，以期衡量资本市场影响寿险需求的显著性。

表 2　寿险需求的影响因素及其指标

| 变量 | 指标名称 | 指标算法 | 相关性预期 |
|---|---|---|---|
| INC | 寿险需求 | 寿险保费收入 | |
| GDP | 国内经济发展水平 | 按照月度工业增加值转换得到的 GDP 月度数据 | 正 |
| RAT | 利率 | 五年定期存款利率 | 正/负 |
| CPI | 通货膨胀 | 2005 年 1 月为基期的居民消费价格指数 | 正/负 |
| IND | 资本市场发展程度 | 上证 A 股各月股指收盘指数 | 正 |
| DD | 制度影响 | 银保新规 | 负 |

[3]李蔬暗:《从经济因素分析我国寿险需求》,载《西南金融》2009 年第 1 期，第 60 页.

### （二）计量模型

多元回归分析是研究多个变量之间关系的回归分析方法，通常是指包含一个因变量与多个自变量的回归模型。应用多元回归可以加深对定性分析结论的认识，并得出各要素间的数量依存关系，从而进一步揭示出各要素间内在的规律。多元回归分析可以划分为线性回归分析和非线性回归分析。在本文中，根据寿险保费收入的影响理论，我们将应用线性回归分析对数据进行建模与解释。其一般形式如下：

$$y_t = \alpha + X_{kt}\beta_k + \mu_t \tag{1}$$

$$k = 1, 2, \cdots\cdots, K, \quad t = 1, 2, \cdots\cdots, T$$

其中，y 是因变量观测值的 $T$ 维向量，$X$ 是解释变量观测值的 $T \times K$ 维矩阵。$K$ 表示自变量个数；$T$ 表示观察值的时间；$\beta$ 是 $K$ 维系数向量；$\mu$ 是 $T$ 维扰动项向量；$\alpha$ 是截距项。

根据方程（1）给出的多元回归模型形式，本文构建以寿险保费收入（INC）为因变量，国内生产总值（GDP）、居民消费价格指数（CPI）、上证 A 股月末收盘指数（IND）、5 年定期存款利率（RAT）为解释变量的多元线性回归模型，以研究上述四个宏观经济因素对寿险需求的影响。本文还将分析 2010 年 11 月 1 日起银保新规对寿险需求的影响，因此设定虚拟变量（DD）加入模型中。最终模型形式如下：

$$INC_t = c + \beta_1 GDP_t + \beta_2 CPI_t + \beta_3 IND_t + \beta_4 RAT_t + \beta_5 DD_t + \mu_t \tag{2}$$

其中 $DD_t = \begin{cases} 0 \\ 1 \end{cases}$，2010 年 11 月 1 日前虚拟变量值为 0；2010 年 11 月 1 日起虚拟变量值为 1，以说明政策制度发生了变化。

### （三）数据信息

#### 1、数据初步处理

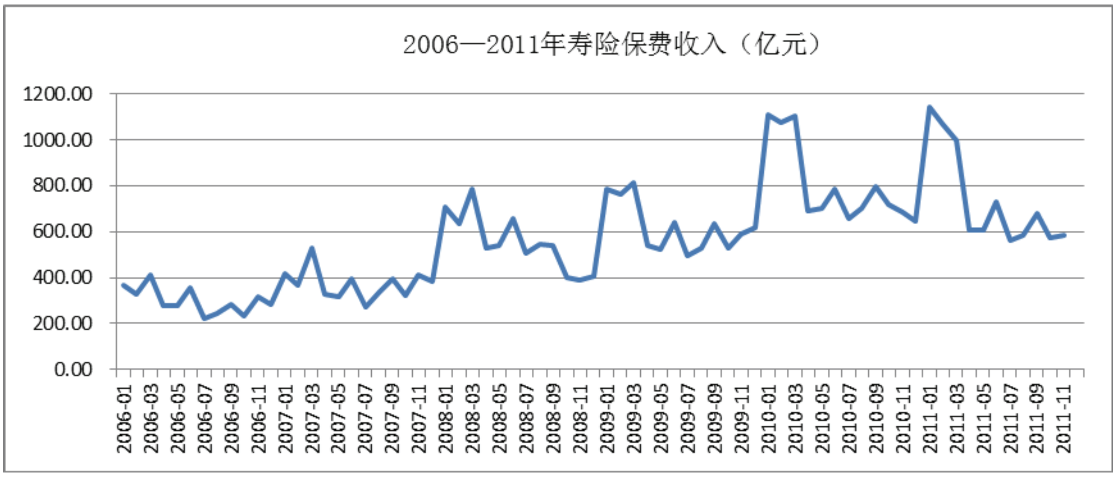
整个数据集包含六个变量，为 2006 年 1 月至 2011 年 12 月共 72 个月的月度数据。数据来自中经网宏观经济数据库以及 wind 资讯；模型构建与参数估计过程采用 Eviews 6.0 软件。由于统计原因，GDP 仅包含季度数据，本文通过运用月度工业增加值进行转换的方法，对 GDP 季度数据进行拆分，从而得到 GDP 的月度数据。具体方法如公式所示：

$$\frac{GDP\text{月度数据}}{GDP\text{季度数据}} = \frac{\text{月度工业增加值}}{\text{季度工业增加值}}$$

由此得出的 GDP 月度数据与工业增加值成正比，较为符合经济现实。

原始数据中，月度 CPI 数据以上年同月为基期，无法用于时间序列的建模分析。因此，我们对数据加以转换，使其成为以 2005 年 1 月为基期的 CPI 数据。5 年定期存款利率的调整若发生在当月 15 日前（包括 15 日），则采用新利率；若在 15 日后，则沿用旧利率。

对变量数据进行初步描述分析，得到下图（不含虚拟变量）：



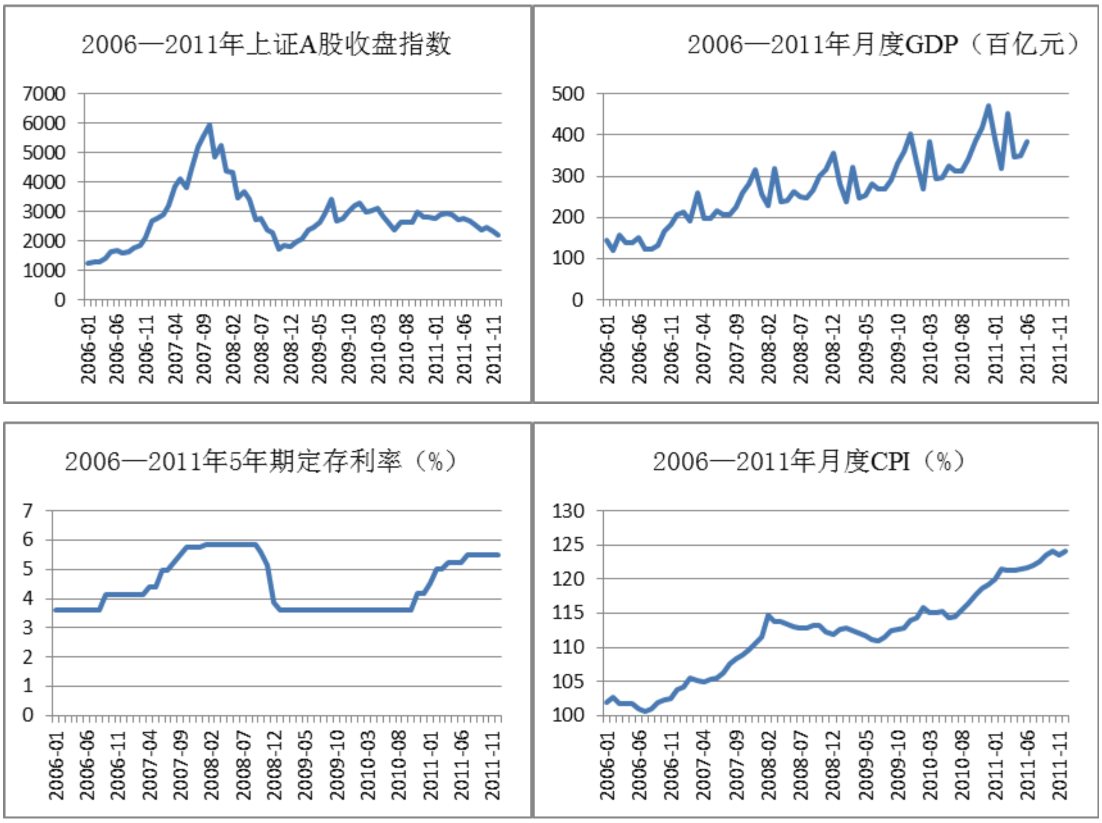



图 2　2006 年 1 月—2011 年 12 月各解释变量趋势图

由图 2 可知寿险保费收入与月度 GDP 具有明显的季节性变动，如寿险保费收入在每年一至三月的平均水平远远高于三月之后的平均水平。经济时间序列由于受到气候、社会制度或风俗习惯的影响，其月度数据与季度数据往往都含有季节变动因素。经济时间序列的季节性波动会遮盖或混淆经济发展中其他客观变化规律，以致给宏观经济分析造成困难。利用 X-12 方法对寿险保费收入序列和 GDP 序列进行季节调整，去除季节变动后的序列能够更好地反映数据的趋势变动，有助于研究经济数据的客观规律（如图 3 所示）。在本文中，分别以 INC_SA 和 GDP_SA 表示季节调整后的寿险保费收入与 GDP。

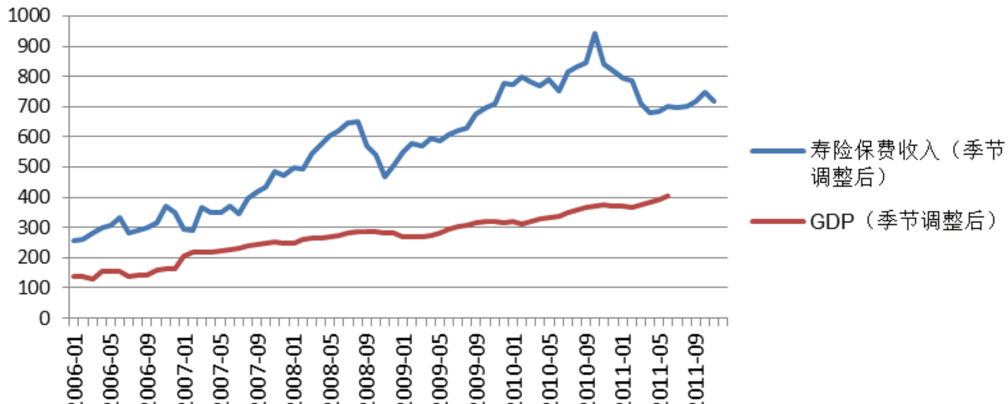



图 3 季节调整后的寿险保费收入与 GDP

### 2、单位根与协整检验

在对多元模型进行参数估计之前，首先应对时间序列进行单位根与协整检验，否则可能由于变量之间的不同阶单整而产生伪回归问题。对因变量和四个自变量（不包括虚拟变量）分别进行 ADF 单位根检验，结果如表 3。可以看出变量原序列均含有单位根，一阶差分后序列不存在单位根，可以认为五个变量均为一阶单整。

表 3 变量 ADF 单位根检验

| 变量<br>名称 | 原序列<br>ADF 检验 P 值 | 一阶差分序列<br>ADF 检验 P 值 | 单整<br>阶数 |
|---|---|---|---|
| INC_SA | 0.7886 | 0.0000 | 一阶单整 |
| GDP_SA | 0.5263 | 0.0000 | 一阶单整 |
| CPI | 0.8194 | 0.0000 | 一阶单整 |
| IND | 0.5814 | 0.0001 | 一阶单整 |
| RAT | 0.6371 | 0.0001 | 一阶单整 |

在建立模型之前，还需要对变量进行协整检验。表 4 显示了协整检验的结果，0.0160 的 P 值显示该检验拒绝了变量间不存在协整关系的原假设，因此我们可用变量建立多元模型以达到我们的分析目的。

表 4 变量间协整检验

| 协整关系 | None | At most 1 | At most 2 | At most 3 | At most 4 |
|---|---|---|---|---|---|
| 检验 P 值 | 0.0160 | 0.0466 | 0.1932 | 0.3584 | 0.9122 |

## （四）参数估计与检验

经初步估计，上证指数(IND)未通过 t 检验（P 值为 0.6555)，可认为其对于寿险保费收入没有显著的影响，若保留该变量会影响其他变量的估计准确性，因而从模型中将 IND 删去，建立模型（3)。

$$INC\_SA_t = c + \beta_1 GDP\_SA_t + \beta_2 CPI_t + \beta_3 RAT_t + \beta_4 DD_t + \mu_t \tag{3}$$

模型（3）与模型（2）相比，拥有更少的变量与不变的拟合优度，且通过了 t 检验和 F 检验，由赤池信息准则和施瓦茨信息准则两者均降低可知，模型（3）比模型（2）更为优秀，因而本文将继续基于模型（3）分析寿险需求的影响因素。

模型建立后，需对其合理与准确性进行检验。对模型（3）分别进行异方差(Breusch-Pagan-Godfrey)检验、自相关(LM)检验以及残差正态性(Normality)检验。经检验，模型（3）的扰动项存在自相关。在这种情况下，OLS 的估计虽为无偏估计，但其标准误已经不再是真实标准误的无偏估计，因而无法再信赖 t 检验的结果，P 值也就失去了其本来意义。为了解决自相关问题，我们把滞后误差逐项代入，得到一个误差项为白噪

声序列、参数为非线性的回归方程，并采用 Gauss-Newton 迭代法求得非线性回归方程的参数。利用 Ljung-Box Q-统计量，我们可以通过调整 AR(p)的阶数确定最后的模型形式。经检验，模型扰动项存在一阶自相关和四阶自相关，将滞后误差项代入模型最终得到模型（4）。

$$\begin{cases} INC\_SA_t = c + \beta_1 GDP\_SA_t + \beta_2 CPI_t + \beta_3 RAT_t + \beta_4 DD_t + \mu_t \\ \mu_t = \rho_1 \mu_{t\text{-}1} + \rho_2 \mu_{t\text{-}4} + \varepsilon_t \end{cases} \tag{4}$$

其中 $\varepsilon_t$ 为白噪声。

同样对模型（4）进行上述检验，结果如表 5。

表 5　模型（4）的检验结果（显著性水平=0.05）

| | Breusch-Pagan-Godfrey | LM test | Normality test |
|---|---|---|---|
| P 值 | 0.58 | 0.76 | 0.50 |
| 原假设 | 扰动项不存在异方差 | 扰动项不存在自相关 | 扰动项服从正态分布 |
| 结论 | 不拒绝原假设 | 不拒绝原假设 | 不拒绝原假设 |

通过上述检验，可见模型（4）解决了模型（3）中存在的扰动项自相关问题，使得参数的假设检验结果更加可信，因而我们采用模型（4）作为最终的实证分析模型。

表 6　模型（4）的参数估计结果

| | c | GDP_SA | CPI | RAT | DD | AR(1) | AR(4) |
|---|---|---|---|---|---|---|---|
| 参数值 | -1815.0600 | 0.0091 | 21.2188 | -49.8559 | -97.6286 | 0.8364 | -0.1947 |
| P 值 | 0.0009 | 0.0514 | 0.0006 | 0.0015 | 0.0070 | 0.0000 | 0.0433 |
| $R^2$ | $R^2$=0.97 | | 调整后 $R^2$=0.96 | | AIC：10.09 | | |
| | F 值=257.14 | | P 值=0.0000 | | SIC：10.33 | | |

# 五、　实证结论与政策建议

## （一）实证结论

由参数估计结果可知，在 0.05 的显著性水平下，经济增长水平、消费者价格指数与寿险保费收入之间存在显著的正相关关系，五年定存利率与寿险保费收入之间存在显著的负相关关系。虚拟变量的系数显著为负，说明银保新规到目前为止确实对寿险需求存在负向影响。这些结果与前人的理论研究和本文的分析大体一致。然而，实证结果表明，资本市场发展程度对寿险保费收入并没有显著影响。

**1、通胀水平与个人寿险产品消费形成显著的正相关关系。**通货膨胀并没有如通常预测的那样明显地阻碍寿险保费收入增长，至少可以认为，通胀对理财方式的刺激作用(拉动寿险购买)不容忽视。原因可能是有二。一是从宏观层面来讲，适度的、温和的通货膨胀能够刺激经济增长、增加居民收入，从而

增加寿险需求；二是从微观层面来讲，国内单纯的定额给付的保障型产品的供给比例近年来大幅下降，新型寿险产品更多向浮动收益方式转变，在一定程度上抵消了通胀的影响。

**2、银行利率关于寿险需求的回归系数显著为负。**这表明对于中国家庭，寿险需求与固定收益率的储蓄债券产品之间存在很大程度的替代效应，而共同促进的程度较低。同时，对于新型寿险产品而言，加息的积极拉动作用不足。从市场实际来看，由于我国寿险投资渠道狭窄、投资能力不足，新型寿险产品的收益率远不如其他金融产品，甚至还不及银行存款利率。因此，从总体上讲，央行多次提高银行存款利率在较大程度上抑制了寿险需求。

**3、资本市场发展程度与寿险需求无显著相关性，这与以往的研究成果结论不相一致。**对此作者尝试做以下解释。首先，虽然新型寿险产品兼具一定的保障功能，但大部分投保人还是希望在具有一定保障基础的情况下适当增加寿险保单的收益性。换言之，投保人还是风险厌恶的，期望能够直接规避资本市场风险、但间接获取资本市场收益。因此，其收益性与资本市场的直接关系不大。同时，由于我国投资渠道有限、投资能力不足，80%以上的寿险资金投资于债市，因此利率水平可谓是制约我国寿险投资最重要的因素，在一定程度削弱了资本市场的相关程度。

**4、银保新规抑制寿险需求增长。**根据瑞再《2011 年保险市场回顾与 2012 年展望报告》，“2011 年中国针对银行保险业务愈加严格的规定导致寿险保费收入下降约 6%”、“由于在监管上收缩产品分销渠道，预计 2012 年中国的寿险销售业绩仍将薄弱”。上述观点也得到本文实证研究的论证。银保新规降低寿险来自于银行的渠道业务收入，这在短期虽然抑制了寿险需求，但从长期来看，对寿险产品结构调整、销售渠道合理安排等未尝不是一件好事。

## （二）实现寿险业发展“软着陆”的政策建议

基于以上分析，2011 年寿险业发展速度放缓有着深刻的经济和制度原因。一方面，在国内生产总值增长速度放缓、银行 5 年定存利率上调、通胀预期强烈的背景下，储蓄型和新型寿险产品销售锐减。而由于国民保险保障意识薄弱，保障型寿险销售一直徘徊在低位。另一方面，过去拉动我国保险业增长的制度性要素不断释放，加之银保新规令新型寿险产品的销售“雪上加霜”，我国寿险业正在经历着增速放缓甚至为负的转型时期。

然而，我们应该清楚的认识到，寿险业长期增长的趋势没有变。随着我国经济的稳健增长，人口老龄化、社会保障低水平、国民风险意识有待增强等现实都决定了寿险业未来广阔的发展空间。因此，寻找寿险业新的增长点、实现寿险行业从增速放缓到下一个快速发展时期的“软着陆”成为摆在我们面前的重要议题。

**1、转变经营理念，回归寿险保障职能。**保障才是寿险产品不同于其他金融产品的根本特点。寿险公司只有在保障产品上进行创新，才能充分发挥其在长期资产负债、风险管理和长期储蓄方面的优势。另外，保障型寿险产品受利率波动的影响较小，不易受货币市场和资本市场震荡的影响。由于目前我国对寿险公司的投资渠道形式的限制较多，要想在收益回报上超过其他金融产品有一定

困难。因此,大可以在保险保障方面做文章,扩大保障范围、提高保障程度。另外一个发展契机是我国的老龄化进程。我国正逐步进入人口老龄化时期,越来越多的人会开始关注养老保险和医疗保险。寿险公司借此机会大力发展保障型产品,注重长期稳定的发展。

**2、加强个险渠道和新型营销渠道的建设。**在预计银保渠道短期无法改观的前提下,寿险公司应更加重视个险渠道及新型营销渠道的建设。首先,积极推进现有渠道和产品开展营销。根据 2011 一季度保险中介市场报告,一季度保险营销员实现保费收入 1778.71 亿元,同比增长 20.84%,占同期全国总保费收入的 38.52%。这说明在营销激励策略得当和产品线广泛的情况下,个险渠道很可能成为寿险产品销售新的增长点。但由于管理粗放、关系不顺等原因,流动性大、增员难一直是个险业务面临的掣肘。为此,监管部门会同行业主体应加大力度,逐步理顺寿险公司与营销员的法律关系,鼓励设立专属保险代理机构或保险销售公司。

此外,鼓励电销、网销等新型渠道的发展。由于电销、网销具有边际利润率高、人均产能高、综合成本率低等优势,很可能成为寿险业转变发展方式的突破口和价值增长点。但同时,监管部门对于电销、网销的监管也应趋于同步,加强对消费者权益的维护并指引新型销售渠道健康发展。

**3、提升寿险行业的投资能力,拓宽投资渠道。**从微观层面来说,寿险公司作为市场经营主体,应当加强投资管理水平和专业人才的培养;借鉴国外寿险投资管理经验合理配置资产负债,增强对投资风险的认识和管理;健全风险管理体系和企业内控,保证公司持续运营和偿付能力充足。从宏观层面来说,首要问题是加快我国金融市场的发展。股票、债券、基金、抵押贷款市场亟待健全完善;加大力度开发创新金融工具,丰富寿险机构投资者的资产组合选择;加快保险立法,加强资金运用监管,保证保险资金的安全性、流动性和收益性。其次,在投资环境逐渐改善的情况下,我们应逐步适当放开权益类投资,拓宽保险资金运用渠道,切实有效的改变以银行存款、国债为主的投资组合结构,提高投资收益率水平。

**4、创新产品形态,提供满足消费者需求的寿险产品。**我国作为拥有 8 亿农民的人口大国,虽然没有研究结果表明我国保障缺口的具体数字,但不难想象这将是一个天文数字,因亡致贫、因残致贫、因病致贫在人们的生活中时有发生。无论从寿险产品的核心职能还是社会长远发展的需要来看,寿险都应努力回归保障,深入挖掘消费者对保障的需求空间。首先,积极倡导传统寿险产品的费率市场化。2010 年 7 月,中国保监会发布了《关于人身保险预定利率有关事项的通知(征求意见稿)》,预示国内已执行十年之久的寿险预定利率 2.5%上限即将放开。然而到目前为止,还没有公司采取实质性措施或表示将推出新产品。传统寿险的预定利率偏低直接导致产品定价偏高或保障不足,将很大一部分寿险需求排除在外。寿险公司应当以此为契机,一方面通过降低保费水平让利于消费者,扩大业务量;另一方面抢占市场先机,开发多元化的寿险产品,形成稳定的客户群体。其次,细分寿险需求,挖掘市场潜力。商业保险在养老、医疗等保障领域已经开始了同政府、企业的有益互动和相互补充,但在纯风险保障方面,社会保障体系主要依赖商业保险这一支柱,且只有商业保险才能提

供最为有效的风险保障工具。因此，寿险公司应当更多的站在行业的角度、消费者的立场来开发产品，从商业寿险如何在社会保障体系进行合理定位和发挥作用的角度上进行深思。唯有如此，才能真正发挥寿险在社会管理的重要作用，才能真正为国民经济保驾护航。

参考文献:

[1]Dale B. Truett and Lila J. Truett, The Demand for Life Insurance in Mexico and the United States: A Comparative Study, *The Journal of Risk and Insurance*, Vol. 57, No. 2 (Jun., 1990), pp. 321-328.

[2]Mark J. Browne and Kihong Kim, An International Analysis of Life Insurance Demand, *The Journal of Risk and Insurance*, Vol. 60, No. 4 (Dec., 1993), pp. 616-634.

[3] Donghui Li, Fariborz Moshirian, Pascal Nguyen, The Demand for Life Insurance in OECD Countries, *The Journal of Risk and Insurance*, Vol. 74, No. 3 (Sep., 2007), pp. 637-652.

[4] Lewis, F.D, Dependents and the Demand for Life Insurance, *American Economics Review*, 1989(79), pp. 52-67.

[5] Zietz, E.N, An Examination of the Demand for Life Insurance, *Risk Management and Insurance Review*, 2003(6), pp. 159-191.

[6]郑伟,刘永东,邓一婷.保险业增长水平、结构与影响要素:一个国际比较的视角[J].经济研究,2010,(8):141-154.

[7]谢丹.论中国寿险资金的运用与监管[D].上海:复旦大学,2008.

[8]刘妍芳.寿险投资及其监管研究[D].北京:中国社会科学院,2000.

[9]李蔬暗.从经济因素分析我国寿险需求[J].西南金融,2009,(1):59-60.

[10]黄小敏.影响个人寿险需求的因素分析[J].浙江金融,2010,(7):55-56,14.

[11]崔勇.我国银行保险发展的制度因素实证分析[J].保险研究,2010,(4):36-43.

# 我国寿险业发展的制度决定与经济影响因素分析

徐婧姝[1]，吴遥[2]

[1]保险学院,中央财经大学,北京,中国,100081

[2]统计学院,中央财经大学,北京,中国,100081

摘要：自银保新规出台以来，银保业务规模出现大幅度缩减，银保业务渠道面临重大变局。受此新规影响的直接冲击，我国寿险行业保费规模增速缓慢，甚至出现负增长。本文从银行保险业务特点出发，细分说明寿险业发展历程中增速放缓的五个阶段。进而结合国内外经济形势和制度变迁，通过多元回归模型实证分析说明国民经济增速放缓、银行定存利率调升、通胀预期强烈、资本市场下挫以及银保新规出台分别是我国寿险业增速放缓的经济和制度原因。最后提出寿险业增速放缓需警惕的问题及应对之策，以期实现我国寿险业向下一个健康持续增长阶段的平稳过渡。

关键词：寿险；发展速度；银保新规；经济影响

# Cyclical Fluctuations and Nonlinear Dynamics of China Insurance Development

XU Li [1,2], YIN Jing [1]
[1] Department of Finance, School of Economics, Xiamen University, Xiamen , China, 361005
[2] Fujian Key Laboratory of Statistical Sciences, Xiamen University, Xiamen , China, 361005

**Abstract:** This Paper studies the cyclical fluctuations of China insurance development using CF filter. Results show that China insurance cycle is pro-cyclical with macroeconomic cycle while duration of life insurance cycle is longer than nonlife insurance cycle together with lager volatility and persistence. Then we introduce STECM to examine the nonlinear, discontinuous, and time-varying adjustment speed between China insurance development cyclical fluctuations and impact factors. We find that not only nonlinear adjustment speeds of nonlife and life insurance markets are different, the adjustment direction of two regimes for nonlife and life insurance markets are also different.
**Keywords:** Insurance development；cyclical fluctuations; nonlinear ynamics

## Ⅰ.引言

改革开放以来，我国保险业从无到有，从小到大，发展速度世界瞩目。保险业在高速增长的同时，其发展的波动性也开始为学者关注。类似于经济增长的波动，保险业发展的波动也呈现明显的周期特征。早期的有关保险发展周期波动的文献主要针对美国市场。研究运用二阶自回归模型发现，除了航空险和非机动车辆保险财产损失责任险以外，美国产险业的其他险种均存在承保周期，其周期为 5 到 11 年之间，产险业整体的周期为 6.06 年（Venezian，1985）。Cummins 和 Outreville(1987)把研究扩展到多国保险市场，发现在所研究的 13 个国家中，有 10 个国家存在承保周期现象，其周期长度从 4.69 到 8.23 年不等。后来的文献也都基本上认可了承保周期的存在，尤其是在非寿险领域（如 Lamm-Tennant 和 Weiss，1997）。与此同时，学者们也对造成承保周期的原因从理论上进行了解释。这些理论或假说包括非理性定价（Venezian，1985)，资本约束（Gron,1994），制度性因素（Cummins 和 Outreville，1987；Lamm-Tennant 和 Weiss，1997)，利率波动（Doherty and Garven,1992）和股市波动(Cummins and Nye)等。

实证方面，Fung 等（1998）在总结承保周期基本假说的基础上采用保险行业和险种的数据里利用向量自回归模型检验了美国财产-责任保险承保周期的原因，得出预期的不确定性可以解释保费收入预测误差的重要部分，不同险种的承保周期原因不同：投资收益一般对长尾险比对短尾险更重要。Chen 等（1999）研究发现新兴保险市场承保周期波动主要与这些国家的经济增长速度相关，而与股票市场和利率的波动几乎无关。Grossman 和 Ginburg（2004）认为健康保险周期是受保险人激烈竞争的影响。利润吸引了行业进入者，竞争迫使市场中的已存在的保险人降低费率以保持市场份额。Rosenblatt(2004)也认为健康计划管理者可能已经将增长目标置于利润目标之上，当增长速度下降时，通过价格竞争增加保费规模，而导致承保周期。Born 和 Santeree（2007）研究了 1960 至 2004 年美国健康险的承保周期，表明偿付能力约束、利率波动和理性预期假说与机构干预可以解释健康险市场承保周期的波动。研究也发现承保周期与利率周期具有相关性（Doherty 和 Kang，1988），认为利率在一定程度上可以解释保费的波动（Fung 等，1998）。之后学者对承保周期与股市波动的相关性也进行了实证研究（如 Cummins 和 Nye（1980），Lamm 和 Weiss（1997））。Blondeau（2001）利用 VAR 协整分析，发现非寿险保费收入与长期利率、股票市场收益率之间具有长期相关性。

近些年来承保周期现象也受到国内学者的关注。如王波、史安娜(2006)选取我国保险产业 22 年的相关年度数据，用二阶自回归模型检验我国保险市场承保周期的存在与否，实证表明我国非寿险市场的承保周期规律尚未显露在主要险种中，机动车辆保险的承保周期约为 6 年。但方法不足之处在于没有对赔付率数据做平稳性检验，而是直接套用最小二乘法建模，信服力受到质疑。胡三明和吴洪(2007)用

1985 年至 2004 年的数据证明国内车险市场存在承保周期，且仅与真实 GDP 有关。张琳、朱园丽(2009)通过构造一个包含多个变量的回归模型来检验各种因素对保费变动的影响，结果表明滞后损失率和滞后保费增长率对当期保费增长影响非常显著，滞后损失增长率对当期保费增长率影响不显著，在我国机动车辆保险中，宏观经济因素包括利率和 GDP 对保费增长率的影响很小。冀玉娜、郑海涛(2009)采用二阶自回归模型和谱分析法两种方法来检验中国整个非寿险市场是否存在承保周期现象，并认为中国非寿险市场确实存在承保周期，且存在 12.5 年～16.7 年的长承保周期和 5.6 年左右的中周期。李心愉、李杰(2010)采用 CF 滤波法对我国 1980 年至 2008 年的非寿险市场承保赔付率进行研究，发现我国非寿险市场存在着承保周期现象，周期长度为 4～5 年不等。非寿险赔付率（承保利润）波动与利率、股票指数波动关系不显著。认为制度冲击假说和经济周期假说适用于解释我国承保周期现象，而非理性定价假说和承保力约束假说对我国承保周期现象的解释力不充分。王丽珍、李秀芳、郭思文(2010)通过对真实 GDP、HHI(赫尔芬达—赫希曼指数)、政策性因素长期和短期影响等进行回归分析，综合考察我国非寿险业承保利润的变化，发现经济周期是造成承保利润周期的主要原因，我国市场结构变化的加速与监管制度的阶段性实施，也对承保利润的周期性起到了推波助澜的作用。孙祁祥、郑伟、肖志光（2011）将经济周期的研究方法运用于保险周期研究中，并用 CF 滤波法测算出 1980 年-2008 年间，保险业经历了 6 个保险周期。寿险业的波动幅度远远大于非寿险业，两者周期成分的粘性也存在明显差异，寿险业的波动与前期波动高度正相关，而非寿险业则高度负相关。研究还表明，新兴市场国家和工业化国家保险周期的特征及影响因素存在显著差异，前者波动幅度加大，主要受经济周期的影响，后者则主要取决于微观市场环境的变化。熊海帆、卓志、王威明（2011）将保险行业指标作为因变量，各宏观经济指标作为自变量而建立回归方程，找寻保险经营和宏观经济发展可能存在的协整关系。研究发现，保险行业运行状况与宏观经济走势长期一致，从而间接证明存在保险周期。韩晓峰、陈诚（2011），以支出法来衡量保险业的发展，将保险业产出计算为各项赔款、营业费用以及投资支出的总和。运用 HP 滤波法测得中国保险周期为 5~7 年。吴洪（2011）将保险波动关系解构为保险数量波动和保险质量波动，保险数量波动反映了保险规模增长的波动情况，而保险质量波动则反映承保质量波动情况，并构建保险数量波动模型和保险质量波动模型，研究保险波动与宏观经济波动的相依关系。

上述文献表明：我国保险发展波动也具有明显的周期性，但既有的研究更多的使用线性模型来研究波动周期的产生原因，不能充分刻画周期波动的动态过程。Anderson(1997) 和 Michael et al.(1997)研究表明存在交易费用的情况下，用门限类非线性模型来刻画金融资产的动态调整更恰当。非线性模型的优势得到了大部分学者的认同，这主要是因为现实中投资者期望的差异性、交易费用的存在及从众行为等，会对变量间的动态调整产生非线性的、非连续的、非对称的、且以时变的速率调整的影响。在保险市场上，对于投保人而言当其面临利率和股价的变动时，在存在相关交易成本的情况，很难让所有的投保人有相同的行为。同样的，当保险人在面临利率和股价的变动时，保险人的经营成本和投资收益都会发生变化，保险人的行为也不可能一致，且对于利率及股价偏离均衡状态的情况不同，保险人所表现出的成本行为也必然不一致。近年来，国外学者开始引入非线性方法研究保险发展波动的原因，如 Jawadi、Bruneau 和 Sghaier（2009）运用 STECM 模型对包括英美在内的五个发达国家的非寿险保费收入、利率和股票价格之间长期和短期关系进行研究，表明非寿险保险收入与金融市场之间存在非线性协整关系。因此，本文拟沿用 Jawadi 等（2009）的模型对我国保险发展的波动性进行研究，以刻画中国保险发展周期波动与其影响因子波动之间非线性的、非连续性的、速率时变的动态调整过程。.

# Ⅱ.中国保险发展波动的周期性

## A. 滤波法

滤波法指的是，用合适的滤波算子，剔除一组由无数条不同频率、不同相位、不同振幅的波形组成的时间序列中的随机扰动部分、长

期趋势部分，从而得出实际周期波动部分的方法。

滤波法是现阶段在一组时间序列中提取周期成分的最常用的方法。代表性的滤波法有HP滤波、BK滤波（部分文献称BP滤波）和CF滤波。不同的滤波技术有不同的特性，适合于不同的样本背景。HP滤波可以看做一个近似的高通滤波器（High-Pass Filter），即HP滤波法在提取周期成分时， HP滤波作为一个近似的High-Pass滤波，会遗漏高频的不规则扰动。BK滤波法由Baxter和King（1999）提出， BK滤波法能够有效克服HP滤波法遗漏高频的不规则扰动的劣势，在季度或者更高频率的数据方面更有优势。CF滤波由Christiano和Fitzgerald（1999，2003）提出，与HP滤波和BK滤波相比，CF滤波的最大特点是比较灵活，不但能够对不同性质的时间序列采用不同的滤波公式，而且在同一时间序列不同时点的估计上也选取不同的截断和权重。

综合比较以上三种滤波方法，HP滤波是高频滤波法的一种，滤波结果放过了很多无为信息；BK滤波、CF滤波都是带通滤波，带通滤波（Band-Pass filter，即BP滤波法），只放过目标信息，并滤去无效内容，所以是最优的。CF滤波放弃了 BK滤波的平稳性和对称性假设，BK滤波可以看作是 CF滤波的一种特殊情况。我们认为，CF滤波更灵活，优势明显，可以根据研究的需要提取特定频率或波长的周期成分。我们选择 CF滤波法来测算中国寿险市场和非寿险市场的保险周期长度，并计算保险周期的波动幅度和粘性。

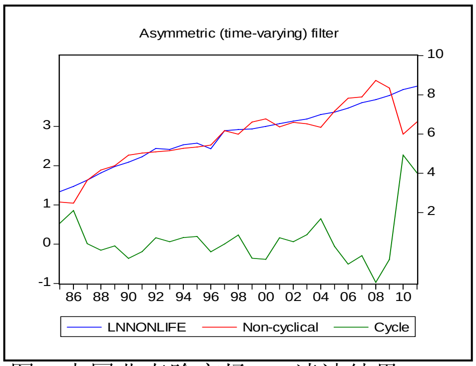



图1 中国非寿险市场CF滤波结果

## B. 数据说明和CF滤波结果

本文选用1985年至2011年我国非寿险、寿险市场保费收入的年度数据，数据来源于中国金融年鉴、中国保险年鉴，对所有数据进行对数化平滑处理， 之后进行 CF（2，8）滤波处理，得到我国非寿险和寿险市场保费收入的CF滤波结果。如图1和图2所示。

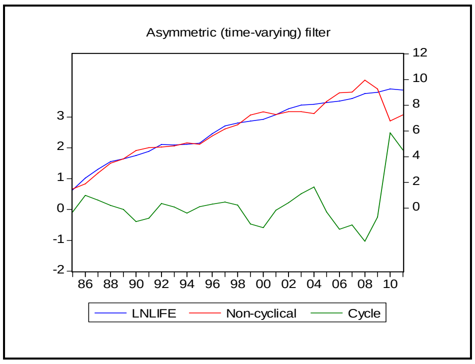



图2 中国寿险市场CF滤波结果

常见的周期研究基本内容包括周期长度、周期波动幅度、周期粘性等的研究。周期长度（Duration），指的是每个周期的平均时间，判断周期长度的方法有“谷-谷”法等。周期性波动的频率（Frequency），等于时间序列长度除以经历的周期个数。周期时间越长，则周期性波动的频率越低。波动幅度（Volatility）是去趋势化后数据的标准差，它反映了波动幅度。数值越大，表明波动幅度越大。粘性（Persistence）是去趋势化后数据的一阶自相关，它表示的是前一期波动对当期波动影响的强度。该系数的符号代表影响的方向，若为负，则表明前一期波动对当期波动产生负面影响，反之亦然。此外，绝对值越大，表明影响强度越大。

我们通过“谷-谷”法确定 1985 年至 2011 年间，中国非寿险市场的保险周期个数约5个，周期平均长度约为5.4年。而中国寿险市场的保险周期个数约4个，周期平均长度约为 6.75 年。再次，我们对周期成分数据进行测试，中国非寿险市场保险周期的波动幅度为 0.67、粘性为 0.53。而中国寿险市场保险周期的波动幅度为0.81、粘性为0.61。

比较中国非寿险、寿险市场的保险周期特点，可以发现，中国寿险市场的保险周期较非寿险市场长，波动幅度、周期粘性也更大。我们认为非寿险、寿险市场的不同经营性质是造成这一现象的主要原因。非寿险市场，承保的是财产、责任等损失风险，合约期限多为一年，一年一保，因承保物质财产损失风险，受

到宏观经济影响（宏观经济投资等）反应更快；而寿险市场，承保的人身风险，经营周期长，一保多年，一人可多保，受到居民可支配收入影响更大，工资刚性将宏观经济影响因素弱化。因此，寿险市场保险周期较非寿险市场长。此外，寿险保费收入的波动受上一期波动影响较非寿险强烈，寿险市场发展较非寿险更具有弹性，寿险市场的保险周期波动更大。

# III. 中国保险发展的周期波动因素分析

## A. 候选变量选择和数据处理

接下来本文分析影响中国保险发展的周期波动的因素。根据既有研究，我们选取 GDP、利率、股指、固定资产投资总额、货币投放量、居民可支配收入等作为候选变量，考察各候选变量波动与中国保险发展的周期波动可能产生的协整关系，在此基础上估计协整方程和 LECM 模型。

首先，我们仍用 CF（2，8）滤波法，对 GDP、利率、股指、固定资产投资总额、货币投放量、居民可支配收入各候选变量去趋势化。其次，考虑到各解释变量之间本就有着复杂的关联性，我们将采用剔除共线性变量，保留使模型估计结果最优的变量，再进行协整关系检验，以及协整方程和 LECM 模型的估计。

受限于中国股票市场发展时间尚短等因素的影响，我们选用 1992 年至 2011 年中国非寿险市场、寿险市场保费收入，GDP、利率（以银行一年期存款利率水平代表）、股指、固定资产投资总额、货币投放量、居民可支配收入（以城镇居民可支配收入代表）各年度数据，将各变量对数化平滑处理，并同样用 CF（2，8）滤波法将各候选因子的波动部分提取出来，并分别用 Lngdp_CF 、Lnrate_CF 、Lnstock_CF 、 Lndl_CF 、 Lninvest_CF 、Lnpi_CF 表示。数据来源于中国金融年鉴，Wind 数据库。

## B. 单位根检验和 OLS 模型估计

考虑到每个变量并不一定都存在同阶单整，各解释因子之间也存在复杂的关联关系。如果将所有的候选因子都纳入协整关系研究中，那么可能出现两种情况，一是因子间的共线性导致统计量不显著，二是变量间的协整关系不存在。因此，我们从两方面对中国保险发展的周期波动候选因子进行选择：一是单位根检验，是否满足同阶单整要求；二是在 OLS 模型初步估计的结果中是否显著。我们对各候选变量分别用 ADF 检验和 PP 检验法进行单位根检验。各变量单位根检验结果见表 1。从各候选变量单位根检验结果，我们发现各变量均是非平稳的，但在一阶差分后能够保持平稳，满足了协整关系研究的前提条件。

表 1 各候选变量单位根检验结果

| Series | ADF 检验 | | | PP 检验 | | |
|---|---|---|---|---|---|---|
| | ADF 检验值 | 临界值 | 是否平稳 | PP 检验值 | 临界值 | 是否平稳 |
| Lnlife_CF | -3.401734 | -4.886426 | 否 | -2.911931 | -3.886751 | 否 |
| Δ | -4.727122 | -4.800080 | 是 | -10.52572 | -4.667883 | 是 |
| Lnnonlife_CF | -0.403090 | -3.959148 | 否 | 1.382132 | -3.886751 | 否 |
| Δ | -6.032232 | -4.728363 | 是 | -14.18256 | -4.667883 | 是 |
| Lngdp_CF | 0.660161 | -3.886751 | 否 | 0.515321 | -3.886751 | 否 |
| Δ | -2.921257** | -2.701103 | 是 | -5.887760 | -4.667883 | 是 |
| Lnrate_CF | -1.049876 | -4.616209 | 否 | -1.049876 | -4.616209 | 否 |
| Δ | -4.008389* | -3.733200 | 是 | -4.008389* | -3.733200 | 是 |
| Lnstock_CF | -2.134095 | -3.886791 | 否 | -2.007306 | -3.886751 | 否 |
| Δ | -4.323089* | -3.759743 | 是 | -10.34302 | -4.667883 | 是 |
| Lndl_CF | -2.005970 | -4.616209 | 否 | -2.327425 | -4.616209 | 否 |
| Δ | -3.986232* | -3.733200 | 是 | -4.935459 | -4.667883 | 是 |
| Lninvest_CF | -4.387526 | -4.800080 | 否 | -1.109927 | -4.616209 | 否 |
| Δ | -3.634213 | -3.362984 | 是 | -7.389895 | -4.667883 | 是 |
| Lnpi_CF | -2.005970 | -4.616209 | 否 | -2.327425 | -4.616209 | 否 |
| Δ | -3.986432* | -3.733200 | 是 | -4.935459 | -4.667883 | 是 |

注：*表示在 5%的置信水平下平稳，**表示在 10%的置信水平下平稳，其他则表示在 1%的置信水平平稳。

单位根检验的结果，并没有令我们剔除不符合条件的解释变量。为了进一步优化解释变量确定变量间协整关系。我们将被解释变量、各候选解释变量进行普通 OLS 模型初步估计；并以此为基础剔除存在共线性、对模型估计结果产生影响的因子，具体结果见表 2。

结果表明，Lngdp_CF、Lndl_CF、Lninvest_CF、Lnpi_CF 存在严重的共线性，四个变量中仅保留 Lnpi_CF 变量，对模型估计最优。而 Lnstock_CF 对 Lnlife_CF、Lnnonlife_CF 的解释能力不明显，而 Lnrate_CF 对 Lnlife_CF 具有强解释力，而对 Lnnonlife_CF 具有弱解释能力。

我们对挑选出的因子与被解释变量组合，构成 Lnnonlife_CF、Lnpi_CF、Lnrate_CF 组合，Lnlife_CF、Lnpi_CF、Lnrate_CF 组合。在下文中，我们将对这两个组合进行协整关系检验、协整方程和 LECM 模型估计。

## C. 协整关系检验和模型估计

我们将 Lnnonlife_CF、Lnpi_CF、Lnrate_CF 组合，Lnlife_CF、Lnpi_CF、Lnrate_CF 组合，并进行 JJ 检验。JJ 检验结果见表 3、表 4，分别给出了迹统计量和最大特征根统计量。

表 3 Lnnonlife_CF、Lnpi_CF、Lnrate_CF 组合 JJ 检验结果

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.894471 | 45.27999 | 29.79707 | 0.0004 |
| At most 1 | 0.346055 | 9.299642 | 15.49471 | 0.3384 |
| At most 2 | 0.144865 | 2.503935 | 3.841466 | 0.1136 |

表 4 Lnlife_CF、Lnpi_CF、Lnrate_CF 组合 JJ 检验结果

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.931460 | 68.35713 | 29.79707 | 0.0000 |
| At most 1 * | 0.760962 | 25.47164 | 15.49471 | 0.0012 |
| At most 2 | 0.148575 | 2.573509 | 3.841466 | 0.1087 |

根据 JJ 检验结果，Lnnonlife_CF、Lnpi_CF、Lnrate_CF 组合之间在 5%的置信水平上，至少存在 1 个协整关系；而 Lnlife_CF、Lnpi_CF、Lnrate_CF 组合之间在 5%的置信水平上，至少存在 2 个协整关系。

我们对 Lnnonlife_CF、Lnpi_CF、Lnrate_CF 组合，Lnlife_CF、Lnpi_CF、Lnrate_CF 组合进行 OLS 估计，并对残差运用 EG 两步法，以证明 Lnnonlife_CF、Lnpi_CF、Lnrate_CF 组合，Lnlife_CF、Lnpi_CF、Lnrate_CF 组合的 OLS 估计结果是协整方程，并估计 LECM 模型。

EG 两步法协整检验步骤如下：首先对 $Y_t = \alpha_0 + \alpha_1 X_{1,t} + \alpha_2 X_{2,t} + z_t$ 进行拟合回归；其次，检验 $z_t$ 平稳性，只有当 $z_t$ 平稳时，才能说明变量之间存在协整关系。

## D. 中国非寿险市场保险周期波动因素分析

根据上文因子的选择，对中国非寿险市场保险周期波动具有解释力的因子有居民可支配收入、利率。我们首先估计介绍中国非寿险市场保险周期波动因素的 OLS 模型，并对 $z_t$ 进行单位根检验，见表 5。

$$\ln nonlife\_CF_t = -0.01 + 0.90 \ln pi\_CF_t - 0.61 \ln rate\_CF_t + z_t$$
t-Statistic 16.77 -2.51
Prob . 0.0000 0.0243 （1）

表 5 中国非寿险市场保险周期波动因素 OLS 模型的 $z_t$ 单位根检验

| Series | ADF 检验 | | | PP 检验 | | |
|---|---|---|---|---|---|---|
| | ADF 检验值 | 临界值 | 是否平稳 | PP 检验值 | 临界值 | 是否平稳 |
| $z_t$ | -4.977014 | -3.920350 | 是 | -7.504978 | -3.886751 | 是 |

从中国非寿险市场保险周期波动因素 OLS 模型的 $z_t$ 单位根检验结果来看，$z_t$ 是平稳的，即通过 EG 两步法的协整关系检验。我们可以将方程（1）视作 Lnnonlife_CF、Lnpi_CF、Lnrate_CF 组合的协整方程，即代表了 Lnnonlife_CF、Lnpi_CF、Lnrate_CF 组合的长期均衡关系。如果变量在某时期受到干扰后偏离其长期均衡点，则均衡机制将会在下一期进行调整以使其重新回到均衡状态，而 LECM 模型刻画了短期非均衡状态向长期均衡状态调整的线性的、对称的方式。

我们以稳定的时间序列 $z_t$ 作为误差修正项，估计中国非寿险市场保险周期波动因素的 LECM 模型，剔除不显著变量后，得到方程（2）。

$$\Delta \ln nonlife\_CF_t = 0.01 + 0.87 \Delta \ln pi\_CF_t - 0.33 \Delta \ln rate\_CF_t - 1.2 ECM_{t-1} + \mu_t$$
$t-Statistic$ 15.38 $-2.51$ $-4.67$
$\Pr ob.$ 0.000 0.040 0.001 （2）

从 Lnnonlife_CF、Lnpi_CF、Lnrate_CF 的长期均衡关系来看（详见方程（1）），居民可支配收入波动、利率波动对中国非寿险市场保险周期波动具有足够的解释力。居民可支配收入的增加、利率水平的降低，能够拉动中国非寿险市场保险周期的上升趋势；而居民可支配收入的降低、利率水平的走高，则会打压中国非寿险市场保险周期的上升。Lnnonlife_CF 关于 Lnpi_CF 的长期变化比率 0.9，而关于 Lnrate_CF 的长期变化比率-0.61。

从 Lnnonlife_CF、Lnpi_CF、Lnrate_CF 的短期修正均衡关系来看（详见方程（2）），非寿险市场的保险周期波动的调整，由两部分组成：一部分由短期波动决定（$\Delta \ln pi\_CF_t$、$\Delta \ln rate\_CF$），另一部分由长期均衡误差修正项决定（$ECM_{t-1}$）。$ECM_{t-1}$ 的系数为-1.2，那么当短期波动偏离长期均衡时，将以-1.2 的调整速度（或力度）非均衡状态拉回到均衡状态。

## E. 中国寿险市场保险周期波动因素分析

同样的，从上文因子的选择结果看来，对中国寿险市场保险周期波动具有解释力的因子有居民可支配收入和利率。

方程式（3）是中国寿险市场保险周期波动因素的 OLS 模型估计结果，我们对 $z_t$ 进行单位根检验，见表 6。

$$\ln life\_CF_t = 1.01 \ln pi\_CF_t - 1.22 \ln rate\_CF_t + z_t$$
t-Statistic 13.71 -3.61
Prob . 0.0000 0.0026 （3）

表 6 中国寿险市场保险周期波动因素 OLS 模型的 $z_t$ 单位根检验

| Series | ADF 检验 | | | PP 检验 | | |
|---|---|---|---|---|---|---|
| | ADF 检验值 | 临界值 | 是否平稳 | PP 检验值 | 临界值 | 是否平稳 |
| $z_t$ | -3.993500 | -3.886751 | 是 | -7.504978 | -3.886751 | 是 |

$$\begin{array}{lllll} \Delta\ln life\_CF_t = 0.01 + 0.97\Delta\ln pi\_CF_t - 0.89\Delta\ln rate\_CF_t - 0.58ECM_{t-1} + \mu_t \\ t-Statistic \quad 10.89 \quad -2.61 \quad -1.92 \\ \Pr ob. \quad 0.000 \quad 0.021 \quad 0.067 \end{array} \tag{4}$$

从 Lnlife_CF、Lnpi_CF、Lnrate_CF 的长期均衡关系来看（详见方程（3）），居民可支配收入波动、利率波动对中国寿险市场保险周期波动具有足够的解释力。居民可支配收入的增加、利率水平的降低，能够拉动中国寿险市场保险周期的上升趋势；而居民可支配收入的降低、利率水平的走高，则会打压中国非寿险市场保险周期的上升。Lnnonlife_CF 关于 Lnpi_CF 的长期变化比率 1.01，而关于 Lnrate_CF 的长期变化比率-1.22。

从 Lnlife_CF、Lnpi_CF、Lnrate_CF 的短期修正均衡关系来看（详见方程（4）），寿险市场的保险周期波动的调整，亦有两部分组成：一部分由短期波动决定（$\Delta\ln pi\_CF_t$、$\Delta\ln rate\_CF$），另一部分由长期均衡误差修正项决定（$ECM_{t-1}$）。$ECM_{t-1}$ 的系数为-0.58，那么当短期波动偏离长期均衡时，将以-0.58 的调整速度（或力度）非均衡状态拉回到均衡状态。

## F. 中国非寿险、寿险市场波动因素比较

从中国非寿险、寿险市场保险周期波动与其因子波动的长期均衡关系来看，Lnpi_CF、Lnrate_CF 对 Lnnonlife_CF、Lnlife_CF 的影响方向一致，但影响力度不同，见表 7。

长期均衡关系上，中国非寿险、寿险市场的保险周期波动与居民可支配收入波动情况一致，当居民可支配收入的增加，中国非寿险、寿险市场的保险周期均处于上升期，且寿险市场的保险周期波动受到的影响较非寿险市场更大。然而，中国非寿险、寿险市场的保险周期波动与利率水平波动情况相反，当利率水平的增加，中国非寿险、寿险市场的保险周期均处于下降期，且寿险市场的保险周期波动受到的影响较非寿险市场更大。

表 7 中国非寿险、寿险市场波动的长期均衡状态比较

| | Lnpi_CF | Lnrate_CF |
|---|---|---|
| Lnnonlife_CF | 0.9 | -0.61 |
| Lnlife_CF | 1.01 | -1.22 |

短期修正均衡关系上，中国非寿险、寿险市场的保险周期波动的调整，均有两部分组成：一部分由短期波动决定（$\Delta\ln pi\_CF_t$、$\Delta\ln rate\_CF$），另一部分由长期均衡误差修正项决定（$ECM_{t-1}$）。短期波动以长期关系为指导，ΔLnnonlife_CF、ΔLnlife_CF 与ΔLnpi_CF 变动方向相同，与ΔLnrate_CF 变动方向相反；且 ΔLnlife_CF 受到两者的影响较 ΔLnnonlife_CF 更大。

长期均衡误差修正项（$ECM_{t-1}$）的系数，是短期波动偏离长期均衡时，非均衡状态拉回到均衡状态的调整速度（或力度）。从计量结果看，中国非寿险市场的保险周期波动从非均衡状态向均衡状态的调整速度高于中国寿险市场。考虑到非寿险与寿险不同的经营特点，我们认为非寿险业务一年一保，周期短，较之经营年限较长的寿险，其受宏观经济因素影响更为敏感，则中国非寿险市场的保险周期波动从短期波动向长期均衡调整的速度更快。

表 8 中国非寿险、寿险市场波动的短期修正状态比较

| | ΔLnpi_CF | ΔLnrate_CF | $ECM_{t-1}$ |
|---|---|---|---|
| ΔLnnonlife_CF | 0.87 | -0.33 | -1.2 |
| ΔLnlife_CF | 0.97 | -0.89 | -0.58 |

# Ⅳ. 中国保险发展周期波动的非线性动态调整

前面我们研究了中国非寿险、寿险市场的保险周期波动与其影响因子波动之间的长期均衡关系和短期动态修正关系。然而，Taylor and Sarno（2001）认为 LECM 模型并不能完全地表示变量由短期波动偏离向长期均衡调整的过程，因为 LECM 模型要求变量间的动态调整必须是线性的、连续性的、且以常数速率调整的。事实上，变量间的动态调整可能是非线性的、非连续性的、速率时变调整的。

为了进一步分析，中国保险发展的周期波动的非线性动态调整，本文以中国保险发展的周期波动的长期均衡关系为基础，对动态调整进行非线性检验，引进 STECM 模型，刻画变量间非线性的、非连续性的、速率时变的动态调整过程。

## A. STECM 模型

LECM 模型要求变量间的动态调整必须是线性的、连续性的、且以常数速率调整的。而 STECM 模型可以允许变量间的动态调整是非线性的、非连续的、非对称的、且以时变的速率调整，其被认为是门限模型的一种。

STECM 是在 LECM 的基础上引入了转换函数 $F(z_{t-d},\gamma,c)$ 和 $\hat{z}_{t-1}$ 的交乘项。Jawadi（2006）和 Prat（2008）提出了 STECM，两区制的 STECM 其表达式如下：

$$\Delta Y_t=\theta_0+\rho_1\hat{z}_{t-1}+\rho_2\hat{z}_{t-1}\times F(z_{t-d},\gamma,c)+\sum_{i=1}^{p}\theta_{1,i}\Delta Y_{t-i}+\sum_{j=0}^{p}\theta_{2,j}\Delta X_{1,t-j}+\sum_{l=0}^{p}\theta_{3,l}\Delta X_{2,t-l}+\varepsilon_t$$

转换函数 $F(z_{t-d},\gamma,c)$ 的分布可以刻画动态调整的非对称性，$c$ 是门限参数，$\gamma$ 是转换速率，要求 $\gamma>0$，$z_{t-d}$ 是转换变量，是导致 $\Delta Y_t$ 由一种变化转换为另一种变化的变量。转换函数有指数和对数两种，即 ESTECM（exponential STECM）和 LSTECM（logistic STECM）主要表达式如下：

LSTECM 中，$F(z_{t-d},\gamma,c)=[1+\exp\{-\gamma(z_{t-d}-c)\}]^{-1}$

ESTECM 中，$F(z_{t-d},\gamma,c)=1-\exp\{-\gamma(z_{t-d}-c)^2\}$

可以看出，无论 ESTECM 还是 LSTECM，均满足：$\gamma$ 越大，$F(z_{t-d},\gamma,c)$ 越大，$\Delta Y_t$ 变化的幅度越快。

在 LSTECM 中，当 $z_{t-d}<c$ 时，$e$ 的指数为正值，所以，$z_{t-d}$ 与 $c$ 差距越大，$e$ 的指数越大，$F(z_{t-d},\gamma,c)$ 越小，当 $z_{t-d}$ 与 $c$ 差距非常大以至于指数趋于 $+\infty$，$F(z_{t-d},\gamma,c)$ 趋于 0。反之，当 $z_{t-d}>c$ 时，$e$ 的指数为负值，所以，$z_{t-d}$ 与 $c$ 差距越大，$e$ 的指数越小，$F(z_{t-d},\gamma,c)$ 越大，当指数趋于 $-\infty$，$F(z_{t-d},\gamma,c)$ 趋于 1。而当 $z_{t-d}$ 趋近于 $c$ 时，$F(z_{t-d},\gamma,c)$ 越趋近于 0.5。所以，LSTECM 中，$F(z_{t-d},\gamma,c)$ 是取值在（0，1）之间的函数，且转换变量 $z_{t-d}$ 在门限参数 $c$ 附近取值时，$F(z_{t-d},\gamma,c)$ 为 0.5。

在 ESTECM 中，$e$ 的指数总是为负，$-\exp\{-\gamma(z_{t-d}-c)^2\}$ 总是为负。$z_{t-d}$ 与 $c$ 差距越大，$-\exp\{-\gamma(z_{t-d}-c)^2\}$ 越趋于 0，$F(z_{t-d},\gamma,c)$ 趋于 1。当转换变量 $z_{t-d}$ 在门限参数 $c$ 附近取值时，$F(z_{t-d},\gamma,c)$ 为 0。所以，ESTECM 中，$F(z_{t-d},\gamma,c)$ 是取值在[0，1)之间的函数。

从 LSTECM 和 ESTECM 的表达式我们可以看出，他们的主要区别在于 LSTECM 侧重对转换变量与门限参数偏差的非线性调整的反映，而 ESTECM 侧重于对转换变量与门限参数差距程度的非对称性的调整的反映，即 ESTECM 中，无论这样的差距是正还是负，都会因为平方的存在而灭失，只考虑两者差距程度问题，进而来探讨其动态调整过程。

显然，在原有的 LECM 基础上加入非线性因素后，序列的变化不再是线性的，对称的，恒定不变的。在 $c$ 的前后，数据的变化会显示出不同，这也是 STECM 的本质特征。

两机制的 STECM 是变量间短期非线性的动态调整过程的刻画方程，它将 STECM 的动态变化理解为以 $\rho_1$ 来衡量的第一机制的动态变化，与以 $\rho_2$ 来衡量的第二机制的动态变化的总和。$\rho_1$ 是 $\hat{z}_{t-1}$ 的系数；$\rho_2$ 是 $\hat{z}_{t-1}$ $F(z_{t-d},\gamma,c)$ 交乘项的系数。

## B. STECM 模型中非线性波动调整的检验和转换变量的选择

正如上文所述，STECM 模型是在 LECM 的基础上加入了转换函数 $F(z_{t-d},\gamma,c)$，且转

换函数 $F(z_{t-d},\gamma,c)$ 中的转换变量必然是原协整方程的残差或者滞后项（$z_t$ 、$z_{t-d}$ ）。

转换变量的加入使得变量间短期偏离均衡的状态向长期均衡状态靠拢的方式是非线性的、非对称性的、速率时变的。

Van Dijk and Franses（2000）将变量间非线性关系的检验落在了考察“加入了转换函数的 STECM 模型估计结果是否能够强烈地表现出变量间短期修正关系的非线性特征”上。他

LM 统计量结果中，能够最强烈地拒绝线性关系的 $z_{t-d}$ 视为最优的转换变量。

Van Dijk and Franses（2000）将变量间非线性关系的检验落在了考察“加入了转换函数的 STECM 模型估计结果是否能够强烈地表现出变量间短期修正关系的非线性特征”上。他们首先分别以 $z_{t-1}$ 、$z_{t-2}$ 、$z_{t-3}$ 、$z_{t-4}$ 为转换变量构建了四个转换函数 $F(z_{t-d},\gamma,c)$，以及四个不同的 STECM 模型。其次，他们运用拉格朗日乘数法（Lagrange Multiplier），将 $F(z_{t-d},\gamma,c)$ 在 $\gamma=0$ 处，以泰勒公式展开，根据 Teräsvirta（1994）理论，分别计算 LM1、LM2、LM3、LM4 统计量，考察 LM 值是否能够强烈地拒绝线性关系的原假设（即 $F(z_{t-d},\gamma,c)$ 前的系数为 0）。再次，在 LM 统计量结果中，能够最强烈地拒绝线性关系的 $z_{t-d}$ 视为最优的转换变量。

此外，在 STECM 转换函数的方程式形式的选择方面，Van Dijk et al.(2007)，Jawadi(2006)，以及 Jawadi&Koubbaa(2007)认为，LM1 和 LM3 能够检验 LSTECM 对非线性关系刻画的适用性，而 LM2 和 LM4 则用以检验 ESTECM 对非线性关系的适用性，哪类统计量的显著性更能够得到确认，则哪类转换函数更适用。在确定了转换变量、转换函数方程式后，利用格点搜索法求出 $F(z_{t-d},\gamma,c)$ 中的 $\gamma,c$ 是最后一步。确定 $\gamma,c$ 的准则是，$\gamma,c$

们首先分别以 $z_{t-1}$ 、$z_{t-2}$ 、$z_{t-3}$ 、$z_{t-4}$ 为转换变量构建了四个转换函数 $F(z_{t-d},\gamma,c)$，以及四个不同的 STECM 模型。其次，他们运用拉格朗日乘数法（Lagrange Multiplier），将 $F(z_{t-d},\gamma,c)$ 在 $\gamma=0$ 处，以泰勒公式展开，根据 Teräsvirta（1994）理论，分别计算 LM1、LM2、LM3、LM4 统计量，考察 LM 值是否能够强烈地拒绝线性关系的原假设（即 $F(z_{t-d},\gamma,c)$ 前的系数为 0）。再次，在使得 STECM 模型估计结果最优。我们效仿 Van Dijk and Franses（2000），按照以下三步骤对中国非寿险、寿险市场的保险周期波动调整的非线性进行实证研究：第一步，在原 LECM 中，引入 $F(z_{t-d},\gamma,c)$，分别以 $z_{t-1}$ 、$z_{t-2}$ 、$z_{t-3}$ 、$z_{t-4}$ 为转换变量，并分别将 $F(z_{t-d},\gamma,c)$ 在 $\gamma=0$ 处，以泰勒公式展开，求出四种情况下的 LM1、LM2、LM3、LM4。第二步，根据四种情况下的 LM1、LM2、LM3、LM4，选择最优的转换变量，转换方程的形式。第三步，对确定的 STECM 模型用格点搜索法求出 $\gamma,c$，求得最优的模型估计。

## C. 中国保险发展周期波动的非线性动态调整分析

我们将按照 STECM 模型的三步骤对中国保险发展周期波动的非线性动态调整进行实证研究。

**1）LM 统计量结果和最优转换变量、转换方程的选择**

我们在原 LECM 模型中，引入 $F(z_{t-d},\gamma,c)$，分别以 $z_{t-1}$ 、$z_{t-2}$ 、$z_{t-3}$ 、$z_{t-4}$ 为转换变量，并分别将 $F(z_{t-d},\gamma,c)$ 在 $\gamma=0$ 处，以泰勒公式展开，求出四种情况下的 LM1、LM2、LM3、LM4，中国非寿险、寿险市场波动保险周期波动调整的非线性检验结果分别见表 9、10。

表 9 中国非寿险市场波动保险周期波动调整的非线性检验

| d | d=1 | d=2 | d=3 | d=4 |
|---|---|---|---|---|
| LM1 | 6.27 | 4.67 | 10.88 | 13.14 |
| LM2 | 5.93 | 7.42 | 10.30 | 12.94 |
| LM3 | 6.33 | 7.11 | 11.92 | 13.49 |
| LM4 | 6.41 | 6.95 | 11.49 | 12.63 |

我们知道，LM 检验的阶数越大，样本的自由度损失越多。比照卡方分布表，以及表 9、10 的结果，我们认为 LM2 的值最能够显著地拒绝非寿险市场发展波动线性动态调整的原假设。此外，d=2 时的显著性大于其他。根据 Van Dijk et al.(2007)，Jawadi(2006)，以

及 Jawadi&Koubbaa(2007)，显然，用以刻画非寿险市场发展波动非线性动态调整的最优转换变量是 $z_{t-2}$，而转换方程应该选择 ESTECM。

表 10 中国寿险市场波动保险周期波动调整的非线性检验

| d | d=1 | d=2 | d=3 | d=4 |
|---|---|---|---|---|
| LM1 | 5.68 | 4.57 | 9.63 | 11.77 |
| LM2 | 5.59 | 4.37 | 10.36 | 11.12 |
| LM3 | 9.00 | 4.21 | 10.80 | 12.23 |
| LM4 | 8.53 | 5.60 | 10.08 | 11.53 |

然而，在寿险市场发展波动的非线性动态调整的研究中，LM3 的值最能够显著地拒绝其线性动态调整的原假设，d=2 时的显著性同样大于其他，那么用以刻画寿险市场发展波动非线性动态调整的最优转换变量是 $z_{t-2}$，而转换方程应该选择 LSTECM。

**2）中国保险发展非线性动态调整的 STECM 模型估计**

根据上文中，对中国非寿险、寿险市场发展的非线性动态调整的 STECM 模型的转换变量和转换函数的选择结果，中国保险发展非线性动态调整的 STECM 模型估计结果如下。

中国非寿险市场保险周期波动的非线性动态调整的 STECM 模型，最终形式确定为

$$\Delta\ln nonlife\_CF_t = \alpha_1 + \beta_1\Delta\ln pi\_CF_t + \beta_2\Delta\ln rate\_CF_t + \rho_1 z_{t-1} + \rho_2 z_{t-1}\times F(z_{t-2},\gamma,c) + \mu_t$$

并且，$F(z_{t-d},\gamma,c) = 1-\exp\{-\gamma(z_{t-2}-c)^2\}$，$z_{t-2}$ 是估计的原协整方程残差的滞后二期。经过格点搜索，当 $\gamma = 28, c = -0.02$ 时，$F(z_{t-2},\gamma,c)$ 能够较好地反映中国非寿险市场的保险周期波动与其影响因子间短期动态均衡向长期均衡靠拢的状态，STECM 模型估计结果最优。

中国非寿险市场保险周期波动调整的 STECM 模型，实证估计结果如下：

$$\Delta\ln nonlife\_CF_t = 0.02 + 0.85\Delta\ln pi\_CF_t - 0.14\Delta\ln rate\_CF_t - 0.31 z_{t-1} - 1.33 z_{t-1}\times F(z_{t-2}, 28, -0.02) + \mu_t$$

| | | | | |
|---|---|---|---|---|
| $t-statistic$ | 14.87 | 2.85 | 2.74 | 2.97 |
| $\Pr ob$ | 0.00 | 0.06 | 0.07 | 0.05 |

对比中国非寿险市场保险周期波动的 STECM 与 LECM 模型，我们发现两者代表长期均衡的解释变量的参数估计值差距不大，但代表短期非均衡状态向长期均衡状态非线性调整的变量系数却发生了很大的改变。在 STECM 模型中，以 $\rho_1 = -0.31$ 来衡量的第一机制的动态变化，以 $\rho_2 = -1.33$ 来衡量的第二机制的动态变化，两者的总和即为中国非寿险市场的保险周期波动的非线性动态调整过程，是其从短期非均衡状态向长期均衡状态调整的过程。

中国寿险市场保险周期波动的非线性动态调整的 STECM 模型，最终形式确定为

$$\Delta\ln life\_CF_t = \alpha_1 + \beta_1\Delta\ln pi\_CF_t + \beta_2\Delta\ln rate\_CF_t + \rho_1 z_{t-1} + \rho_2 z_{t-1}\times F(z_{t-2},\gamma,c) + \mu_t$$

并且，$F(z_{t-d},\gamma,c) = [1+\exp\{-\gamma(z_{t-d}-c)\}]^{-1}$，$z_{t-2}$ 是估计的原协整方程残差的滞后二期。经过格点搜索，当 $\gamma = 15, c = 0.03$ 时，$F(z_{t-2},\gamma,c)$ 能够较好地反映中国非寿险市场的保险周期波动与其影响因子间短期动态均衡向长期均衡靠拢的状态，STECM 模型估计结果最优。

中国寿险市场保险周期波动调整的 STECM 模型，实证估计结果如下：

$$\Delta\ln life\_CF_t = 0.04 + 0.93\Delta\ln pi\_CF_t - 0.71\Delta\ln rate\_CF_t + 0.17 z_{t-1} - 0.94 z_{t-1}\times F(z_{t-2}, 15, 0.03) + \mu_t$$

| | | | | |
|---|---|---|---|---|
| $t-statistic$ | 9.09 | 2.71 | 2.78 | 2.87 |
| $\Pr ob$ | 0.00 | 0.07 | 0.07 | 0.06 |

同样地，我们将描述中国寿险市场保险周期波动的 STECM 与 LECM 模型进行比较。从各解释变量系数来看，与中国寿险市场保险周期波动存在长期均衡关系的解释因子，在 STECM 模型和 LECM 模型中的估计值差距不大，但代表短期非均衡状态向长期均衡状态非线性调整的变量系数同样发生了很大的改变。

在寿险 STECM 模型中，$\rho_1 = 0.17$ 是来衡量的第一机制的动态变化，而 $\rho_2 = -0.94$ 是来衡量的第二机制的动态变化，两机制的调整方向是相反的，这与非寿险的 STECM 动态调整不同。两机制的总和代表了中国寿险市场的保险周期波动的非线性动态调整过程，是其从短期非均衡状态向长期均衡状态调整的过程。

通过上述研究，我们发现中国寿险、非寿险市场的保险周期波动的非线性调整状态的不同主要表现在三个方面：

一是两者适用的 STECM 模型的形式不同。根据 LM 检验，中国非寿险市场的保险周期波动从短期非均衡状态向长期均衡状态变化的非线性调整适用 ESTECM 模型，而中国寿险市场则适用 LSTECM。两模型的不同在于，LSTECM 反映出转换变量与门限参数偏差在非线性调整中的作用，而 ESTECM 反映了转换变量与门限参数差距程度对非对称性调整的作用。

二是中国非寿险、寿险市场的保险周期波动的非线性调整的速率不同。通过格点搜索法，我们发现中国非寿险市场的保险周期波动调整的速率是远大于寿险市场的。我们认为这一现象产生的原因，是非寿险市场的保险周期短，对于宏观经济变量带来的波动频繁，则对于短期偏离的收拢速度更快。

三是中国非寿险、寿险市场的两机制动态调整模型中的调整方向不同。在中国非寿险市场的两机制动态调整模型中，以 $\rho_1 = -0.31$ 来衡量的第一机制的动态变化，和以 $\rho_2 = -1.33$ 来衡量的第二机制的动态变化，具有相同的调整方向。而在中国非寿险市场的两机制动态调整模型中，以 $\rho_1 = 0.17$ 来衡量的第一机制的动态变化，与以 $\rho_2 = -0.94$ 来衡量的第二机制的动态变化，具有相反的调整方向。这也从另一个侧面，解释了为什么中国非寿险市场较寿险市场的保险周期波动的非线性调整速率更快。

## Ⅴ、结论

本文首先采用 CF 滤波法考察中国保险发展的周期波动，进而引进 STECM 模型，刻画中国保险发展周期波动与其影响因子波动之间非线性的、非连续性的、速率时变的动态调整过程。我们得出以下主要的研究结论：

（一）中国非寿险市场的保险周期平均长度约 5.4 年，波动幅度为 0.67，粘性为 0.53。而中国寿险市场的保险周期平均长度约 6.75 年，波动幅度为 0.81，粘性为 0.61。比较中国非寿险、寿险市场的保险周期特点，可以发现，中国寿险市场的保险周期较非寿险市场长，波动幅度、周期粘性也更大。我们认为非寿险、寿险市场的不同经营性质是造成这一现象的主要原因。非寿险市场，承保的是财产、责任等损失风险，合约期限多为一年，一年一保，因其承保的是物质财产损失风险，那么受到宏观经济影响（宏观经济投资等）反应更快；而寿险市场，承保的人身风险，经营周期长，一保多年，一人可多保，受到居民可支配收入影响更大，工资刚性将宏观经济影响因素弱化。因此，寿险市场保险周期较非寿险市场长。此外，寿险保费收入的波动受上一期波动影响较非寿险强烈，寿险市场的保险周期较非寿险波动更大。

（二）在对中国保险市场的保险周期波动因素研究中，我们发现 Lnnonlife_CF、Lnpi_CF、Lnrate_CF 组合，Lnlife_CF、Lnpi_CF、Lnrate_CF 组合存在协整关系。协整方程所代表的长期均衡关系表明，中国非寿险、寿险市场的保险周期波动与居民可支配收入波动情况一致，而与利率变动情况相反。LECM 模型代表的短期修正均衡关系表明，中国非寿险、寿险市场的保险周期波动的调整，均由两部分组成：一部分由短期波动决定（$\Delta \ln pi\_CF_t$、$\Delta \ln rate\_CF$），另一部分由长期均衡误差修正项决定（$ECM_{t-1}$）。短期波动以长期关系为指导，ΔLnnonlife_CF、ΔLnlife_CF 与ΔLnpi_CF 变动方向相同，与ΔLnrate_CF 变动方向相反；且 ΔLnlife_CF 受到两者的影响较 ΔLnnonlife_CF 更大。长期均衡误差修正项（$ECM_{t-1}$）的系数，是短期波动偏离长期均衡时，非均衡状态拉回到均衡状态的调整速度（或力度）。从计量结果看，中国非寿险市场的保险周期波动从非均衡状态向均衡状态调整的速度高于中国寿险市场。

（三）在对中国保险市场保险周期波动调整的非线性研究中，我们发现中国非寿险市场保险周期波动调整适用 ESTECM 模型，而中国寿险市场则适用 LSTECM。两模型的不同在于，LSTECM 反映出转换变量与门限参数偏差在非线性调整中的作用，而 ESTECM 反映了转换变量与门限参数差距程度对非对称性调整的作用。此外，中国非寿险、寿险市场的保险周期波动的非线性调整的速率不同。通过格点搜索法，我们发现中国非寿险市场的保险周期波动调整的速率是远大于寿险市场的。我们认为这一现象产生的原因，是非寿险市场的保险周期短，对于宏观经济变量带来的波动，其短期偏离的收拢速度更快。最后，中国非寿险、寿险市场的两机制动态调整模型中的调整方向不同。在中国非寿险市场的两机制动态调整模型中，以 $\rho_1 = -0.31$ 来衡量的第一机制的动态变化，和以 $\rho_2 = -1.33$ 来衡量的第二机制的动态变化，具有相同的调整方向。而在中国非寿险市场的两机制动态调整模型中，以 $\rho_1 = 0.17$ 来衡量的第一机制的动态变化，与以 $\rho_2 = -0.94$ 来衡量的第二机制的动态变化，具有相反的调整方向。这也从另一个侧面，解释了为什么中国非寿险市场较寿险市场的保险周期波动的非线性调整速率更快。

## 参考文献：

[1] Anderson, H. M. Transaction Costs and Nonlinear Adjustment Towards Equilibrium in the US Treasury Bill Market [J]. Oxford Bulletin of Economics and Statistics, 1997, 59 (4): 465-484.

[2] Balke, N. S., and T. B. Fomby, Threshold Cointegration [J]. International Economic Review, 1997(38): 627-646.

[3] Christiano, L. J, and T. J. Fitzgerald. The Band Pass Filter [J]. International Economic Review, 2003(44): 435-465.

[4] Dick van Dijk, Timo Teräsvirta. Smooth Transition Autoregressive Models: A Survey of Recent Developments [R]. Econometric Institute Research Report. 2000.

[5] Engle, R. F., and C. W. J. Granger, Cointegration and Error Correction: Representation, Estimation and Testing, Econometrica, 1987(2): 251-276.

[6] Fredj Jawadi, Catherine Bruneau. Nadia Sghaier. Nonlinear Cointegration Relationships Between Non-life Insurance Premiums and Financial Markets [J]. Journal of Risk and Insurance. 2009(76): 753-783.

[7] Outreville J. F. The Economic Significance of Insurance Markets in Developing Countries [J]. Journal of Risk and Insurance, 1990b, 57(3): 487-498.

[8] Outreville J. F. Life Insurance Markets in Developing Countries [J]. Journal of Risk and Insurance, 1996, 63(2): 263-278.

[9] Ralph A. Winter. The Dynamics of Competitive Insurance Markets [J]. Journal of Financial Intermediation, 1994(4): 379-415.

[10] Taylor, M. P., and L. Sarno, 2001, Real Exchange Rate Dynamics in Transition Economies: A Nonlinear Analysis, in: Studies in Nonlinear Dynamics and Econometrics,(Berkeley, CA: Berkeley Electronic Press), 153-177.

[11] 蔡秋杰．保险供求互动关系的一般特征及其原因分析[J]．江西财经大学学报，2005，(3)：33-37.

[12] 陈昆亭，周炎，龚六堂．中国经济周期波动特征分析：滤波方法的应用[J]．世界经济，2004，(10)．

[13] 陈磊，张屹山．我国转轨时期经济周期波动的谱分析[J]．数量经济技术经济研究，2001，(1)：18-21.

[14] 李谦．论财产保险利润周期[J]．上海保险，1996，(5)：10-13.

[15] 孙祁祥，郑伟，肖志光．经济周期与保险周期[J]．数量经济技术经济研究, 2011 (3)：3-20.

[16] 谈儒勇．中国金融发展和经济增长关系的实证研究[J]．经济研究，1999 (10)：53-61.

# 中国保险发展的周期波动及非线性动态调整

许莉[1，2]，殷婧[1]

1.厦门大学经济学院金融系，中国厦门　361005
2.福建省统计科学重点实验室

**摘要**：本文首先采用CF滤波法考察中国保险发展的周期波动，研究结果表明，中国保险周期顺宏观经济周期，但是寿险市场的保险周期较非寿险市场长，波动幅度、周期粘性也更大；进而本文引入STECM模型，刻画中国保险发展周期波动与其影响因子波动之间非线性的、非连续性的、速率时变的动态调整过程。我们发现中国非寿险和寿险市场周期波动的非线性调整不仅速率不同，两市场的两机制动态调整的调整方向也不同。

**关键词**：保险发展；周期波动；非线性动态调整

表 2 各候选变量模型解释能力结果

| 解释变量 / 被解释变量 | C | Lngdp_CF Prob. | Lnrate_CF Prob. | Lnstock_CF Prob. | Lndl_CF Prob. | Lninvest_CF Prob. | Lnpi_CF Prob. | Adjusted R-squared | F-statistic Prob(F-statistic) | D.W.值 |
|---|---|---|---|---|---|---|---|---|---|---|
| Lnlife_CF | 0.00 | 0.78（0.00） | -1.30（0.00） | - | - | - | - | 0.9555 | 183.41 | 1.29 |
| | 0.00 | 0.81（0.00） | -1.25（0.00） | -0.08（0.74） | - | - | - | 0.9526 | 115.06 | 1.32 |
| | 0.00 | 0.89（0.00） | -1.42（0.01） | - | -0.14（0.85） | - | - | 0.9534 | 116.98 | 1.33 |
| | 0.00 | -0.61（0.25） | -0.49（0.27） | - | - | 1.38（0.02） | - | 0.9689 | 177.61 | 1.70 |
| | 0.00 | -6.41（0.00） | -0.41（0.23） | - | - | - | 9.33（0.00） | 0.9782 | 256.35 | 2.72 |
| | 0.00 | - | -1.22（0.00） | - | - | - | 1.01（0.00） | 0.9604 | 207.43 | 1.35 |
| Lnnonlife_CF | -0.01 | 1.36（0.00） | - | - | - | - | - | 0.9649 | 234.51 | 1.54 |
| | -0.00 | 0.69（0.00） | -0.69（0.02） | - | - | - | - | 0.9752 | 334.78 | 2.37 |
| | -0.01 | 0.65（0.00） | - | -0.10（0.59） | - | - | - | 0.9636 | 225.83 | 1.60 |
| | -0.01 | 0.49（0.00） | - | - | 0.15（0.43） | - | - | 0.9657 | 240.32 | 1.70 |
| | -0.00 | -0.20（0.49） | - | - | - | 0.86（0.01） | - | 0.9765 | 354.02 | 2.27 |
| | -0.00 | -4.46（0.00） | - | - | - | - | 6.67（0.00） | 0.9866 | 626.47 | 2.01 |
| | 0.00 | - | -0.62（0.02） | - | - | - | 0.90（0.00） | 0.9782 | 382.86 | 2.39 |
| | -0.01 | - | - | - | - | - | 0.78（0.00） | 0.9711 | 571.27 | 1.58 |

# Research on China Property Insurance Companies’ Competitiveness

XU Minmin, LI Bomeng
School of Economics, Beijing Technology and Business University, Beijing, China, 100048

**Abstract:** In this article, we analyze the elements that effect China property insurers’ competitiveness. . Based on it, we do an empirical research on it and get the ranking of 2011 China property insurers’ competiveness. Finally, we come up with several suggestions on property insurers’ development.
**Keywords:** *competitiveness*; insurance company; property

## Ⅰ.引言

对于保险公司竞争力，不同的学者和研究团队对此有不同的界定。姚壬元（2004）认为保险公司的竞争力是一个包括资源、能力、环境三要素里在内的综合系统，每个要素又分解为不同的能力和指标体系，通过对指标要素赋予权重，实现对保险公司竞争力的评价。王成辉、江生忠（2006）认为保险竞争力是一个保险行为主体与其他保险行为主体竞争资源的能力，它不仅包括某一保险产品竞争力，也包括某一保险公司竞争力，还保险行业竞争力好保险业的国际竞争力。寇业富（2011）认为保险公司竞争力是保险公司根据行业和自身特点，在市场经济环境中，综合运用其人力、物力和财力等资源，获得相对于竞争对手所表现出的更强的生存能力、创新能力和持续发展能力的综合，是公司综合能力的体现。21 世纪研究中心联合美国加州大学构成的课题组（2009）认为，保险公司竞争力是指在同一环境下，同业竞争者实现其经营目标的综合实力。本文认为竞争力是在一定的客观环境下，保险公司竞争力是保险公司自身持续发展、创造价值、实现资本保值增值、保证资金安全、保障各利益相关者利益的综合实力。本文对保险公司竞争力的评价以 21 世纪研究中心联合美国加州大学的课题组的指标及方法为基础，在此基础上进行改进。

## Ⅱ.研究对象及研究方法

### A.研究对象

以保费收入为标准，选取前 25 家财产保险公司为研究对象；在前 25 家中，如因数据缺失等原因，会顺序递延。在选取保险公司时，以保费收入在 100 亿元以上的为大型保险公司，保费收入在 20-100 亿元中间的为中型保险公司，保费收入在 20 亿元以下的为小型保险公司。按照这个界定标准，在研究对象中有 5 家大型保险公司，12 家中型保险公司和 8 家小型保险公司。

### B.指标体系的设定

1）一级指标的设定

本研究在保险公司竞争力的衡量共设一级指标六个，二级指标 19 个。其中一级指标包括市场规模、资产管理能力、准备金充足性、盈利能力、流动性和经营稳定性六个方面。各一级指标之间的权重如表 1 所示。

表 1 保险公司竞争力衡量的一级指标体系

| 一级指标 | 市场规模 | 资产管理能力 | 准备金充足性 | 盈利能力 | 流动性 | 经营稳定性 |
|---|---|---|---|---|---|---|
| 所占百分比 | 17.5% | 17.5% | 10% | 25% | 15% | 15% |

**2）二级指标的设定**

市场规模：

表 2 市场规模的二级指标

| | 市场规模 | |
|---|---|---|
| 二级指标 | 原保费收入 | 总资产 |
| 所占百分比 | 8.75% | 8.75% |
| 衡量标准 | 越高越好 | 越高越好 |

资产管理能力：

表 3 资产管理能力的二级指标

| | 资产管理能力 | | |
|---|---|---|---|
| 二级指标 | 净保费/所有者权益 | 净负债/所有者权益 | 分出保费/总保费收入比例 |
| 所占百分比 | 7.875% | 7.875% | 1.75% |

| | | | |
|---|---|---|---|
| 衡量标准 | 越接近行业平均水平越好 | 越接近行业平均水平越好 | 在行业平均水平的 10%范围内波动 |

准备金充足性：

表 4 准备金充足性的二级指标

| | 准备金充足性 | |
|---|---|---|
| 二级指标 | 赔款责任准备金/所有者权益 | 未到期责任准备金/所有者权益 |
| 所占百分比 | 5.00% | 5.00% |
| 衡量标准 | 越低越好 | 越低越好 |

盈利能力：

表 5 盈利能力的二级指标

| | 盈利能力 | | | | | |
|---|---|---|---|---|---|---|
| 二级指标 | 赔付比率 | 费用比率 | 税前收益率 | 投资资产收益率 | 净资产收益率 | 总资产收益率 |
| 所占百分比 | 2.50% | 2.50% | 10.00% | 2.50% | 5.00% | 2.50% |
| 衡量标准 | 越低越好 | 越低越好 | 越高越好 | 越高越好 | 越高越好 | 越高越好 |

流动性：

表 6 流动性的二级指标

| | 流动性 | |
|---|---|---|
| 二级指标 | 流动比率 | 总流动性 |
| 所占百分比 | 7.50% | 7.50% |
| 衡量标准 | 在行业平均水平的50%范围内波动 | 在行业平均水平的10%范围内波动 |

经营稳定性：

表 7 经营稳定性的二级指标

| | 经营稳定性 | | | |
|---|---|---|---|---|
| 二级指标 | 年净保费收入变化百分比 | 年所有者权益变化百分比 | 2011 年偿付能力充足率 | 偿付能力充足率变化百分比 |
| 所占百分比 | 3.75% | 3.75% | 3.75% | 3.75% |

| | | | | |
|---|---|---|---|---|
| 衡量标准 | 在行业平均水平的5%范围内波动 | 在行业平均水平的20%范围内波动 | 在行业平均水平的20%范围内波动 | 在行业平均水平的20%范围内波动 |

**3）计算方法**

首先，对于每一个指标均计算出平均值和标准差。其次将每个保险公司的数额减去行业平均值，并将二者之差除以标准差。具体的公式是 $z=\frac{x-\mu}{\sigma}$，$\mu$是行业平均值，$\sigma$是标准差。然后根据衡量标准分为以下四种：

若衡量标准为越高越好，则直接使用标准化后的得分（z）；

若衡量标准为越低越好，则将得分（z）乘上-1；

若衡量标准为越接近行业平均值越好，当得分（z）大于 0 时，就将（z）乘上-1。反之，就直接使用标准化后的得分（z）；

若衡量标准为在行业平均水平的一定范围内波动，如某比率在平均数上下 20%较为理想，则需采取以下步骤：计算 Q=20/σ；如果得分（z）大于 Q，就将（z）乘上-1；否则，就直接使用标准化后的得分（z）。

# Ⅲ. 对 2011 中国财产保险公司竞争力的实证研究

## A.2011 中国财产保险公司竞争力实证分析结果

按上述方法对各个财产保险公司的数据进行处理后，得到各个财产保险公司 2011 年各项竞争力指标的分数。

表 8 2011 年中国财产保险公司竞争力得分

| | 市场规模 | 资产管理能力 | 准备金充足性 | 盈利能力 | 流动性 | 经营稳定性 |
|---|---|---|---|---|---|---|
| | 0.175 | 0.175 | 0.100 | 0.250 | 0.150 | 0.150 |
| 人保股份 | 0.226 | -0.057 | -0.078 | -0.296 | -0.790 | -0.079 |
| 平安财 | 0.088 | -0.024 | -0.026 | -0.135 | -0.758 | -0.023 |
| 太保财 | 0.061 | 0.025 | 0.011 | -0.196 | -0.728 | 0.001 |
| 国寿财产 | -0.001 | -0.048 | 0.018 | 3.598 | -0.712 | 0.015 |
| 阳光财产 | -0.005 | -0.054 | -0.015 | -0.067 | -0.767 | -0.064 |
| 天安 | -0.013 | -0.082 | -0.281 | -1.224 | -0.814 | -0.236 |
| 安邦 | -0.016 | -0.155 | 0.092 | 6.576 | -16.628 | -12.421 |
| 永安 | -0.014 | -0.048 | -0.013 | -0.395 | -0.756 | -0.127 |
| 太平保险 | -0.015 | -0.078 | -0.099 | -0.382 | -0.799 | -0.100 |
| 永诚 | -0.016 | 0.124 | -0.009 | -0.676 | -0.735 | -0.121 |
| 华安 | -0.015 | -0.106 | 0.055 | -0.479 | -0.678 | 0.273 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 华泰 | -0.015 | -0.040 | -0.009 | -0.317 | -0.783 | -0.264 |
| 天平车险 | -0.018 | -0.038 | 0.013 | -0.554 | -0.768 | -0.049 |
| 英大财产 | -0.019 | -0.018 | 0.055 | 0.229 | -0.603 | 0.085 |
| 中银保险 | -0.019 | -0.019 | 0.038 | 0.111 | -0.721 | -0.012 |
| 安华农业 | -0.020 | 0.002 | 0.058 | -0.929 | -0.672 | 0.205 |
| 民安 | -0.021 | -0.011 | -0.119 | -1.590 | -0.805 | -0.099 |
| 浙商财产 | -0.021 | -0.082 | -0.015 | -0.543 | -0.760 | 0.084 |
| 大众 | -0.021 | 0.010 | 0.022 | -0.472 | -0.700 | -0.011 |
| 安诚 | -0.020 | -0.129 | 0.071 | -0.110 | -0.346 | 0.194 |
| 阳光农业相互保险 | -0.021 | -0.084 | 0.056 | -0.333 | -0.618 | -0.029 |
| 紫金财产 | -0.021 | -0.090 | 0.072 | 0.124 | -0.463 | -0.085 |
| 国元农业 | -0.021 | -0.085 | 0.061 | -0.668 | -0.519 | -0.113 |
| 渤海 | -0.021 | -0.052 | -0.022 | -0.977 | -0.755 | 0.877 |
| 鼎和财险 | -0.021 | 0.001 | 0.064 | -0.296 | -0.578 | 0.023 |

## B. 对竞争力及各指标的分析

**1）财产保险公司竞争力的排名**

2011年中国财产保险公司竞争力排名如表9所示，在竞争力排前十的财产保险公司中，第一家、第七家和第八家是大型保险公司；第二家、第五家和第九家为中型保险公司；第三家、第四家、第六家和第十家为小型保险公司。这表明在竞争力上，大型保险公司仍占据着一定的优势，而经营管理效率较高的中型和小型保险公司，在竞争力上不逊色于大保险公司。

表9 2011中国财产保险公司竞争力排名

| 排名 | 保险公司 | 竞争力总分 |
|---|---|---|
| 1 | 国寿财产 | 2.868946 |
| 2 | 英大财产 | -0.27096 |
| 3 | 安诚 | -0.34003 |
| 4 | 紫金财产 | -0.46309 |
| 5 | 中银保险 | -0.62152 |
| 6 | 鼎和财险 | -0.80698 |
| 7 | 太保财 | -0.8259 |
| 8 | 平安财 | -0.87902 |
| 9 | 华安 | -0.9509 |
| 10 | 渤海 | -0.95094 |
| 11 | 阳光财产 | -0.97179 |
| 12 | 阳光农业相互保险 | -1.02981 |
| 13 | 人保股份 | -1.07271 |
| 14 | 大众 | -1.17143 |
| 15 | 浙商财产 | -1.33628 |
| 16 | 国元农业 | -1.34453 |
| 17 | 永安 | -1.3538 |
| 18 | 安华农业 | -1.35598 |
| 19 | 天平车险 | -1.41328 |
| 20 | 华泰 | -1.42789 |
| 21 | 永诚 | -1.43351 |
| 22 | 太平保险 | -1.47299 |
| 23 | 民安 | -2.64403 |
| 24 | 天安 | -2.65103 |
| 25 | 安邦 | -22.5513 |

**2）市场规模排名**

在市场规模上，由于考核的主要是保费收入和资产的规模，市场规模的排名与保费收入的排名基本大同小异，大型保险公司占据较为明显的优势，在前十中占了50%。

表10 2011中国财产保险公司市场规模排名

| 排名 | 保险公司 | 市场规模 |
|---|---|---|
| 1 | 人保股份 | 0.226419 |
| 2 | 平安财 | 0.087607 |
| 3 | 太保财 | 0.060946 |
| 4 | 国寿财产 | -0.00119 |
| 5 | 阳光财产 | -0.00489 |
| 6 | 天安 | -0.01314 |
| 7 | 永安 | -0.01416 |
| 8 | 华安 | -0.01469 |
| 9 | 华泰 | -0.01484 |
| 10 | 太平保险 | -0.01534 |
| 11 | 安邦 | -0.01596 |
| 12 | 永诚 | -0.01636 |
| 13 | 天平车险 | -0.01792 |
| 14 | 中银保险 | -0.01853 |
| 15 | 英大财产 | -0.01907 |
| 16 | 安华农业 | -0.02024 |
| 17 | 安诚 | -0.02041 |
| 18 | 紫金财产 | -0.02054 |
| 19 | 浙商财产 | -0.02085 |
| 20 | 民安 | -0.02087 |
| 21 | 大众 | -0.021 |
| 22 | 鼎和财险 | -0.02107 |
| 23 | 阳光农业相互保险 | -0.02123 |
| 24 | 渤海 | -0.02128 |
| 25 | 国元农业 | -0.02141 |

**3）.资产管理能力**

在资产管理能力上，前十名中大中小保险公司所占的比重分别为2家、5家和3家，说明大型的财产保险公司在资产管理水平上并未显示与其保费收入和资产规模相匹配的能力，反而是中型保险公司显示出了较强的资产管理能力。

表 11 2011 中国财产保险公司资产管理能力排名

| 排名 | 保险公司 | 资产管理能力 |
|---|---|---|
| 1 | 永诚 | 0.124018 |
| 2 | 太保财 | 0.025233 |
| 3 | 大众 | 0.010441 |
| 4 | 安华农业 | 0.001911 |
| 5 | 鼎和财险 | 0.000989 |
| 6 | 民安 | -0.01115 |
| 7 | 英大财产 | -0.01766 |
| 8 | 中银保险 | -0.0191 |
| 9 | 平安财 | -0.02447 |
| 10 | 天平车险 | -0.03825 |
| 11 | 华泰 | -0.0402 |
| 12 | 国寿财产 | -0.04803 |
| 13 | 永安 | -0.04838 |
| 14 | 渤海 | -0.05233 |
| 15 | 阳光财产 | -0.0544 |
| 16 | 人保股份 | -0.05653 |
| 17 | 太平保险 | -0.07755 |
| 18 | 浙商财产 | -0.08209 |
| 19 | 天安 | -0.08246 |
| 20 | 阳光农业相互保险 | -0.08416 |
| 21 | 国元农业 | -0.08468 |
| 22 | 紫金财产 | -0.09041 |
| 23 | 华安 | -0.10577 |
| 24 | 安诚 | -0.12899 |
| 25 | 安邦 | -0.15482 |

4）准备金充足性

在准备金充足性测试上，排名前十的保险公司有四家中型保险公司和六家小型保险公司，这说明中小型保险公司准备金的充足性均优于大型保险公司。

表 12 2011 中国财产保险公司准备金充足性排名

| 排名 | 保险公司 | 准备金充足性 |
|---|---|---|
| 1 | 安邦 | 0.092152 |
| 2 | 紫金财产 | 0.071501 |
| 3 | 安诚 | 0.07077 |
| 4 | 鼎和财险 | 0.06361 |
| 5 | 国元农业 | 0.061105 |
| 6 | 安华农业 | 0.057764 |
| 7 | 阳光农业相互保险 | 0.056253 |
| 8 | 英大财产 | 0.055017 |
| 9 | 华安 | 0.054512 |
| 10 | 中银保险 | 0.037962 |
| 11 | 大众 | 0.022208 |
| 12 | 国寿财产 | 0.017638 |
| 13 | 天平车险 | 0.013488 |
| 14 | 太保财 | 0.011273 |
| 15 | 华泰 | -0.00892 |
| 16 | 永诚 | -0.00921 |
| 17 | 永安 | -0.0128 |
| 18 | 浙商财产 | -0.01454 |
| 19 | 阳光财产 | -0.01515 |
| 20 | 渤海 | -0.02185 |
| 21 | 平安财 | -0.02623 |
| 22 | 人保股份 | -0.07781 |
| 23 | 太平保险 | -0.09875 |
| 24 | 民安 | -0.11878 |
| 25 | 天安 | -0.28121 |

5）盈利能力

在盈利能力上，在前 10 家保险公司中，大中小保险公司分别为 4 家、3 家和 3 家，这说明虽然大型保险规模较大，但在经营管理水平上相对于中小保险公司平均水平要高。

表 13 2011 中国财产保险公司盈利能力排名

| 排名 | 保险公司 | 盈利能力 |
|---|---|---|
| 1 | 安邦 | 6.576226 |
| 2 | 国寿财产 | 3.597522 |
| 3 | 英大财产 | 0.228803 |
| 4 | 紫金财产 | 0.124094 |
| 5 | 中银保险 | 0.110846 |
| 6 | 阳光财产 | -0.06711 |
| 7 | 安诚 | -0.10956 |
| 8 | 平安财 | -0.13484 |
| 9 | 太保财 | -0.19631 |
| 10 | 鼎和财险 | -0.29597 |
| 11 | 人保股份 | -0.29597 |
| 12 | 华泰 | -0.31691 |
| 13 | 阳光农业相互保险 | -0.33332 |
| 14 | 太平保险 | -0.38185 |
| 15 | 永安 | -0.39491 |
| 16 | 大众 | -0.47207 |
| 17 | 华安 | -0.47948 |
| 18 | 浙商财产 | -0.54307 |
| 19 | 天平车险 | -0.55356 |
| 20 | 国元农业 | -0.66767 |
| 21 | 永诚 | -0.67558 |
| 22 | 安华农业 | -0.92867 |
| 23 | 渤海 | -0.97689 |
| 24 | 天安 | -1.22395 |
| 25 | 民安 | -1.58981 |

6）流动性

在流动性上，在前 10 家保险公司中，大中小

保险公司分别为 1 家、3 家和 6 家，小型保险公司的流动性较强，大型保险公司的流动性相对较弱。

表 14 2011 中国财产保险公司流动性排名

| 排名 | 保险公司 | 流动性 |
|---|---|---|
| 1 | 安诚 | -0.34627 |
| 2 | 紫金财产 | -0.46278 |
| 3 | 国元农业 | -0.51861 |
| 4 | 鼎和财险 | -0.57803 |
| 5 | 英大财产 | -0.60288 |
| 6 | 阳光农业相互保险 | -0.61846 |
| 7 | 安华农业 | -0.67191 |
| 8 | 华安 | -0.67849 |
| 9 | 大众 | -0.69966 |
| 10 | 国寿财产 | -0.71235 |
| 11 | 中银保险 | -0.72051 |
| 12 | 太保财 | -0.72824 |
| 13 | 永诚 | -0.73502 |
| 14 | 渤海 | -0.75513 |
| 15 | 永安 | -0.75634 |
| 16 | 平安财 | -0.7576 |
| 17 | 浙商财产 | -0.7602 |
| 18 | 阳光财产 | -0.76667 |
| 19 | 天平车险 | -0.76814 |
| 20 | 华泰 | -0.78292 |
| 21 | 人保股份 | -0.79016 |
| 22 | 太平保险 | -0.79905 |
| 23 | 民安 | -0.8047 |
| 24 | 天安 | -0.81429 |
| 25 | 安邦 | -16.6284 |

**7）经营稳定性**

在经营稳定上，在前 10 家保险公司中，大中小保险公司分别为 2 家、3 家和 5 家，在经营稳定性上，大中小保险公未有显著差异。

表 152011 中国财产保险公司经营稳定性排名

| 排名 | 保险公司 | 经营稳定性 |
|---|---|---|
| 1 | 渤海 | 0.876546 |
| 2 | 华安 | 0.273016 |
| 3 | 安华农业 | 0.205166 |
| 4 | 安诚 | 0.194438 |
| 5 | 英大财产 | 0.084821 |
| 6 | 浙商财产 | 0.084462 |
| 7 | 鼎和财险 | 0.02348 |
| 8 | 国寿财产 | 0.015345 |
| 9 | 太保财 | 0.001195 |
| 10 | 大众 | -0.01136 |
| 11 | 中银保险 | -0.01219 |
| 12 | 平安财 | -0.02349 |
| 13 | 阳光农业相互保险 | -0.02889 |
| 14 | 天平车险 | -0.0489 |
| 15 | 阳光财产 | -0.06356 |
| 16 | 人保股份 | -0.07866 |
| 17 | 紫金财产 | -0.08496 |
| 18 | 民安 | -0.09872 |
| 19 | 太平保险 | -0.10045 |
| 20 | 国元农业 | -0.11326 |
| 21 | 永诚 | -0.12136 |
| 22 | 永安 | -0.12721 |
| 23 | 天安 | -0.23597 |
| 24 | 华泰 | -0.26411 |
| 25 | 安邦 | -12.4206 |

# IV.结论及未来研究方向

## A. 结论

**1）大型保险公司在竞争力上仍有一定的优势**

在竞争力的总得分中，五个大型保险公司有三家进入前十。同时，在六个方面的一级指标中，大型保险公司在市场规模和盈利能力上具有较为明显的优势，但在准备金充足性上，与中小保险公司有较大的差距。因此，大型保险公司在竞争力上由于市场规模和盈利能力等因素在竞争力上仍有一定的优势；在资产管理能力和稳定性上与其他保险公司基本一致。因此大型保险公司需要提升其资产管理水平以保持其竞争力。

**2）中小型保险公司需提高其盈利能力**

中小型保险公司在盈利能力上明显劣于大型保险公司，但在准备金充足性上优于大型保险公司，因此需要提升其盈利能力。经营较好的中小保险公司竞争力甚至由于大型保险公司。

## B. 未来研究方向

由于受时间的限制，本研究只对前 25 家财产保险公司进行了研究，基本上都为中资保险公司，因此无法对中外保险公司的差异进行分析。此外在各指标设置上，可能某些因素未被考虑进来会对研究结果产生影响。

# References

[1]Yao Renyuan, Construction on Insurance Corpany Competitiveness' evaluation : Journal of Shijiazhuang Economic School ,2004.4

姚壬元，保险公司竞争力评价指标体系的构建：石家庄经济学院学报，2004 年第 4 期。

[2]Wang Chenhui and Jiang Shengzhong, Diagonsis and Application on China Insurance Industry Evaluation System Nankai Economic Research ,2006.5.

王成辉、江生忠，我国保险业竞争力诊断指标体系及其应用，南开经济研究，2006 年第 5 期。
[3]21Century Finance Research Centre, Research on 2009 Asia Insurance Competitvemess Ranking http://www.china-insurance.com/news-center/newslist.asp?id=145525.
21 世纪研究院金融研究中心联合美国加州大学课题组，2009 亚洲保险公司竞争力排名研究报告，http://www.china-insurance.com/news-center/newslist.asp?id=145525
[4]Kou Yefu, Research on 2011 China Insurance Industry Competitiveness China Cultural and History Press ,2011.
寇业富，2011 中国保险公司竞争力评价研究报告，中国文史出版社，2011 年。

# 中国财产保险公司竞争力研究

许敏敏，栗博萌
经济学院，北京工商大学，北京，中国，100048

**摘　要**：本文分析了影响财产保险公司竞争力的因素，并在此基础上，对 2011 年中国财产保险公司的竞争力进行了实证分析，并在此基础上对我国财产保险公司的未来发展提出了相应的建议和未来研究方向。
**关键词**：竞争力；保险公司；财产

# Insurance Business and the Demand for Money: Empirical Evidence from China

XU Xu

Central University of Finance and Economics, Beijing, China, 100081

**Abstract:** According to the Keynesian theory of monetary demand, combining with the reality of China, we consider that the insurance market will affect the monetary demand through several direct effects and indirect effects, and analyze the transmission mechanism to monetary demand by each of these factors. Based on the quarterly data from 2000 to 2011, this paper will analyze the quantity of monetary demand by the influence of insurance industry with VAR models, and comes to the conclusion that the growth of premium income has a positive impact on monetary demand. We proposed that Central bank must increase money supply and pay a proper attention to insurance market in monetary policy-making, and they need to take insurance factors, including structure of insurance product and the scale of insurance business, into those monetary demand indicators, to decrease the influence caused by insurance cycle and enhance the efficiency of the monetary policy.

**Keywords:** Insurance, monetary demand, structure of insurance product, VAR.

## 一、引言

（一）问题的提出

中国保险业自 1980 年逐步恢复以来，至今已高速发展逾三十年。截至 2011 年 12 月底，全年保费收入已达到 1.43 万亿元，保险业总资产达到 5.9 万亿元，保险深度和保险密度也有所增长，分别达到 3.03%和 1061.34 元。但是，我国保险保障水平与发达保险市场相比差距仍然较大。保险作为一种金融工具，与普通的商品交易一样，其交易也需要货币作为媒介，每个业务环节都离不开货币的支持。在保险产品的交易之初，投保人需要交付保险费购买保险产品和服务；当发生合同约定的保险事故时，保险人向被保险人赔偿或给付以货币形式体现的保险金；由保费汇聚而成的保险基金也都是由货币的形式表现出来的。同时，在诸如保单质押贷款、保单贴现等创新业务中，货币都将发挥不可或缺的作用。

随着保险市场规模的不断扩大，保险在国民经济中发挥着日益重要的作用，它将在一定程度上影响企业和居民的资产数量和结构，社会的储蓄行为和消费行为也会有所改变，保险资金在运用过程中也将越来越多地对货币需求产生影响。这种变化使得传统的货币需求函数已经不足以解释当前的货币需求总量，在这样的大背景下，研究货币需求时，有必要将保险对货币市场的影响纳入模型中。

通过对比保险收入与 M2 的增速图（如图 1）不难发现，2000-2010 的十年间，两者的规模增速存在一定的联系，保费收入增速领先于 M2 增速 1 年。为了更直观的观察两者关系，我们将“保费收入增速”的曲线滞后一年（如图 2），两者基本呈同向波动：2008 年，保费收入大幅增长 39.1%，次年，M2 也大幅增长，增幅达 28.4%。

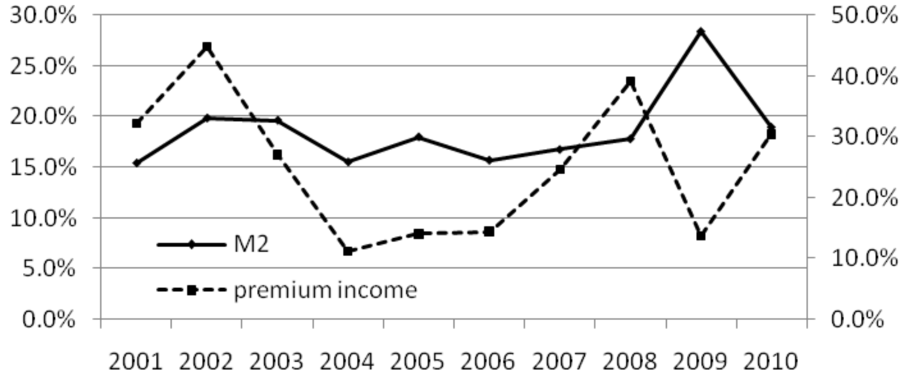



**图 1 保费收入增长率与 M2 增长率的关系图**

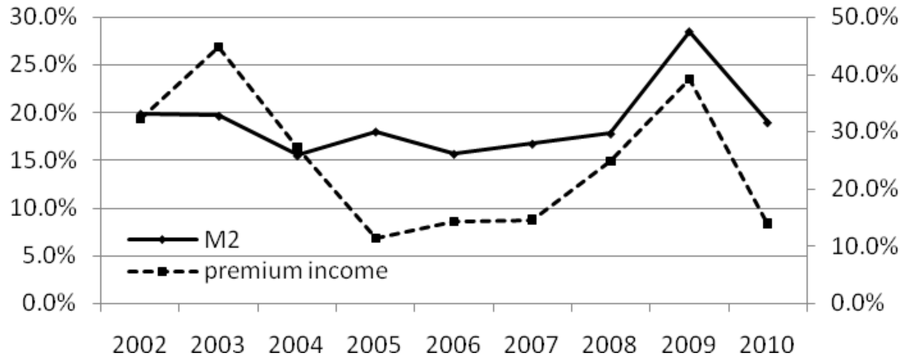



**图 2 M2 增长率与滞后 1 年的保费收入增长率关系图**

保险业务具有明显的货币需求效应，在以货币供应量作为货币政策中介目标的背景下，中央银行在制定货币政策时若不考虑保险对货币需求产生的影响，可能降低货币政策传导中介目标的有效性。因此，正确认识保险市场对货币需求的影响以及他们之间的变化规律，对于保险市场的健康发展有着重要意义；同时，对中央银行货币政策操作而言，分析和判断保险市场影响下的货币需求量，可以进一步增强货币政策的有效性。

（二）文献综述

保险市场发展对货币需求量影响的相关理论目前在国内外都很少见。但是，研究股市对货币需求影响和传导途径的文献相对较多。关于股票市场对货币需求的影响途径和机制，Friedman（1988）的经典研究认为，股票市场通过财富效应、资产组合效应和交易效应增加货币需求，而替代效应则会减少货币需求。研究股市对货币需求量影响的文献中，Friedman（1988）的理论也最为经典，他认为在 1886-1985 年，股票价格上涨对 M2 的财富效应小于替代效应；Palley（1995）的实证研究发现 1976-1991 年美国的股票市场交易额与货币需求呈显著正相关，并且认为引入股票市场变量可以提高货币需求函数的预测能力。

国内关于保险市场发展对货币市场影响的文献大多集中于保险资金运用对货币政策传导、货币政策工具及货币政策目标的作用和影响。刘彦、陶江（2006）认为保险资金

运用将延长货币政策内部时滞；并认为保险资金运用将导致货币流通速度不均匀变化。韦生琼（2002）认为恰当的货币政策有利于保险政策作用的发挥，促进保险市场发展。高杨（2010）认为保险资金的增加无论从长期还是短期都可以显著地引起货币供应量的正向增长，而货币供应量的增加引起保险资金的增长效果在短期内更为显著。

通过回顾文献，发现国内外研究保险市场对货币需求量影响的文献较少。因此，本文将基于金融市场的相似性，借鉴股市对货币量影响研究中的经典思路和方法，首先从理论上分析保险市场对货币需求的影响途径和机制，并基于 2000-2011 年的季度数据研究保险市场对货币需求量的影响。

## 二、保险市场对货币需求影响的理论分析

（一）基于货币需求理论的分析

凯恩斯货币需求理论认为，人们的货币需求行为取决于三种动机，即交易性动机（transaction motive）、预防性动机（precautionary motive）和投机性动机（speculative motive）。因而从货币需求理论的角度，当保险产品购买量或者保险市场规模发生变动时，也将从以上三种因素影响人们的货币需求行为：

1. 预防性动机

预防性动机是指为了应付可能遇到的意外支出而持有货币的动机。虽然近年来负利率的情况并未改善，但我国储蓄率仍居高不下，一项调查数据显示，2009 年，内地居民出于预防性动机进行储蓄的家庭比例为 48%，而居民储蓄存款用途的前三项分别是教育、养老、防范意外。风险客观存在于生活之中，且它的发生具有偶然性、不可避免性，因而人们常常持有货币以满足这种预防性货币需求。保险作为重要的风险对冲工具，是对可以用货币衡量或标定价值的物质财产、经济利益或人的寿命及身体提供风险保障的经济行为，是能够以确定金额的经济支出将个人不确定的风险转嫁出去的经济手段。居民储蓄中很大一部分用于预防意外支出的准备资金，可以通过购买保险的方式分散风险，同时，由于保险高风险保障杠杆的特性，居民支付少量保费即可达到风险预防和分散的效果，从而减少预防性储蓄和货币需求。

随着保险市场的不断发展，保险覆盖率的持续提高，民众风险保障程度也稳步提升。保险将在一定程度上有效消除民众的后顾之忧，减少市场对于预防性货币的需求。

2. 交易性动机

交易性动机主要是通过货币的交易媒介功能体现出来的，随着保险市场的不断扩大，交易性动机所形成的货币需求也会逐渐增加。一方面，在保险交易中，不论是合同初始阶段所缴纳的保费，还是发生保险事故后的赔付款，都是以货币作为交易媒介进行的。即便是在保单质押贷款、保单贴现等创新业务中，也离不开货币作为媒介的支持。另一方面，保险作为有效的风险对冲工具，能够提高民众的风险保障程度，提高消费信心，提升居民消费水平，扩大内需，增加货币需求。

3. 投机性动机

投机性动机是指为了储存价值或财富而持有货币的动机。寿险产品具有储蓄功能，尤其是近年来，随着分红险、万能险等理财型险种规模的扩大，产品的投资和储蓄功能进一步强化，越来越多的民众将保险作为长期理财工具进行投资，分流了一部分因投机性动机引起的货币需求。另外，保险公司作为具有独立财务安排功能的微观经济主体，为了实现准备金等保险基金的保值增值，将

通过合理的资金运用手段进行投资安排。可见，保险交易双方都将由投机性动机产生货币需求。

（二）对货币需求量的影响方向分析

保险市场发展对货币需求量的变动存在正向和负向两种可能的影响。对于货币政策而言，这意味着完全不同的操作方式。若保险市场的货币需求效应为正，保险规模增大时，货币当局应当增加货币供给，才能达到预期的 GDP 或通货膨胀率目标；反之，若保险市场的货币需求效应为负，保险规模的增大时，应该采取紧缩的货币政策。为了简化分析过程，本文将在保险市场规模增大的假设前提下，讨论保险市场对于货币需求量的影响。

1. 基于凯恩斯三种货币需求动机的分析

对于保险的货币需求影响效应，凯恩斯的三种货币需求动机主要体现为不同类型保险产品对货币需求的差异化影响。按照目前中国保险市场上保险产品的主要功能划分，可以将保险产品划分为保障型产品和理财型产品。保障型产品主要包括财产保险和普通寿险产品，这类产品风险保障杠杆较高，投保人可以通过缴纳少量保费分散较大损失，因而由交易性动机产生的货币需求并不明显，同时，保障功能较强的产品将在很大程度上减少预防性货币需求。而诸如分红险、万能险等理财型保险产品，其主要功能是实现资金的保值增值，保障功能相对较弱，主要通过投机性动机增加对货币的需求量，同时，这类产品保障杠杆较低，保费相对较高，因而保费支出通过交易性动机增加的货币需求也更为明显。

2. 其他因素的综合分析

通过凯恩斯货币需求理论的分析，保险市场将通过交易性动机、预防性动机和投机性动机影响货币需求，但对于货币需求量影响效应的方向问题，还需要通过综合考虑各种因素进一步判断。

（1）替代效应。若只从保险的角度出发，保险将通过降低预防性持币动机对货币需求产生负向影响，通过提高交易性动机和投机性动机对货币需求产生正向影响。但与此同时，保险市场的发展可能对其他形式的货币需求形成挤出效应：保险产品兼具投资、储蓄等功能，与其他金融产品具有趋同性，因而可能对银行存款、股票投资、基金信托类产品产生替代作用，从而减少货币需求量。

（2）货币流通加速效应。凯恩斯货币需求理论暗含着货币流通速度不变的假设，若考虑到这一因素，根据费雪的货币数量说，当商品价格和交易总量不变时，货币流通速度越快，流通中所需货币量越少。因此，保险市场发展对货币流通速度的加速作用，可能间接对货币需求量产生负向影响。

保险市场发展将从以下两个方面加快货币流通速度：一方面，保险投资将促进储蓄向投资转化，加快货币流通速度。Lemond（1994）的研究表明，保险投资能提高储蓄向投资转化的规模，同时提高储蓄向投资转化的效率。Bencibenga（1991）、Pagano（1993）认为寿险降低了对货币和其他可变现资产的安全性需求，同时将个人的储蓄组合转化为回报率更高的资产。相对于银行存款，我国寿险产品收益率一般较高，居民会将部分储蓄存款用于购买保险产品。由于保险公司资金运用渠道更为广泛，并通过将社会闲散资金汇聚、加之专业化运作和管理，促进资金在不同市场间的进出，加快货币流通速度。另一方面，保险产品在提高保障水平的同时，消除民众后顾之忧，能有效提高整体消费水平，减少预防性货币需求，增加交易性货币需求和投机性货币需求。与此同时，消费水平的提高将加快货币流通速度，在一定程度上降低货币需求。

因此，综合挤出效应、货币流通加速效应等因素，保险市场发展对于货币需求量的影响机制较为复杂，对其进一步的量化分析显得尤为重要。

## 三、实证研究

（一）变量选择和数据处理

1. 变量选择

根据货币需求研究的基本框架 $M^{d}=f(\mathrm{P},Y,\mathrm{R})$，货币需求的影响变量主要由规模变量 Y、机会成本变量 R 两种类型的变量构成，并通过价格 P 考察变量名义值和实际值的影响。本文选择具体指标如下：

（1）解释变量：货币需求函数中规模变量是指决定货币需求规模的变量，本文选取国内生产总值 GDP 作为规模变量；机会成本变量包括货币自身收益率、货币以外其它资产的收益率和预期通货膨胀率，本文选取居民消费价格指数 CPI 作为通货膨胀率的代理变量，度量物价水平的变动情况，并选择一年期定期存款利率 R 作为机会成本变量。另外，由于主要研究对象是保险市场对货币需求的影响，因此，在货币需求函数中加入“保费收入”作为保险市场的代表变量，考察其对货币需求的影响。

（2）被解释变量：相对于狭义货币供给 M1，M2 不仅能反映现实购买力，还反映潜在购买力，能较好的体现社会总需求的变化；同时，M2 与保险资金运用渠道具有更高的匹配性。因此，本文选择实际广义货币需求 M2（流通中的现金+活期存款+定期存款+储蓄存款+其他存款）扣除价格变动以后的货币需求作为被解释变量，即作为货币需求的实证分析对象。

2. 数据选取和处理

本文选取 2000 年第一季度到 2011 年第三季度的数据，共 47 个样本数据。将 M2、GDP、premium 通过 CPI 进行平减，变为实际货币需求量 M2、实际 GDP、实际保费收入，R 仍然使用名义值。由于使用的是季度数据，具有明显的季节特征，因而运用 X12 季节调整方法对 M2、GDP、premium 等季节性趋势强的变量进行季节调整。另外，由于 M2、GDP、premium 呈指数形式增长，故取对数来消除这种指数增长效应。处理后的数据分别用 $LNRM2$、$LNRGDP$、$LNRPREMIUM$ 和 R 表示。

（二）研究方法

依据货币需求函数，运用向量自回归模型（VAR）方法建立如下模型：

$$LNRM2=\sum_{i=1}^{p}\beta_{i1}LNGDP(-i)+\sum_{i=1}^{p}\beta_{i2}LNRPREMIUM(-i)+\sum_{i=1}^{p}\beta_{i3}R(-i)+\sum_{i=1}^{p}\beta_{i4}LNRM2(-i)+C \qquad (1)$$

其中， i 为滞后阶数，p 为 VAR 最大滞后阶数；$\beta$ 为参数，C 为常数项。

本文运用 Eviews6.0 软件考察保险市场对货币供应量影响，实证研究主要分为以下五个步骤进行：单位根检验、协整检验、构建 VAR 模型、脉冲分析和方差分解。

（三）实证研究

1. 建立 VAR 模型

对各变量进行 ADF 单位根检验的结果显示，$LNRM2$、$LNRGDP$、$LNRPREMIUM$、R 均为一阶差分平稳变量，都是一阶单整的，符合协整检验的前提条件，因而本文将选择

Johanson 检验方法，对变量进行检验。根据 AIC 和 SC 准则，应取 VAR 模型滞后阶数 p=2，基于该最优滞后期，可以进行协整检验。

在给定 5%显著性水平下，迹检验和最大特征根检验结果一致，都拒绝了存在 0 个协整向量的原假设，表明 LNRGDP、LNRM2、LNRPREMIUM 和 R 四个变量之间存在协整关系。

对协整向量正规化得到：$\hat{\beta}=(1,-0.928650,-0.179511,0.056524)$，其对应的协整关系代数表达式为：

$$LNRM2=0.928650*LNRGDP+0.179511*LNRPREMIUM-0.056524*R$$

由此可知，规模变量 GDP 和机会成本变量 R 的系数符号与经济理论一致，当经济总量增加时，货币需求相应增长，而当货币成本价格上涨时，货币需求量随之降低。同时，保险市场发展对货币需求量具有正效应，广义货币供应量 M2 与保险市场呈同向变动的关系。M2 对保费收入的弹性系数为 0.179511，说明保费收入每增加 1%，M2 将增加 0.18%。

AR 根检验显示，VAR 模型中的根都在单位圆内，因此根据式（1）建立的 VAR(2) 模型是稳定的。由于 VAR 模型本身并不适合政策分析，因此通过脉冲响应函数和方差分解技术对变量之间的相互冲击进行解析，分析各个变量之间的单位变化如何通过其内在联系引起对整个系统的扰动，以及各变量对这些扰动的综合反应。

2. 脉冲响应分析

图 3 描述了 LNRM2 对来自保费收入一个标准差新息在未来 10 期的响应（两侧虚线为脉冲响应函数值加减 2 倍标准差的置信带）。LNRM2 对来自保费收入一个标准差的随机扰动在短期内有正向冲击。第 1 期的响应值在 0 附近，LNRM2 对保费收入的脉冲响应不明显，到第 2 期出现正效应，同时响应值达到最大值 0.01，然后逐渐减小到第 6 期出现负的效应，8 个季度之后，响应值基本稳定在-0.004 左右，形成较为微弱的负向影响。

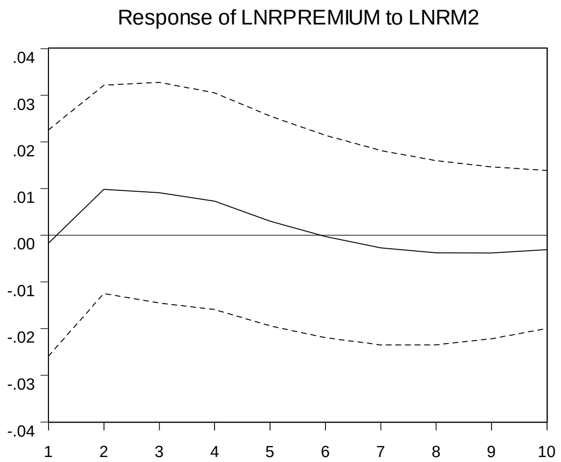



**图 3 LNRM2 对保费收入一个标准差新息的响应**

3. 方差分解

对变量 LNRM2 进行方差分解，以评价各内生变量新息对实际 M2 需求的相对重要性，结果如图 4 所示。图中横轴表示滞后期

间数（单位：季度），纵轴表示该变量对 M2 变动的贡献率（单位：百分数）。

**表 1 LNRM2 的方差分解结果**

| Period | S.E.（标准差） | LNRM2 | LNRGDP | LNRPREMIUM | R |
|---|---|---|---|---|---|
| 1 | 0.013625 | 100.0000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 0.023970 | 95.07862 | 0.054572 | 0.046216 | 4.820594 |
| 3 | 0.031073 | 90.64922 | 0.482034 | 1.968949 | 6.899801 |
| 4 | 0.035400 | 85.84215 | 1.656663 | 6.387780 | 6.113408 |
| 5 | 0.038451 | 78.50774 | 3.529153 | 12.53193 | 5.431173 |
| 6 | 0.041543 | 68.55986 | 5.719615 | 18.04480 | 7.675726 |
| 7 | 0.045176 | 58.07713 | 7.642795 | 21.19116 | 13.08891 |
| 8 | 0.049153 | 49.07310 | 9.061341 | 21.97723 | 19.88833 |
| 9 | 0.053074 | 42.16193 | 10.05121 | 21.37477 | 26.41208 |
| 10 | 0.056651 | 37.06923 | 10.77809 | 20.23297 | 31.91972 |

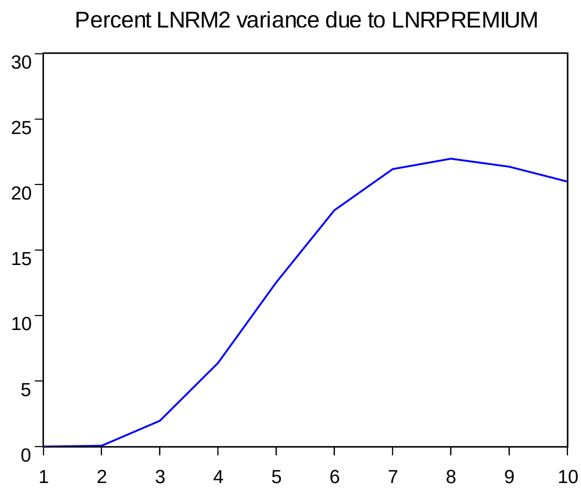



**图 4 LNRM2 的方差分解结果**

从上图可知，不考虑 M2 自身的贡献率，利率对 M2 影响的贡献率最大达到 31.9%（$RVC_{4\to1}(10)=31.9\%$），保险行业对 M2 的贡献率最大达到 22.0%（$RVC_{3\to1}(8)=22.0\%$），GDP 对 M2 影响的贡献率最低，各期影响程度基本处于 10%以下。

LNRM2 的自身新息的冲击对预测误差的贡献度在 8 个时期后仍维持在 40%左右，是影响货币需求的主要原因。保费收入新息对 LNRM2 预测方差的贡献在 5 期以后开始增加，所占比重达到 10%以上，在 7 期以后所占比重达到 20%以上，逐渐成为影响货币需求的重要原因。

## 四、结论与启示

（一）主要研究结论

实证研究的结果显示，M2 与国内生产总值、保险市场发展指标和利率之间均存在稳

定关系，保费收入增长对广义货币需求量产生正向作用。

①短期的正向效应。根据协整方程，M2 对保费收入的弹性系数为 0.18；脉冲响应结果也显示，短期内保险市场与货币需求之间呈正相关关系。保险市场将对广义货币需求 M2 产生正向影响，原因是由保险市场产生的交易动机、投机动机等正向货币需求高于预防动机、替代效应和流通加速效应等对货币需求量产生的负向影响。②长期的负向效应。从保费收入冲击对货币需求产生影响的动态过程来看，保费收入的一次随机冲击在开始阶段会对 M2 产生正的需求效应，但随时间延长而转化为负向效应，且具有持续性。

这种现象与保险产品结构存在较大关系。目前，我国保险市场中理财型险种占据主导地位，保障程度相对较弱。因此，短期内，主要是通过交易性动机和投机性动机等正向效应对货币需求量发挥作用；随着时间的延长，保险产品交易之初的保费收入逐渐通过计提准备金的方式转化为保险投资资金，这部分资金运用主要通过替代效应和流通加速效应减少货币需求，导致长期内保险对货币量体现为负向影响。

总体看来，由于正向响应值高于负向响应，且随着时间的递延，保险市场对货币需求量影响效果也将逐渐减弱，因而保险业的发展对广义货币需求量发挥正向作用。

（二）对央行货币政策的启示

保险市场已对我国的货币需求产生了一定的影响，传统的货币需求理论仅仅关注 GDP 等宏观经济指标，而忽视了保险市场引发的货币需求。因此，央行在制订货币政策时应对保险市场给予适当关注，并结合我国保险市场的发展情况进一步研究是否应当把保险指标纳入货币需求指标体系。保险市场对货币需求的正向作用，意味着随着保险规模增大，货币当局必需适当增加货币供给，才能达到预期的 GDP 或通货膨胀率目标。同时，较为恰当的货币政策有利于稳定经济增长，促进保险市场发展。

从发达国家保险市场经验来看，保险周期通常与实体经济周期不一致。因此，央行货币政策操作不应紧盯保险市场发展，应当将保费收入、保险产品结构等保险市场指标纳入货币政策参考指标。因此，中央银行的货币政策操作，应更多地在对实体经济运行状况、利率等指标的综合分析的基础上进行判断；现阶段应重点加强对保险市场影响货币需求以及货币政策传导机制的研究，强化央行应用多种政策工具调节货币供应的能力，减少保险周期对货币政策实施过程的影响。

参考文献

[1]邓永亮，李薇．货币需求、储蓄存款与股市投机性[J]．湖北经济学院学报，2010（3）：45-51．

[2]董子颖．股票市场对中国货币需求函数影响的实证研究世界经济情况[J]．2010（1）：38-43．

[3]高莉，樊卫东．中国股票市场与货币政策新挑战[J]．金融研究，2001（12）：29-42．

[4]高铁梅．计量经济分析方法与建模——Eviews 应用及实例[M]．清华大学出版社，2006．

[5]石建民．股票市场、货币需求与总量经济：一般均衡分析[J]．经济研究，2001（5）：41-52．

[6]韦生琼．论货币政策与保险政策的关系[J]．财经科学，2002（5）：77-79．

[7]谢富胜，戴春平．中国货币需求函数的实证分析[J]．金融研究，2000（1）：25-29．

[8]易行健，龚志明，易君健．中国股票市场对货币需求总量与结构影响的实证检验[J]．上海财经大学学报，2004：46-52．

[9]A.J.Field,Asset. Exchanges and the Transactions Demand for Money: 1919-1929[J]. American Economic Review, 1984(74).

[10]John Thornton. Real Stock Prices and the long-run Demand for Money in Germany [J].

Applied Financial Economics,1998(8).
[11]T.Choudhry. Real Stock Prices and the long-run Money Demand Function: Evidence from Canada and the USA [J]. Journal of International Money and Finance, 1996(15).
[12]Tomas.I.Palley. The Demand for Money and Non-GDP Transactions [J]. Economics Letters, 1995(48).

# 中国保险市场对货币需求量影响的实证研究

许栩
中央财经大学，北京 100081

**摘要：**结合凯恩斯货币需求理论和中国实际，保险业将通过直接效应和间接效应对货币需求产生影响。本文利用 VAR 模型对 2000-2011 年季度数据的实证研究结果表明，保费收入增长对广义货币需求量具有正向作用。建议央行在制订货币政策时要适当增加货币供给，应当对保险市场给予适当关注，将保险产品结构、保险业务规模等指标纳入货币政策参考体系，减少保险周期对货币政策实施过程的影响。

关键词：保险 货币需求 产品结构 VAR
**JEL 分类号：E41,E52,G22**

# Influences It Has on Insurance Institutions' Assest Liability Management by Insurance Capital Participate in Affordable Housing

ZHANG Daijun, BAO Weiwei
Zhejiang University of Finance and Economics, Hangzhou, China, 310018

Abstract: This paper demonstrates that insurance capital participate in affordable housing construction meet the needs of insurance company assets liabilities management. And make a study about influences it has upon insurance institutions' optimizing investment structure by insurance capital participating in affordable housing constrction. Utilizing assest liability managemnt can optimize insurance capital allocation, and it can scheme out investment variety structure, term structure and interest rate structure. Nature of insurance capital decides it pursues the match between assest and liability, especially the match between in yields and durations. Insurance capital has the characteristic of long term, large scale, high stability, high security requirements, low demand of yields. Affordable housing has public nature, and it is a long term, large demand, produce effective slowly. It is a policy project which belongs to the state investment, so the risk is low. Nature of insurance capital accords with the choice of participating in affordable housing. The main investment channels of Insurance capital in China including bank savings, bonds, securities investment funds and stock. Recently, anlong with the broaden of investment channels, it is allowed to invest in real estate, however, as yields is higher, risk is also exists at the same time. Because affordable housing has quasi-public product attributes, so the risk is lower compared with other assets. Insurance capital participate in affordable housing construction not only could lower the risk, but also can gain stable yields, what's more, it could optimize overall assest allocation structure. The main Influences it has on insurance institutions' assest liability management by insurance capital participate in affordable housing are: make asset and liabiliy match on the term and structure, optimizing the whole capital portfolio, lower the risk caused by sigle asset proportion occpy too much weight to higher the whole systematic risk. This paper based on VaR model, Markowitz mean variance model, use Local Treasury Bonds yield rate as data source to leverage yield rate of participating afford housing by insurance companies, so we put forward the conceive of positive analysis about insurance capital participate in affordable housing optimze asset liability management. The innovation of this paper is the conbination of insurance capital participate in affordable housing and asset liability management，and states the influences it could have for insurance institutions.

Keywords: insurance capital, affordable housing, assest liability management

## I.资产负债管理概述

广义的资产负债管理是指金融机构按照一定的策略来配置资产, 以实现安全性、流动性和盈利性的经营目标。狭义的定义是指在利率波动的情况下, 金融机构通过调整利率敏感性资产和负债的配置, 来规避利率风险。北美精算学会对资产负债管理给出的定义为“ 资产负债管理是管理企业的一种实践, 用来协调企业对资产和负债做出的决策。它可以被定义为在给定的风险承受能力和约束下为实现财务目标而针对与资产和负债有关的决策进行的制定、实施、监督和修正的过程。资产负债管理是适用于任何利用投资平衡负债的机构的财务管理的一种重要手段。”资产负债管理要求保险公司根据其所管理的资金的不同性质、期限长短、成本高低、可能承受的风险大小等因素, 根据保险公司对现金流的要求，制定使负债在期限、结构上的匹配，从而有效的降低风险，实现收益的最大化。通过建立科学的投资组合。资产负债管理则注重资产与负债关系的协调以及对风险的量化和控制， 目前已成为保险公司风险管控与价值创造的重要手段之一。

### A.资产负债管理理论的发展历程

20 世纪 60 年代以前,在银行业发展的初期，资产管理理论一直占据主导地位。当时商业银行的资金来源稳定，以活期存款为主，商业银行管理的重心是维护其资产的流动性，并在满足流动性的前提下追求盈利性。因此各银行均把经营的重点放在资产管理上，即通过现金、证券、贷款等资产项目的最佳组合来满足银行安全性、流动性和盈利性的目标。资产管理理论有两种方法：（1）各种资金来源与对应的资产组合期限相一致，即资产与负债的偿还期限有高度一致性。（2）线性规划法，即通过线性规划模型，寻求资产组合的最佳配置。

20 世纪 60 年代以后，银行业竞争加剧、利率管理严格、金融工具不断创新背景下，负债管理理论形成。该理论核心是：假定商业银行资产按照既定的目标增长，银行通过调整负债方的项目，即通过货币市场上的主动性负债，例如购买资金实现负债项目的最佳组合。这种借入资金的方式既保证了银行资产的流动性又

不用维持大量高流动性资产。由于利率管制下的金融创新，西方商业银行管理策略由资产管理向负债管理转变。

20 世纪 70 年代中期，由于存款利率自由化，市场利率大幅上升，单一的负债管理或是资产管理都不能保证商业银行安全性、流动性和盈利性的均衡。特别是 20 世纪 80 年代后，西方各国先后取消或放松利率管制，此时只有通过资产和负债的共同调整，保持净利差和自有资本的净值为整数。资产负债管理应运而生。

## B.资产负债管理主要技术

资产负债管理方法和模型, 主要有久期和凸性免疫、缺口分析、现金流测试、现金流匹配模型、动态财务分析(Dynamic Financial Analysis,DFA ) 等。

免疫也是一种控制利率风险的方法， 其主要思路是匹配资产和负债对利率的敏感性，使盈余不随着利率的变化而减小。构建免疫投资组合应满足以下 3 个条件：资产和负债的久期相同；资产的现值大于负债的现值；资产的凸性大于负债的凸性。以上 3 个条件成立时，无论利率上升还是下降，盈余都会增加。免疫具有很好的灵活性，将未来各期的现金流匹配简化为现值的匹配，简化了计算要求。在实际应用中，通常不会严格按照上述免疫条件进行投资组合构造， 而是通过控制资产负债久期和凸值的缺口，降低可能的利率风险。

久期是资产负债风险管理的重要方法, 主要是因为久期具有度量市场利率风险的重要功能。久期可用于度量金融资产尤其是有价证券的市场价格对利率变化的弹性。凸度是预测价格利率弹性的另一个工具,是用来测算当利率变化时, 久期怎样变化的一种方法。在大多数情况下, 凸度对金融工具价格行为的影响比久期小但市场利率变化幅度越大, 杠杆作用越大, 类似期权的性质越强, 凸度则越重要。凸度弥补了久期的不足, 反映了久期也会受利率变化影响的事实。如果资产和负债的凸度相等, 则二者的久期随利率变动的速率相等, 于是动态上实现了资产和负债的匹配。

缺口分析是针对利率风险的一种常用资产负债管理方法。保险公司不同险种和资产的利率特征不同, 利率敏感性资产和负债是指浮动利率的资产和负债。缺口管理模型包括到期缺口模型和久期缺口模型。到期缺口模型测量利率敏感性资产和负债之间绝对值的差异, 即缺口。久期缺口管理则是通过相机调整资产和负债结构, 使金融机构控制或者实现一个正的权益净值, 以降低再投资或融资的利率风险。

现金流测试是运用数学模型, 在假设一系列相关变量发生变化时, 判断在负债到期日保险公司的资产现金流是否满足负债的现金流出。如, 分析利率变化对保单退保、公司债券和抵押担保证券提前清偿的影响来测试资产与负债的匹配, 以验证保险公司有足够的现金流用于清偿到期负债。

现金流匹配方法是一种比较简单的资产负债管理方法, 即维持负债的现金流量与资产的现金流量相匹配, 以规避利率风险。现金流匹配方法包括古典现金流匹配模型和改进后的现金流匹配模型。古典现金流模型要求任何时间的资产和负债现金流匹配,约束条件过于苛刻。考虑到古典现金流匹配模型过于严格的约束条件, 人们对其进行了改进, 即放松约束条件。只要每期的累计净现金流为正值即可。

情景分析包括确定性情景分析和随机情景分析。确定性情景分析是使用预先设定好的一组情景进行测试， 选择的情景可以代表管理者认为未来最有可能的情况， 也可以是一些较为极端的情况，后者也被称为压力测试。压力测试通过模拟极端情况下公司的经营状况和风险，并判断公司能否度过危机，针对可能的危急情况事先设计好应急方案及措施。随机情景分析则需要模拟未来情景的具体分布，通过随机情景发生器生成一系列情景。

动态财务分析（DFA）最近几年才发展起来的，它是一种整体性的财务建模方法，通过对公司未来生存环境和营运结果进行模拟，显示公司营运结果如何受外部环境变动和内部战略决策变动的影响。动态财务分析及其模型技术将保险公司视为整体，而非单个保险产品线，是在整个企业内进行模拟分析的有效预测工具和方法。

## C.资产负债管理方法在保险公司的运用

保险公司负债管理的对象是保险公司现在及未来所要偿还的各类负债，构成主要包括权益性资产(主要是指资本金、公积金和未分配利润)、保险责任准备金(未决赔款准备金、未到期责任准备金、已发生未报告赔款、长期责任准备金)以及其他资金等。准备金是保险公司负债最重要的组成部分, 代表了保险公司对

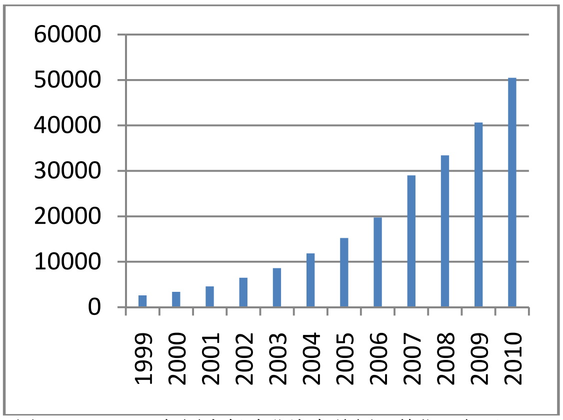
被保险人承担的赔付责任, 准备金和其他负债的总和决定了保险公司需要持有的资产和盈余规模。其中权益性资产占到财险公司资金的 50%-65%，占到寿险公司资金的 80%一 95%。保险公司的负债具有长期性、稳定性、巨额性的特征。负债管理的目的是准确反映各项负债及负债期限，以便对保险公司资金来源的变动情况进行分析并据此调整保险公司的有关经营策略，保证充足的偿付能力，为保险企业进行中长期的投资提供了雄厚的资金保证。

保险公司资产管理的核心主要是对资金运用的管理，保险公司的资产运用的比例占总资产的 80%以上。资产管理的目标是在资产组合流动性能够满足当前支付负责的前提下，使得投资组合的收益最大化。在保险公司资产中出去维持公司经营所必需的资产或因经营活动所产生的资产，如应收分保账款、自用固定资产、待摊费用等，其余的大部分作为能为能为保险公司带来收益的投资资产，其包括债券、股票、基金等。保险公司负债具有长期性、稳定性、巨额性等特点决定了其资产管理运作原则应符合以下三大原则：安全性、流动性、收益性。

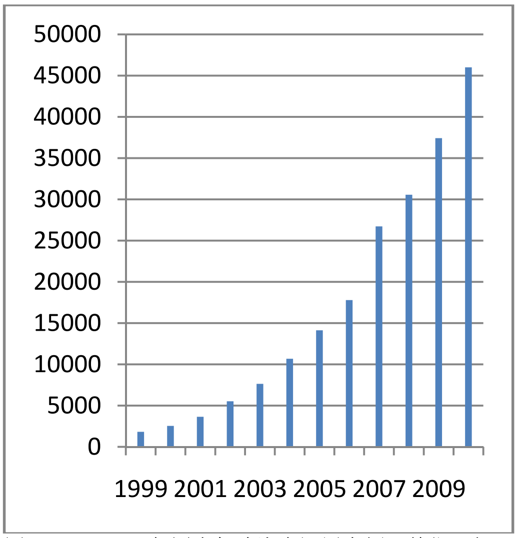
# Ⅱ. 我国保险业资产负债管理现状

## A.保险资金运用余额不断增长，资金运用渠道不断拓宽

我国近年来保费收入逐年增长，保险资金运用余额不断增加，体现了我国保险业发展势头良好，为拓宽投资渠道，增加投资收益提供了充足的资金支持。1995 年以来，我国保险业随着保险业的发展壮大和资本市场的不断完善投资渠道逐渐拓宽。1995 年，《保险法》规定资金运用渠道限于银行存款、买卖政府债券、金融债券。1999 年 10 月 29 日允许保险资金投资证券投资基金业务。2009 年 2 月 28 日，《保险法》经第十一届全国人民代表大会常务委员会第七次会议重新修订，并于 2009 年 10 月 1 日起开始实施。其中规定保险公司的资金运用限于下列形式：银行存款；买卖债券、股票、证券投资基金份额等有价证券；投资不动产；国务院规定的其他资金运用形式。此次修订后的保险法将之前的“买卖政府债券、金融债券”，拓宽为“买卖债券、股票、证券投资基金等有价证券”，并增加了“投资不动产”的内容。我国自保险业恢复以来，监管部门本着稳健经营为首要目标的原则，对保险资金运用的规定也经历了从无到有、从自由到严格限制再到逐步宽松的过程。




图一 1999-2010 年国内保险业资产总额（单位：亿元）

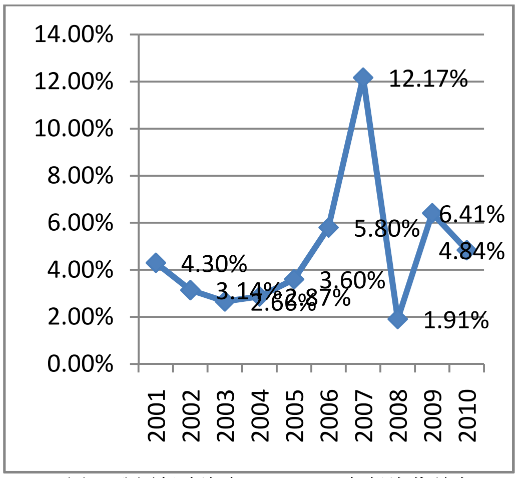



图二 1999-2010 年国内保险资金运用余额（单位：亿元）

## B. 国际比较上看，保险资金的收益率偏低

统计数据显示，2010年我国保险业资金运用余额为46000亿元，比上年增长23%，而收益率较之2009年的6.41%下降为4.84%。收益率偏低的主要原因是外部环境的约束和政府的监管，保险资金运用渠道较狭窄且存在较大的风险，使得保险资金的投资收益率偏低。当前我国的投资渠道主要有银行存款、债券、证券投资基金、股票等方向。但是目前我国保险公司以投资债券和银行存款为主，2010年情况来看，债券投资占比重为49.86%,银行存款占比重为30.22%，二者相加约占资金运用额的80%。由于银行存款的利息远不能使保险资金增值，而债券市场也存在一定风险，二级市场债券价格波动幅度接近20%。通过图三可以看出，除

2007年收益率较高，达12.17%，2001-2010平均收益率为4.77%，2003年和2004年更是低于3%的收益率。而国际比较上看，截止2004年，美国保险公司历年平均收益率为6.67%，波动率为0.34%，投资收益稳健增长，与其较成熟的资本市场无不关联。保险资金收益率偏低与中国资本市场尚未成熟，金融产品单一有关。目前我国资本市场的规模日益扩大，但是我国上市公司水平参差，与发达国家成熟市场相比，在治理结构和运作水平方面有较在差距，业绩整体偏低，平均市盈率偏高，缺乏可供投资者长期持有的品种，股市的投机性大于投资性。资本市场的不发达使得保险公司缺乏可投资的工具，面对风险较大的资本市场现状，也使得保险公司不愿将资金集中投资于资本市场。当前保险资金运用模式是以银行利率为支点，在银行和证券产品的撬动下，被动的参与资本市场与货币市场，因此效益难以凸显。




图三 我国保险资金 2001-2010 年投资收益率

## C.资产负债期限不匹配

保险公司(尤指寿险公司)承担的多为长达几十年的长期负债，但由于我国保险资金的投资渠道受到较严格的限制以及投资市场长期投资产品匮乏等原因，保险公司负债的久期远大于资产的久期，资产负债不匹配现象严重,存在着较大的再投资风险。目前,由于我国比较缺乏具有稳定回报率的中长期投资项目,致使不论资金来源如何,期限长短与否,基本都用于短期投资。目前国内寿险公司5年以内的资产与负债不匹配程度虽然低于50%,但中长期资产与负债的不匹配程度已超过50%，且期限越长,不匹配程度越高,有的甚至高达80%。以寿险公司为例，总体看,我国寿险业资产与负债的平均期间相差10-15年,远大于日本和韩国等国家寿险公司资产与负债的期限差距。从数量匹配情况看,截至2002年底,我国寿险业长期负债约为4000亿元,但同期可供投资的10年期长期债券总量不到2500亿元。期限结构与数量的不匹配,特别是可供寿险公司投资的、收益率较高的中长期金融资产规模太小、品种过少,直接限制了我国寿险公司进行较好的资产与负债匹配,使我国寿险业面临很高的资产负债匹配不风险。保险公司的资产负债匹配风险将直接导致偿付能力风险。

发达国家寿险业在资产负债匹配问题上曾经有过深刻的教训。由于资产负债的不匹配，在20世纪80年代的利率大幅波动时期，欧美国家有600多家寿险公司面临偿付能力危机，如美国寿险巨头标准人寿曾因资产负债严重不匹配濒临破产。日本寿险公司在高利率时期大量销售高预定利率的传统保单，随后为满足偿付需要，一些寿险公司被迫无视资产负债匹配的要求，将资产大量投资于证券、房地产等高风险项目，泡沫经济破灭后形成了大量的不良资产。90年代后，投资收益率不断下滑，远远低于保单预订利率，形成了大量利差损。最终导致了日产生命保险等7家大型寿险公司倒闭。

表一亚洲各国寿险业资产负债期限匹配情况对比表

| 年数 | 中国大陆 | 中国台湾 | 韩国 | 日本 |
|---|---|---|---|---|
| 负债的平均年限 | 15–20 | 14.5 | 10 | 15 |
| 资产的平均年限 | 5 | 10.5 | 4 | 7 |
| 资产与负债的平均年限之差 | 10–15 | 4 | 6 | 8 |

资料来源：德意志银行 2003 年专题研究报告

## D.投资结构仍需优化

目前我国保险资金运用的主要渠道有银行存款、债券、证券投资基金、股票、基础设施建设、海外投资等。但是由于我国保险业市场不够成熟和金融市场不完善，特别是资本市场体系不健全，使我国可供选择的投资品种较少。尽管现在我国已允许保险公司投资股票和证券投资基金，但由于可投资比例太小，其收益对总体收益贡献十分有限。受我国经济发展水平和资本市场成熟程度的影响，在我国现有的资金运用渠道中，银行存款和政府债券占有很大的比例，真正投资于企业债券、证券投资资金等“新”品种的资金很少，证券投资基金的投资比例几年来一直在5%左右。投资渠道的单一，直接导致了我国保险资金运用的投资收益率处于较低的水平。

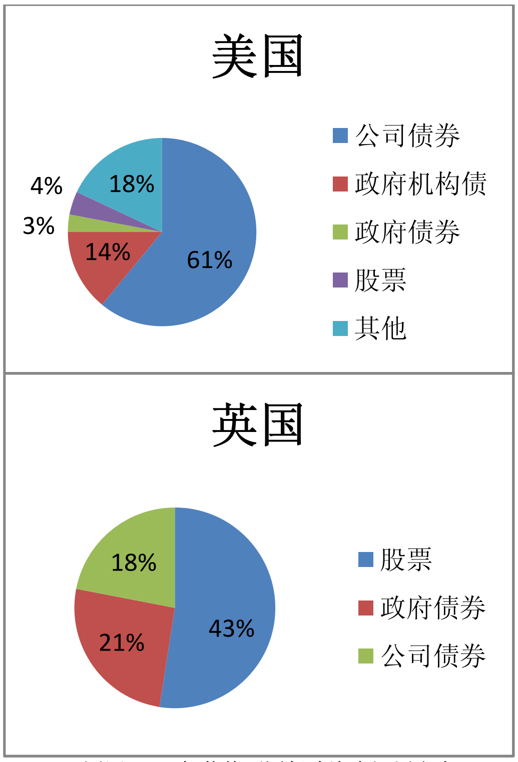
表2中可以看出我国保险资金运用的主要方向仍以债券、银行存款为主，银行存款近年呈现增长趋势，在2010年银行存款占比重高达

30.22%。而在国际市场上，保险资金主要投向股票、债券等收益率相对较高的有价证券，而其他投资项目只占很小的一部分。美国和英国由于拥有发送的资本市场，因而其保险投资以债券和股票为主。其中，美国的债券市场尤其发达，是美国储蓄资金向投资转化的主渠道，因而美国保险公司的资金运用又以债券投资为主，在2002年其债券投资比例达到61%，是美国国内债券市场最大的机构投资者；相对于美国而言，英国的债券市场发达程度不够，但英国拥有较大规模的股票市场，因而英国的保险公司资金运用以股票投资为主，在2002年股票投资比例达到43%。

从与国外相比较，我国保险业投资结构明显过于单一。我国保险公司的利润来源主要是银行存款和政府债券利息与保单预定利率之差。保险公司的整体利率水平和利率变动呈很大的相关性，但是由于我国国债市场规模小，期限结构短，制约了保险资会运用的规模和比例，各大保险公司大比例持有银行存款，一旦利率下调，保险公司特别是寿险公司就会面临利差损风险，保险资金的缩水也使保险公司面临巨大的经营风险。

**表 2 我国保险业近年投资 2006-2010 年国内保险资金配置情况**

| 资产类型 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|
| 银行存款 | 33.67% | 24.39% | 26.47% | 28.11% | 30.22% |
| 债券 | 53.14% | 43.98% | 57.88% | 50.96% | 49.86% |
| 证券投资基金 | 5.13% | 9.47% | 5.39% | 7.37% | 5.67% |
| 股票 | 5.22% | 17.65% | 7.94% | 11.22% | 11.12% |




**图四 2002 年英美两国保险资金运用方向**

## III.保险资金参与保障房建设对我国资产负债管理的影响

### A.符合保险资金资产管理要求

根据保险业经营的特点，保险资金运用一般要遵循“三性原则”，即安全性、流动性与收益性原则。安全性是保险投资的首要原则。保险投资的安全性是指保险公司能够如期收回投资资金的本息，保证投资资金的安全。正是由于保险公司经营内容的特殊性和保险投资资金性质的特殊性，无论从保险法规规定上还是从实际运作过程上，都要求在进行保险资金运用时应该把安全性作为首要目标。安全性第一的原则要求保险投资应该以安全性较；风险较小的工具和方式为主，而对投机性较强、高风险的投资工具进行较严格的限制。同时这也是由保险资金的社会属性和公众属性决定的———必须要保证及时足额的赔付。流动性是指资产变现的能力，而且这种变现要以资金不受损失为前提。非寿险业的特点是险种期限短，且所承保的保险事故在发生时间上具有随机性。因此，非寿险公司必须保证随时有足够的流动性资产用来满足随机发生的保险赔付事件。而寿险险种的期限一般都比较长，其承保的保险事件(通常是死亡)也具有一定程度的“确定性”，因此寿险公司对资金的流动性要求也相应较低。值得注意的是，在当金融风险加剧的情况下，寿险公司也应保持一定比例的流动性较强的资产，以备不时之需。流动性原则要求在保险投资时要将一部分资产配置在高流动性的资产上。资产的收益性往往与风险性相联系，由于要保证偿付能力的实现，保险资金对于资金的安全性更为重视，而对收益率的要求相对不高。

保障性住房是政府的安居工程，资金需求量大、建设开发收益稳定、回款方式基本确定，由于政府的支持安全性高，投资风险较小。参与保障房建设投资具备期限长、稳定性高、安

全性高的特点。因此从保险资金属性来看，与保障房建设非常匹配，适合保险资金的投资需求，符合保险公司资产负债管理的需要。

### B.促进保险资金可投资渠道多元化，优化投资结构

根据 2010 年保监会的监管规定，保险资金的 10%可以用于不动产投资，其中投资不动产金融产品的比例为 3%。按照 2011 年 3 月底保险业的总资产 5．4 万亿计算，可用于投资不动产的额度为 5 400 亿元，其中可投资不动产金融产品的额度为 1 620 亿元，而保险公司的不动产金融产品投资基本上是空白。从国际惯例上来看，保险资金投资的多元化已是趋势，包括不动产等投资在保险资金运用中都占有很大的比重。从中国保监会 2010 年 9 月份发布《保险资金投资不动产暂行办法》以来，由于受制于宏观环境的影响，一直没有保险企业实质的不动产投资行为。2011 年才由太平洋资产管理公司发起设立“太平洋－ 上海公共租赁房项目债权投资计划”，成为自《保险资金投资不动产暂行办法》出台之后第一单不动产债权投资计划，开始了保险资金涉足保障性住房的实践。。

随着 2009 年 10 月 1 日新《保险法》的颁布实施,保险资金已被允许进行不动产投资, 但是保险资金直接投资于商业性质不动产风险较大，流动性差，受市场行情波动影响较大，所以保险资金参与保障房建设既符合保险资金的投资运用首先必须遵循安全、稳健性的原则,又可防止发生偿付需求的流动性风险，又配合政府改善民生，因此保险资金投资保障性住房有十分重要的社会意义，从长远角度来看，这种实践对于拓展保险资金的运用渠道、实现保险资金的有效配置、合理匹配保险公司的资产负债方面有十分积极的影响。

### C.实现资产负债期限、现金流匹配

从保险资金负债的角度看角度看，保险资金来源于保费收入，资金流入和流出具有稳定性和可预测性，一般不会出现大的波动; 寿险资金的久期一般在 6 年以上，财产险虽然是短期业务，但由于其未到期责任准备金和未决赔款准备金是滚存的，实际上业具备长期资金的特点，久期甚至长于某些寿险资金。投资保障性住房的债权投资计划期限一般较长，符合保险资金（尤其是寿险资金）期限长的特点，可以和保险资金的久期相匹配，有助于实现保险资金的资产负债匹配管理。同时，债权投资计划与股票、债券类资产具有不同的属性特征，相关性较小，有利于增强公司资产组合收益的稳定性。

### D.降低交易费用，减少期限结构调整所带来的损失。

吴跃平在《中国寿险资金运用风险研究》一书中认为我国保险公司出现利差损的深层原因是当利率下调趋势未能及时调整资产的期限结构。利率下调只是保险公司利差损发生的诱因而根本原因是资产与负债的不匹配。当保险公司资产的理论债期<负债理论债期时，理论债期空差<0，此时若利率下降，将导致所有者权益的减少，因及时调整期限结构，提高资产的债期；反之，若资产的理论债期>负债的理论债期，理论债期空差>0，利率的上升带来所有者权益的减少，应该降低资产的债期。目前我国利率不断下调，并在近日又进行了降息，而我国保险公司的资产债期小于负债的债期，如果持有安全性高的较长期限资产资产，将带来收益的增加。

另一方面，结构调整会带来资产市场价值的损失，主要包括交易成本损失和资产转让损失，保险资金参与保障房建设长期性的资金投资属性能够降低期限结构调整、转换资产配置所带来的资产转让损失和交易费用。因此保险资金参与保障房建设既能保证安全性的同时，由于期限较长，既能降低交易成本，减少结构调整所带来的损失，增加保险资金运用的收益。

## Ⅲ.保险资金参与保障房建设的资产结构优化模型

### A 马克维茨投资组合理论在保险投资中的应用

马克维茨投资组合理论主要内容：投资者用均值表示投资组合的预期收益，用收益率的方差(或标准差)表示风险的大小，投资组合的整体风险取决于组合中各资产的方差和各资产收益率之间的相关性。投资组合理论主要是针对化解投资风险而提出来的。对于保险资金运用来说，资产组合投资管理就是通过构建和调整资产投资组合，达到以下目的：

1)尽可能使未来获得的现金流与不同保单所有可能需要的赔付、满期支付

的资金量和期限相匹配。

2)在投资风险一定的前提下，使得收益最大化；在投资收益一定的前提下，

使投资风险最小化。

3)有效控制投资风险。

4)尽可能最充分地利用投资账户资金。

马克维茨模型被认为是构建有效投资组合的典范，本文正是在这个模型的基础上来确定保险资金参与保障房建设的资产结构优化模型

马克维茨投资组合理论的基本假设为：1)投资者是风险规避的，追求期望效用最大化：2)投资者根据收益率的期望值与方差来选择投资组合；3)所有投资者处于同一单期投资期；4)投资者的决定仅仅是根据证券的风险和收益。

马克维茨提出了以期望收益和方差确定有效投资组合。

投资组合的方差为：

$$v\,\mathrm{ar}(r)=\sum_{i=1}^{N}x_i^{\,2}\,\mathrm{var}(r_i)+2\sum_{i\le j}\sum_{j=1}^{N}w_iw_j\,\mathrm{cov}(r_{i,}r_j)$$

资产组合的收益率为 $r_p=\sum_{i=1}^{N}w_ir_i$

资产组合的预期收益率为

$$E(r_p)=E(\sum_{i=1}^{N}w_ir_i)=\sum_{i=1}^{N}w_i\square E(r_i)$$

式中：$r_p$ ——由N种证券构成的资产组合收益翠；

$r_i$ ——第i种资产的收益率；

$w_i$，$w_j$ ——分别表示资产i，j在组合中的权重

$\mathrm{cov}(r_{i,}r_j)$ ——两种资产之间的协方差。

马克维茨模型是以资产权重为变量的双重目标的线性---二次规划问题{

$$\begin{cases}\max E(r)\\ \min Var(r)\\ s.t\\ \sum_{i=1}^{N}w_i=1\\ w_i\ge 0(i=1,2,\ldots,n)\end{cases}$$

假设保险公司将资金投资于N+1种资产上，其中一种为无风险投资，另外N种为风险资产，则保险公司投资组合的收益率为：

$$R=w_0r_0+\sum_{i=1}^{N}w_ir_i$$

其中 $w_0$，$r_0$ 分别表示无风险投资的投资比例和投资收益率，并且 $r_0$ 是一个常量；$r_i$ 表示投向第i种风险资产的投资收益率，由于受到市场风险的影响，所以 $r_i$ 是一个随机变量；$w_i$ 表示投向第i种风险资产的投资比例(0≤ $w_i$ ≤1)，是一个可控变量。因此，资产组合的期望总收益率和风险(方差)分别 为：

$$E(R)=w_0r_0+\sum_{i=1}^{N}w_iE(r_i)$$

$$\delta^2(R)=\sum_{i=1}^{N}w_i^{\;2}\,Var(r_i)+2\sum_{i=1}^{N}\sum_{j=1}^{N}w_iw_j\,\mathrm{cov}(r_i,r_j)$$

为了求得保险公司的投资比例，由以上分析我们可得投资组合模型为

$$\begin{cases}\max E(R)=w_0r_0+\sum_{i=1}^{N}w_iE(r_i)\\ \min\sum_{i=1}^{N}w_i^{\;2}\,Var(r_i)+2\sum_{i=1}^{N}\sum_{j=1}^{N}w_iw_j\,\mathrm{cov}(r_i,r_j)\\ s.t\;w_0+\sum_{i=1}^{N}w_ir_i=1\\ w_i\ge 0(i=1,2\cdots N)\end{cases}$$

在此投资组合模型中，各投资资产的收益率、风险水平(方差)和协方差作为常量，各资产类型的权重则是该模型需要求解的变量。

王明涛在《证券投资风险计量、预测与控制》中介绍了现有风险计量指标总体分为三类：一、以以收益率的方差、标准差为风险计量指标，二、以hurs指数计量的投资风险指标；三、包括VaR、单边离差均值、目标半方差等以收益率的下偏距为基础的风险计量指标。以收益率的方差计量为指标是有一些假设条件的，其中最重要的假设条件是收益率服从正态分布或投资者的效用函数二项式，这些假设难以符合我国目前证券市场的实际情况。Longley-Cook(1997)认为：保险公司的资产通常是高质量、流动性强的债券，VaR可以直接测算保险公司的资产风险。我国保监会2009年出台的《关于规范保险机构股票投资业务的通知》规定：“保险公司和保险资产管理公司应当加强基础建设，运用在险价值（VaR）等量化分析手段，按季进行股市风险压力测试，分析风险暴露程度，评估潜在风险因素及对整体风险承受能力”。因此以VaR指标来衡量资产风险比用方差更加科学有效。在本文的资产负债优化模型构建中以资产组合的VaR值作为衡量资产组合风险的指标。

## B、模型中 VaR 值计量方法的选取

VaR(Value-at-Risk)方法是近年来主流的金融风险度量工具，J.P.摩根将其定义为“给定置信区间的持有期内的最坏的预期损失”。它的含义是：某项资产或组合在给定的置信水平和持有期内，正常的市场条件下的最大预期损失。公式表示为：$\Pr ob(\Delta\omega \geq \mathrm{VaR})=1\text{-}c$。其中，$\Delta\omega$ 为资产或资产组合在持有期内的损失，VaR为在置信水平c下处于风险中的资产价值。上述定义表达式可等价转换为 $c=\Pr ob(\mathrm{VaR} \geq \Delta\omega)$，如果假设资产未来回报的概率密度函数为 $f(\omega)$，则在一定置信水平c下，资产的最大损失值由下式得出：$c=\int_{\omega}^{\infty} f(\omega)d\omega$，这是计算VaR值最基本的方法。VaR计算的基本方法主要有参数分析法、历史模拟法和蒙特卡罗模拟方法。保险资金投资具有非正态性、时变的波动性和相关性以及投资持有期较长的特性，在计算各项资产的VaR值时，采用历史模拟法进行计算。该方法先将投资资产样本数据中的月收益率按照由大到小进行排序，然后用设定的分位数与样本总数相乘并取整，该整数所对应的收益率就是单个资产的VaR值。

陈辉和陈建成在《我国保险投资组合的模拟和金融风险测量研究》中指出保险投资组合运用H-VaR计算VaR是一种比较好的近似方法。H-VaR是高斯Copula-VaR和学生t Copula-VaR的一种比较合理的且具有保守性的近似方法。Copula函数的选择(高斯Copula和学生t Copula)对于风险测量结果影响不大，投资组合权重的变化对于总风险测量结果具有更大的影响。H—VaR近似方法的计算表达式为：

$$H-VaR_p(\alpha)=-\sqrt{(w^Tq)R(w^Tq)^T}+r_p$$

式中，$r=(r_1,\cdots r_i)$ 为单个资产收益率组成的收益向量，$w=(w_{1,}\cdots,w_i)$ 为各资产投资比例组成的权重向量，$r_p=rw^T$ 为投资组合的总体收益率，$q=(VaR_1(\alpha),\cdots VaR_i(\alpha))$ 是由各资产在险价值组成的行向量，R为各资产种类之间的相关系数组成的相关系数矩阵。

（三）保险资金参与保障房建设的资产结构优化模型构想

1.理论模型

$$\begin{cases} \max R_p=\sum_{i=0}^{n}\omega_i r_i \\ \min VaR_p=\sqrt{VCV^T} \\ s.t\begin{cases} 0\leq\omega_i\leq q_i \\ \sum_{i=0}^{n}\omega_i=1 \end{cases} \end{cases}$$

$R_p$：保险资金投资组合总体收益率

$\omega_i$：保险资金投资于第i种资产的比例

$r_i$：第i种资产的收益率

$VaR_p$：保险资金投资组合的在险价值

$V$：单个资产投资比例 $\omega_i$ 与其VaR值乘积组成的行向量，

C：各资产之间的相关系数组成的 $n\times n$ 矩阵

$q_i$：第i种资产的投资法规政策限制比例

同时根据我国保险业各资产限定比例，明确各资产可投资额上限，作为模型的约束条件带入. 本模型相对于马克维茨投资组合模型的修改主要有三点：(1)用投资组合的VaR值代替组合收益的方差作为风险度量指标；(2)不允许卖空，即各投资比例均为非负，这是由我国资本市场的规定决定的。(3)各投资资产的分配比例有最高限制。

**表 3　2010 年保险资金投资渠道、范围和比例规定的变化**

| 投资渠道 | 原规定 | 新规定 |
|---|---|---|
| 活期存款、政府债券、央行票据、政策性银 | 政府债、央行票据和政策性银行债券和次级债券合计不低于总资产 5% | 此类资产的账面余额合计不低于总资产的 5% |
| 权益投资 | 股票和股票基金投资合计不超过总资产的 20%，分别不超过总资产的 10% | 股票和股票型基金的账面余额合计不超过 |
| 不动产投资 | 无规定 | 不动产投资的账面余额不高于总资产的 10%， |
| 未上市股权 | 无规定 | 未上市股权投资的账面余额不高于总资产的 |

| | | |
|---|---|---|
| 无担保债和非金融企业债务融资工具 | 投资的账面余额不高于总资产的 15% | 投资的账面余额不高于总资产的 20% |
| 基础设施债权投资计划 | 寿险公司投资的账面余额不高于总资产的 6%，财险公司投资的账面余额不高于总资产的 4% | 投资的账面余额不高于总资产的 10% |
| 控股投资 | 未明确规定 | 累计投资成本不得超过其净资产 |
| 创业板 | 未进入投资范围 | 尚未出台细则 |

### C 模型数据来源。

无风险收益率可选用活期存款基准利率为参考，风险资产可选用中证指数代表保险投资中各类资产，如以沪深300指数代表股票投资，以中证基金指数代表基金投资，以中证国债指数代表政府债券投资，以中证金融债指数代表金融债投资，以中证企业债指数代表企业债投资。鉴于目前财政部相继下发《2012年地方政府自行发债试点办法》和《财政部代理发行2012年地方政府债券发行兑付办法》，财政部明确提出，2012年增加的地方政府债券收入，要优先用于保障性安居工程。我国目前浙江、广东、深圳、上海四地区已发地方政府债券。因此筹集到的资金将有很大比重用于投资保障房建设，例如上海将地方政府债券募集到资金的1/3用于筹建保障房。保障房收益率可以借鉴以上地区所发地方债券的收益率。鉴于以上省市2011年11月才发行地方债，因此数据可用数据有限，因此本文提出模型构想以及可用数据来源，但实证部分暂未进行，这也是本文的不足之处。该优化模型的求解可采用matlab优化工具箱的非线性规划求解函数，就可以求出在不同的投资损失率P下，模型的最优解。

## V.结论

目前我国保险资金运用效率仍然不高，保险资产的运用渠道仍需拓宽，同时保险机构资产负债存在资产与负债期限、结构上的不匹配。而保险资金参与保障房建设则既能拓宽投资渠道、符合保险资金的三性原则、实现资产与负债在期限上的匹配，从而优化保险公司的资产负债管理结构，既有利于保险机构自身经营管理健康发展的同时，也体现了保险资金取之于民用之于民的社会价值，长远来看，对保险业的发展壮大有着深远的社会意义。

## References

[1] Wu Yan, China Non- life Insurance Market Development of Research Report 2010 [M]. China Ecnomic Publishing House,2010.
[2] Hu JinJin. Rate Risk Management of life Insurance Companies in China [M]. Shanghai University of finance and economics Press. 2011.
[3]Wu YuePing. Risk Research about life insurance in China[M]. China Finance Publishing House,2010,10:90 -100.
[4] Globa l Investment Performance Standards, Gu idance Statement on Calcu lationM ethodo logy, 2008.
[5] Swiss Re, Sigma [J].No.5,2001
[6] Xu Xuan. Research about assest liability management by insurance companies[J]. Shanghai Insurance,2011,1.
[7] Tian Jun,Chen Weizhong. Research about insurance capital investment based on assest liability management [J] Shanghai Insurance,2005,10.
[8] Qu Yang . Insurance capital utilization of international comparison and enlightenment [J]. Insurance research,2008,6.
[9]Wang Zhaohui,Wu Ting. Asset and libility mangement of insurance companies[J]. China Insurance,2009,1.
[10] Aldo Balestreri, Jeremy Kent, Ed Morgan. Dynamic asset liability management: a method for optimising investment strategy Stock index spot market and futures market relations 2011,1.
[11] Zeng SuFen. Insurance investment risk measuremnt and performance evaluation[J].JiangXi university of finance and economics,2009,5.
[7] Swiss Re, Sigma [J].No.5,2001
[8] Wu Yan, China Non- life Insurance Market Development of Research Report 2010 [M]. China Ecnomic Publishing House,2010.
[9] Hu JinJin. Rate Risk Management of life Insurance Companies in China [M]. Shanghai University of finance and economics Press. 2011.
[10]Wu YuePing. Risk Research about life insurance in China[M]. China Finance Publishing House,2010,10:90 -100.
[11] Globa l Investment Performance Standards, Gu idance Statement on Calcu lationM ethodo logy, 2008.

# 保险资金参与保障房建设对保险机构资产负债管理的影响

张代军，包薇薇
浙江财经学院，杭州，中国，310018

**摘　要：**本文论证了保险资金参与保障房建设符合保险公司资产负债管理的需要，同时针对保险资金参与保障房建设对保险公司优化投资结构的影响进行了探讨。运用资产负债管理可以使保险资金进行合理的资产配置，在投资品种结构、期限结构、利率结构等方面进行统筹规划。保险资金的三性原则决定了保险资金投资管理讲求资产和负债的匹配，特别是资产与负债在收益、期限上的匹配。保险资金具有规模大、周期长、稳定性高、安全性要求高、收益率要求低的特点。保障房投资具有公共属性，是一种期限长、需求大、见效慢且属于国家政策性项目的投资需求，风险小并且有长期投融资性，保险资金属性决定其较符合保障房投资的选择。目前我国保险资金主要的投资方向主要包括银行存款、证券投资基金、股票、债券，随着保险资金可运用渠道的逐渐拓宽，允许保险公司在限定比例内投资不动产。资金运用渠道的拓宽不仅使投资收益得到提高但同时也带来风险的增加。保障房具有准公共产品的属性，使其相比其他商业属性不动产风险大大降低。保险资金参与保障房建设，不仅可以降低风险实现收益的安全稳定，同时可以优化现有的资产结构。保险资金参与保障房对于资产负债管理的影响主要有：实现资产负债期限的相对匹配，改善由于单一资产占比重过大带来的投资组合带来的系统性风险上升趋势，优化保险资金的投资组合。本文基于VaR模型，马克维茨的均值- 方差模型,鉴于我国部分省市已开展地方债试点，故本文以筹资保障房建设的地方债收益率为主要数据来源，提出了实证分析保险资金参与保障房建设优化保险资金投资组合研究思路的构想。本文的创新之处是将保险资金参与保障房建设融资同保险公司的资产负债管理模式相结合，阐述了保险资金参与保障房建设融资对资产负债管理产生的影响以及对于优化资产结构的积极意义。

**关键词：**保险资金、保障房、资产负债管理

# Risk Research of Insurance Funds Investment in Long Cycles

ZHU Nanjun[1] ZHAI Jianhui[2]

[1]School of Economics, Peking University, Beijing, China, 100871

[2] Hanqing Advanced Institute of Economics and Finance, Renmin University, Beijing, China, 100872

**Abstract:** Investment return is a major source of profits for insurance companies. The investment yields of insurance funds are deeply affected by the macroeconomic fluctuation according to the performance of the recent years. Reviewing the long-wave theory and based on Schumpeter's innovation model, we make an analysis of the historical data of technological innovation and economy growth of UK. We find that they influence and determine each other. Considering the positive effect of innovation boom, we believe that the estimation of the potential growth rate recession is too serious. Drawing on experiences of US and Japan, we think the risk of expected interest rate and the risk of investment channels are most significant for the insurance companies in the long cycles.

**Key words:** Economic Cycle; Insurance Fund Investment; Risk

# I. 引言

保险公司的承保业务和投资业务是影响保险公司利润的两个主要因素。随着保险市场竞争的日趋激烈，拓宽投资渠道、提高投资收益就成为维持保险公司持续经营的关键。通过近年来的保险资金运用表现可以发现，保险资金运用风险极大程度上受到宏观经济波动的影响。不论在宏观经济领域还是在保险领域，“周期”都无疑是过去二三十年来最热门的研究话题之一。

在宏观经济领域和保险领域，对周期研究关注的方面似乎遵循着截然不同的方向。对于前者，宏观经济学家对经济周期的关注主要围绕产出变量的长期增长趋势反复出现的波动，以及各经济变量之间的联动关系，系统地描述、划分和测量经济周期已经成为经济周期实证研究的重要任务。对于保险学者而言，大部分的注意力则集中于对承保周期(Underwriting Cycle)的研究，即“坚挺市场”和“疲软市场”的交替出现。

根据波动持续时间的长短，可以将经济周期分为长周期、中周期和短周期，常见的经济周期长短划分主要包括基钦短周期(Joseph Kitchin,1923)、朱格拉中周期（Juglar，1860）、库兹涅茨中长周期（Simon S. Kuznets，1930）、康德拉季耶夫长周期（N.D. Kondratieff，1939）以及熊彼特长周期(Joseph A．Sehumpeter，1912，1939)。

宏观经济周期对保险业的发展具有重要影响。Taub(1989)最早研究了保险发展与经济增长之间的关系，他认为个体在经济增长过程中受到异质性随机生产力的冲击。在不完全信息的情况下，鼓励投资的收入补贴是有效的并促进经济增长，但是补贴扩大了贫富差距。Arestis 和 Demetriades(1997)、Demetriades 和 Hussein(1996)、Pesaran 等(2000)以及 Ward 和 Zurbruegg(2000)，检验了保险发展与经济增长之间的短期和长期的因果关系，指出不同国家金融业与宏观经济增长之间的相互影响不同，一些国家保险发展促进经济增长，而另一些国家则得到了相反的结论。在国内，林宝清(1996)、孙祁祥和贲奔(1997)、肖文和谢文武(2000)、栾存存(2004)、曹乾和何建敏(2006)、胡宏兵(2007)也分别就该问题进行了研究。在对保险业经营的周期性研究方面，国内外的研究大部分集中在承保周期的研究上。

承保周期的研究主要发生在工业化国家。这些国家的保险市场相对已经比较成熟，因此其周期性的波动主要源于保险业自身经营策略的改变等市场自身的因素。对于新兴市场国家而言，保险市场可能面临相对更为剧烈的波动，周期性波动产生的原因也截然不同，可能主要源于经济增长波动等宏观环境因素，而非取决于市场微观环境的变化。因而，对保险业经营周期的研究仅仅局限在承保周期上，是不足够的。

# II. 我国保险资金运用的现状

截至 2011 年底，保险业总资产达 60138.10 亿元，保险资金运用余额达 37736.67 亿元。2011 年保险行业投资收益率为 3.60%。最近几年，受宏观形势的影响，投资收益率的波动性非常大。2011 年，股债双熊的局面导致概念投资收益率仅为 3.6%，为近三年的最低值。

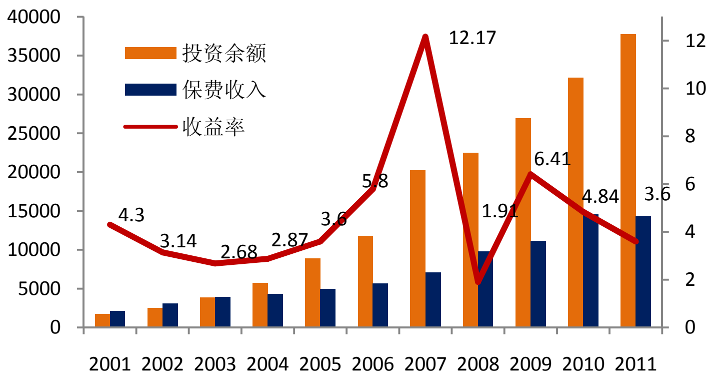



**图 1：保险业资金规模及收益率变化情况[1]**

由于监管限制的存在，保险业资金运用渠道一直有限，长期以来以银行存款和债券为主。从近几年的趋势看，存款比重有所下降，债券比重逐渐上升。2009 年 10 月 1 日前，保险资金尚不能直接投资于不动产市场。2009 年 10 月 1 日开始实施的新《保险法》第 106 条规定，保险公司可以从事不动产投资。不过从保险公司的报表看，业内投资不动产等领域的比重仍然较低，以中国人寿为例，存款、债券占比为 80%左右，股票基金约为 13%，不动产等其他方式比重不足 5%。[2]

目前的保险资金在运用中主要存在以下几个问题：

保险资金的投资收益率偏低，稳定性差。发达

[1] 数据来源：中国保险监督管理委员会网站，http://www.circ.gov.cn/web/site0/

[2] 数据来源：公司中期报告

国家的资本市场由于发展的比较完善，波动性较小，保险资金可以通过长线投资获得较为稳定的收益。我国保险业发展时间不长，保险公司的主要力量集中在承保业务上，加上我国金融环境不成熟、投资渠道有限，与发达国家相比，我国保险资金收益率一直非常低。

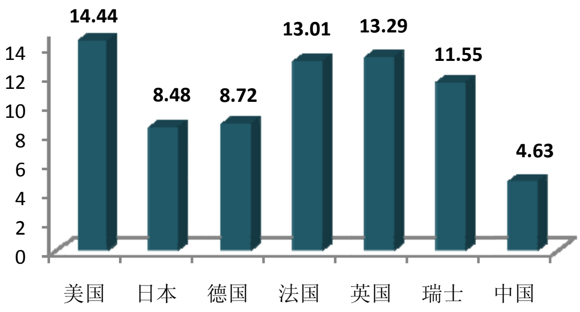



**图 2：各国保险资金投资收益率对比（1975-1992）**[3]

保险资金的投资结构不合理。我国资本市场体系尚不健全，投资产品较少，保险资金的运用渠道较为狭窄。保险资金中有 80%以上投资于利率很低的国债、金融债券和银行定期存款。

保险投资行为短期化，期限匹配问题极为严重。可供保险公司投资的、收益率较高的中长期金融资产规模小、品种过少，直接限制了我国寿险公司进行较好的资产与负债匹配，使我国寿险业面临很高的资产负债匹配风险。

经济周期对保险资金运用的影响主要体现在对资产价格的影响上。在经济周期的上行阶段，全社会的保险需求不断增长，带动保险市场规模的快速扩张，由于我国保险业资产平均年限短，投资行为短期化，可以非常好的利用投资机会，提高投资收益率。在经济周期的下行阶段，隐藏的风险可能暴露，新的风险不断产生。由于利率下降、资本市场表现低迷，保险资金的收益率可能会很低，如 2008 年的情况。[4]

中国的保险业经营仍显粗放，在保险资金运用方面，短期化趋势导致长期规划的缺乏，因而在面对经济周期时，抵御风险的能力较低。尝试着分析长周期、建立基于长周期视角下的保险资金运用的风险管理体系，这是中国保险业在资金运用方面亟待改进的方面。

[3] 转引自周爱玲，我国保险资金运用存在的主要问题和对策[J]，职业时空，2009 年 9 月。其中，除中国以外的六国数据源自 Sigma 杂志 1995 年的调查。中国的收益率数据是笔者通过 2000 年到 2011 年的收益率计算

[4] 吴定富，经济周期背景下的保险业发展与监管[C]，保险、金融与经济周期——北大赛瑟论坛文集 2010，2010 年 5 月

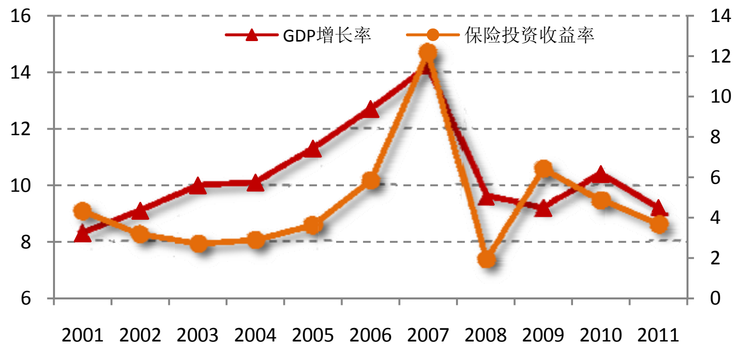



**图 3：GDP 增长率与保险投资收益率走势（2000-2011）**[5]

## III. 保险资金运用的国际经验——日本

### A. 日本保险资金运用监管的变迁

日本在经济起步的 20 世纪 50 年代，下调了股票投资、外国国债的上限，上调了公司债、存款投资的上限。50 年代到 70 年代是日本经济高速发展的时期，在 60 年代末，日本逐步放宽了保险资金运用的限制。例如，1971 年，日本就已经允许保险公司进行海外投资，并且规定海外证券占总资产的比重上限为 10%。日本监管机构在 1986 年将保险公司持有海外证券占总资产比重的限制提高到 30%。1996 年修订的《日本保险业法》增加新的规定，保险公司在经过保险监管机构的批准后可以突破上述限制比例。[6]目前，日本对保险资金运用的比重上限的详细规定为：购买股票占 30%；购买不动产占 20%；购买同一公司的公司债券和股票以及以此为抵押的放款为 20%；对同一人的放款为 10%；对同一银行的存款或对同一信托公司的资金占 20%；以同一物体为抵押的放款占 5%。但因实际需要，经过批准的不在此限。日本的保险资金运用监管有一个明显的从严到宽的过程。

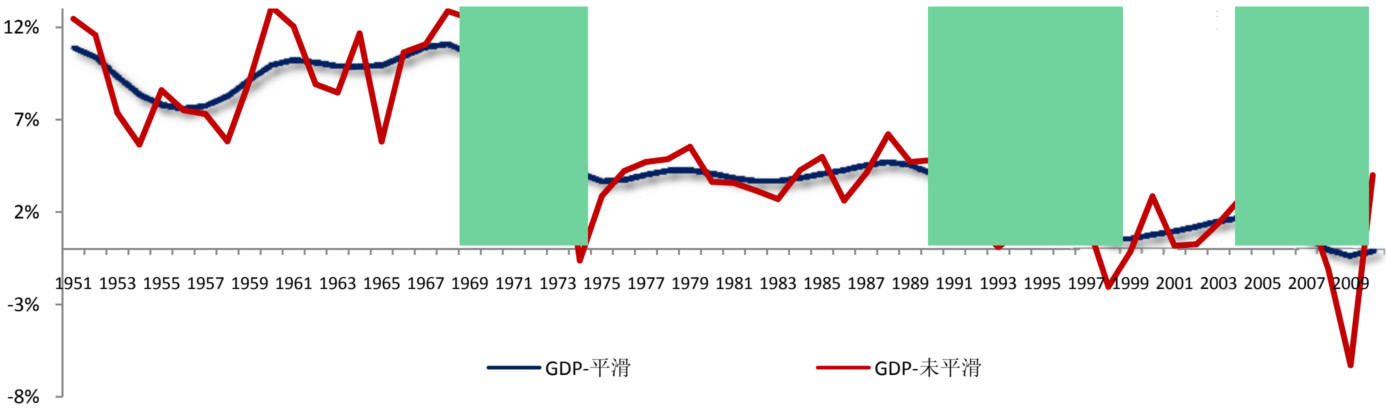
20 世纪 90 年代，日本实施了一系列的金融改革，通过立法确立了“经营信息公开”原则，还通过《经营信息公开标准》和每年需修改补充的《经营信息公开纲要模式》量化了保险公司的信息公开时间、公开方式和公开内容。[7]

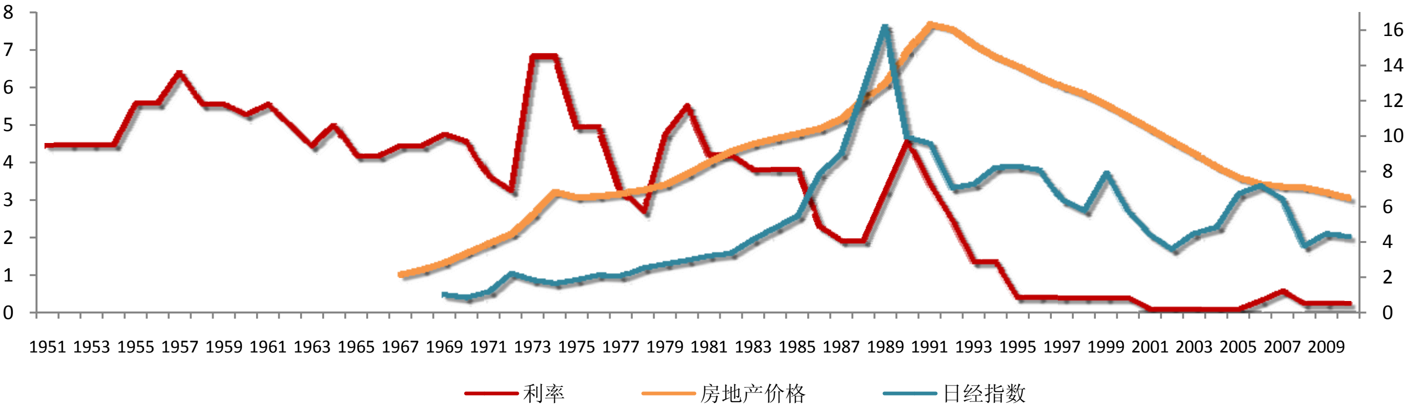
[5] 数据来源：国家统计局及保监会网站

[6] 倪琦珉，保险资金运用国际比较及中国的选择[D]，博士论文，浙江大学，2003 年

[7] 孟昭亿，保险资金运用的国际比较[M]，北京：中国金融出版社，2005 年，170-172 页

## B. 长周期视角下的日本保险资金运用




20 世纪 70 年代之前，日本经济保持了高速的增长，这导致了日本的利率水平一路走高。70 年代初的石油危机之后，GDP 急速下滑，与此对应，利率在 1973 年左右出现了较大的降低。房地产价格和股票市场的持续上升的态势也一度中断。在 70 年代后期，日本经济增速逐渐恢复。1989 年左右开始的第二次经济增速下滑的影响更加严重。房地产泡沫破灭、地产价格下滑，日经 225 指数大幅下挫，利率水平连续降低，这些集中出现在 90 年代初。日本经济结束了高速增长的阶段，开始了持续的低迷。亚洲金融危机之后，日本的经济有所起色，但增长依然乏力。2008 年全球金融危机的打击令日本的经济雪上加霜。2009 年甚至出现了 6%以上的负增长。

在 20 世纪八十年代之前，贷款在日本寿险资金运用中占的比重最大，占 60%以上。股票次之，债券等占比较少。这一时期，房地产投资所占比重也较高。这是因为该阶段是日本经济高速发展的时期，经济发展对资金有非常强烈的需求。随着经济

以为保险投资带来稳定丰厚的回报。证券市场受益于经济繁荣，也实现了高速发展与高投资回报率，日本保险公司对股票等的投资比重也较之前有了较大提高。

为了获得高投资收益率，加上对资本市场发展的乐观预期，日本保险公司积极提高股票、房地产等的投资比重，在 1990 年，股票投资达到了 27.33%，房地产投资虽有大幅下降，仍然有 6.01%的比例。考虑到抵押贷款等与房地产相关的投资，该数值会更高。90 年代之后，房地产价格剧烈下跌，日经指数下滑，利率下调，这三种巨大的消极冲击几乎在同一年出现并在几年内得以延续。日本保险资金的投资收益率降到了非常低的水平。

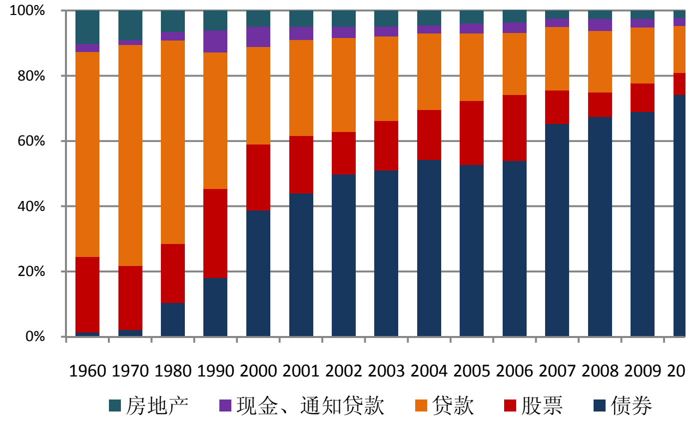



**图 5：日本寿险公司投资结构变动[8]**

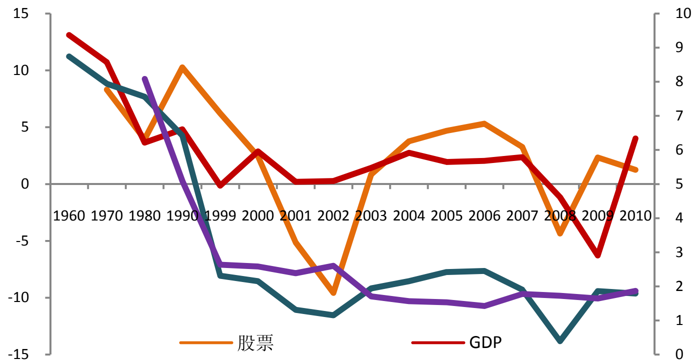



**图 6：日本保险资金投资收益率及 GDP 增长率[9]**

20 世纪 80 年代到 20 世纪 90 年代末，这一期间的日本资金运用的经验教训对我国具有很强的借鉴意义。保险市场的启动与快速发展通常始于一国经济高速增长的时期，这一时期由于经济繁荣、融资需求强劲，利率水平都会较高，例如 20 世纪 50-70 年代的日本。寿险合同一般都是一种长期契约，经济从高速增长到增速减缓进而陷入低迷，资本市场及利率水平都会发生相应的变化，这对签订长期合同的保险公司而言存在着巨大的风险。

日本保险业的预定利率在 1946 年只有 3%，低于同期利率水平。随着经济的高速增长，利率水平提高，预定利率也逐渐提高，直至 70 年代末，预定利率仍然低于同期利率水平。在经历了长期的高速经济增长之后，日本保险业对未来经济增长的预期过于乐观，如表 1 所示，10 年以下保单的预定利率竟然达到了 6.3%。随着 80 年代末房地产泡沫的破灭，日本经济增速开始下滑，1996 年签订的保单的预定利率只有 2.8%，而同期利率水平低至 0.5%。1985 年的对应水平是 6.3%和 5.0%。缺乏前瞻性、对经济增长估计得过于乐观，这是日本承担如此重大的预定利率风险的原因。在经济繁荣时期，保险公司会因为市场的繁荣忽略了对风险的控制，在高风险的投资渠道配置了过多的资金。经济衰退通常会导致整个资本市场的低迷。激进的投资组合在经济繁荣期会取得高收益，但在经济低迷时同样会带来巨大的风险。长期的低利率导致日本保险公司出现了巨额的利差损，经济增长未见好转、低利率持续，导致利差损逐渐累积，最终导致了一批保险公司在 20 世纪 90 年代末的破产。

# IV. 保险资金运用的国际经验——美国

## A. 美国保险业的监管变迁：

美国早期对保险资金运用的监管并不严格，保险企业的投资自由而混乱。1906 年通过的 Armstrong 法案，对保险业经营、投资、信息披露等方面做出了严格的监管限制。[10]1929-1933 年大危机之后美国保险监管更加严格，Glass-Steagall Banking 法案确认了分业经营的理念。随着经济的发展，资本市场的逐步完善，对于不动产和股票市场的投资限制在 20 世纪 40 年代和 50 年代先后得到了放松。

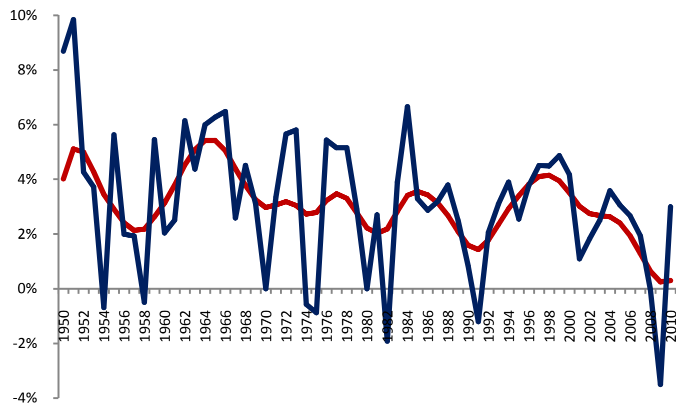



**图 7：美国 GDP 增长率及趋势（1950-2010）[11]**

50 年代中后期开始，美国的经济开始了快速

[8] 数据来源：日本寿险协会(LIAJ)
[9] 数据来源：日本寿险协会（LIAJ）和世界银行

[10] 杨明生，重温阿姆斯特朗调查对我国保险业发展和监管的启示——中美保险业跨世纪比较，保险研究， 2010 年第 12 期
[11] 数据来源：世界银行 WDI 数据库，使用的是 2000 年美元，平滑方法为 HP 滤波，λ=25

发展，1969 年，美国保险监督官协会通过了《保险控股公司体系监管法》，保险公司可以通过设立子公司和持股公司进入共同基金、信托、证券等业务。基于 70 年代经济危机的环境，保险公司在原有的投资监管规定下与其他金融机构的竞争中处于劣势。80 年代，针对保险投资监管的自由化改革再次深化，通过修改保险法，保险公司的投资范围和对子公司的投资限制得到了放宽。[12]到了 20 世纪 80 年代末和 90 年代初，美国经济陷入低迷，资本市场的动荡使得保险公司破产案例的不断增加，NAIC 在 1991 年颁布了《投资模式法》，该法规对保险公司的投资提出了新的要求。[13]90 年代中后期，NAIC 实施了风险资本标准(Risk-Based Capital Standards，RBC)，偿付能力监管开始逐步取代单纯的严格监管。

进入 21 世纪后，次贷危机的爆发迫使美国政府对监管问题进行反思并颁布了新的政策。2009 年 6 月 17 日，奥巴马政府公布了的金融改革白皮书《金管改革：新基础》。白皮书认为，单一的市场监管或者偿付能力监管已经不再适应保险市场快速发展的需要，多种因素打包组合的监管方式将成为美国保险监管的主要内容。

从最初保险业成立时监管的混乱，到后期对投资比例、投资渠道的严格限制，进而在经济好转时放松监管，随后在经济低迷时改变监管目标，在遭遇经济危机之后再次加强监管，美国的保险业监管及资金运用的监管的变迁深刻地受到经济形势的影响。

目前，美国各州对保险公司资金运用的监管规定不尽相同。一般而言，美国的保险资金可以投资于债券、不动产、股票、保单贷款、抵押贷款、现金存款等渠道。在债券方面，主要是政府债和公司债。

## B. 长周期视角下的美国保险资金运用

如图 8 所示，美国保险资金的投资收益率虽然受到经济增长的影响，但是其波动性远小于 GDP 增长率的波动。美国的保险投资收益率具有非常强的稳定性。另外，保险投资收益率在 1970 年以后明显高于 GDP 增长率，这与中国目前的情况是很不一样的。

[12] 孟昭亿，保险资金运用的国际比较[M]，北京：中国金融出版社，2005 年，141-145 页

[13] 倪琦珉，保险资金运用国际比较及中国的选择[D]，博士论文，浙江大学，2003 年

如图 9 所示，美国的保险投资中比重最大的是债券投资，该部分占比一直较为稳定。股票投资占比在 20 世纪 70 年代之后在稳定提高，而抵押贷款的占比则在逐步降低。保单贷款、房地产的规模不大，90 年代之后较为稳定。

观察美国的寿险投资比重及经济增速变化，可以发现，当经济增速放缓后，资金需求降低，利率也会结束之前持续上行的态势。保险公司将投资的重点放在了具有较高收益的长期性公司债券上。当经济在高速发展时期，融资需求的扩张会催生高利率的宏观环境，股票市场、房地产市场会相应繁荣，保险公司会适当扩大对股票和房地产的投资比重。

以大都会为例。大都会的投资收益率一直较为稳定，且显著优于中国保险公司的投资收益率。具体看来，固定期限证券、抵押贷款、保单贷款的收益率较为稳定，而房地产、股权投资、现金及其他短期投资的波动性非常大。

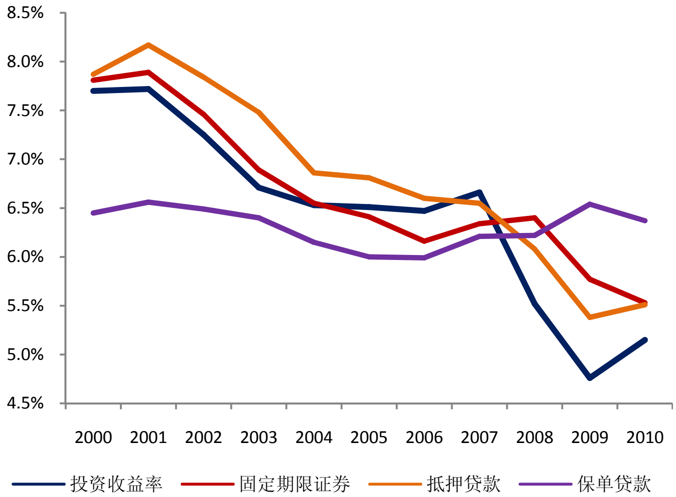



**图 10：美国大都会（metlife）投资收益率表现：贷款及固定收益类[14]**

[14] 数据来源：公司年报

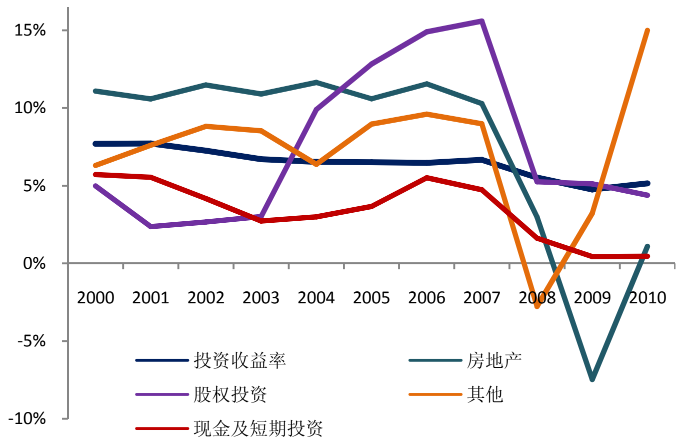



**图 11：美国大都会（metlife）投资收益率表现：其他[15]**

2009 年，房地产投资收益率一度为负的情况下，其他投资（主要是金融衍生工具等）的收益率出现了大幅上升。这对冲掉了房地产投资的部分损失。表现在总收益率上，2007 年之前的投资收益率平均值为 6.94%，2009 年的情况最为糟糕，也有 4.76%的收益率，高于同期的 GDP 增长率，与平均值相比，下降幅度有限。

固定收益类的投资收益率非常高，是因为美国的保险公司持有较高的公司债比重，在普通账户中，该比重高达 46.60%。长期债券的比重高达 72.40%。[16]收益率高的长期资产比重大，波动性强的股票、房地产和收益率低的现金及现金等价物占比少，这使得美国的保险资金运用可以获得较高的收益率，同时受短期经济波动的影响较小。

在完善的资本市场中，坚持以长期且稳定的固定收益类资产为主要配置对象，适当调整股票、房地产及衍生工具等的投资比重，在资产配置时，注意利用衍生工具对冲风险，这是美国保险公司能够在长期中稳定地取得较高的保险资金投资收益率的原因。

# V. 中国经济的长周期分析

## A. 熊彼特创新理论简介

对于经济长周期的分析，我们认为，应该关注的是供给层面，对于生产函数产生重大影响的要素，如劳动力、资本存量及技术进步。要实现经济的长期增长，技术进步无疑是最为关键的生产要素。我们在该部分引入熊彼特对于技术进步及创新的论述，作为我们分析长周期经济走势的理论支撑。

熊彼特（1939）认为，市场经济本身具有繁荣和萧条的周期性特征，经济学的中心问题不是均衡，而是结构性变化。经济的变动是一个不断趋向均衡，但是永远无法达到理想均衡的过程。危机是使得经济适应新环境的过程。[17]

按照熊彼特的定义，“创新”是指“新的生产函数的建立”，即“企业家对生产要素的新的组合”。企业家扮演着动态经济中的英雄角色，他们是利润的来源。只要企业家不是均匀、连续地出现，它对均衡状态的干扰就是一种跳跃式的干扰。缺乏创新是萧条的主要原因。但是周期的波谷不必然导致创新：只有在周期的波谷，当利用殆尽的技术所带来的利润低得令人不堪忍受时，资本才能克服对承担风险的厌恶，并依赖于可能会获得的资本创新。[18]

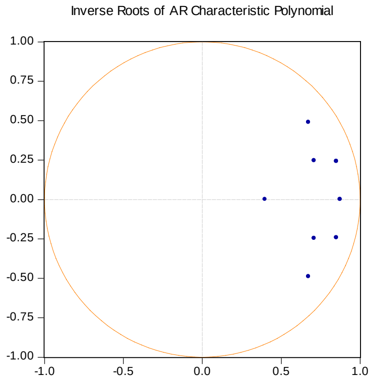
## B. 技术创新与经济发展关系的实证分析

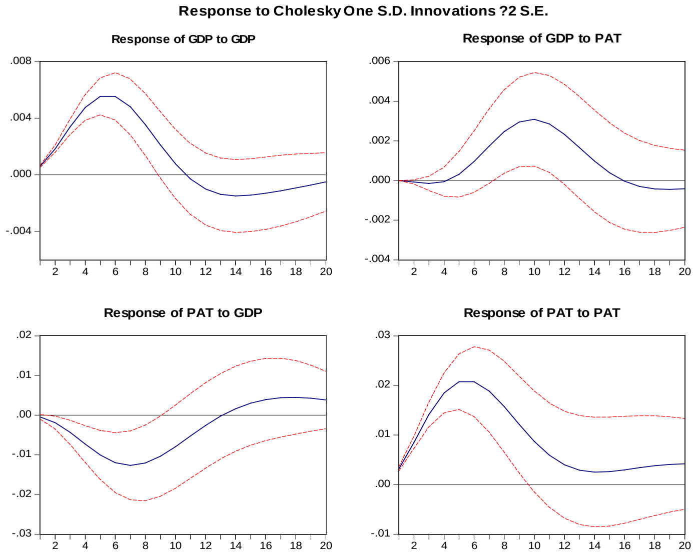
使用 GDP 增长率代表经济增长情况，使用授权专利数量增长率代表技术创新活动的活跃度。使用历史数据记录较好的英国经济增长和专利授权数量的年度数据，并进行一定处理，可以得到图 12。

经济进入低谷之后刺激了技术创新，技术创新为新一轮的经济增长奠定了基础。宏观经济就是在这样一种相互作用中循环。从图 12 中我们可以直观地看到技术创新与经济增长之间的关系。使用 VAR 模型进行简单地统计分析。

对模型进行回归，计算结果得表 2。检验 VAR 模型的稳定性，可以发现，解全部落在单位圆内，VAR 模型是稳定的。

15 数据来源：公司年报
16 数据来源：ACLI (American Council of Life Insurers) Life Insurers Fact Book 2011
17 熊彼特，经济周期循环论[M]，叶华编译，北京：中国长安出版社，2009，7-10 页
18 门斯（G. Mensch ,1975），技术的僵局，转引自杜因（Van Duijn），经济长波与创新[M]，刘宇英等译，上海：上海译文出版社，1993，121 页




对模型估计的结果进行 Granger 因果检验，在5%的显著性水平上，认为 GDP 增长率与授权专利数量增长率互为 Granger 原因。

**VAR Granger Causality/Block Exogeneity Wald Tests**

**Sample: 1884-2010**

| | | | |
|---|---|---|---|
| Dependent variable: GDP | | | |
| Excluded | Chi-sq | df | Prob. |
| PAT | 13.23215 | 4 | 0.0102 |
| All | 13.23215 | 4 | 0.0102 |
| Dependent variable: PAT | | | |
| Excluded | Chi-sq | df | Prob. |
| GDP | 9.558895 | 4 | 0.0486 |
| All | 9.558895 | 4 | 0.0486 |

进行脉冲反应分析，可以发现：

第 0 期 GDP 增长的正冲击对经济增长本身有积极影响，且会持续 6 期左右才开始下降。对于技术创新活动，该影响则是消极的。

如果创新活动在第 0 期发生了一个正向冲击，该冲击在最初的 4 年内对经济增长并没有显著的拉动作用，这种影响甚至可能是负的。从第 5 年开始，创新对经济的拉动作用会显现出来，并在第 10 年左右达到峰值。

如果第 0 期创新突然有了较大的增长，这种冲击对于创新活动本身而言，是有积极意义的，且会在 5-6 年内持续增加。

我们可以将上述分析总结如下：

当经济处于萧条阶段时，收益率的普遍下降使创新的机会成本降低，于是资本乐于投资于技术创新活动，因而容易出现创新活动的相对活跃期。起初小规模的创新活动会减少创新的障碍并带来后续的更大规模的创新热情，创新可能在一个较短的时期内集中爆发。

从创新到应用大约需要 5 年，因而，经济会在创新活动达到峰值后的一段时间，出现繁荣期。随着经济繁荣的到来，市场上出现了过度投资行为，导致银行信用过度膨胀、产能过剩。技术创新带来的利润空间逐渐缩小。繁荣期各项投资活动的投资收益率提高，创新的机会成本提高。饥饿动机的削弱也会降低创新的动力，改变了人们对待工作和风险的态度。[19]创新活动会逐渐陷入低潮，企业无法实现预期利润，从而会减少投资，经济步入衰退阶段，直至下一次的创新热情的到来，经济才会重新进入繁荣期。

## C. 中国目前的创新周期及经济周期分析

[19] 杜因，经济长波与创新[M]，刘宇英等译，上海：上海译文出版社，1993 年，237 页

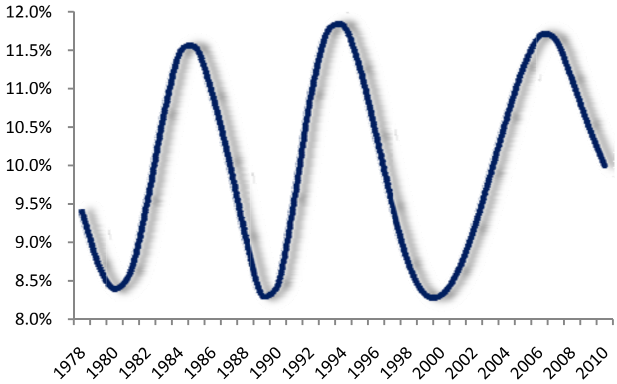



**图 13：HP 滤波分解下的中国潜在增长率（1978-2010）[20]**

1978 年以来，中国经济维持了平均接近 10% 左右的高速增长。然而，对投资的过度依赖使得中国经济增长质量饱受质疑。Krugman（1994）明确提出了“东亚无奇迹”的论断，认为东南亚许多经济体的增长是靠资源的投入带动的，这种粗放型外延扩张的增长过程不可能持续。其根据主要在于这些国家的全要素生产率（Total Factor Productivity）很低，甚至为负。[21][22]如果 TFP 不增长，则资源再多也无法促进经济的持续增长。

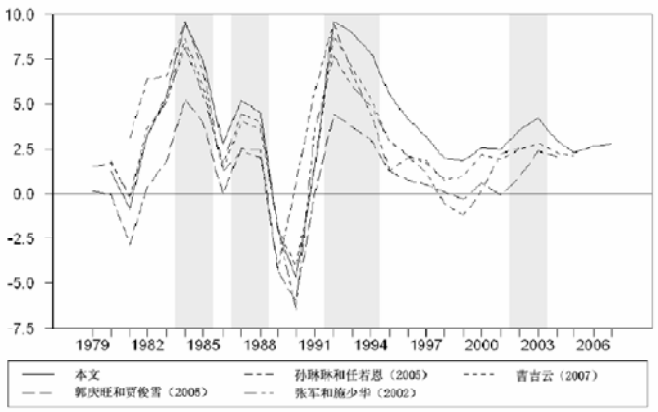



**图 14：中国 TFP 变化的不同估计（1978-2007）[23]**

从大多数学者对中国 TFP 的估计来看，中国的 TFP 在 1992 年之后就一直处于下滑状态。2000 年之后潜在增长率的上升更多的是因为加入 WTO 之后，对外贸易的增长使得中国的劳动力优势得到了发挥。2007 年以来，次贷危机引发了全球金融危机，至今全球经济仍未能彻底摆脱其阴霾。有研究基于中国经济增长中较低的 TFP 贡献率、潜在增长率处于下行区间、出口压力增加等原因，对中国经济的未来充满悲观看法。[24]

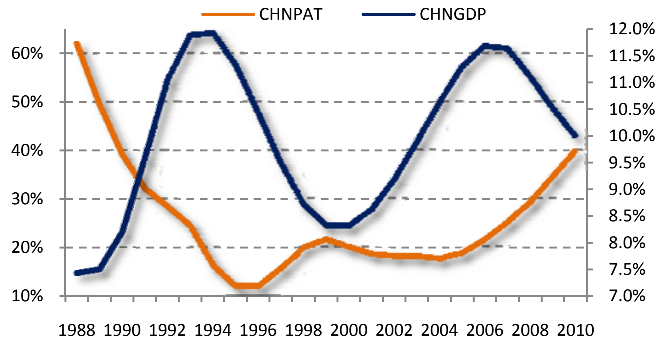



**图 15：中国潜在生产率与授权专利数量变动趋势图（1988-2010）[25]**

在长期中探寻经济增长的动力，必然要以技术进步和创新为依据。中国的创新活动在 20 世纪 90 年代确实处于低潮期，这与 TFP 贡献率低的结论相印证。从 2006 年开始，创新活动的热情才重新高涨。考虑到大约 5 年左右的滞后期，创新活动持续增长的积极作用会在 2011 年之后逐渐显现出来。笔者认为，对中国未来经济发展趋势的判断，不止要看到当前正处于潜在增长率下滑的区间，更应该看到目前正处在创新发明活动迅速增加的区间。后者正在为未来的增长积蓄力量。短期内可能会有经济增速的下滑，但这种下滑幅度可能并没有预期的那么大。

[20] Lambda=25，使用的是 OECD 计算方法

[21] Paul Krugman , The Myth of Asia’s Miracle [J], Foreign Affairs, Nov/Dec 1994, Vol.73, Iss. 6; pg. 62. Krugman 研究使用了刘遵义和 Alwyn Young 的研究成果。见刘遵义，东亚经济增长的源泉与展望[J]，数量经济技术经济研究，1997 年第 10 期； Alwyn Young, The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience[J], The Quarterly Journal of Economics, MIT Press, August ,1995, vol. 110(3), pages 641-680.

[22] 关于 TFP 的讨论可参见于永达，吕冰洋，中国生产率争论：方法的局限性和结论的不确定性[J]，清华大学学报，2010 年第 3 期

[23] 李宾，曾志雄，中国全要素生产率变动的再测算：1978－2007[J]，数量经济技术经济研究，2009 年第 3 期，图中的本文即指此文

[24] 这方面的观点多出现在业界，如高善文，新周期渐行渐明 流动性阶段缓解，安信证券，2011 年 4 月 20 日；彭文生，2012 是起点还是终点：中国经济周期的逻辑，中金公司，2011 年 11 月 15 日

[25] 数据来源：世界银行 WDI 数据库

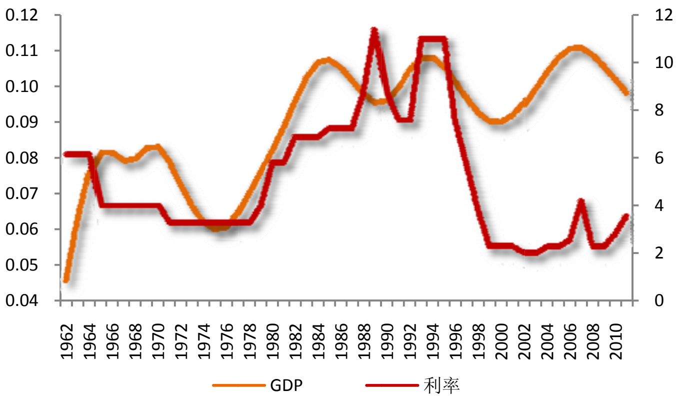



图 16：中国的潜在 GDP 增长率与一年期存款利率变动[26]

从历史数据来看，中国的利率水平变动与GDP 潜在增长率密切相关，当经济繁荣时，投资扩张导致利率水平会相应得到提高。在经济增长率下滑时，投资下滑导致对资金需求降低。基于对未来 5-10 年中国经济增长情况的判断，我们认为利率水平在短期内下行、但长期中维持在较高水平的可能性很大。值得注意的是，利率市场化过程在这一阶段会加快，这对利率波动性以及债券市场的影响将会扩大。

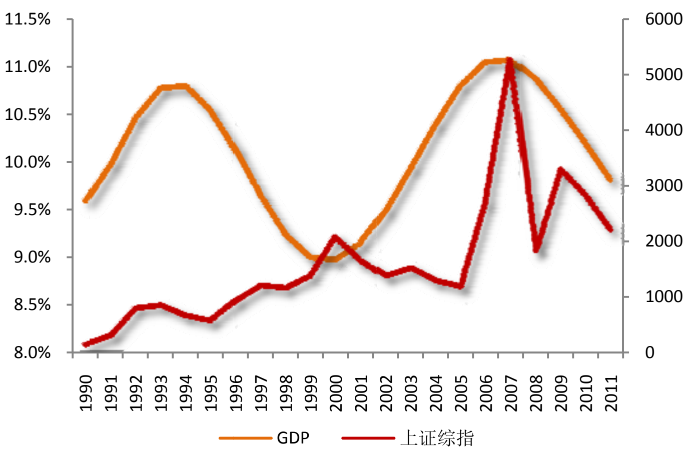



图 17：GDP 增长率与上证指数变动情况[27]

证券市场的波动虽然与宏观经济走势有联系，但是这种联系不是很明显。这是因为中国的资本市场发展历史较短，目前仍然存在着诸多问题，比如，上市公司的质量不高，操纵市场行为比较严重，政策性风险依然较大等。中国的资本市场的问题在于，在经济高速增长的时期，并没有给投资者带来比经济增速更高的收益。随着转型期的来临，资本市场的波动性仍然会维持在较高的水平。

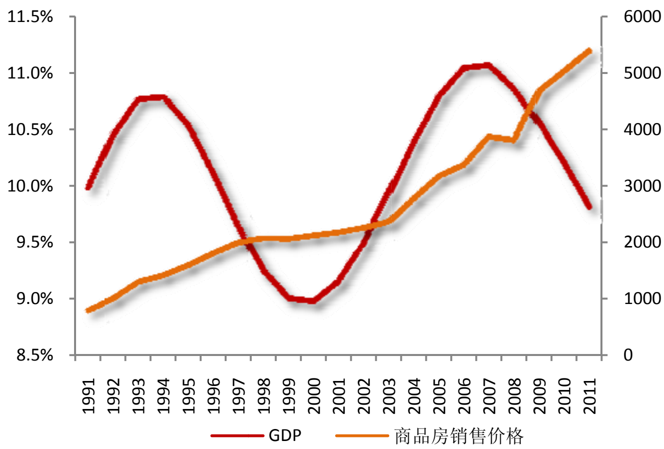



图 18：GDP 增长率与商品房销售价格变动情况[28]

2008 年金融危机暂时改变了房地产价格上升的趋势，2009 年之后房价恢复了上涨。2011 年以来严厉的房地产调控措施使得房价上涨趋势得到了缓和，但持续性值得观察。中国的房地产市场起步晚，虽然近年来发展较快，但它严重地受到宏观政策的影响，政策风险非常大。从日本、美国的经验看，在最近几次潜在增长率下滑的过程中，都伴随着房地产价格的下滑。预计房地产价格增速在短期内会随着经济潜在增长率的下滑而放缓，但长期中仍然会有较高的增长率。

# VI. 美、日经验对中国的启示

## A. 美日保险资金运用模式的总结

目前，日本的保险资金运用的投资理念不如之前积极，更注重投资的安全性和流动性原则，债券在投资结构中占了最大的比重。美国保险资金运用的效果是最理想的：投资收益率的稳定性高，收益率也高。成熟的资本市场对此发挥了关键作用。保险资金可以大量投资于收益率相对较高的公司债，而且资产负债的期限匹配良好，即便在低利率环境下，这种投资的安全性、收益性仍然可以得到保证。

[26] 数据来源：GDP 数据位使用世界银行数据进行平滑后的结果，利率数据来源于 WIND
[27] 数据来源：同上

[28] 数据来源：GDP 数据位使用世界银行数据进行平滑后的结果，商品房销售价格数据来自国家统计局

**表 3：20 世纪 90 年代中期以来美日两国保险资金运用模式的总结**

| | 美国 | 日本 |
|---|---|---|
| 投资理念 | 比较积极，完善的投资管理体系，兼顾保险投资的收益性、安全性、流动性原则 | 比较传统，投资策略相对不积极，更注重安全性、流动性原则 |
| 投资监管 | 严格 | 较为严格 |
| 投资结构 | 以债券为主，其次为股票 | 以债券为主，其次为贷款 |
| 收益性 | 高 | 低 |
| 稳定性 | 高 | 较高 |

从中国的实际情况看，我们目前正处在一个短期中潜在增长率下滑的阶段，虽然从长期看，我们仍然对中国的经济增长偏乐观，但短期的下滑对利率及投资收益率的不利影响正在显现。同时，中国经济也处在深刻的转型与变革之中，市场经济制度仍需要完善，资本市场仍不完善，美国和日本的经验可以给我们有益的启示。

## B. 经济增速放缓背景下的预定利率风险

中国正在推进利率市场化改革，这可能加大保险公司面临的利率风险。宏观政策环境方面的低利率、低汇率以及低能源、低原材料价格政策压低了工业经济的资本形成门槛，企业可以产生大量的利润，这是中国传统的经济体制的重要组成部分。渐进式改革让我们继承了部分传统体制，国有企业和非国有企业在获取信贷等资源时存在区别。在低利率政策环境下，国有经济与非国有经济相比，在争夺资金方面有较强的竞争力。[29]1993 年，中国政府提出，我国利率改革的长远目标是建立以市场资金供求为基础，以中央银行基准利率为调控核心，由市场资金供求决定各种利率水平的市场利率体系的市场利率管理体系。近期，政府关于利率市场化的表述是"深化金融体制改革。构建逆周期的金融宏观审慎管理制度框架。稳步推进利率市场化改革"。[30]央行也连续表态，将有规划、有步骤、坚定不移地推进利率市场化改革。[31]利率机制改革期间无疑会加大保险产品的预定利率风险。

从日本的经验看，经济繁荣时，因为市场竞争的需要，保险公司的预定利率较高，由于保险合同的长期性，一旦经济陷入低迷，这种长期的高利率产品对保险公司的打击是沉重的。在中国也发生过类似的情况。1996 年以来，央行连续降息，中国的利率水平巨幅下调。1997 年以前我国寿险公司的预定利率为 7%-9%。1997 年利率下调时，保险公司的资金运用仍然被限制在银行存款、购买国债、购买金融债等有限渠道，利率下调导致保险公司的投资收益同时下滑，这对保险公司的经营是极大的风险。

在宏观经济增长速度短期内下滑的趋势下，利率水平难以维持在高水平。虽然目前保险公司的预定利率仍然低于 1 年期定期存款利率，但竞争力的缺乏使得适当提高预定利率的呼声渐高。2007 年初，保监会批准中国人寿在河北、江苏和河南省试行的新简易人身两全保险的预定利率为 3.3%，突破了 2.5%的上限规定。2010 年，保监会又下发了《关于人身保险预定利率有关事项的通知（征求意见稿）》，考虑由保险公司自行决定传统产品的预定利率。这意味着，关于预定利率的监管规定可能会放松，在目前的竞争态势下，该规定一旦放开，极有可能出现保险公司争相提高预定利率的情况。考虑到目前的宏观经济环境，我们认为应该密切关注预定利率水平及其可能对保险公司经营带来的风险。

## C. 经济转型期的资金运用渠道风险

经济增速的暂时下滑并不意味着保险投资收益率的下滑。美国的保险资金投资收益率长期高于 GDP 增长率，即便进入了经济增速下滑的阶段，保险资金仍然可以取得较高的投资收益率。美国的保险资金运用之所以能够取得比较理想的投资效果，主要是因为美国的资本市场相对比较成熟，可以为保险公司提供多种投资渠道，比如，在债券投资中，保险公司可以投资安全性较好的国债，也可以将较大比重的资金投向收益相对较高且期限较长的公司债，从而获得较高的收益。虽然房地产投资不稳定，但 REITs 等投资工具的存在可以让美国的保险公司在房地产投资中保持了较好的流动性，配合对冲工具，保险公司可以将这种风险降低。

由于中国资本市场发展时间较短，投资渠道有限，暂时无法提供如此多的投资渠道供保险公司选择。中国市场上目前尚没有期权，REITs 等房地产投资工具也未产生。目前的债券投资仍然集中在国

[29] 吴敬琏，中国增长模式抉择（修订版）[M]，上海：远东出版社，2005 年，114-115 页

[30] 中共十七大五中全会《中共中央关于制定国民经济和社会发展第十二个五年规划的建议》，2010 年 10 月 18 日

[31] 周小川，《关于推进利率市场化改革的若干思考》，http://www.pbc.gov.cn

债、金融债，以中国太平洋保险 2009 年年报的数据为例，企业债仅占 25.8%，其投资期限也较短，不足以匹配长期的保险公司负债。中国目前的企业债券市场结构单一，企业债券产品品种少、规模小、交易不活跃。2007 年以前，中国的债券市场中，国债、金融债、企业债的比例分别占 51%、44%、5%，企业债占债券市场的比例是最低的。公司债发行总额占债券融资总额的比重从 2007 年 0.14%，增长到 2011 年的 1.65%，依然非常低。

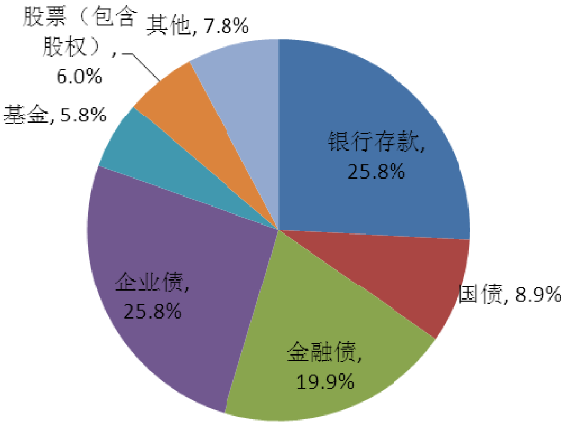



**图 19：太平洋保险 2009 年保险资金运用结构[32]**

困扰中国企业债券市场的最大问题就是多头管理。发行企业债由国家发改委审批、利率由央行管理、企业债上市又由证监会负责。这种分级及多部门审批的架构，导致发行主体申请时间过长、效率低下，加上准入限制过多，制约了中国债券市场发挥其应有的为企业融资的作用。

在期限结构方面，2007 年债券市场发行的公司债的期限结构只有 5 年期，7 年期和 10 年期。2008 年债券市场新发行了 3 年期和 8 年期公司债，2009 年债券市场首次出现 6 年期公司债，2010 年和 2011 年分别推出 15 年和 2 年期公司债。2012 年 2 月债券市场又发行了 4 年期债券。截至到 2012 年 2 月末，债券市场上公司债的期限结构分布相对集中，主要以 5 年期、7 年期和 10 年期为主。10 年以上的长期债券比重仍然偏低。

**表 4：2007-2012 年公司债发行主体评级分布情况**

| 主体评级 | 发行只数 | 占比 | 发行金额 | 占比 | 单只平均发行额 |
|---|---|---|---|---|---|
| AAA | 37 | 20.0% | 1196 | 39.3% | 32.2 |
| AAA- | 1 | 0.5% | 11 | 0.4% | 11.0 |
| AA+ | 31 | 16.8% | 659 | 21.7% | 21.3 |
| AA | 78 | 42.2% | 841 | 27.7% | 10.8 |
| AA- | 30 | 16.2% | 291.1 | 9.6% | 9.7 |
| A+ | 6 | 3.2% | 33 | 1.1% | 5.5 |
| A | 2 | 1.1% | 9.8 | 0.3% | 4.9 |

数据来源：Wind

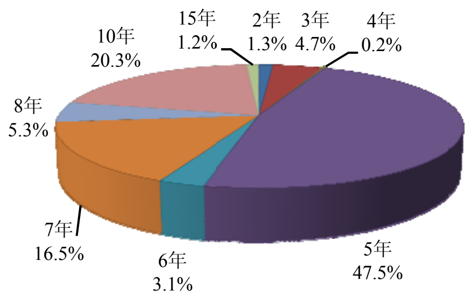



**图 20：2007-2012 年公司债期限结构分布[33]**

2007 年全国金融工作会议作出了“加快发展债券市场”的部署，国务院总理温家宝明确提出要“扩大企业债的发行规模，大力发展公司债”。2007 年 8 月 14 日中国证监会正式颁布了《公司债券发行试点办法》。近年来企业债发行总额有了较大提高。在中国经济转型的大背景下，改善长期以来困扰中国经济发展的融资制度问题已经被提上日程，借鉴美国的经验，公司债市场如果能够在规范、合理的前提下得到健康发展，我们相信，这是提高保险公司的资金运用效率、匹配资产负债结构的一个重要突破点，对中国保险业发展的意义大的。

[32] 数据来源：公司年报

[33] 数据来源：Wind

# VII. 参考文献

[1]. Simon S. Kuznets, Secular movements in production and prices[M]，Boston: Houghton Mifflin, 1930

[2]. N.D. Kondratieff, The Long Waves in Economic Life[J], The Review of Economic Statistics, Vol.17, Issue6(Nov.,1935)

[3]. Dinopolous, E., and F. Sener, New Directions in Schumpeterian Growth Theory[A], in Hanusch,H.,and A.Pyka, Elgar Companion to Neo-Schumpeterian Economics[M]. Edward Elgar: Cheltenham,2007.

[4]. Schumpeter, Business Cycles:A Theoretical，Historical and Statistical Analysis of the Capital Process[M], New York and London: McGraw-Hill,1939.

[5]. Mack，Ruth，The Flow of Business Funds and Consumer Purchasing Powe[M],New York:Columbia，1941.

[6]. Walter Hoffmann, Growth of Industrial Economics[M], Manchester: Manchester University Press, 1958

[7]. Paul Krugman , The Myth of Asia’s Miracle[J] , Foreign Affairs, Nov/Dec 1994, Vol.73, Iss.6

[8]. Doherty,N. and Kang,H.B.. Interest Rates and Insurance Price Cycles [J]. Journal of Banking and Finance, 1988, 12: 199-214.

[9]. Lamm-Tennan and Weiss, International Insurance Cycles: Rational Expectations/Institutional Intervention [J]. Journal of Risk and Insurance, 1997, 64(3): 415-439.

[10]. Cummins, J.D. and Outreville, J. F..An International Analysis of Underwriting Cycles in Property-Liability Insurance [J]. Journal of Risk and Insurance, 1987, 54: 246-262.

[11]. Venezian, E. C. Ratemaking Methods and Profit Cycles in Property and Liability Insurance [J]. Journal of Risk and Insurance, 1985, 52: 477-500.

[12]. Grace, M. F. and Hotchkiss, J. L. External Impacts on the Property-Liability Insurance Cycle [J]. Journal of Risk and Insurance, 1995, 62(04): 738-75

[13]. Cummins,J.＆P.Danzon. Price Shocks and Capital Flows in Liability Insurance [R]. Working Paper, University of Pennsylvania, 1992.

[14]. Gron & Anne.Capacity Constraints and Cycles in Property-Casualty Insurance Markets [J]. Rand Journal of Economics,1994a(25)：111

[15]. Chen, Underwriting Cycles in Asia[J].Journal of Risk and Insurance,1999（66）：29.

[16]. Haley,J.A Cointegration Analysis of the Relationship between Underwriting Margins and Interest Rate:1930-1989[J].Journal of Risk and Insurance,1993（60）：480-493.

[17]. Baxter, M. and King,R. G. Measuring Business Cycles: Approximate Band-pass Filters for Economic Time Series[J]. Review of Economics and Statistics, November 1999, 81(4), pp 575-593.

[18]. Burns, A. F and Mitchell, W. C.Measuring Business Cycles[M].NBER Books, 1946, New York.

[19]. Hodrick, R. and Prescott, E. C.Post-war U.S. Business Cycles : An Empirical Investigation[J].Journal of Money,Credit and Banking 29, 1997, pp.1-16.

[20]. Schmookler. J. Invention and Economic Growth[M]. Harvard University Press, 1966. 122-123.

[21]. Schumpeter, Business Cycles[M], China Changan Press, 2009, Beijing
熊彼特，经济周期循环论[M]，叶华编译，北京：中国长安出版社，2009 年

[22]. Schumpeter, The Theory of Economic Development [M], The Commercial Press, 1990, Beijing
熊彼特，经济发展理论[M]，北京：商务印书馆，1990 年

[23]. Duijn, Economic Long Wave and Innovation[M], Shanghai Translation Press, 1993, Shanghai
杜因，经济长波与创新[M]，刘宇英等译，上海：上海译文出版社，1993 年

[24]. Wu Jinglian, The Choice of China’s Growth Pattern[M], Shanghai Far East Press, 2005, Shanghai
吴敬琏，中国增长模式抉择（修订版）[M]，上海：远东出版社，2005 年

[25]. Lin Yifu Cai Fang Li Zhou, The China Miracle : Development Strategy and Economic Reform [M], Shanghai People Press,1999, Shanghai
林毅夫，蔡昉，李周，中国的奇迹：发展战略与经济改革[M]，增订版，上海：上海人民出版社，1999 年

[26]. Zhang Bing, The Speciality of China s Economic Long Wave, South China Journal of Economics, Vol.9, 2006
张兵，论中国经济长周期波动的特殊性[J]，南方经济，2006 年第 9 期

[27]. Li Bin Zeng Zhixiong, Recalculating the Changes in China s Total Factor Productivity[J], The Journal of Quantitative & Technical Economics, Vol.3,2009
李宾，曾志雄，中国全要素生产率变动的再测算：1978－2007[ J]，数量经济技术经济研究，2009 年第 3 期

[28]. Yongda Yu Bingyang Lu, Debate on China s Productivity Deficient Methods and the Uncertain Conclusions[J], Journal of Tsinghua University, Vol.3, 2010
于永达，吕冰洋，中国生产率争论：方法的局限性和结论的不确定性[N]，清华大学学报，2010 年第 3 期

[29]. Xu Hongfei, The Brief Analysis of Debenture and Corporation Finance in China[J], Value Engineering, Vol. 6, 2008
徐宏飞，浅析我国的公司债与企业融资[ J]，价值工程，2008 年第 6 期

[30]. Zhang Lin Zhu Yuanli, The Regression Model Analysis of the U/W Cycle in Automobile Insurance, The Theory and Practice of Finance and Economics[J], Vol. 02, 2009
张琳，朱园丽，机动车辆保险承保周期的回归模型分析[J]，财经理论与实践，2009 年 02 期

[31]. Chen Kunting Zhou Yan Gong Liutang, The Business Cycle in China[J], World Economy, Vol.10, 2004
陈昆亭，周炎，龚六堂，中国经济周期波动特征分析：滤波方法的应用[J]，世界经济，2004 年第 10 期

[32]. Sun Qixiang, Zheng Wei, Xiao zhiguang, Insurance Cycle and Business Cycle[J], The Journal of Quantitative & Technical Economics, Vol.03, 2011
孙祁祥，郑伟，肖志光，经济周期与保险周期———中国案例与国际比较[J]，数量经济技术经济研究，2011 年第 3 期

[33]. Meng Zhaoyi, International Comparison on Insurance Fund Investment[M], China Financial Press, 2005, Beijing
孟昭亿，保险资金运用的国际比较[M]，北京：中国金融出版社，2005 年

[34]. Ni Qimin, International Comparison on Exertion of Insurance Capital & China’s Choice[D], Zhejiang University, 2003
倪琦珉，保险资金运用国际比较及中国的选择[D]，博士论文，浙江大学，2003 年

[35]. He Yongsheng, International Comparison of Insurance Supervison and Study on Law of Insurance Supervison in China[D], Dalian Maritime University, 2010
何勇生，保险监管的国际比较与我国保险监管的法律研究[D]，博士论文，大连海事大学，2010 年

[36]. Cui Dongchu, Study on the Insurance Regulatory System in the United States[D], Jilin University, 2010
崔冬初，美国保险监管制度研究[D]，博士论文，吉林大学，2010 年

# 长周期视角下的保险资金运用风险研究

朱南军[1] 翟建辉[2]

[1]经济学院，北京大学，北京，中国，100871

[2]汉青经济与金融高级研究院，中国人民大学，北京，中国，100872

**内容摘要：**投资业务是保险公司利润的重要来源。通过近年来的保险资金运用表现可以发现，保险投资收益率极大程度上受到宏观经济波动的影响。通过考察长波理论，我们基于熊彼特的创新理论分析宏观经济的长周期走势，使用英国的历史 GDP 增长率和专利授予数量增长率，我们发现，GDP 增长率和专利授权数量在长期中存在着相互影响的关系。本文认为，考虑到技术进步的影响，潜在增长率的下滑可能并不像预计的那么严重。借鉴美国和日本的经验，在长周期中，我们认为中国的保险资金投资应该注意预定利率和投资渠道两个方面的重要风险。

**关键词：**经济周期　保险资金投资　风险

**表 1：日本保险业预定利率与市场利率　　　%**

<table>
<tr><td></td><td></td><td>1946</td><td>1952</td><td>1976</td><td>1981</td><td>1985</td><td>1990</td><td>1993</td><td>1994</td><td>1996</td><td>1999</td><td>2001</td><td>2002</td></tr>
<tr><td rowspan="3">保单期限</td><td>10 年以下</td><td rowspan="3">3.0</td><td rowspan="3">4.0</td><td rowspan="2">5.5</td><td>6.0</td><td>6.3</td><td>5.8</td><td rowspan="3">4.8</td><td rowspan="3">3.8</td><td rowspan="3">2.8</td><td rowspan="3">2.0</td><td rowspan="3">1.5</td><td rowspan="3">1.5-0.75</td></tr>
<tr><td>10-20 年</td><td>5.5</td><td>6.0</td><td rowspan="2">5.5</td></tr>
<tr><td>20 年以上</td><td>5.0</td><td>5.0</td><td>5.5</td></tr>
<tr><td>利率</td><td></td><td>3.65</td><td>5.84</td><td>6.5</td><td>5.5</td><td>5.0</td><td>6.0</td><td>1.75</td><td>1.75</td><td>0.5</td><td>0.5</td><td>0.1</td><td>0.1</td></tr>
</table>

数据来源：周刊朝日，2003年2月

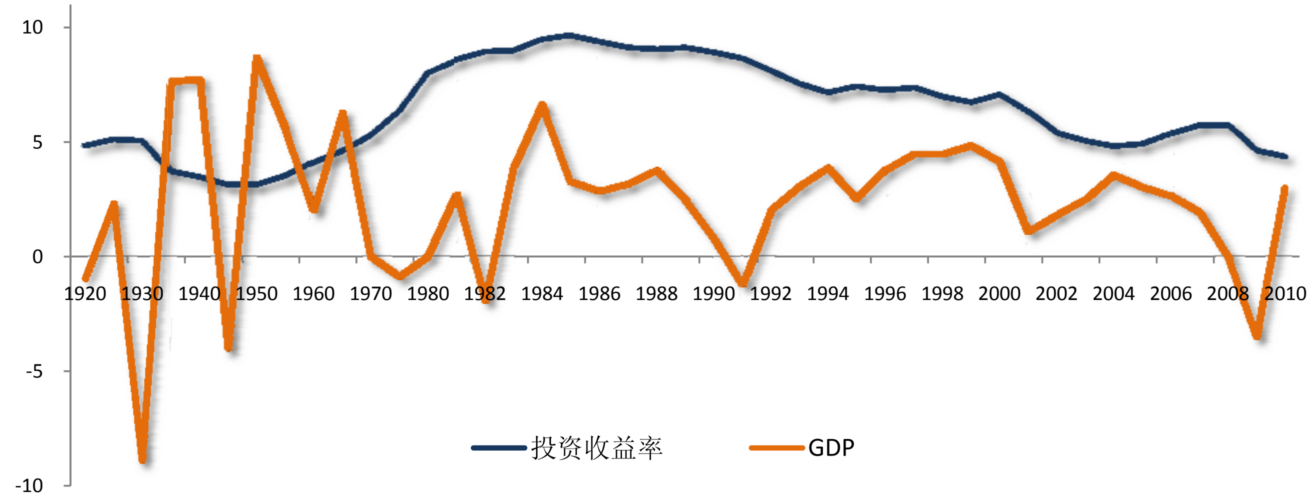



**图 8：美国保险资金投资收益率与 GDP 增长率的变动情况**[34]

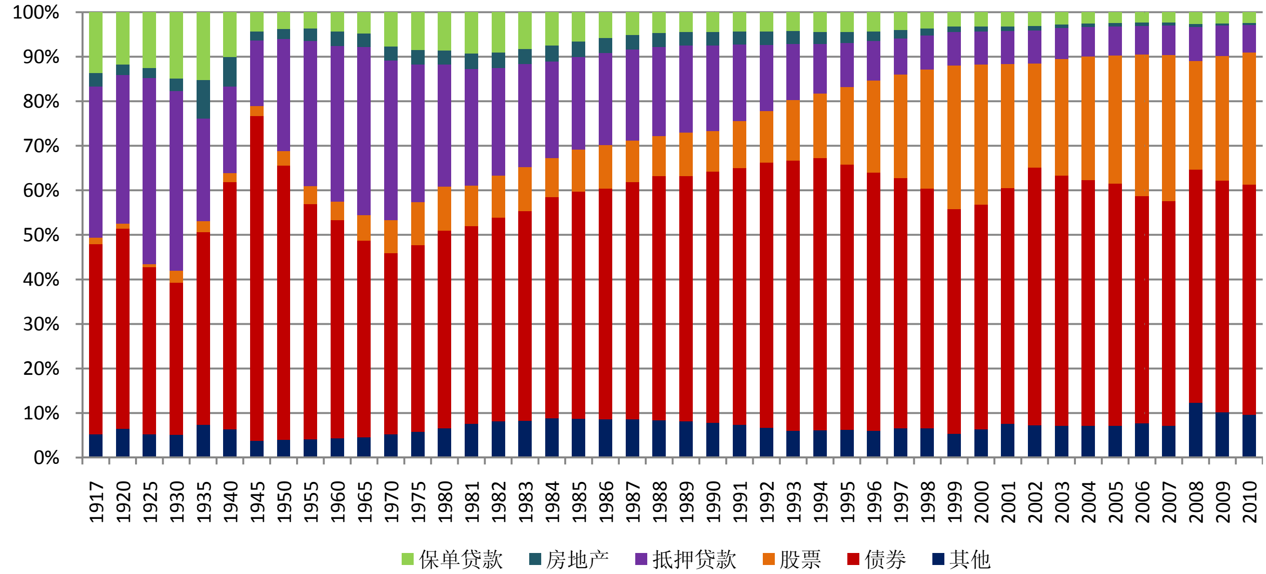



**图 9：美国保险资金投资渠道比例历史变动情况**[35]

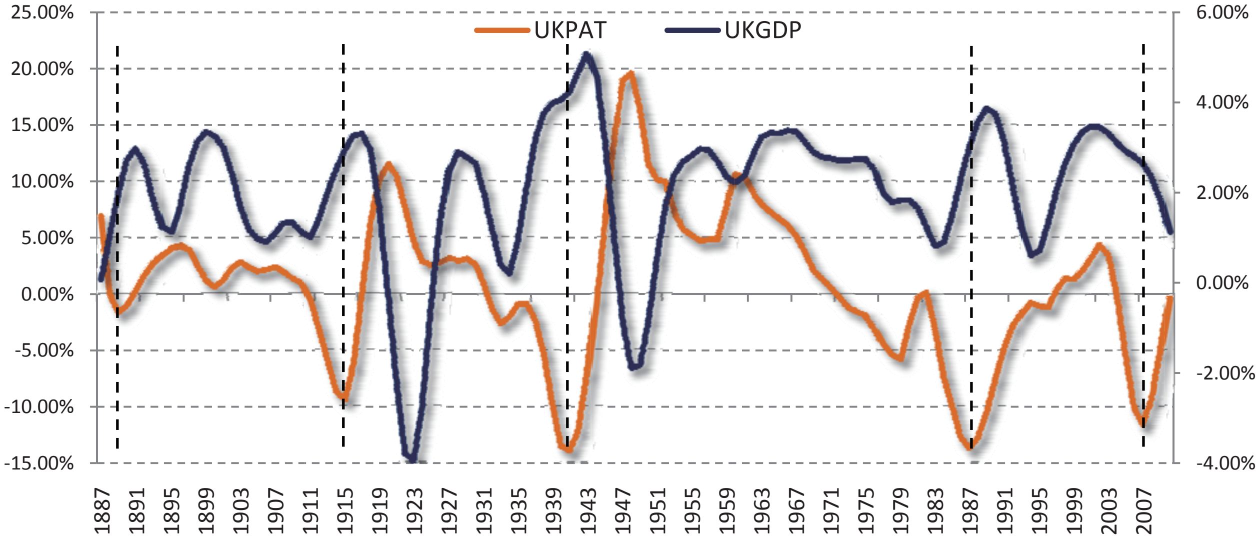



**图 12：英国经济增长与技术创新的历史趋势（1887-2010）**[36]

**表 2：VAR 回归结果**

| | | GDP(-1) | GDP(-2) | GDP(-3) | GDP(-4) | PAT(-1) | PAT(-2) | PAT(-3) | PAT(-4) | C |
|---|---|---|---|---|---|---|---|---|---|---|
| Coefficient | GDP | 3.0595 | -3.7559 | 2.2148 | -0.5384 | -0.0228 | 0.0858 | -0.0927 | 0.0315 | 0.00035 |
| | PAT | -1.1387 | 2.6495 | -2.2215 | 0.6958 | 2.6792 | -2.7575 | 1.3023 | -0.2381 | 0.00030 |
| Std Error | GDP | -0.0786 | -0.2090 | -0.2075 | -0.0773 | -0.0169 | -0.0424 | -0.0388 | -0.0127 | -0.00015 |
| | PAT | -0.4219 | -1.1211 | -1.1131 | -0.4148 | -0.0908 | -0.2276 | -0.2081 | -0.0683 | -0.00079 |

[34] 数据来源：ACLI (American Council of Life Insurers)；世界银行；麦迪森（Maddison），世界经济二百年回顾[M]，北京：改革出版社，1997 年，102-104 页

[35] 数据来源：NAIC

[36] 数据来源：1887-1994 年英国 GDP 数据来自于麦迪森（Maddison），世界经济二百年回顾[M]，北京：改革出版社，1997 年，102-104 页。该统计使用的是 1990 年美元。1995-2010 年数据来源于世界银行 WDI 数据库，使用的是 2000 年美元，笔者做了调整。授权专利的历史数据来自于 WIPO Statistics Database, December 2011。根据计算出的 GDP 和授权专利增长率数据，使用 HP 滤波获取长期中的趋势，λ=25，使用了 OECD 的算法。

# Feasibility Analysis of Implementing Viatical Settlements in China

LIU Xihua[1],LIN Qiaozhen[2], CUI Song[1]

1.School of Economics, Qingdao University，Qingdao 266071,China;

2. Zhejiang Branch, Postal Savings Bank of China, Hangzhou, 310003,China

**Abstract:** Firstly, this article analyses the demand factors of the viatical settlements from the insurance industry, the threat of major diseases and the aging population. Secondly, this article uses cointegration tests and error correction model to predict the needs of viatical settlements, studies have shown that the needs of viatical settlements in Chinese market increases, and the rate of increase is growing, the potential needs is enormous. In addition to the demand side of the viatical settlements, a successful life settlement transaction also needs the supply side. So, this article deeply analyses China's financial market transaction entities' (insurance companies, banks, securities companies and investors) possibility of becoming the viatical settlements providers. The core issue of viatical settlements transactions is the pricing issues, the viatical settlements transaction involves two prices, one price is the cash that the viatical settlements company paid for a life insurance policy, and the other price is the cash that investors paid to the viatical settlements company. And this article uses the existing actuarial, financial pricing tools to build the basic idea of pricing models, theoretically. What's more this article analyses the legal feasibility of the viatical settlements mainly from the law of the insurable interest law and the policy transference, the analysis shows that there is no conflict between the viatical settlements transactions and our existing the Insurance Law.

**Keywords:** Viatical settlements; Feasibility analysis; Aged tendency of population

## Ⅰ.引言

随着科技的进步，人们的生活日新月异，但却始终无法回避生老病死的宿命。人们会因为不幸罹患慢性疾病（Chronical Illness）、绝症（Terminal Illness）等，面对昂贵的医疗费用而束手无策；或者因为年老体弱，失去工作、收入甚微以至于难以维持生计。为了应付某些突发事件，人们往往需要大笔流动资金，但却苦于没有足够的现金和流动资产，因此而陷入困境。鉴于多数人手中握有寿险保单，且有着“提前支取”保险金的意愿，保单二级市场——保单贴现市场应运而生。

在世界范围内，保单贴现兴起于 20 世纪 80 年代末美国艾滋病蔓延之时[1]，三十多年间取得了长足发展[1]。目前，保单贴现在我国还属于新鲜事物，并没有出现真正意义上的保单贴现市场[2]。[2]本文从我国的国情入手，基于保单贴现的需求、供给、技术可行性以及法律可行性四个方面，对我国推行保单贴现交易的可行性进行分析。.

## Ⅱ.保单贴现的需求分析

### A. 保单贴现需求的影响因素分析

1）保险业的发展

保险业的发展水平是保单贴现需求产生的基础，只有当一个地区的保险业，尤其是人身保险业发展至一定程度，居民人均持有寿险保单数达到一定程度，才会产生保单贴现的需求。

从保险业的整体发展来看（参见表 11），根据保监会最新统计数据，2011 年我国总体保费收入达到 14339.3 亿[3]，位居全球前列[4]，我国已经逐步成长为世界新兴的保险大国。我国自 1980 年恢复国内保险业务以来，保险市场的规模、保险深度、密度都处在高速增长阶

*作者简介：刘喜华（1965-），山东胶州人，青岛大学经济学院教授，博士，博士生导师。
林巧珍（1986—），浙江台州人，现供职于中国邮政储蓄银行浙江省分行会计部，经济学硕士，中国准精算师。

[1]随着全球金融创新浪潮的激荡，2004 年以保单贴现为标的的证券化商品第一次在市场上出现，受到广大投资者的热捧，尤其是在 2007 年次贷危机之后，保单贴现证券化商品成为华尔街的新宠，其影响范围也在不断的扩大。

[2] 仅在香港、台湾、广州等发达省市或地区出现一些保单贴现的地下组织，因缺乏监督管理，操作不规范，规模也较小。参见盛荣.关于我国开展寿险保单贴现业务的思考（上）[N].中国保险报，2010-01-05. http://insurance.baidu.com/2010-01-05/122255674.html

[3] 2011 年保费数据来自中国保险监督管理委员会网站 http://www.circ.gov.cn/web/site0/tab61/i191553.htm

[4] 根据瑞士再保险股份有限公司经济研究及咨询部发行的杂志《Sigma》，2008 年和 2009 年中国保费收入分列世界第六位和第七位。

段。具体来看，在 1980 年——2011 年的三十年间，保费收入以年均 30.81%的增长率，从 4.6 亿[5]上升至 14339.3 亿，市场规模增长了 3116 倍；保险深度从 0.10%增至 3.04%，增加了近 30 倍；保险密度从 0.47 元增至 1064.54 元，增加了 2264 倍。[6]根据瑞士再保险公司研究数据[7]显示，我国保险市场在世界范围内属于新兴市场范畴，加之我国人口基数庞大，可见我国保险业的市场潜力巨大，有广阔的发展空间。

**表 1 我国保险保费收入、保险深度、保险密度一览表**

| 项目 / 年份 | 保费收入（亿） | GDP（百亿） | 总人口数（亿） | 保险深度（%） | 保险密度（元/人） |
|---|---|---|---|---|---|
| 1980 | 4.6 | 45.46 | 9.87 | 0.10 | 0.47 |
| 1985 | 33.1 | 90.16 | 10.59 | 0.37 | 3.13 |
| 1990 | 135.2 | 186.68 | 11.43 | 0.72 | 11.83 |
| 1995 | 594.9 | 607.94 | 12.11 | 0.98 | 49.12 |
| 2000 | 1595.9 | 992,15 | 12.67 | 1.61 | 125.92 |
| 2001 | 2112.3 | 1096.55 | 12.76 | 1.93 | 165.50 |
| 2002 | 3053.1 | 1203.33 | 12.85 | 2.54 | 237.68 |
| 2003 | 3880.4 | 1358.23 | 12.92 | 2.86 | 300.28 |
| 2004 | 4318.1 | 1598.78 | 13.00 | 2.70 | 332.19 |
| 2005 | 4928.4 | 1832.17 | 13.08 | 2.69 | 376.92 |
| 2006 | 5640.2 | 2119.24 | 13.14 | 2.66 | 429.08 |
| 2007 | 7033.4 | 2573.06 | 13.21 | 2.73 | 532.31 |
| 2008 | 9784.1 | 3006.70 | 13.28 | 3.25 | 736.74 |
| 2009 | 11137.3 | 3409.03 | 13.34 | 3.27 | 833.14 |
| 2010 | 14528.0 | 4012.02 | 13.41 | 3.62 | 1083.37 |
| 2011 | 14339.3 | 4715.64 | 13.47 | 3.04 | 1064.54 |

数据来源：《中国保险年鉴》（1997-2009），中国保险监督管理委员会网站，《中国统计年鉴 2011》，《2011 年国民经济和社会发展统计公报》。

从与保单贴现密切相关的人身保险业务来看（见表 2），2000 年——2011 年的十一年间，我国人身保险保费从 997.5 亿逐年递增至 9721.4 亿，增幅高达 874.58%，其中 2008 年的增加额度达到最大值 2411.76 亿；人身险保险深度在此期间总体呈现上升趋势，但有小幅度的震荡，自 2000 年的 1.10%快速增至 2003 年的 2.22%，随后 4 年处于小幅下降期，到 2008 年迅速升至 2.48%；人身险保险密度在此期间也基本处于持续上升的趋势，从 2000 年的 78.70 元/人逐年递增至 2011 年的 721.71 元/人，增幅为 817.04%。可见，我国人身保险业呈现保险深度波动上升，保费、保险密度快速上升的状态，过去的十年间也取得了长足的发展，而且随着我国居民保险意识的提升，人口老龄化的加剧，人身险业务的深化，可以预期到未来对人身险的需求将进一步加大。

**表 2 我国人身保险保费收入、保险深度、密度一览表**

| 项目 / 年份 | 保费收入（亿） | GDP（亿） | 总人口数（亿） | 保险深度（%） | 保险密度（元/人） |
|---|---|---|---|---|---|
| 2000 | 997.5 | 99214.6 | 12.67 | 1.01 | 78.70 |
| 2001 | 1424.0 | 109655.2 | 12.76 | 1.30 | 111.58 |
| 2002 | 2274.8 | 120332.7 | 12.85 | 1.89 | 177.09 |
| 2003 | 3011.0 | 135822.8 | 12.92 | 2.22 | 233.00 |
| 2004 | 3228.2 | 159878.3 | 13.00 | 2.02 | 248.35 |
| 2005 | 3696.5 | 183217.4 | 13.08 | 2.02 | 282.70 |
| 2006 | 4130.1 | 211923.5 | 13.14 | 1.95 | 314.20 |
| 2007 | 5035.6 | 257305.6 | 13.21 | 1.96 | 381.11 |
| 2008 | 7447.4 | 300670.0 | 13.28 | 2.48 | 560.79 |
| 2009 | 8261.5 | 340902.8 | 13.34 | 2.42 | 618.96 |
| 2010 | 10632.8 | 401202.0 | 13.41 | 2.65 | 792.90 |
| 2011 | 9721.43 | 471564.0 | 13.47 | 2.06 | 721.71 |

数据来源：《中国保险年鉴》（2001-2009），中国保险监督管理委员会网站，《中国统计年鉴 2011》，《国民经济和社会发展统计公报》（2011）。

**2）重大疾病的威胁**

改革开放以来，我国经济取得了长足发展，医疗卫生事业也有明显进步，卫生总费用从 1978 年的 110.21 亿，增至 2009 年的 17204.81 亿，[8]但是制约其发展的制度性问题并未彻底解决。医疗卫生事业发展的滞后，难以满足公众对医疗卫生服务的需求，加之城市化造成人口流动、环境污染、职业病、意外伤害的加剧，以及人口老龄化的压力，都使我国的医疗卫生服务体系面临严峻挑战。

国家卫生服务调查数据显示，近年来我国居民慢性病患病率没有明显下降，反而在 25 岁及以上人群中有上升趋势，尤其是 65 岁及以上的老年人慢性病患病率显著上升。据 2008 年调查数据，我国人口每一千人中有 157 个患慢性疾病，约合 2 亿[9]人口，且老年人的慢性患病率高达 645.4‰，不容乐观（参见表 3）。

---

[5] 1980 年我国保费收入为 4.6 亿元人民币，数据来源：《中国保险年鉴 1981-1997》。

[6] 1980 年的保险深度和密度数据来自《中国保险年鉴 1981-1997》，2011 年 GDP、人口总数来自国家统计局网站《2011 年国民经济和社会发展统计公报》，http://www.stats.gov.cn/tjgb/ndtjgb/qgndtjgb/t20110228_402705692.htm。

[7] Daniel Staib. Sigma 2008 年度世界保险业，瑞士再保险股份有限公司经济研究及咨询部，2009 年第 3 期。该期《Sigma》杂志数据显示，2008 年世界平均保险深度为 7.1%，其中工业化国家为 8.8%，新兴市场为 2.7%；2008 年世界平均保险密度为 647 美元/人，其中工业化国家为 3655 美元/人，新兴市场为 89 美元/人。显然，我国保险业在世界范围内仍属新兴市场范畴。

[8] 数据来源：《2010 中国卫生统计年鉴》。

[9] 13 亿×157.4‰≈2.05 亿

**表 3 我国居民慢性病[10]患病率** 单位：千分比（‰）

| 项目 \ 年份 | 1993 年 | 1998 年 | 2003 年 | 2008 年 |
|---|---|---|---|---|
| 按人数计算 | — | 128.2 | 123.3 | 157.4 |
| 按例数计算 | 169.8 | 157.5 | 151.1 | 199.9 |
| 男性 | 152.3 | 141.6 | 133.5 | 177.3 |
| 女性 | 187.6 | 173.9 | 169.0 | 222.5 |
| 0-4 岁 | 19.2 | 13.4 | 6.3 | 6.4 |
| 5-14 岁 | 19.2 | 18.6 | 9.6 | 8.7 |
| 15-24 岁 | 26.0 | 25.8 | 18.0 | 20.2 |
| 25-34 岁 | 66.4 | 72.5 | 58.3 | 51.3 |
| 35-44 岁 | 162.0 | 142.2 | 117.1 | 121.7 |
| 45-54 岁 | 263.4 | 232.0 | 219.5 | 259.5 |
| 55-64 岁 | 430.5 | 386.5 | 362.1 | 419.9 |
| 65 岁及以上 | 540.3 | 517.9 | 538.8 | 645.4 |

数据来源：《2010 中国卫生统计年鉴》，各年国家卫生服务调查所得。

除却慢性病患病率之外，重大疾病对我国民众的威胁并没有随着收入的增长而消减。根据国家统计局数据显示[11]，2011 年全年我国农村居民人均纯收入为 6977 元，城镇居民人均可支配收入为 21810 元。而重大疾病的医疗费用少则几万，多则几十万（参见表 4），与居民收入相比，堪称 “巨额”，远超过普通民众的经济承受能力，给居民带来了潜在的经济压力。一旦罹患重大疾病，居民的收入势必下降，“巨额”医疗费用很可能使其陷入财务困境，此时，居民就有将持有的寿险保单变现的需求，是保单贴现的潜在需求者。

**表 4 我国重大疾病发病率、医疗费用一览表**

| 疾病种类 | 发病率（1/10 万） | 医疗费用（万） |
|---|---|---|
| 心肌梗塞 | 男性 215.63；女性 151.07 | 3-6 |
| 脑中风 | 230/年 | 2-7 |
| 慢性肾衰竭（尿毒症） | 98-198/年 | 20-30 |
| 恶性肿瘤 | 男性 129.3-305.4；女性 39.5-248.7 | 5-50 |
| 瘫痪 | - | 5-20 |
| 重大器官移植 | - | 大于 10 |
| 急性重症肝炎 | 66.5/年 | 5-11 |
| 再生障碍性贫血 | 0.74/年 | 10-40 |

数据来源：根据《2008 中国卫生服务调查研究报告》整理，国家卫生部网站。

### 3）人口老龄化趋势

**表 5 我国历年老年人口占总人口比重 单位：万人**

| 项目 / 年份 | 年末总人口数 | 65 岁及以上 人口数 | 65 岁及以上 比重（%） |
|---|---|---|---|
| 1982 | 101654 | 4991 | 4.9 |
| 1987 | 109300 | 5968 | 5.4 |
| 1990 | 114333 | 6368 | 5.6 |
| 1995 | 121121 | 7510 | 6.2 |
| 1996 | 122389 | 7833 | 6.4 |
| 1997 | 123626 | 8085 | 6.5 |
| 1998 | 124761 | 8359 | 6.7 |
| 1999 | 125786 | 8679 | 6.9 |
| 2000 | 126743 | 8821 | 7.0 |
| 2001 | 127627 | 9062 | 7.1 |
| 2002 | 128453 | 9377 | 7.3 |
| 2003 | 129227 | 9692 | 7.5 |
| 2004 | 129988 | 9857 | 7.6 |
| 2005 | 130756 | 10055 | 7.7 |
| 2006 | 131448 | 10419 | 7.9 |
| 2007 | 132129 | 10636 | 8.1 |
| 2008 | 132802 | 10956 | 8.3 |
| 2009 | 133450 | 11307 | 8.5 |
| 2010 | 134091 | 11894 | 8.9 |
| 2011 | 134735 | 12288 | 9.1 |

数据来源：《中国统计年鉴 2011》、《2011 年国民经济和社会发展统计公报》。

老龄化是一个全球性话题，对中国也不例外。根据表 5 显示，从 1982 年开始，我国 65 岁及以上人口占总人口的比重一直在上升，自 2000 年该比重首次达到 7%正式迈入老龄化社会。截至 2009 年底，全国 65 岁及以上老年人口达 11309 万人，比 2008 年增长了 3.22％，占全国总人口的 8.5％，比上年上升了 0.2 个百分点；60 岁及以上老年人口 16714 万人，比上年增长了 4.53％，占全国总人口的 12.5％，比 2008 年上升了 0.5 个百分点。[12]现阶段，我国老龄化的基本特征为：老龄人口绝对数为世界之冠；“跑步”进入老龄化——速度快[3]；[13]未富先老[4]；[14]区域分布不均匀[5]；[15]高龄化

[10] 此处慢性病包括：传染病、寄生虫病、恶性肿瘤、良性肿瘤、糖尿病、精神病、心脏病、高血压、脑血管病、消化系统疾病、呼吸系统疾病等。

[11] 数据来源：《2010 年国民经济和社会发展统计公报》。

[12] 民政部：《2009 年民政事业发展统计报告》，2010-6-10。
http://cws.mca.gov.cn/article/tjbg/201006/20100600081422.shtml

[13] 据推算，从现在到 2020 年，我国人口老龄化进程明显加快，年均增长速度将达到 3.28%，大大超过总人口年均 0.66%的增长速度。随着 20 世纪 60~70 年代中期的新中国成立后第二次生育高峰人群进入老年，2021~2050 年是人口加速老龄化阶段。由于总人口逐渐实现零增长并开始负增长，人口老龄化将进一步加剧。到 2023 年，老年人口数量将增加到 2.7 亿人，与 0~14 岁少儿人口数量相等。到 2050 年，老年人口总量将超过 4 亿人，老龄化水平推进到 30%以上，进入重度老龄化阶段。到 2051 年，中国老年人口规模将达到峰值 4.37 亿人，约为 0~14 岁少儿人口数量的两倍。
苏向东.专家预测：2051 年中国老年人口将达到 4.37 亿[N].中国网，2009-02-26.
http://www.china.com.cn/news/txt/2009-02/26/content_17341420.htm

[14]我国的老龄化要超前于现代化，属于典型的“未富先老”。而发达国家一般是在人均国内生产总值 5000 至 10000 美元之间、基本实现现代化的条件下进入老龄社会的，属于“先富后老”或“富老同步”，而我国的人均国内生产总值目前才刚刚超过 1000 美元，就已经进入老龄化社会，可以说是典型

趋势十分明显[16]。这将对我国经济社会的可持续发展构成现实挑战，因为无论是在物质财富的积累，还是福利配套设施的建设上，我国当前都尚未做好充分准备。当单纯的家庭养老和政府社保不足以完全解决老龄化问题时，老年人需要借助市场的力量，将所持有的寿险保单贴现，以安度晚年。

## B.我国保单贴现需求的实证预测

**1）数据选取**

由于保单贴现在我国尚未开展业务，又考虑到退保与保单贴现之间的替代关系，本文选取各年退保金额作为衡量保单贴现需求的指标，并以此为被解释变量。解释变量的选取主要考虑我国老龄化的程度和寿险发展水平两个方面的因素，故以各年 65 岁及以上老年人口和人身保险的保险密度作为衡量指标。本文取数的时间范围为 1983 年——2008 年，其中退保金额来自《中国保险年鉴》（1997——2009）各保险公司的损益表；1983——2008 年的 65 岁及以上老年人口数来自《中国统计年鉴 2009》；人身保险的保险密度由各年人身保险保费和全国总人口数所得，1983——1995 年的人身保险保费来自《2007 年中国保险业发展报告》[6]，1996——2008 年人身保险保费来自《中国保险年鉴》（1997——2009），全国总人口数来自《中国统计年鉴》（1984——2009）。

**2）模型构建**

**平稳性检验**（Stationarity Test）

本文以退保金额（$Y_t$）为被解释变量，老年人口（$X_t^1$）和人身险密度（$X_t^2$）为解释变量构建一个回归模型（Regression Model）对保单贴现的市场规模作出预测（Forecast）。为了避免出现“伪回归”现象，先对序列 $Y_t$、$X_t^1$、$X_t^2$ 进行平稳性检验，所用软件为 Eviews6.0。

**表 6 ADF 单位根检验结果一览表**

| 项目 序列 | 原值 | | 一阶差分 | | 二阶差分 | |
|---|---|---|---|---|---|---|
| | t 值 | P 值 | t 值 | P 值 | t 值 | P 值 |
| $Y_t$ | 2.27 | 1.00 | -0.77 | 0.95 | -7.14 | 0.00 |
| $X_t^1$ | 19.43 | 1.00 | 0.42 | 0.80 | -6.35 | 0.00 |
| $X_t^2$ | 4.17 | 1.00 | -0.41 | 0.98 | -5.73 | 0.00 |

由表 6ADF 单位根检验（Unit Root Test）结果可知，序列 $Y_t$、$X_t^1$、$X_t^2$ 的原值不能拒绝存在一个单位根的原假设，原序列为非平稳的，而且经过一阶差分处理仍为非平稳的，在二阶差分的条件下各序列的 P 值近似为 0，可知在 1%的显著性水平下 t 值是显著的，可拒绝原假设。即二阶差分序列是平稳的，序列 $Y_t$、$X_t^1$、$X_t^2$ 均为二阶单整——I（2）。

**协整检验（Cointegration Test）**

由于原值序列 $Y_t$、$X_t^1$、$X_t^2$ 是非平稳的，且均为二阶单整，因而需对序列进一步作协整检验，确定序列 $Y_t$ 和序列 $X_t^1$、$X_t^2$ 是否存在协整关系。因为本文涉及三个变量，故选用扩展的两步 Engle-Granger 检验（1987）[17]。

第一步，协整回归（Cointegrating）。将 $Y_t$ 对 $X_t^1$、$X_t^2$ 进行回归，即用 OLS 法估计方程：

$$Y_t = \alpha_0 + \alpha_1 X_t^1 + \alpha_2 X_t^2 + \varepsilon_t \tag{1}$$

得到：

$$\hat{Y}_t = 11644.10 - 2.07X_t^1 + 230.97X_t^2$$

（0.66） （-0.80） （6.59*）[18]

调整 $R^2$=0.86 DW=1.08

可知，存在较强的自相关，考虑适当加入滞后项，并经过显著性检验的调整，最终得到估计如下：

$$\hat{Y}_t = 0.99Y_{t-1} + 64.05X_t^1 - 66.10X_{t-1}^1$$

（9.87*） （3.84*） （-3.84）

$$-215.34X_t^2 + 333.51X_{t-1}^2 \tag{2}$$

（-4.62*） （6.43*）

调整 $R^2$=0.98 DW=1.96**

可知，自相关基本消除，并将（2）式初步认定为 $Y_t$ 和 $X_t^1$、$X_t^2$ 的长期稳定关系，得到残差序列：

$$\hat{e}_t = Y_t - \hat{Y}_t \tag{3}$$

第二步，检验 $\hat{e}_t$ 的平稳性。同样，用 ADF 单位根检验 $\hat{e}_t$ 的平稳性，根据检验结果

---

的“未富先老”。

曹建文.“中国式养老”临双重挑战 农村养老新政在期许中起步[N].光明日报，2009-12-11. http://news.xhby.net/system/2009/12/11/010644910.shtml

[15]上海早在 1980 年就进入老龄化社会，而青海、宁夏等西部省区要到 2010 年左右才能进入。

李宝库.中国人口老龄化和老龄工作的实践[R].2002“人口老龄化：机遇和挑战”研讨会及展览.

[16] 按照国际惯例，一般将 80 岁及以上老人称为“高龄”老年人。根据《2009 年民政事业发展统计报告》，2009 年，我国 80 岁以上高龄老年人口达到 1899 万，今后每年以 100 万速度在增加，“十二五”期间将超过 2600 万。

[17] Engle-Granger 检验，是 Engle 和 Granger 于 1987 年提出的两步法协整检验，也成为 EG 检验，一般用于两个变量的协整检验，扩展的 EG 检验主要针对超过两个变量的多变量协整关系的检验。

[18] *代表 1%的显著性水平，**代表 5%的显著性水平，***代表 10%的显著性水平。

可知，$e_t$ 经 ADF 单位根检验的 t 值为-4.75。根据 MacKinnon(1991)通过模拟试验得到的不同变量协整检验的临界值，变量数为 3，样本容量为 25 时，5%显著性水平下的临界值为-4.1，显然-4.75 小于-4.1，可以拒绝原假设，即在 5%的显著性水平下，序列$\hat{e}_t$是平稳的，则可以认为变量 $Y_t$、$X_t^1$ 以及 $X_t^2$ 为（2，2）阶协整。

**误差修正模型（ECM）**

根据 Granger 表述定理（Granger Representation Theorem）[19]，变量 $Y_t$、$X_t^1$ 以及 $X_t^2$ 为（2，2）阶协整，说明变量 $Y_t$ 和变量 $X_t^1$、$X_t^2$ 存在长期稳定关系，可以构建误差修正模型（Error Correction Model，ECM）[20]。误差修正模型最显著的特点是将 $Y_t$ 和 $X_t^1$、$X_t^2$ 的长期稳定关系和短期动态调整过程加以区分，即首先通过（2）式初步认定 $Y_t$ 和 $X_t^1$、$X_t^2$ 之间的长期稳定关系，而后依据前期 $Y_t$ 和 $X_t^1$、$X_t^2$ 关系对均衡的偏离程度不断对 $Y_t$ 进行调整。以平稳的时间序列$\hat{e}_t$作为误差修正项，建立的误差修正模型如下：

$$\Delta\hat{Y}_t = 7190.06 + 1.16\Delta Y_{t-1} + 67.88\Delta X_t^{\,1} - 101.55\Delta X_{t-1}^{\,1}$$

(1.76***) (8.51*) (5.23*) (-6.52*)

$$-186.59\Delta X_t^{\,2} + 250.72\Delta X_{t-1}^{\,2} - 1.19\hat{e}_{t-1} \qquad (4)$$

(-5.29*) (4.19*) (-5.23*)

调整 $R^2$=0.81 DW=2.03**

其中，误差修正项为：

$$\hat{e}_{t-1} = Y_{t-1} - 0.99Y_{t-2} - 64.05X_{t-1}^{\,1} + 66.10X_{t-2}^{\,1} + 215.34X_{t-1}^{\,2} - 333.51X_{t-2}^{\,2} \qquad (5)$$

根据误差修正模型回归结果，从短期来看，保单贴现差额增加 1%，会促使下一年保单贴现差额增加 1.16%；老年人口差额增加 1%会促使同年保单贴现差额增加 67.88%，但是将导致下一年保单贴现差额减少 101.55%；人身险保险密度差额增加 1%会导致同年保单贴现差额减少 186.59%，而将促使下一年保单贴现差额增加 250.72%。从长期来看，保单贴现额度增加 1%会使下一年保单贴现额度增加 0.99%；老年人口增加 1%将促使同年保单贴现额度增加 64.05%，而导致下一年保单贴现额度减少 66.10%；人身险保险密度增加 1%会导致同年保单贴现额度减少 215.34，却会促使下一年保单贴现额度增加 333.51%。该误差修正模型的意义在于定量分析我国保单贴现额度与老年人口和人身险保险密度的长期均衡关系和短期动态关系，并且确定前一年老年人口和人身险保险密度的变化，对后一年保单贴现额度变化的影响。

**3）预测结果**

根据误差修正模型中保单贴现额度与老年人口数和人身险保险密度的关系，可以对未来五年我国保单贴现额度进行预测。假设未来五年 65 岁及以上老年人口数的增速为 3.28%，总人口数的增速为 0.66%，[3]人身保险保费收入的增速为 15%，[7]得到我国未来五年保单贴现额度的预测值（表 7）。从预测值的趋势来看，我国保单贴现额度总体呈上升态势，而且增加的幅度越来越大。虽则，该预测以保单贴现的替代品——退保金额为基础，但是从预测结果来看，我国保单贴现有巨大的潜在需求，其市场潜力可见一斑。

**表 7 保单贴现额度预测值** 单位：亿

| 年份 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|
| 保单贴现额 | 1165.10 | 1647.25 | 2257.48 | 2950.89 |
| 年份 | 2013 | 2014 | 2015 | 2016 |
| 保单贴现额 | 3740.94 | 4641.77 | 5669.63 | 6843.04 |

# III. 保单贴现的供给分析

保单贴现的成功交易，除了保单贴现需求方的参与之外，还要有保单贴现供给方的配合。因此，本节主要探讨我国金融市场各交易主体成为保单贴现供给者的可能性。

## A. 保险公司

保险公司成为寿险保险收购者的可能性较高，主要基于两方面的优势：

一是信息优势。保险公司与投保人/被保险人的接触广泛，倘若投保人因经济问题不能及时缴纳保费，保险公司能够及时得知，并提供保单贴现的相关服务。保险公司当前业务的客户即是保单贴现最好的潜在客户，能够即刻洞察客户的变现意向。

二是技术优势。保单贴现的价格需要在被保险人预期余命的基础上，结合寿险精算模型和技术共同厘定，[21]目前国内的精算人才主要集中在保险公司，因而在保单贴现的技术操作上保险公司具有优势，能够及时开发各类保单贴现产品，满足市场需求。

[19] Engle 与 Granger 1987 年提出了著名的 Grange 表述定理（Granger representaion theorem）：如果变量 X 与 Y 是协整的，则它们间的短期非均衡关系总能由一个误差修正模型表述。

[20] 误差修正模型（Error Correction Model，ECM）是一种具有特定形式的计量经济学模型，它的主要形式是由 Davidson、 Hendry、Srba 和 Yeo 于 1978 年提出的，称为 DHSY 模型。

[21] 保单贴现的定价问题在本文第三部分详细阐述。

**表 8 三大保险公司退保、保单贷款比较[22]** 单位：亿

| 公司 | 中国人寿 | | 中国平安 | | 中国太保 | |
|---|---|---|---|---|---|---|
| 时间 | 退保金 | 保单贷款 | 退保金 | 保单贷款 | 退保金 | 保单贷款 |
| 2008 | 254.85 | 86.76 | 57.15 | 37.25 | 39.74 | 6.98 |
| 2009 | 233.20 | 138.31 | 49.93 | 54.34 | 43.86 | 13.52 |
| 2010 | 257.14 | 239.77 | 38.16 | 84.31 | 44.89 | 23.07 |
| 2011 | 365.27 | 323.21 | 44.07 | 141.05 | 95.88 | 40.94 |

数据来源：三大公司 2009 年、2010 年年报。

与此同时，在保单贴现出现之前，保险公司一直都有提供相似的交易，例如退保、保单贷款，且数目较大（参见表 8）。可见，保险公司是保单贴现交易的潜在供给者。

## B. 银行

银行作为保单贴现供给者的角色与保险公司较为相似，主要体现在两个方面：一方面，在银行保险合作中，银行代理销售保险产品，与投保人/被保险人直接接触，有良好的客户资源；另一方面，在保单贴现出现之前，银行也有将保单贷款纳入业务范畴，能够较为便捷地了解到客户对保单贴现的需求。除此之外，从银行的角度来看，相较于保单贷款，保单贴现的流动性更强，较少占用银行的现金流，对银行更为有利。在保单贷款交易中，银行先将贷款给投保人，在一定的期限（一般为 6 个月）之后才能收回本息；而在保单贴现交易中，银行在购得寿险保单之后，可以将受益权直接或间接转让给第三方投资者，迅速获得资金的回笼。而且，银行可将回笼的资金投入其他业务，获得更多收益。可见，保单贴现为银行提供了更多的获利机会，银行有理由成为保单贴现的供给者。

## C. 证券公司

证券公司可以以多种形式参与到在保单贴现交易中：

第一，证券公司直接从保单贴现人处购得贴现保单，再将其以直接或间接的方式转让给第三方投资者。在这种形式中，证券公司的角色定位相当于是保单贴现公司，其利益来源为保单买卖之间的差价。

第二，证券公司作为保单贴现证券化产品的承销商，在资本市场上向投资者出售该投资产品。根据证券公司在承销过程中承担的责任和风险的不同，承销又可分为包销、投标承购、代销、赞助推销四种方式[23]，其利益来源为承销的手续费。

第三，证券公司向其投资客户，提供买卖保单贴现证券化产品的服务。在该种形式中，证券公司按照投资者的意愿，代理其进行受益权证券的买卖投资，并收取交易手续费作为报酬。

第四，证券公司直接买卖保单贴现证券化产品，即以投资者的身份参与到保单贴现交易中，该业务属于证券公司的自营业务，其收益来自于产品本身的收益率或买卖的差价。

由此可见，保单贴现交易为证券公司提供了多种获利方式，增加了获利来源，丰富了投资品种，有助于其赢得更多的客户群体，从而使证券公司获得更多收益。作为一个商业的盈利机构，利益的驱动将使证券公司成为保单贴现供给者的可能性提高。

## D. 投资者

投资者是保单贴现最终的供给者，同时也是最重要的供给者。保单贴现作为保险业与证券业融合的代表性金融创新产品，能够吸引投资者，并在资本市场赢得一定的市场份额，主要原因在于其较为稳定的高收益率。美国保单贴现市场的年平均收益率为 10%，很多投资者将定期存款从银行移至保单贴现市场。从历史角度来看，我国存款利率整体呈下降趋势，当前年利率从活期到八年定期均未超过 5%，[24] 远低于保单贴现 10%的年收益率；证券市场上股票和基金的收益率虽高，但是波动较大、风险较高、不确定性大，不适合稳健的理财计划。保单贴现的风险主要来自被保险人的长寿风险，在受益权证券化出售时通常会由再保险人分散，不确定较低，在一定程度上达到收益性和稳定性的平衡，能够吸引保单贴现潜在供给方——投资者的加入。另外，保单贴现与其

[22] 本表格所采用的数据是经过新会计准则调整之后的。

[23] 包销是指发行人与承销机构签订合同，由承销机构买下全部或销售剩余部分的证券，承担全部销售风险，适用于那些资金需求量大、社会知名度低而且缺乏证券发行经验的企业。投标承购通常是在承销机构处于被动竞争较强的情况下进行的，采用这种形式发行的证券通常信用较高，受到投资者欢迎的证券。代销一般是由承销机构认为该证券的信用等级较低，承销风险大而形成的，这时承销机构只接受发行者的委托，代理其销售证券，如在规定的期限计划内发行的证券没有全部销售出去，则将剩余部分返回证券发行者，发行风险由发行者自己承担。赞助推销是指当发行公司增资扩股时，其主要对象是现在股东，但又不能确保现有股东均认购其证券，为防止难以及时筹集到所需资金，甚至引起本公司股票价格下跌，发行公司一般都要委托承销机构办理对先有股东发行新股的工作，从而将风险转嫁给承销机构。

[24] 中国人民银行历年存款利率表（1952——2008）
http://wenku.baidu.com/view/bff33b29647d27284b73517c.html
1996-2011 历年银行存款利率调整一览表
http://www.gzjy168.com/Html/2011-03/Detail_1561.html

他投资产品相关性低，对投资者而言是构成投资组合分散风险的良好选择。可见，与其他投资产品相比，保单贴现以较低的风险现实了较高的收益，投资者成为其供给者的可能性大。

# Ⅳ.保单贴现的技术可行性

保单贴现的定价问题是保单贴现交易得以进行的核心，保单贴现的技术可行性也由此体现。保单贴现交易涉及两个价格，一个是保单贴现公司购买寿险保单向保单贴现人支付的保单贴现金，另一个是投资者支付给保单贴现公司的价格，本节主要从这两方面探讨定价模型构建的可行性。

## A.保单贴现金的定价

**1）时点分布**

根据美国保单贴现市场的经验，能够用来贴现的保单种类较多，例如：终身寿险、定期寿险、万能寿险等，而终身寿险是其中的基础类型，本文就以期缴终身寿险为例讨论定价模型。如图 1 所示，假定某消费者在 X 岁时购入一张保额为 B，年缴保费为 P 的终身寿险保单，缴费时间为每年年初，在 X+t 时刻由于某种原因需将保单贴现，T-t 为医疗机构根据被保险人的身体状况估计的预期余命，ω 为极限年龄[25]，X+n 为被保险人实际的死亡时间，介于 X+t 和 ω 之间。

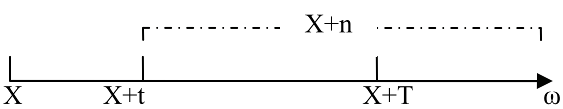



**图 1 保单贴现时间轴**

**2）设定模型**

美国现行保单贴现金一般是以保险金的一定折扣比例来表示，该折扣比例主要依据被保险人的预期余命来决定，还包括续期保费、市场利率、保单现金价值、保单贷款额、保单种类、生前给付比例、保险公司的信用级别等因素。

在 X+t 的保单贴现时刻来看，该寿险保单的未来现金流入为被保险人死亡时刻得到的由保险公司支付的保险金（减去提前支付和保单贷款额），现金流出为被保险人生存状态下的续期保费支出。由此，可以用未来现金流量来估计保单贴现金的额度，得到如下模型：

$$PY=\theta\left\{[(1-\alpha)B-D]e^{-r_1(T-t)}-P\sum_{i=0}^{|T-|1+t||}e^{-r_1(i+|1+t|-t)}\right\} \tag{5}$$

其中，$PY$ 代表保单贴现金额，即保单贴现人出售保单的所得；$\alpha$ 代表该保单提前给付的比例，$D$ 代表该保单贷款的额度，$[(1-\alpha)B-D]$ 代表除去提前给付和保单贷款之后可得的保险金；$r_1$ 代表利率，$e^{-r_1(T-t)}$ 代表 X+T 时刻一单位货币在 X+t 时刻的现值，$[(1-\alpha)B-D]e^{-r_1(T-t)}$ 代表 X+T 时刻保险公司支付的金额折现到 X+t 时刻的值；$|1+t|$ 代表小于等于 $1+t$ 的最大整数，$P\sum_{i=0}^{|T-|1+t||}e^{-r_1(i+|1+t|-t)}$ 表示后续保费在 X+t 时刻的现值；$\theta$ 代表保险公司信用风险调整因子，$\theta\in[0,1]$，保险公司信用评级越高则 $\theta$ 越接近 1，反之则越接近 0，通常保险公司不存在违约风险则可取 $\theta=1$。

由（5）式可知，保单贴现金定价的关键在于预期余命和利率的确定。该模型利率主要用于衡量保费的机会成本（Opportunity Cost），笔者以为可以参考市场的无风险利率，例如三个月期的国债利率。预期余命的准确与否直接关系到定价的合理性，而事实上一个人生命的长短本身有很大的不确定性，医疗机构根据被保险人以往的病历和检查，很难给出准确的估计，从大数定理（Law of Large Numbers）的角度从发，保单贴现公司只有购得足够多的保单，方能集中大量标的以分散风险。

## B.保单贴证券化的定价

**1）时点分布**

继续沿用保单贴现金定价部分的假设，保单贴现证券化的时点分布如图 2 所示，与图 1 相较，多出 X+s、X+W 以及 X+k 三个时点，这正是保单贴现证券化时点分布的最大特点。X+s 为投资者购买保单贴现证券的时点，介于保单贴现人出售保单和被保险人预期余命之间。X+W 为再保险人保证履约的时点，也就是投资者投资保单贴现证券的终止日。为了分散被保险人的长寿风险（Longevity Risk），保单贴现公司往往引进再保险公司作为保单贴现证券履约的保证，即当被保险人的生存超过 X+W 时刻，则再保险公司根据双方合同的约定给付保险金，并由此取得保单的受益权，一般 X+W 为预期余命之后的 12 个或 24 个月。X+k 为投资者获得投资回报的时刻，介于 X+s 和 X+W 之间，取决于被保险人的死亡时间（即 X+n），如果 $X+s\le X+n<X+W$，则

[25] 人的生命是有限的，通常人的寿命不会超过某一特定年龄，该特定年龄即为极限年龄，例如：中国人寿保险业经验生命表（2000-2003）采用的极限年龄为 105 岁。

$X+s \le X+k = X+n < X+W$；如果 $X+W \le X+n \le \omega$，则 $X+k = X+W$。

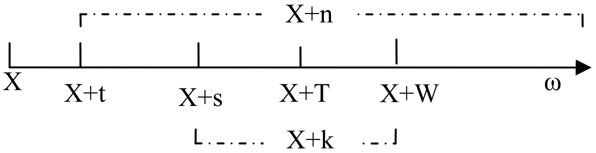



**图 2 保单贴现证券化时间轴**

**2）定价模型**

保单贴现证券化是以一揽子贴现保单的受益权为担保而发行证券，投资者的未来现金流来自于该一揽子保单到期时保险公司给付的保险金，而每张保单的被保险人身故时间并不相同，因而未来现金流入会出现在不同时间并且有一定的不确定性。令投资者在 X+s 时刻的投资支出等于未来现金流的现值，可以得到保单贴现证券化的定价模型如下：

$$PV = \sum_{i=1}^{m} \psi_i \theta_i [(1-\alpha_i)B_i - D_i] e^{-r_2(k_i - s)} \quad (6)$$

其中，$PV$ 就是保单贴现证券的价格，即投资者购买的保单贴现证券商品的价格；$m$ 是被证券化一揽子保单的数目，对于不同的保单贴现证券有不同的 $m$；$B_i$、$\alpha_i$、$D_i$ 以及 $\theta_i$ 的意义与（5）式中相同，但是会随着每张保单的不同而变化；$k_i - s$ 代表投资者获得第 $i$ 张保单产生现金流的时间距离，因为被保险人的身故时间不确定，$k_i - s$ 为一随机变量，$0 < k_i - s \le T_i - s$；$r_2$ 代表投资者投资保单贴现证券的预期收益率，即将未来现金流折算为现值的折现率；$e^{-r_2(k_i - s)}$ 代表 $X+k_i$ 时一单位货币在 $X+s$ 时的现值；$\psi_i$ 代表保单贴现证券的分割比例，即投资者投资于每一张保单的比例，$\psi_i \in [0,1]$。

**3）死亡率的确定**

由（6）式可知，$PV$ 值随随机变量 $k_i - s$ 的变化而变化，即 $PV$ 也是一个随机变量。虽则，保单贴现引入再保险人作出履约保证，但是也不能改变被保险人死亡时刻的随机性质，笔者以为可以将 $X+T_i$ 作为被保险人余命的极限年龄，估计其死亡率，可得更为准确的定价模型：

$$PV = \sum_{i=1}^{m} \psi_i \theta_i [(1-\alpha_i)B_i - D_i] \int_s^{T_i} e^{-r_2(k_i - s)} \, {}_{k_i - s}p_{X+s} \mu_{X+k_i} \, dk_i \quad (7)$$

其中，$\mu_{X+k_i}$ 是死力，表示被保险人在 $X+k_i$ 时刻瞬间死亡的概率；${}_{k_i - s}p_{X+s}$ 表示被保险人在 $X+s$ 时刻生存的条件下，继续生存至 $X+k_i$ 的概率，并有 ${}_0p_{X+s} = 1$，${}_{T_i - s}p_{X+s} = 0$；${}_{k_i - s}p_{X+s}\mu_{X+k_i}$ 表示被保险人在 $X+s$ 时刻生存的条件下，在 $X+k_i$ 时刻瞬间死亡的概率。而死力 $\mu_{X+k_i}$ 的确定是该模型的核心，常见的死力有四种形式：de Moivre（1729）形式，Gompertz（1825）形式，Makeham（1860）形式，Weibull（1939）形式，[26] Alistair（2002）认为寿险保单贴现的特殊死亡率服从 Makeham 函数形式，并指出该函数较适用于高龄或者重病的被保险人。笔者以为可以将被保险人的身体状况因素结合死力形式，构造余命死力以更准确的反应被保险人的死亡率状况，或者可以采用蒙特卡洛（Monte Carlo）模拟[27]来对被保险人死亡的随机路径进行模拟，由此测算被保险人死亡率的期望值。另外，考虑到身故保险金于身故时即可给付，故采用连续型寿险模型（即积分形式）。

**4）收益率的确定**

根据未来现金流的定价模型对投资的收益率的估计提出很高的要求，通常假设其在证券续存期间是不变的。笔者以为可以借助资本资产定价模型（Capital Asset Pricing Model，CAPM）对保单贴现证券的风险和收益进行分析，并估计投资者期望的投资收益率，对证券未来的现金流折现定价。首先要根据被证券化的一揽子贴现保单的风险程度，确定其系统风险系数，再结合市场风险溢价和无风险收益率，得到投资收益率的期望估计值。一揽子贴现保单的风险程度越大系统风险系数越高，期

[26] de Moivre（1729）形式为：
$\mu_x = \frac{1}{\omega - x}(0 \le x < \omega)$，$\omega$ 是期限年龄；
Gompertz（1825）形式为：
$\mu_x = BC^x(x \ge 0, B > 0, C \ge 1)$；Makeham（1860）形式为：
$\mu_x = A + BC^x(x \ge 0, B > 0, C \ge 1, A \ge -B)$；
Weibull（1939）形式为：
$\mu_x = kx^n(x \ge 0, k > 0, n > 0)$。

[27] 蒙特卡洛(Monte Carlo)模拟是一种通过设定随机过程，反复生成时间序列，计算参数估计量和统计量，进而研究其分布特征的方法。具体的，当系统中各个单元的可靠性特征量已知，但系统的可靠性过于复杂，难以建立可靠性预计的精确数学模型或模型太复杂而不便应用时，可用随机模拟法近似计算出系统可靠性的预计值；随着模拟次数的增多，其预计精度也逐渐增高。

望的投资收益率就越高，相应证券的价格就越低，反之则越高。具体计算公式如下：

$$E(r_j)=r_f+\beta_j[E(r_m)-r_f] \quad (8)$$

其中，$r_f$ 是市场的无风险利率；$E(r_m)$ 是市场的期望收益率；$E(r_m)-r_f$ 是市场的风险溢价；$\beta_j$ 是第 $j$ 个保单贴现证券对应的一揽子保单的系统风险系数，且 $\beta_j=\dfrac{Cov(r_j,r_m)}{Var(r_m)}$。

无论是 $\beta_j$ 还是 $E(r_j)$ 的确定，都需要参考大量相关的历史数据和统计分析，由于保单贴现业务在我国尚未开展，在定价时可借鉴美国的数据进行统计分析，并结合我国保单的具体情况进行调整。

# Ⅴ.保单贴现的法律可行性

## A.保险利益的法律规定

保单贴现是指保单贴现人出售保单以获得保单贴现金，最终保单贴现公司或者是投资者成为受益人，享有被保险人的身故保险金的交易，交易的实质是受益权的转让和变更。但是，该交易一直以来遭到社会舆论的诟病，原因在于保单贴现公司和投资者是保险合同的无关第三方，对被保险人并无保险利益，却因被保险人死亡而获利。此问题的关键在于受益人是否要对被保险人具有保险利益。

保险利益（Insurable Interest）原则是保险的四大基本原则之一，其意义在于：限定保险金额度；防止道德风险；使保险区别于赌博。[8]对于人寿保险合同而言，由于人的生命是不可估价的，因而不存在保险金额的限制，主要的风险来自于以他人的生命进行赌博和道德风险。根据我国《保险法》第十二条规定：“人身保险的投保人在保险合同订立时，对被保险人应当具有保险利益。保险利益是指投保人或者被保险人对保险标的具有的法律上承认的利益。”即，为了控制“赌博”风险，要求投保人或被保险人对保险标的具有保险利益，尤其强调寿险合同在订立时投保人必须有保险利益，以此规避无保险利益者的非法得利。第三十九条规定：“人身保险的受益人由被保险人或者投保人指定。投保人指定受益人时须经被保险人同意。投保人为与其有劳动关系的劳动者投保人身保险，不得指定被保险人及其亲属以外的人为受益人。”即为了防止来自受益人的道德风险，《保险法》规定受益人的指定须得到被保险人的同意，而非要求受益人必须有保险利益。显然，在我国现行《保险法》的规定下，对被保险人无保险利益并不构成保单贴现公司和投资者成为保单新受益人的阻碍。

## B.保单转让的法律规定

保单贴现交易涉及寿险合同的转让和受益权的转让，而该交易能够达成的主要原因是受益权的转让，正是基于受益权的转让投资者才能获得投资收益，因而受益权的转让是保单贴现交易的核心。

首先，考察寿险保单的转让。我国《保险法》第三十四条第二款规定：“按照以死亡为给付保险金条件的合同所签发的保险单，未经被保险人书面同意，不得转让或者质押。”可见，我国《保险法》并未禁止寿险保单的转让。因为寿险合同在订立之后即以保障被保险人的利益而存在，故在保单转让之时要考虑到被保险人的风险规避。为了维护被保险人的权益，《保险法》限定只有经过被保险人“书面”同意的寿险保单才能转让。

其次，受益权的转让。《保险法》第四十一条规定：“被保险人或者投保人可以变更受益人并书面通知保险人。投保人变更受益人时须经被保险人同意。”可见，受益权的转让是被法律允许的，被保险人和投保人都可以行使该权利。但是，投保人和被保险人不是同一个人时，只有经过被保险人的同意，投保人才有权变更受益人，即受益权转让的实质权利在被保险人手中，从而降低道德风险发生的可能性。

显然，在法律层面上，只要得到被保险人的同意，保单转让、受益人变更都是可行的，即当前我国开展保险贴现业务并无法律障碍。

# Ⅵ.结论

综上所述，对在我国推行保单贴现的可行性有以下结论：

在保单贴现需求方面，根据对我国当前保险业的发展、重大疾病的威胁和老龄化的趋势的分析，并且结合对保单贴现未来需求预测的实证分析，得出保单贴现在我国有较大潜在需求的结论；在保单贴现供给方面，通过对保险公司、银行、证券公司、投资者成为保单贴现供给者可能性的分析，认为保单贴现在我国不乏供给主体；在保单贴现的技术可行性方面，以现有的精算、金融定价工具为基础，在理论上给出了构建保单贴现金和保单贴现证券化定价模型的思路；在保单贴现的法律可行性方面，保单贴现交易与我国现有《保险法》的相关规定不存在冲突，满足可行性。

# References

[1] Joy D. Kosiewicz, Death for Sale: A Call to Regulate the Viatical Settlement Industry, CASE W. RES. L. REV. 1998, 48(3): 701-704 .

[2] Sheng Rong, Study on Developing the Life Settlements of China, China Insurance News, 2010-01-05
盛荣.关于我国开展寿险保单贴现业务的思考（上）.中国保险报，2010-01-05。 http://insurance.baidu.com/2010-01-05/122255674.html
[3]Su Xiangdong, Experts predict: The Population of the Elderly in China will Reach 437Million in 2051, China Network,2009-02-26
苏向东.专家预测：2051 年中国老年人口将达到 4.37 亿.中国网，2009-02-26。
http://www.china.com.cn/news/txt/2009-02/26/content_17341420.htm
[4]Cao Jianwen, The Pension of China Faces a Double Challenge, The New Policy of Rural Pension Started in Hopes, Guangming Daily, 2009-12-11.
曹建文."中国式养老"面临双重挑战 农村养老新政在期许中起步.光明日报，2009-12-11。
http://news.xhby.net/system/2009/12/11/010644910.shtml
[5]Li Baoku, The Aging Population of China and the Practice of the Aging Work, 2002 "Aging Population: Opportunities and Challenges" Seminars and Exhibitions.
李宝库.中国人口老龄化和老龄工作的实践.2002"人口老龄化：机遇和挑战"研讨会及展览。
[6]Jiang Shengzhong, Development Report of China's insurance industry in 2007, China Financial and Economic Publishing House, First edition, 2007. 9.
江生忠.2007 年中国保险业发展报告.北京：中国财政经济出版社，2007 年 9 月第一版。
[7]Wang Jiahao, Ping An Securities Believes The Growth of China Life and Ping An Life will be Slightly above the Average Growth, Shihua News, 2007-7-23.
王嘉豪.平安证券认为中国人寿和平安寿险的保费增长会略高于平均水平.世华财讯，2007-5-23。
http://content.caixun.com/NE/00/9q/NE009qq0.shtm
[8]Wei Hualin, Lin Baoqing, Insurance, Higher Education Press, first edition, 1999.8.
魏华林，林宝清.保险学.北京：高等教育出版社，1999 年 8 月第一版。

# 我国推行保单贴现的可行性分析

刘喜华 [1]，林巧珍 [2]，崔松 [1]

1. 青岛大学经济学院 山东青岛 266071；
2. 中国邮政储蓄银行浙江省分行，浙江杭州，310003

**摘 要**：首先本文从保险业发展、重大疾病威胁和人口老龄化三个方面分析了保单贴现需求的影响因素，在此基础上，运用协整检验和误差修正模型对我国保单贴现需求问题进行了实证预测，研究表明，我国保单贴现额度总体上呈上升态势，而且增加的幅度越来越大，保单贴现有巨大的潜在需求。除了保单贴现需求方的参与之外，保单贴现的成功交易还要有保单贴现供给方的配合。为此，本文深入分析了我国金融市场各交易主体（保险公司、银行、证券公司和投资者）成为保单贴现供给者的可能性。而保单贴现交易的核心问题是保单贴现的定价问题，保单贴现交易涉及两个价格，一个是保单贴现公司购买寿险保单向保单贴现人支付的保单贴现金，另一个是投资者支付给保单贴现公司的价格。对此，本文以现有的精算、金融定价工具为基础，在理论上给出了构建保单贴现金和保单贴现证券化定价模型的基本思路。在保单贴现的法律可行性方面，本文主要从保险利益的法律规定和保单转让的法律规定方面分析了保单贴现交易的法律可行性，分析表明，保单贴现交易与我国现有《保险法》的相关规定不存在冲突。
**关键词**：保单贴现；可行性；人口老龄化

# Exploration of the Insurance Model to Boost the Microenterprises' Financing

LUAN Hong
School of Economics, Beijing Technology and Business University
Beijing, China, 100048

**Abstract:** The Chinese micro-enterprises have made major contributions to boost the economic growth, to augment employment and to promote the scientific and technical innovation and the social harmony and stability and so forth. But in recent years, our steady monetary policy and the increasing factor price have made the enterprises to increase the investment and decrease the benefit. Thus it is very difficult now for them to get loans from the bank. As a result, financing difficulty has become the bottleneck for the micro-enterprises to develop themselves. Against this background, the insurance industry is actively opening up the guarantee insurance, the credit insurance and the liability insurance and so forth to explore and boost the micro-enterprises' financing effectively . Some insurance companies are making corresponding experiments. This paper analyses the background of the corresponding businesses which can play active roles in boosting the micro-enterprises' effective financing. This paper also compares these above mentioned different insurance modes, points out the existed problems and puts forward proposals and strategies for risk control and the sustainable development through the insurance subject, the object insured and the conditions of the insurance.

**Keywords:** Micro-enterprise, guarantee insurance, credit insurance , liability insurance, proposal

## Ⅰ. Introduction

The micro-enterprises are the general terms for the small enterprises, the mini-enterprises, the family workshops and the individual-owned businesses. The Chinese micro-enterprises have made major contributions to boost the economic growth, to augment employment, and to promote the scientific and technical innovation and the social harmony and stability and so forth. [1]Owing to their small scale and lack of the collateral, it is very difficult for the micro-enterprises to obtain the loans from the bank. As a result, the financing difficulty has become the bottleneck for them to develop themselves. This situation has already drawn the high attention of the government and all the circles of the society. The State Council thus unveiled nine taxation and financial policies and measurements to support the development of the micro-enterprises including the guarantee insurance and the credit insurance to help develop the micro-enterprises and the mini-enterprises in October,2011. China Insurance Regulatory Commission also instructs the insurance companies to play an active role in raising the insurance trustworthiness and upgrade the level of the credit risk management. How to boost the micro-enterprises to solve the problems of the corporate finance has become an issue in the insurance business. The key of this issue lies in what kind of the insurance mode should be taken in order to combine the petty loan transaction and the insurance services. Against this background, the insurance industry is actively opening up the guarantee insurance, the credit insurance and the liability insurance and so forth to explore and to boost the micro-enterprises' financing effectively. Some insurance companies are making corresponding experiments.

At present, some provinces are making experiments on the combination of the petty loan and the insurance services. Some insurance companies are targeting to launch the innovation of the related insurance products and the insurance patterns. Whereas in most provinces and insurance companies adopt the pattern of the petty loan and the guarantee insurance. Some others adopt the pattern of the credit insurance and the liability insurance.

Ningbo, Zhejiang Province adopts the mode of "government + insurance + bank" to share the risk altogether. 1485 small enterprises have obtained 15.64 billions with the support of insurance. This breakthrough can be described as what the Chinese idiom says to lever a ton of weight with four ounces force. Shanghai experiments the loans with the performance bond insurance and is warmly welcomed by the small and medium- sized enterprises. On the tri-corporation among the government, the bank and the insurance ( guarantee) industry, they participate in and share the risks together. The insurance company takes the place of the surety company, which makes up for gap of the financing difficulties. Co-operated with the bank. PINGAN Insurance Company of China,Ltd. has customized for the small and micro-enterprises the " loan guarantee insurance" which will help them to get the loans from the bank.. This is a real breakthrough to solve the financing difficulties for the small and medium-sized enterprises. China Export Credit Insurance Corporation thrusts out an easy "SMECUI" project, that is an easy credit underwriting insurance

[1] This thesis is financed by The Capital Circulation Industry Research Base of Beijing Planning Office of Philosophy and Social Sciences.

project for the micro-enterprises. It will give the small and micro--enterprises still greater support. Its distinguishing feature is " comprehensive guarantee, simplicity of operation". The product interface is compact, clear and attractive and is easy for the small and micro-enterprises to understand and use. IEL, namely the mode of bank + guarantee + insurance is the first financing product for the enterprises launched by Jiaxing Bank in China, the risk is shared by the bank, the insurance company and the guarantee company. Its basic mode is that Jiaxing Bank provides the loans, the guarantee company offers the guarantee and the insurance company insures the guarantee liability for the guarantee company. The diversification and the compensation of the credit risk is executed and operated through the marketization. If a loan occurs the risk, the guarantee company will first compensate for it for the loss of the bank, the insurance company will then settle the claim according to the insurance liability. China Pingan Group sells a product called the Pingan Easy Loan Insurance which is a free mortgage loan for the ordinary residents to get the credit guarantee loans with mortgage free. Once succeeded, the applicant can get a small loan from 10,000 yuan - 150,000yuan from the cooperative bank without mortgage and the guarantee. The procedure is simple, the length of the loan is flexible and the approval process moves fast. There are more insurance products such as the insurance policy mortgage, the comprehensive policy for the small loans and the short-term trade credit insurance and so forth. From the theoretical point of view, all these products launched by different cities or companies belong to the guarantee insurance, the credit insurance and the liability insurance. The purpose is to solve the difficulties in financing.

# Ⅱ. The Main Insurance Modes In Supporting The Small and Micro-Enterprises' Financing

## A. Small loan guarantee insurance

The guarantee insurance means the debtor insures his own credit risk to the insurer in answer to the creditor’s request. On the condition that the debtor fails to repay the debt on time, the insurer will compensate the loss for the creditor. In fact, the insurer plays the role of guarantee. From the angle of the person concerned, the insurer of the guarantee insurance is the debtor, and the insured is the creditor. The debtor becomes a party of the insurance contract. From the insurance object, the guarantee insurance uses the debtor's own credit as the insurance object. According to the insurance terms, the guarantee insurance is the debtor to use his own credit to insure himself according to the creditor's request. It is clear that the guarantee has credit risks. To decrease the insurer's risk, such as the moral risk, the debtor is usually requested to provide a counter warranty,( impawn and guarantee and so on). Thus, the contract of the guarantee insurance also involves the debtor, the counter-guarantor and the creditor besides the insurer. There are different kinds of the guarantee insurances, the small loan guarantee insurance can be used to boost the small and micro-enterprises' financing.

The small loan guarantee insurance means that the enterprise buys it from the insurance company, applies for the loan with the policy and then the bank will lend the loan to the enterprise after going through the checking process. When the risk occurs, the insurance company will repay the debt for the bank in accordance with the proportional liabilities and the compensational order.. There are two such insurances: one is the mortgage free loan guarantee insurance, the insurance company will bear certain loan risks; the other is the mortgage loan guarantee insurance to increase the credit limit by means of evaluating the impawn of the enterprise.

## B. Small loan credit insurance

The credit insurance means that the creditor insures the debtor's credit risk from the insurer, that is the creditor, as the obligee, asks the insurer to take the responsibility of the credit risk for the debtor so as to avoid loss for the creditor. From the point of view of the party client, the insurer and the insured of the credit insurance are all creditors and the parties of the insurance contract. However the debtor becomes the third party. From the object of the insurance, the credit insurance is based on the object of insurance of the credit assets of the creditor. From the insurance conditions of view, the credit insurance does not need the insurer (creditor) to provide the counter-guarantee measures.

The small loan credit insurance means the bank insures the small and micro-enterprises' credit risk at the insurance company which bears the bank's loss owing to the debtor's credit risk.

## C. Small loan liability insurance

The liability insurance is the kind of insurance: The object insurance must be responsible for the compensation liability of the third party according to the law. The insurer's reparation is directly paid to the insured. But actually this reparation is paid to the aggrieved party. That is the third party besides the insured. Thus the mode of the liability insurance is a dual protection mechanism to protect the interests of the insured directly and the aggrieved party indirectly. Here the insured becomes a party in the insurance contract, the risk of the civil law becomes the insurance subject. In practice, there are several liability insurances, However, the small and medium-sized enterprises' loan liability insurance can be used to support their enterprises' financing.

The small and medium-sized enterprises' loan guarantee insurance means that the enterprise should first send the application to the guarantee company, the guarantee company then insures the liability at the insurance company. After checking by the three parties, the bank grants the loan. Once the credit risk occurs, the guarantee company will first repay the bank' loan. After handling the anti-guarantee collateral together, the guarantee company will claim the insufficient from the insurance company.

# III. Functions

## A. To raise the credit of the loan and the financing ability of the micro-enterprise

When buying the small loan guarantee insurance, the small enterprise can obtain the loan from the bank with no collateral or a few collaterals. And even obtain more loans. The guarantee institution can also buy the loan liability insurance to get the risk guarantee from the insurance company so as to request the bank to reduce the portion of the margin., to raise the guarantee ability and to help more enterprises to finance.. Because of the special functions of the insurance products, the insurance company is able to bear the credit risk. Therefore, the enterprise's credit can be raised on the one hand and enhance the willingness of the bank to give out loans.

## B. To reduce the cost of financing, to help the enterprise decrease the pressure of the management

Since the insurance company is well-capitalized and the ability to pay debt, the bank will provide favorable terms to reduce the interests and can also lower the cost of financing besides well covering the insurance expenses.

## C. To share management and control the risk, to provide the complete risk guarantee

By utilizing its technical experience and the reserve of talents, the insurance company to complete the credit examinational, analytical and disposal system together with the bank and the guarantee company and so forth. The purpose is to distinguish, be on guard and defuse the risk of the credit. Meanwhile, the traditional products like the accident and injury insurance, the business property insurance and the cargo and transportation insurance can also be insured to provide the risk guarantee for the small and micro-enterprises and to decrease the uncertainty during the business operation.

# IV. Problems

From what has been mentioned above, different insurance modes can help the small and medium-sized enterprises to finance, transfer risks, promote the development of the enterprises. But as to the insurance companies, they deal with the high-risk businesses and face the challenge from the developmental environment, policies, techniques and talents. In service of the small and medium-sized enterprises and the risk prevention, The problem confronting the insurance company is how to avoid risks and how to reach the balanced development.

## A. The small loan guarantee insurance reduces the bank's responsibilities, this will lead to the disadvantage of establishing true risk-sharing system

In the small loan guarantee insurance, the party of the contract is the borrower ( insurer ), the bank ( insured ) is only the related party. This causes most guarantee insurance contracts are lack of the binding force to the bank.. The bank actually is in a unconcerned position with them. If the insurance company's solvency is adequate, the bank's risk is very low. The insurance company is always in the passive position. This is not good for establishing a fair and reasonable mechanism.

## B. Lack of a perfect credit management system of the enterprises

The credit management system is comprised of the investigation reports and the credit data base of the enterprise. At present, the enterprise is credit system has not been established in China, the insurance industry has not connected with the data of the bank's reference system. When underwriting the loan insurance, the insurance company mainly depends on the borrower's information from the bank. It is clear that the insurance company is in a passive position. Meanwhile, the credit reporting system of the small and medium-sized enterprises is not perfect, the insurance company can not get a clear picture of the insurer's credit status. This will increase the risk. These will be increased .Often the insurance company will raise the requirements and the adopt complex procedures to avoid the risk. To certain extent, it is in favor of the risk control, but it will also bring more difficulties and increase the cost to small and medium-sized enterprises. The result is some will give up applying the loans through the insurance company.

### C. Lack of sufficient law support and the well established law system

The survival foundation of the liability insurance lies in the well-established law system. But now the trial implementation of the loan guarantee liability insurance is short of such base. In practice, The situations confronted are:The warrantor does not have the qualification or does not have capability to guarantee. Then this guarantee is an invalid guarantee.The warrantors provide warranties in several banks, warrant one another or provide serial warranties among themselves.The borrower's collateral is not registered in the related institution. Out of a variety of causes, the bank gives tactic consent to it. The collateral loan only remains the name in reality. The value of the collateral is not estimated in the related institution. It sometimes leads to the phenomena of overvalued collateral .

### D. The operational high risk and high cost challenge the managerial and administrative expertise of the insurance company

The economic circle greatly influences the small and medium-sized enterprises to repay the loans on time. So does their own managerial and technical level. Once the economy is going down periodically fairly quickly, the loan guarantee insurance business will face a large scale risk. And on the other hand, the financial accounting of most small and medium-sized enterprises is not standard, the transparency of the financial information is quite low, the authenticity and reliability of the financial data and the reliability exist flaws. The amount of the work for the insurance company to examine and verify is fairly big. Because of the fairly small loans, the insurance company will bear fairly high operational cost. Generally speaking, this kind of insurance challenges the risk control level of the insurance company.

## V. Proposals

### A. To complete the risk-sharing mechanism between the bank and the insurance company

When implementing the small loan guarantee insurance, the insurance company and the bank will share the risk of the loss of the loan principle according to a curtain proportion and that the proportion and the ways to the share risk should be adjusted with differentiation on the basis of the practical situation of the quality of the risk management and the loss of the loan. The borrower may also be asked to insure the accident and injury insurance at the same insurance company, the insured amount must not less than the loan principle. The borrower's property insurance should also be insured at the same insurance company.

### B. To establish a complete credit information system

Bank of China should take the lead in establishing a unified credit reporting platform, which will bring into the relative credit information from the insurance and the security institutions step by step so as to not only realize the resource sharing among the financial institutions to guard against the credit risk effectively, but also to actively promote the formation of the integrity system of the whole society. To immediately establish a practical credit file system will save the numerous risk examining workload, reduce the acquisition cost and will also do good to the insurance company to carry on the follow up service well and to improve the risk management.

### C.To improve the legal Environment

The Suggestion is that China Insurance Regulatory Commission or agencies to strengthen corporation with the judicial institution and unveil legal documents in accordance with the new situation and new problems out of the small and medium-sized enterprises to complete the disciplinary measures to punish these discreditable borrowers. vicious default, the personnel getting of the financial debt severely. Those in serious circumstances will be subjected to criminal prosecution. These legal and effective financing of the small and medium-sized enterprises will be protected by the law. The insurance company must study "the Guaranty Law" seriously and other details about the secured loan related with the law, raise the secured loan quality, reduce and guard against the risk of the secured loan.

#### D. The government provides the policy support

1) .To establish the credit insurance fund for the small and medium-sized enterprises

Owing to the high risk, the small and medium-sized enterprises will be very difficult to speed up the development of the loan credit insurance, if merely depends on the market mechanism. The suggestion is that the government to invest the fund for the small and medium-sized enterprises which will be used to provide the subsidy of the credit guarantee insurance fee of the small and medium-sized enterprises and share the amortization cost of the loss of the loan in order to encourage the insurance company to provide the credit insurance service. When the bank issues the loan to the small and the medium-sized enterprise, it can use the credit insurance fund to subsidise a portion of the insurance fee so as to reduce its insurance cost. If the loan fails to be paid back, the enterprise, the government and the insurance company will share the loss all together according to the proportion. Thus the insurance company can reduce the loss.

2).To use the credit guarantee insurance of the small and medium-sized enterprise as the "policy insurance"

Since the big customer's cash flow is abundant, the requirement for the credit guarantee is not urgent. On the contrary, the small and medium-sized enterprises have a high demand for it. Many are asset-light. Their financial condition may not accord with the bank credit requirements. The suggestion is to develop the credit guarantee insurance of the small and medium-sized enterprises into the "policy insurance", just like the government supported export credit insurance. Therefore, the business volume of the credit guarantee will surely be increased. The policy orientation can be reflected from their customers, such as the policy supports the small and medium-sized enterprises, the cultural enterprises and the scientific enterprises and etc.

3).The suggestion is to establish a credit guarantee system for the small and medium sized enterprises to meet with their needs of financing. The small and medium-sized enterprises find it difficult to seek guarantee. The government should take the lead to establish a loan guarantee center. The other important organizations are the mutual assistance fund and a commercial guarantee organization for the small and medium-sized enterprises which belong to the constituent part of the guarantee system.

4).With the support of the government, a research should be made to establish a reinsurance organization which will effectively help disperse the risks of the insurances companies. Engaging in loan insurance businesses.

# REFERENCES


[1] Wang Shujing, Property Insurance,Beijing University Press March, 2011

[2] Guo Zuojian,Lou Ysnhua and Xu Fang,Renovation of the Loan Insurance Mode of SME, China Finance, 2012.3

[3] Zhuang Huibing, To Solve the Financing Puzzle in the Countryside: the Analysis of the advantages and the Disadvantages Between the Loan guarantee and the Loan Credit Insurance, Insurance Studies, 2010.2

[4] Yang Yang and Li Wenji, To Develop the Credit guarantee Insurance to Help SME Financing, Finance Times, 2012-03-01

[5] Xu Mingming, The small Loan Guarantee Insurance Helps the Bancassurance Win-Win", China Urban and Rural Finance Times, 2011-05-25

[6] Long Anjue, "The Current Situation of SME Financing and the Problem Analyses, China Foreign Capital, 2011(17)

[7] Wu Yuanbo and Wang Cheng ,The Current Situation of the SME Financing, Problems and the Countermeasure Analysis, GuiZhou Institution of Finance and Economics Joural, 2008(1)

[8] Li Yizhong, the State Council Repot on Promoting the Development of SME, 2009-12-24

[9] Nin Jing, Probe into the Micro-Enterprise Insurance, China Insursnce Daily, 2012-05-11

# Rationality of Insurance Pricing: Do Insurers Herd?

REN Yayuan

College of Business, Illinois State of University, Illinois State, the U.S., 61791

**Abstract:** This paper investigates the role of herding behavior in insurance pricing for property-casualty insurance companies in United States. We examine whether insurance price movements are due to rational adjustments for fundamental changes or over-adjustments resulted from irrational herding. Consistent to the herding hypothesis, we find that insurers tend to follow the herd to lower or raise insurance price. We also find that insurers are more responsive to the herd to decrease price than the herd to raise price. Firms of larger size and older age are more likely to follow the herd. Mutual and stock insurers are found to have similar patterns of herding.

**Keywords:** Herding, Insurance Pricing

## 1. Introduction

The term "herding" broadly refers to a tendency of many agents to take similar actions at the same time (Sia, 2004; Jegadeesh, 2010). Academic studies often attribute many market failures such as excess market volatility, bubbles and the emerging market meltdowns to the phenomenon of herding. The property-casualty insurance market is known to alternate between soft markets and hard markets. Premium rates are low in soft markets and much higher in hard markets. Do insurers herd to lower or raise insurance price in soft and hard markets? Are the insurance price movements due to rational adjustments for fundamental changes, or over-adjustments resulted from irrational herding? Such questions are essential to understanding insurer pricing behavior and the underwriting cycle.

Why do agents herd? There has been substantial theoretical and empirical literature that explores the issue and offers many reasons.[1] One reason why agents may herd is because they act based on similar information. Their information may be similar either because they all independently acquired information that happened to be correlated, or they may have rationally learned information from their peers' actions. This information-driven herding, which we refer to as rational adjustment, would not have the destabilizing effect especially when they all react to the same fundamental changes in a timely manner. On the other hand, if herding is driven by a desire to imitate the actions of others, then herding forces may move price away from fundamentals and lead to excess volatility in price. We refer to this imitation-driven herding as irrational herding. In this paper, we investigate the role of herding in insurer pricing for the U.S. property-casualty insurers, which to my knowledge has not been directly addressed in prior research.

The phenomenon of the underwriting cycle in property-casualty insurance market has attracted long-time research interest. There have been various theories proposed to explain the causes of the underwriting cycle.[2] A notable work by Lai et al. (2000) suggests that the market-wide insurance price movements are mainly resulted from the changes of expectations on fundamental factors. This theory posits that the changes of expectation on interest rate, future losses and expenses to much extent affect the insurance pricing. It is suggested that the collective price adjustment by insurance companies is largely a rational reaction to changes of fundamentals.

In contrast, Harrington and Danzon (1994) and Harrington (2004), in their explanation of the fluctuations of insurance price, propose a hypothesis that the herding behavior among insurers results in mispricing and aggravates the underwriting cycle. They suggest that some

[1] For example, the payoff externalities models (e.g.Brennan, 1990; Froot et al. 1992; and Hirshleifer et al. 1994) show that the payoffs to an agent adopting an action increases in the number of other agents adopting the same action. Principle-agent models (Scharfstein and Stein, 1990; Rajan, 1994; Zwiebel, 1995) show that managers, in order to preserve or gain reputation, may prefer to follow the market consensus. Cascades models (Bikhchandani et al. 1992; Welch, 1992) show that later agents, inferring information from the actions of prior agents, optimally decide to ignore their own information and act alike. For more discussion on the literature regarding herding, refer to Devenow and Welch (1996). See Bikhchandani and Sharma (2001), Hirshleifer and Teoh (2003), and Devenow and Welch (1996) for detailed surveys of the herding literature.

[2] For example, the capacity constraint theory (Gron, 1994; Winter, 1988, 1991, 1994; Cummins and Danzon, 1997) suggests that the cyclical premium adjustments reflect changes in insurer surplus that affect the industry's capacity for bearing risk. The institutional intervention theory proposed by Cummins and Outreville (1987) posits that the informational lags in data collection, regulation, and policy renewals lead to the cyclical performance. The interest rate theory (e.g. Doherty and Kang, 1988; Doherty and Garven, 1995) relates the underwriting cycles to the fluctuations in interest rates. The under-pricing theory (e.g. Harrington and Danzon, 1994; Harrington, 2004) suggests that the competition-induced excessive price cutting in soft market contributes to the overpricing in the subsequent hard market. Moreover, Lai et al. (2000) develop a multi-factor model to explain the underwriting cycle and emphasizes the role of expectation changes in generating a cycle.

insurers may have priced below cost because of moral hazard that is resulted from limited liability and risk-insensitive guaranty programs or low loss forecasts relative to optimal forecasts, giving rise to winners' curse effects. Other insurers could cut prices in response to such aberrant firms to preserve market share and avoid loss of quasi-rents from renewal business related to investments in tangible and intangible capital. As a result, aberrant behavior by some firms could aggravate price cutting during soft markets, which contributes to the overpricing in the subsequent hard market.

While Lai et al. (2000) implies insurance price movements are rational adjustment for fundamental changes, Harrington and Danzon (1994) suggests that irrational herding among insurers contribute to the volatility of insurance price. Neither of them, however, empirically examines the role of herding in insurance pricing, which motivate this study.

Drawing from the literature, we test two hypotheses in this paper: (1) The insurance price movements are rational adjustments for fundamental changes, and (2) The insurance price movements are over-adjustments resulted from herding. We call the former "Rational Adjustment Hypothesis" and the latter "Herding Hypotheses." The two hypotheses are not necessarily competing with each other, as the underwriting cycle is a complicated phenomenon simultaneously caused by multiple factors. Therefore, it is an empirical issue to what extent each factor contributes to the insurance price movements.

To test above hypotheses, we first develop a measure to capture the herding in insurance pricing. The measure, inspired by Lakonishok et al. (1992) and Wermers (1999), is based on the portion of the insurers that increase (decrease) insurance price. To differentiate rational adjustments from irrational herding, we regress the measure on fundamental variables and use the residual values of the regression to capture the degree of irrational herding.

With the measures of herding, we are able to examine whether insurers herd in pricing. The empirical results support the irrational herding hypothesis—fundamental changes cannot fully explain insurance price changes, and insurers follow the herd to lower or raise insurance price. We also find that insurers have higher propensity to follow the herd to decrease price than the herd to increase price. Moreover, firms of large size and older age are more likely to herd.

The rest of the paper is organized as follows. Section 2 describes the sample and data. The mythology of empirical tests and model results are presented and discussed in Section 3. Section 4 concludes.

# 2. Sample and Data

We investigate the role of herding in insurance pricing for property-casualty insurers in United State. Our primary data source is the database of statuary financial statements of insurance companies provided by SNL Financial. The data are available from 1996 to 2011. Because we need past three-year data to compute two variables in the regression, the final sample covers the period 1998 to 2011 and consists of 15372 observations for 2218 insurance companies. The firms in the sample are affiliated and unaffiliated individual companies. About seventy percent of the insurers are stock companies. The industry-level data, such as combined ratio, investment return and market concentration, are obtained from SNL database of aggregated statistics for insurance markets. The interest rate and GDP data are published by U.S. Department of Treasury and U.S. Bureau of Economic Analysis.

# 3. Methodology and Empirical Results

## A. Measurement of Herding

To test the research hypotheses, we first develop a measure of herding. Prior studies have proposed many herding measures mostly for the stock market and investors.[3] Our measure is essentially similar to that used in Lakonishok et al. (1992) and Wermers (1999).

It takes two steps to construct our measures of herd. In the first step, measures are constructed to capture the propensity of herd which is based the portion of firms revising price toward to the prevailing price. To differentiate the direction of herding, we define as the measure of herding to increase insurance price, and as the measure of herding to lower insurance price, which are expressed as

$$IHM_t = (I_t - E[I]) - E( \quad (1)$$

$$DHM_t = (D_t - E[D]) - E(D_t - \quad (2)$$

where is the proportion of all insurers that increase insurance price, and is the proportion of all insurers that decreases insurance price in year t. and are the average proportion

[3] For example, Lakonishok, Shleifer, and Vishny (1992) and Wermers (1999) develop a measure of herding in stock market based on changes in the number of buyers and sellers. Nofsinger and Sias (1999) use the proportion of institutional ownership to measure herding. Chang et al. (2000) and Christie and Huang (1995) employ cross-sectional standard deviation of stock returns to detect herd behavior in a market setting. Hwang and Salmon (2004) develop a measure of herding in a market based on the cross-sectional variance of beta.

of insurers increasing and decreasing price over the sample period. Then, an adjustment factor, or , is subtracted to account for the trend of the expected proportion of insurers increasing or decreasing insurance price. Insurance price charged by firm i in year t, is measured as the ratio of premiums written net of underwriting expenses and policyholder dividends to the discounted value of incurred losses and loss adjustment expenses. Incurred losses and loss adjustment expenses are net of changes in prior years' reserves, on an accident year (AY) basis, and are discounted using the U.S. Treasury yield curves.[4]

To test the two hypotheses, it is critical to empirically differentiate between co-movements reacting to changes in fundamentals and correlated behavior due to irrational herding in the market. In the second step, therefore, we regress and on the changes of macro-fundamental factors including the changes of industry combined ratio, investment return rate, concentration ratio, and GDP, and then use the residuals from the regression to capture the degree of insurer irrational herding. In this way, we remove the effect of fundamental adjustments from and . The resulted measures of herding are denoted as HER and HERD. The time-series trends of HER and HERD are displayed in Figure 1. As shown in Figure 1, HER is relatively high for periods 1997- 1999 and 2006-2008, which are known to be soft market periods. HEI is higher during the hard market of 2001-2005.

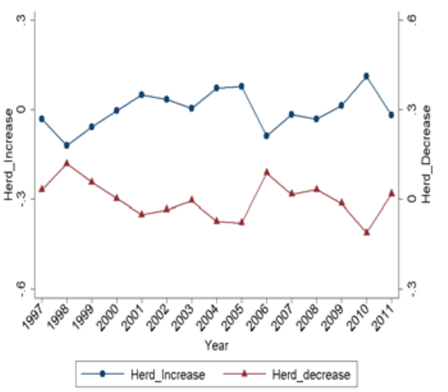



Figure 1 Industry Herding Measures over Time

## B. Do Insurers Herd in Pricing?

With the measures of herding, we are able to test the research hypotheses by incorporating the measures of herding into the insurance pricing model. Lai et al. (2000) develop a model of the determination of insurance premium. We include the determination factors in their models in our insurance pricing model.

$$\text{Dependent Variable}_{it} = \text{HERD\_INCREASE}_t \ (\text{HERD\_DECREASE}_t) + f\,(\text{LOSS, VLOSS, EXPENSE, VEXPENSE, INVEST, LEVERAGE, SIZE, REINS, LIQ, STOCK, AFFILLIATE, AGE})_{it} \quad (3)$$

where

Dependent Variables include three measures of price change: PRICE_CHANGE, INCREASE, and DECREASE. The herding measure of HERD_INCREASE$_t$ and HERD_DECREASE$_t$ are defined in the earlier section. The other variables are defined as follows:

PRICE_CHANGE is the change of insurance price between year t and t-1
INCREASE is a dummy variable equal to 1 if the insurance price in year t is higher than the price in year t-1
DECREASE is a dummy variable equal to 1 if the insurance price in year t is lower than the price in year t-1
LOSS is the change of the loss between year t and t-1
VLOSS is the change of the variance of past-three-year loss ratio between year t and t-1
EXPENSE is the change of expenses between year t and t-1
VEXPENSE is the change of the variance of past-three-year expense ratio between year t and t-1
INVEST is the change of investment return of the firm between year t and t-1
LEVERAGE is the natural logarithm of liabilities-to-surplus ratio in year t
SIZE is the natural logarithm of total assets of the firm in year t
REINS is net reinsurance ceded divided by direct premiums written in year t
LIQ is cash plus government bonds over admitted assets in year t
STOCK is a dummy variable equal to 1 for stock companies and 0 otherwise
AFFILLIATE is a dummy variable equal to 1 for affiliated single companies and 0otherwise
AGE is firm age calculated as (2011- year in which the firm was established)

[4] This price measure is based on the work of Winter (1991), Berger, Cummins, and Tennyson (1992), Cummins and Danzon (1995), and Sommer (1996). See Cummins and Danzon (1995) for a more detailed explanation of the insurance price measure.

If insurers adjust price rationally for fundamental changes, then the coefficients of HERD_INCREASE (HERD_DECREASE) should be insignificant in model (3). On the other hand, a significant HERD_INCREASE (HERD_DECREASE) would suggest evidence supporting the herding hypothesis. We estimate the coefficients using panel data fixed-effect models. While both fixed-effect and random-effect models generate very similar results, we report the results of fixed-effect models because Hausman's test suggests that fixed-effect models are superior to random-effect
models. The constant firm specific variables STOCK and AFFFILIATE, however, are not
estimable in fixed-effect models. Therefore, the coefficients of these variables are estimated using random-effect models. Moreover, to account for serial correlation in price change, we assume the covariance structure in the fixed-effects models follows a first order autoregressive process AR(1).

Table 1 reports the summary statistics of the variables. Both SIZE and LEVERAGE are highly skewed and are log transformed. The negative means of PRICE_CHANGE and the greater mean of DECREASE than INCREASE suggest that over the sample period there is a higher proportion of insurers decreasing price than the proportion of insurers increasing price. This phenomenon is probably due to the increasing competition in the insurance market.

The estimation results for model (3) are presented in Table 2. Note that by construction HERD_INCREASE and HERD_DECREASE are almost perfectly inversely related, so we include only one of them in a regression. When the dependent variable is INCREASE_DUM,

| Variable | Number of Observations | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| PRICE_CHANGE | 15372 | -0.302 | 8.951 | -90.957 | 93.503 |
| INCREASE_DUM | 15372 | 0.465 | 0.499 | 0 | 1 |
| DECREASE_DUM | 15372 | 0.535 | 0.499 | 0 | 1 |
| LOSS | 15372 | 0.087 | 34.227 | -790.667 | 715.746 |
| VLOSS | 15372 | -159.541 | 10160.160 | -450354.420 | 359725.29 |
| EXPENSE | 15372 | 0.815 | 35.042 | -617.436 | 819.412 |
| VEXPENSE | 15372 | -73.515 | 8185.21 | -273729.88 | 350831.07 |
| INVEST | 15372 | -0.170 | 1.505 | -45.371 | 45.667 |
| LEVERAGE | 15372 | 4.264 | 1.048 | -5.809 | 7.869 |
| SIZE | 15372 | 11.270 | 1.894 | 5.445 | 18.499 |
| REINS | 15372 | 0.598 | 0.931 | 0 | 58.233 |
| LIQ | 15372 | 47.842 | 234.786 | -96.169 | 8897.15 |
| STOCK | 15372 | 0.681 | 0.466 | 0 | 1 |
| AFFILIATE | 15372 | 0.056 | 0.230 | 0 | 1 |
| AGE | 15372 | 50.791 | 41.912 | 1 | 212 |

Table 1 Descriptive Statistics of Variables

| | Dependent Variables | | |
|---|---|---|---|
| | PRICE_CHANGE | INCREASE | DECREASE |
| INTERCEPT | -0.442*** | 0.400*** | 0.599*** |
| | (0.077) | (0.024) | (0.027) |
| HERD_INCREASE | 2.935 *** | 0.909*** | |
| | (1.011) | (0.072) | |
| (HERD_DECREASE) | -2.935*** | | 0.909*** |
| | (1.011) | | (0.072) |
| LOSS | -0.004 | -0.001*** | 0.001*** |
| | (0.002) | (1.19E-4) | (1.19E-4) |
| VLOSS | 2.055E-6 | 4.562E-7*** | -4.91E-7*** |
| | (6.057E-6) | (<0.10E-8) | (<0.10E-8) |
| EXPENSE | -0.013*** | -0.001*** | 0.001*** |
| | (0.002) | (1.22E-4) | (1.23E-4) |
| VEXPENSE | 0.620E-4*** | 2.54E-4*** | -2.54E-4*** |
| | (0.086E-4) | (<0.10E-8) | (<0.10E-8) |
| INVEST | -0.055 | 0.003 | 0.003 |
| | (0.049) | (0.003) | (0.003) |
| LEVERAGE | 0.002*** | 0.027*** | -0.027*** |
| | (0.0004) | (0.004) | (0.004) |
| SIZE | -0.040 | -0.005*** | 0.006*** |
| | (0.028) | (0.002) | (0.002) |
| REINS | 0.14E-4 | 2.51E-6* | -2.51E-6* |
| | (0.21E-4) | (1.315E-6) | (1.315E-6) |
| LIQ | 0.78E-4 | 0.65E-4*** | -0.65E-4*** |
| | (2.35E-4) | (0.16E-4) | (0.16E-4) |
| AGE | -0.001 | 0.10E-4 | -0.60E-4 |
| | (0.001) | (0.90E-4) | (0.90E-4) |
| STOCK[††] | -0.042 | -0.008 | 0.008 |
| | (0.127) | (0.009) | (0.009) |
| AFFILIATE[††] | -0.117 | -0.052*** | 0.052*** |
| | (0.240) | (0.016) | (0.016) |
| $\chi 2$ | 1210.3 | 61.94 | 61.94 |

Table 2 Effect of Herding in Insurance Pricing[†]

Notes:
* indicates significance at 10% level; ** indicates significance at 5% level; *** indicates significance at 1% level
† Standard errors are heteroscedasticity and autocorrelation consistent. Robust standard errors are reported in the parentheses below coefficient estimates. Company specific intercepts are included in the fixed effects models, but are not reported here.
†† Because in fixed-effect model, the constant firm specific variable STOCK and AFFILIATE cannot be estimated, the coefficients for these two variables are estimated using random-effect models. Fixed-effect and random-effect model generate very similar results for other variables.

we use HERD_INCREASE, and in the DECREASE_DUM regression, we use HERD_DECREASE. The results for the HERD_INCREASE and HERD_DECREASE regressions are very similar with reversed signs.

Consistent to the herding hypothesis, the coefficients of HERD_INCREASE or HERD_DECREASE are significant for all the three dependent variables. When the herding measure HERD_INCREASE (HERD_DECREASE) is higher, insurers tend to increase (decrease) insurance price. The results suggest that fundamental changes in insurance product cannot fully explain the insurance price movements, and insurers tend to irrationally follow their peers to raise or lower insurance price ignoring their own analysis.

## C. What Kind of Insurers Tend to Herd?

After establish the fact that insurers irrationally herd to raise or lower insurance price, a natural question follows: what kind of insurers tend to herd? What are the relationships between firm characteristics and decisions to herd? To answer these questions, we first need to capture a firm's propensity to herd.

Let HERD_INCREASE_DUM be denoted for a dummy variable equal to 1 if a firm increases insurance price when the market appears to herd to increase price, i.e. $HERD\_INCREASE_t > E[HERD\_INCREASE_t$ . $E[HERD\_$ is the average of $HER$ for the sample period. Similarly, HERD_INCREASE_DUM represents a dummy equal to 1 if a firm decreases insurance price when the market herds to decrease insurance price, i.e. $HERD\_DECREASE_t > E[HERD\_DECREASE_t$ . Moreover, let a dummy variable HERD_DUM equal to 1 when a firm follows the herd. These dummy variables can be expressed as

$$HERD\_INCREASE\_DUM_{it} = \begin{cases} 1, & \text{if } PRICE\_CHANGE>0 \text{ when } HERD\_INCREASE_t > E[HERD\_INCREASE_t] \\ 0, & \text{otherwise} \end{cases}$$

$$HERD\_DECREASE\_DUM_{it} = \begin{cases} 1, & \text{if } PRICE\_CHANGE<0 \text{ when } HERD\_DECREASE_t > E[HERD\_DECREASE_t] \\ 0, & \text{Otherwise} \end{cases}$$

$$HERD\_DUM_{it} = \begin{cases} 1, & \text{if } HERD\_INCREASE\_DUM=1 \text{ or } HERD\_DECREASE\_DUM=1 \\ 0, & \text{Otherwise} \end{cases}$$

We then regress the above dummy variables on a series of firm characteristics variables, including LOSS_RATIO, EXPENSE_RATIO, LEVERAGE, LIQ, REINS, INVEST, SIZE, STOCK, AFFILIATE and AGE, and the industry herding measure HERD_INCREASE (HERD_DECREASE).

Table 3 reports the results of the probit model. Model 1 and Model 4 are for HERD_INCREASE_DUM. Model 2 and Model 5 are for HERD_DECREASE_DUM.

Model 3 and Model 6 are for HERD_DUM. In Model 1 and Model 2, the coefficient of HERD_DECREASE_DUM is greater than the coefficient of HERD_INCREASE_DUM with a higher significance. It suggests that firms are more responsive to the herd of decreasing price than to the herd of increasing price.

The coefficients of AGE and SIZE are generally significantly positive, suggesting that firms of larger size and older age are more likely to follow the herd, especially the herd to raise price. Affiliated firms are more likely to herd to decrease price, while unaffiliated firms are more likely to herd to raise price. In addition, firms with higher leverage and more liquid assets are more likely to herd to raise price; firms with a lower level of loss ratio, expense ratio and liquid assets are more likely to herd to lower price.

Table 4 Means of Herding Dummies for Mutual and Stock Insurers

| | Mutual | Stock |
|---|---|---|
| HERD_INCREASE_DUM | 0.531 | 0.551 |
| HERD_DECREASE_DUM | 0.651 | 0.625 |
| HERD_DUM | 0.580 | 0.581 |

While we expect that mutual insurers may behave differently from stock insurers, the coefficient of STOCK is insignificant. Table 4 confirms this result by showing the tendency of herding for mutual and stock insurers. We can see that mutual and stock insurers share the similar pattern of pricing change.

# 4. Conclusion

Herding is believed to be a crucial element of behavior in financial markets and contribute to a number of economic phenomena such as bubbles, momentum and business cycles. In the insurance market, herding may lead to systematic erroneous pricing. To our knowledge, this paper is the first study to explore the role of herding in insurance pricing.

Using a sample of property-casualty insurers in United States, we investigate the role of herding in insurance pricing. We first establish the fact that fundamental changes cannot fully explain insurance price movements, and insurers tend to irrationally herd to raise or low insurance price. We also find that insurers are more responsive to the herd to lower price than to the herd to raise price. We then investigate the features of insurers that are more likely to herd than others. We identify that larger and older firms are more likely to herd, especially herd to decrease price. This result is consistent to the prediction of Harrington (2004) that some inexperienced small insurers may have priced below cost because of moral hazard that is resulted from limited liability or low loss forecasts, giving rise to winners' curse effects. Other insurers may follow such aberrant firms to cut price in order to preserve market share and avoid loss of quasi-rents from renewal business. We also find that mutual insurers have the similar herding pattern as stock insurers.

The results of this paper enrich the understanding of insurer pricing behavior and the underwriting cycle. Herding not only contributes to the systemic mispricing but prolongs the length of the underwriting cycle. The issue of herding in insurance price has important implications for insurance regulation and deserves future research.

# Reference

[1] Bikhchandani, Sushil, David Hirshleifer, and Ivo Welch, 1992, A Theory of Fades, Fashion, Custom, and Cultural Change as Informational Cascades, Journal of Political Economy, 100, 992–1026

[2] Christie, W. G., and R. D. Huang, 1995, Following the Pied Piper: Do Individual Returns Herd Around the Market? Financial Analysts Journal (July-August), 31-37

[3] Cummins, David J. and Patricia Danzon, 1997. "Price, Financial Quality, and Capital Flows in Insurance Markets," Journal of Financial Intermediation 6: 3-38

[4] Cummins, David J. and Francois J. Outreville, 1987. "An International Analysis of Underwriting Cycles in Property-Liability Insurance," Journal of Risk and Insurance 54: 246-262.

[5] Devernow Andrea and Ivo Welch, 1996, Rational Herding in Financial Economics, European Economic Review, 40, 603-615

[6] Doherty, Neil A. and James Garven, 1995. "Insurance Cycles: Interest Rates and the Capacity Constraint Model," Journal of Business, 68: 383-404.

[7] Doherty, Neil A. and Han-Bing Kang, 1988. "Interest Rates and Insurance Price Cycles," Journal of Banking and Finance, 12: 189-214.

[8] Froot, Kenneth A., David S. Scharfstein, and Jeremy C. Stein, 1992, Herd on the street: Informational inefficiencies in a market with short-term speculation, Journal of Finance 47, 1461–1484

[9] Gron, Anne, 1994. "Capacity Constraints and Cycles in Property-Casualty Insurance Markets," Rand Journal of Economics 25: 110-127.

[10] Harrington, Scott E., 2004, Tort Liability, Insurance Rates, and the Insurance Cycle, Brookings-Wharton Papers on Financial Services, 97-138

[11] Harrington, Scott E. and Patricia M. Danzon, 1994, Price Cutting in Liability Insurance Markets, Journal of Business, 67, 511-538

[12] Hirshleifer, David, Avanidhar Subrahmanyam, and Sheridan Titman, 1994, Security analysis and trading patterns when some investors receive information before others, Journal of Finance 49, 1665–1698

[13] Hirshleifer, David, and Siew Hong Teoh, 2003, Herd Behaviour and Cascading in Capital Markets: a Review and Synthesis, European Financial Management, 9, 25-66

[14] Hwang, S. and M. Salmon, 2003, Herding and Market Stress, the Journal of Empirical Finance, 11, 585-616

[15] Lai, Gene C. and Robert. C. Witt, Hung-Gay Fung, Richard D. MacMinn and Patrick L. Brockett, 2000, Great (And Not so Great) Expectations: An Endogenous Economic Explication of Insurance Cycles and Liability Crises, the Journal of Risk and Insurance 67, 617-652.

[16] Jegadeesh Narasimhan, and Woojin Kim, 2010, Do Analysts Herd? An Analysis of Recommendations and Market Reactions, Review of Financial Studies, 23, 901-937.

[17] Lakonishok, J., Andrei. Shleifer and Robert.W. Vishny, 1992, The Impact of Institutional Trading on Stock Prices, the Journal of Financial Economics 32, 23-43

[18] Nofsinger John R and Richard W. Sias, 1999, Herding and feedback trading by institutional and individual investors, the Journal of Finance, 54, 2263-2295

[19] Park, S., 1991, Bank Failure Contagion in Historical Perspective, Journal of Monetary Economics 28, 271-286

[20] Rajan, Raghuram G., 1994, Why credit policies fluctuate: A theory and some evidence, The Quarterly Journal of Economics 436, 399-442

[21] Scharfstein, David S., and Jeremy C. Stein, 1990, Herd behavior and investment, American Economic Review 80, 465–479

[22] Sommer W. David, 1996, The Impact of Firm Risk on Property-Liability Insurance Prices, the Journal of Risk and Insurance, 63, 501-514

[23] Welch, Ivo, 2000, Herding among Security Analysts, Journal of Financial Economics 58, 369-396

[24] Wermers, Russ, 1998, Herding, Trade Reversals, and Cascading by Institutional Investors, working paper

[25] Wermers, Russ, 1999, Momentum investment strategies of mutual funds, performance persistence, and survivorship bias, working paper

[26] Winter, Ralph A., 1988. “The Liability Crisis and the Dynamics of Competitive Insurance Markets,” Yale Journal on Regulation 5: 455-499.

[27] Winter, Ralph A., 1991. “The Liability Insurance Market,” Journal of Economic Perspectives 5: 115-136.

[28] Winter, Ralph A, 1994. “The Dynamics of Competitive Insurance Markets,” Journal of

[29] Financial Intermediation 3: 379-415.

Zwiebel, Jeffrey, 1995, Corporate Conservatism and Relative Compensation, Journal of Political Economy, 103, 1-25.

# Reinsurance and Systemic Risk:
# The Impact of Reinsurer Downgrading on Property-Casualty Insurers

**Sojung Carol Park**

Assistant Professor of Finance
Mihaylo College of Business and Economics
California State University, Fullerton
Fullerton, CA 92834-6848, USA
Email: sopark@fullerton.edu
Phone: (657) 278-3754

and

**Xiaoying Xie**

Assistant Professor of Finance
Mihaylo College of Business and Economics
California State University, Fullerton
Fullerton, CA 92834-6848, USA
Email: xxie@fullerton.edu
Phone: (657) 278-5389

# Reinsurance and Systemic Risk:
# The Impact of Reinsurer Downgrading on Property-Casualty Insurers

**Abstract**

This paper analyzes the interconnectedness between reinsurers and US property-casualty insurers and presents the first detailed examination on the likely impact of major global reinsurer insolvency on the US property-casualty insurance industry in order to illustrate the potential systemic risk caused by the interconnectedness of the insurance sector through reinsurance. We find that the likelihood of a primary insurer's downgrade increases with its reinsurance default risk exposure from downgraded reinsurers. Counterparty primary insurers' stocks also react negatively to their reinsurers' downgrades. The negative effects also spill over to insurers that are not directly exposed to the credit risk of downgraded reinsurers. Despite the close interconnectedness, worst-case scenario analyses show that the likelihood of systemic risk caused by reinsurance transactions is relatively small for the US property-casualty insurance industry.

**Keywords**: Reinsurance; systemic risk; property-casualty insurers; rating; event study; scenario analysis

## 1. Introduction

The danger of systemic risk to the financial services industry and the world economy as a whole, triggered by the potential failure of the reinsurance industry, has drawn much attention from industry practitioners, regulators, and academic scholars since the early 2000s (Swiss Re, 2003; Rossi and Lowe, 2002; The Group of Thirty, 2006). Earlier research in general finds the risk is small and inconsequential. Such a view was challenged in the wake of the recent financial crisis, as the meltdown of insurance giant AIG (American International Group) severely deepened the crisis. As a result, a new round of research has emerged to examine the financial stability of the insurance industry and its potential to pose systemic risks to the whole financial system and to national/international economies (Geneva Association, 2010; Cummins and Weiss, 2010; Grace, 2010; Bell and Keller, 2009; Acharya, et al., 2009; Harrington , 2009; Billio, et al., 2011).

Literature generally uses three primary indicators to assess the degree of systemic risk posed by an institution / industry: size, interconnectedness, and substitutability. It is argued that the property-casualty insurance industry may be subject to systemic risk because of its heavy dependence on reinsurance and the complexity of the reinsurance market (Cummins and Weiss, 2010). As argued in Acharya, et al. (2009), “The reinsurance market increases the interconnectedness of the system exponentially and therefore might increase the systemic risk in the overall market” because of the “bilateral [relationship] in nature and [the lack of] adequate risk controls due to the opacity of bilateral markets.” Despite the broad discussion on reinsurance and systemic risk in existing literature, little empirical work has been done to examine the actual interconnectedness of the insurance and reinsurance systems and test how significant the risk could be. Our research intends to fill this gap to some extent by investigating this interconnectedness through examining the reaction of property-casualty insurers to reinsurer downgrading and conducting scenario analyses to show hypothetical impacts of major reinsurance groups' insolvency on the US P/C insurance industry.

Reinsurance companies are at the top of the insurance sector network. The failure of reinsurance companies may create financial instability within the broader insurance sector, which could cause a spillover effect into the whole economy. In addition, this risk could be aggravated if the increased default risk of primary insurers due to the failure of reinsurers cannot be conceived transparently in the market, as we have seen in the recent financial crisis. In fact, to outside investors, reinsurance arrangements between primary insurers and reinsurers often seem quite complicated, given the complexity of the contract terms and the number of parties involved in the cession and retrocession arrangements. Therefore, it is important to understand the connectedness of the insurance and reinsurance industries and whether the market can evaluate the reinsurance risk exposure of primary insurers. In this research, we analyze the impact of reinsurance company credit rating downgrades on counterparty primary insurance companies' credit ratings and their stock returns in order to illustrate the interconnectedness of the insurance sector and to investigate whether the reinsurance credit risk information is transparently delivered to the capital market.

Understanding the interconnectedness is an important step in the context of evaluating the potential systemic risk caused by reinsurance companies. However, this does not provide us information on how serious the potential problem could be. We cannot assess systemic risk brought by reinsurers using historical data because there was no major reinsurance company collapse in history (Swiss Re, 2003). To get some sense on the magnitude of systemic risk, we conduct multiple scenario analyses where major global reinsurer(s) collapse.

By providing empirical evidence of interconnectedness, the market's ability to evaluate this risk, and the potential impact on the US P/C industry caused by major reinsurance insolvency, we hope the paper can shed light on the systemic risks that the reinsurance sector may pose to the entire financial system and overall economy. The remainder of the article proceeds as follows. After the discussion of relevant literature on insurance industry interconnectedness, we move to discuss the data, samples, and methodology, then present empirical results and discussion.

## 2. Reinsurance and Insurance Industry Interconnectedness

The functions of reinsurance have been widely documented and acknowledged in insurance operations. Reinsurance companies have traditionally provided the global risk diversification mechanism by pooling the risks of local insurance companies at a global level. Thus, primary insurers can stabilize their loss experiences and limit catastrophic losses by transferring risks to reinsurance companies. In addition, reinsurance transactions can increase the underwriting capacity of primary insurers and provide surplus relief. Other functions of reinsurance include providing underwriting guidance and facilitating a market segment withdrawal for primary insurers.

Reinsurance companies are essential to the global insurance industry and have functioned smoothly in the past. However, some concerns in relation to the possibility of systemic risk posed by reinsurance companies have been raised recently, and these concerns can be summarized as follows. First, the top five reinsurance groups[1] provided approximately 60% of reinsurance worldwide in 2009 (A. M. Best, 2010). The US P/C insurance market also depends heavily on the top reinsurance groups. Based on data reported to the NAIC, the top five global reinsurance groups provide about 30% of unaffiliated reinsurance to US P/C insurers. In terms of number, 1,315 companies out of a total 2,492 P/C insurers in US had unaffiliated reinsurance

[1] Munich Re, Swiss Re, Berkshire Hathaway Reinsurance, Hannover Re, and XL Capital.

with Swiss Re, Munich Re, and Berkshire in 2009. Therefore, these reinsurance companies are at the top of the insurance sector's interconnectedness (Swiss Re, 2003; Cummins, 2007; Cummins and Weiss, 2010). Reinsurance company failure would have a significant impact on primary insurers because those reinsurers may no longer be able to pay the primary insurers' losses. Unfortunately, little is known about the pattern and degree of damages caused by reinsurer failure on primary insurers throughout the world and, consequently, the systemic risk to the real economy (Swiss Re, 2003).

Second, it will be hard to isolate the impact of major reinsurer failure from primary insurers and the economy due to the complexity and opacity of reinsurance. There is a serious lack of transparency associated with the risk of reinsurance transactions due to the international nature of reinsurance companies and lack of standardized prudential supervision (Cole and McCullough, 2006; Rossi and Lowe, 2002; Acharya, et al., 2009). To some extent, rating agencies may help reduce some information asymmetry and perhaps may serve as the "de facto" regulator in the insurance industry (IMF Global Financial Stability Report, 2004). However, they still cannot eradicate the lack of transparency and supervision problems and the credibility of ratings of complex and opaque risks was challenged during the 2007-2009 financial crisis.

Third, there are risks of retrocession spirals or reinsurance spirals of the kind that once spread out during the period 1988 to 1992 in the London Market Excess (Schwartzman, 2008; Cummins and Weiss, 2010). The retrocession spirals may trigger failures of multiple reinsurers all at once through the retrocession channel, and this shock may cause a ripple effect in a broad range of primary insurers.

There have been a few studies examining the systemic risk posed by the reinsurance industry; many were done by research institutions sponsored by insurance companies. Swiss Re (2003) examines the systemic risk posed by reinsurance companies and concludes that the risk is insignificant because reinsurance company defaults have been a very rare event in history and reinsurance companies generally have very high credit ratings. Even if a reinsurance company were to become insolvent, the risk of a ripple effect to other industries through primary insurers seems to be minimal because a bank run on reinsurance companies is unlikely, given the sticky nature of reinsurance liability (withdrawal is only allowed when loss is actually realized). In addition, total reinsurance premiums are relatively small, accounting for only 6 percent of total direct premiums.

The Group of Thirty (2006) also investigates the systemic risk of reinsurance. It runs a simple “stress test” under an assumption that 20% of global reinsurance capacity fails and reaches, as in Swiss Re (2003), a similar conclusion: even major reinsurer failure will have only a limited short-term effect because 20% of global reinsurance capacity is still only about 2-2.5% of gross total premiums; additionally, the reinsurance sectors’ linkage to the banking sector and capital market is rather limited.

Although research by Swiss Re (2003) and the Group of Thirty (2006) demonstrates that the systemic risk posed by the failure of reinsurance companies is low, the interests and concerns of financial institution supervisors and academic researchers have not abated since the financial crisis of 2007-2008. Bell and Keller (2009) and the Geneva Association (2010) revisited this issue and draw similar conclusions: the insurance sector is fundamentally different from the banking sector, and thus the systemic risk posed by reinsurance companies seems to be insignificant. The only possible source of systemic risk posed by the insurance and reinsurance industries is through their non-core activities, such as derivative transactions, including Credit Default Swaps (CDS), financial derivative trading, short-term funding, and security lending, all of which were major factors behind the AIG crisis. Cummins and Weiss (2010) examine various dimensions of systemic risk posed by the insurance sector. They also conclude that the possibility of systemic risk caused by core insurance activities is very limited. However, there could be a significant systemic vulnerability within the insurance sector through reinsurance spirals and the interconnectedness of the insurance sector, which calls for further empirical studies.

Previous studies argue that reinsurers pose a low systemic risk because of the very low default probability of major reinsurance companies. For example, Swiss Re (2003) identifies 24 reinsurer bankruptcies during the 1980-2002 period, and none of them involved major reinsurance companies. Due to the limited number of bankruptcies and the relatively small size of bankrupt reinsurers, counterparty credit risks regarding reinsurance companies were considered to be insignificant. Several empirical studies on primary insurer failures also find that, historically, reinsurer bankruptcy accounts for only about 2-5% of primary insurers' failure cases (McDonnell, 2002; Sharma et. al., 2002; Cummins and Weiss, 2010). However, as we learned from the 2007-2008 financial crisis, there is no such thing as "too big to fail" in the financial world. In recent years, the ratings of reinsurers' financial strength have deteriorated. As shown by S&P and Moody's, the percentage of reinsurers with AAA and AA ratings decreased significantly between 2002 and 2010, as more firms now fall into the A and BBB rating categories. Table 1 shows the number of ratings upgrades and downgrades for reinsurers during the 2002-2010 period. In total, there are 173 downgrades; there are far fewer upgrades in that period. It seems that the declined investment income in the 2000s and the recent financial crisis have deteriorated the asset quality of reinsurers, and the impact of the terrorist attacks and intensified natural disasters, such as the 2004-2005 hurricane seasons, have exposed reinsurers to greater risks. Meanwhile, the global reinsurance industry has become more concentrated than ever. Cummins and Weiss (2000) report that the top ten reinsurers accounted for 35 percent of the world reinsurance market in 1991, but that percentage increased to 52 percent in 1998 after the merger and acquisition waves during the 1990s. The number further increased to 79 percent by net premiums earned in 2009 in the property-casualty market (A.M. Best Company, 2010). The increased concentration of the reinsurance market, combined with the seemingly deteriorating quality of reinsurers and the possibility of failure of the major reinsurance companies, magnify concerns over potential reinsurer failure and the possible spillover effect into the whole insurance industry and beyond.

Credit risk from reinsurance counterparties has been a concern of ceding companies, as reflected in regulation and contracting terms. For example, for US property-casualty insurers, the NAIC specifies that the risk-based capital of P/C firms will include a risk charge equal to 10 percent of reinsurance recoverable to guard against the risk of uncollectability of reinsurance recoverable. Additionally, ceding companies have been increasingly using the special termination clause (STC) with rating triggers in their reinsurance contracts (Reynolds Porter Chamberlain LLP, 2007) to reduce their credit risk. However, such practices may actually exacerbate the problem of retrocession spirals because the clause would allow the primary company to cancel the reinsurance policy if the reinsurer's rating was downgraded below a certain threshold, making already weak reinsurers even weaker (Cummins and Weiss, 2010), thus leading to a greater potential for systemic risks.

Given the increasing concern over interconnectedness in the insurance market, this paper will empirically investigate the dependency of US P/C insurers on reinsurance and the ability of rating agencies and the capital market in assessing the reinsurance risk by examining how the downgrading of reinsurers affects the credit risk of primary insurers (and, therefore, their ratings) and the stock price of publicly traded insurance groups. We also provide scenario analyses of the impact of reinsurer failure(s) by examining how many rating downgrades and insolvencies could be triggered if leading world reinsurers were to collapse.

## 3. Data

We study the interconnectedness of insurers and reinsurers in the US property-casualty insurance industry by using a sample from the 2002 to 2009 period. Financial data for ceding insurers is obtained from NAIC annual statements. In particular, reinsurance premiums ceded and reinsurance recoverable data is extracted from the NAIC Schedule F− part 3. Ratings information for ceding insurers and domestic reinsurers is extracted from A. M. Best's Key Rating Guide, and ratings information for global reinsurers is obtained from S&P, Moody's and A. M. Best. Since the NAIC Schedule F− part 3 data may involve some reporting errors, especially regarding the names of reinsurers (Cummins, 2007), we clean the raw data to correct the errors with our best discretion.[2] We manually merge the ratings data and NAIC data by matching the reinsurer's name and domicile.

## 4. The Dependency of Primary Insurers on Reinsurers

### *4.1. Summary statistics: reinsurance usage by the US P/C industry*

This section discusses the dependency of primary insurers on reinsurers. Insurance companies can choose to cede their business to affiliated companies within the same insurance group for the benefits of intra-group portfolio diversification. They can also choose to cede business to unaffiliated insurers for the benefits of inter-company diversification of risks. These affiliates and non-affiliates could domicile in the United States and be subject to US regulation, but they could also be alien companies that are not subject to US regulations. Both types of reinsurance can pose an insolvency threat to insurers, as pointed out by Cummins and Weiss (2010), though

[2] For example, the database reports each Lloyd's of London syndicate (or managing agent) as an individual entity. We systematize the reporting of names (e.g., by checking the Lloyd's of London's website and using the FEIN number of the entity) and put them into one category: Lloyd's of London.

non-affiliated reinsurance is generally considered to pose more counterparty risk than affiliated reinsurance.

Reinsurance could pose significant credit risks to ceding insurers. Reinsurance recoverable may have a significant impact on balance sheets of ceding insurers. In Schedule F– part 3, the reinsurance recoverable on paid losses and loss adjustment expenses represents the reinsurance receivable item on an insurer's balance sheet, and the reinsurance recoverable on unpaid losses and loss adjustment expenses represents the contra-liability item to loss reserves of primary insurers. As a result, the net reinsurance recoverable item in schedule F– part 3 is the total effect that reinsurance could have on ceding insurers' surplus levels (Feldblum, 2002). The recoverable item helps reduce the ceding company's leverage ratio and expand its capacity to write insurance.

Table 2 shows the dependence of US P/C insurers on reinsurance at the industry level. Because professional reinsurers differ from non-reinsurers in reinsurance activities,[3] we perform separate analyses for them. The results for professional reinsurers are not reported in the paper but discussed in the footnote in pursuit of brevity. We adopt A. M. Best's definition in defining professional reinsurers; that is, if a firm's reinsurance assumed from unaffiliated firms is more than 75 percent of the sum of reinsurance assumed from affiliates and its direct premiums written, then it is classified as a professional reinsurer (Cole and McCullough, 2008).

Panel A of Table 2 shows the percentage of total ceded premiums to total direct premiums written and the percentage of total net reinsurance recoverable to policyholder surplus for US P/C industry (excluding professional reinsurers). There is an obvious upward trend in the premiums ceded percentage and a downward trend in recoverable percentage, suggesting that US P/C insurers use more reinsurance services over time but become less "dependent" on

[3] Professional reinsurers underwrite little to no direct business and tend to contract with other reinsurance firms.

reinsurance because of their strong capital position. However, percentage-wise, reinsurance could still pose significant risks to primary insurers. For example, the percentage of net reinsurance recoverable over surplus ratio was 131.3% in 2009.

When breaking down reinsurance activities by contracted reinsurers' type, we find that the industry cedes more premiums to and has more recoverable from affiliated reinsurers (Panel B and Panel C), while using significantly fewer reinsurance services from unaffiliated reinsurers over time (Panel D and Panel E). This trend may be the result of mergers and acquisitions in the US domestic insurance market and global insurance markets, where more unaffiliated firms have become affiliated (Cummins and Xie, 2010; Cummins and Weis, 2004). The percentages show that US primary insurers depend the most on affiliated reinsurers domiciled in the United States (e.g., 77.3% ceded premiums are to the US affiliated reinsurers, and 72.8% net recoverable are from US affiliated reinsurers in 2009, see panel B). The second largest category is composed of US unaffiliated reinsurers (8.0% ceded premiums and 10.9% net recoverable in 2009, see panel D), followed by alien affiliated reinsurers (Panel C) and alien unaffiliated reinsurers (Panel E).[4]

### *4.2. Diversification of reinsurance portfolios (at firm level)*

[4] The analyses for professional reinsurers show that, unlike non-reinsurers, professional reinsurers cede their premiums mostly to alien affiliated reinsurers (e.g., 58.5% in 2009) and spread the rest almost equally to the other three types of reinsurers. A similar pattern is observed for net recoverable, with the percentage of alien affiliated reinsurers increasing over time. Major reinsurance groups usually operate globally, and many professional reinsurers in the US are subsidiaries of these groups. As a result, it is not surprising that these reinsurers cede their business to their non-US affiliates to seek intra-group risk diversification.

Compared to non-reinsurer ceding insurers, professional reinsurers have less aggregated reinsurance (retrocession) exposure. For example, the net reinsurance recoverable over surplus ratio for this group of firms is only 63.26% in 2009, suggesting US professional reinsurers in aggregate maintain a strong capital ability. However, these professional reinsurers are exposed to higher credit risks from unaffiliated reinsurers than the non-reinsurer ceding companies. For example, in non-reinsurer ceding companies' portfolios, about 15.6 percent of net reinsurance recoverable is from unaffiliated reinsurers, whereas the percentage for the professional reinsurer was 30.7 percent. It is also worth noting that the credit risk for professional reinsurers is sensitive to catastrophic losses. The net reinsurance recoverable over surplus ratio was as high as 105% in 2002 and 195.49% in 2005 following the huge losses from the September 11th terrorist attacks and Hurricane Katrina, respectively, which depleted reinsurers' capital significantly.

Table 3 shows the diversification of reinsurance portfolios for US P/C insurers (professional reinsurers excluded). Five types of Herfindahl indices are calculated based on ceded premiums and net reinsurance recoverable, respectively: (1) Herfindahl index for all reinsurers, regardless of their affiliation and domicile; (2) Herfindahl index for US affiliated reinsurers only; (3) Herfindahl index for alien affiliated reinsurers only; (4) Herfindahl index for US unaffiliated reinsurers only; and (5) Herfindahl index for alien unaffiliated reinsurers only. Both mean and median values of Herfindahl index are reported, along with the number of ceding firms that use those types of reinsurers. Since the level and trend of Herfindahl indices are similar for both ceded premiums-based and recoverable-based, we proceed with the recoverable-based Herfindahl.

The results indicate that US insurers overall are not diversified enough in their reinsurance portfolios (with a mean Herfindahl index higher than 0.6). The situation improves slightly over time (from 0.657 in 2002 to 0.639 in 2009). The concentration in reinsurance portfolios is mainly attributable to firms that cede premiums to their US affiliates. About 60 percent of ceding firms (out of more than 2,000 ceding firms with positive reinsurance recoverable) have reinsurance recoverable from their US affiliates. This affiliated reinsurance portfolio is extremely concentrated (with a mean Herfindahl index higher than 0.9) and shows no sign of changing over time. This result supports the view of Cummins and Weiss (2010) that affiliates could be a significant source of credit risk to US insurers. There are also a growing number of US insurers using alien affiliated reinsurer services (from 10% in 2002 to 13% in 2009, calculated from the number of ceding firms, recoverable-based). This reinsurance portfolio is concentrated as well (with a mean Herfindahl index higher than 0.8).

More than 70% of US insurers have reinsurance transactions with US non-affiliates, and this set of reinsurance portfolios is more diversified (with a mean Herfindahl index 0.543 in 2002 and 0.532 in 2009) than the affiliated reinsurance portfolio. Still, the credit risk could be high; a Herfindahl index higher than 0.5 indicates that ceding insurers depend very much on the top one or two reinsurance companies. A significant percentage of US insurers (40% in 2002, 52% in 2009) use alien unaffiliated reinsurance services; this set of reinsurance portfolios is the most diversified, and the diversification level increases over time (mean Herfindahl index 0.484 in 2002 and 0.449 in 2009), suggesting that credit risk exposure from these types of reinsurance services is relatively small.[5]

In summary, the reinsurance portfolios of US insurers are highly concentrated. The industry cedes business heavily to affiliated reinsurers, and the portfolio is extremely concentrated. Though the industry depends less on unaffiliated reinsurers, significant credit risks still exist because of the relatively high concentration of the unaffiliated reinsurance portfolio and the significance in size of this portfolio to ceding insurers' surplus.

## 5. The Impact of Reinsurer Downgrades on Primary Insurers' Risk

This section analyzes the impact of reinsurer downgrades on primary insurers' risk. A downgrade of a reinsurer's financial rating may lead to an increase in the risk of its counterparty primary insurers because of the increased default risk of reinsurance recoverable. Therefore, through reinsurance transactions, the risk of reinsurers is connected to the primary insurers' risk. If rating agencies and capital market can assess the extent of the connection, rating downgrades

[5] We also analyze the diversification of reinsurance portfolios for US professional reinsurers only. This mostly reflects the retrocession activities of these companies, since such firms have little direct business. Overall, professional reinsurers' retrocession portfolios are more diversified (with a mean Herfindahl index 0.533 in 2009) than those of ceding insurers that are not professional reinsurers. Only a small proportion of professional reinsurers (about 35%) retrocede to their affiliates (domestic or alien) and do not diversify their portfolio with affiliates (mean Herfindahl index close to 0.9, with an upward trend from 2002 to 2009). More than 90 percent of professional reinsurers retrocede to US unaffiliated reinsurers, and that portfolio is quite diversified, with a downward trending Herfindahl index (0.506 in 2002, and 0.448 in 2009). Percentage-wise, an increasing number of US professional reinsurers (63% in 2002 and 77% in 2009) retrocede to alien unaffiliated reinsurers, and this type of reinsurance portfolio is the most diversified (mean Herfindahl index 0.426 in 2009). Overall, professional reinsurers tend to be more diversified in unaffiliated reinsurance but very concentrated in affiliated reinsurance usage.

of counterparty reinsurers should negatively affect primary insurers' financial strength ratings and stock prices. The objective of this section is to conduct joint tests examining the extent of risk transition from reinsurers to primary insurers and the ability of the market to conceive of these risks.

### *5.1. The impact of reinsurer rating downgrades on counterparty primary insurers' rating*

To examine the interconnectedness in the insurance-reinsurance market, we first analyze the rating changes of primary insurers following the downgrades of their reinsurer counterparties. We expect that reinsurers' ratings downgrades will negatively impact the ratings of their primary insurers. Specifically, we run the following logit regression model:

$$\mathrm{PDown}_{it} = \alpha + \beta \times \mathrm{RDown}_{it} + \gamma \times \mathrm{RDownRec}_{it} + \delta \times \mathrm{X}_{it} + \theta \times \mathrm{Year}_{t} + \varepsilon_{it}, \qquad (1)$$

where $\mathrm{PDown}_{it}$ is a dummy variable with the value of 1 when a primary insurer is downgraded. $\mathrm{RDown}_{it}$ is a dummy variable with the value of 1 when any of the reinsurers of the insurer *i* has been downgraded between the prior rating date and current rating date of the insurer *i*. $\mathrm{RDownRec}_{it}$ is the proportion of reinsurance recoverable from the downgraded reinsurer(s) to the surplus of the insurer *i*. $\mathrm{X}_{it}$ is a set of control variables of primary insurer characteristics which may affect the rating change of the insurer *i*. Finally, $\mathrm{Year}_{t}$ represents year-fixed effect dummy variables that allow us to control both the macroeconomic conditions and insurance industry-specific conditions that affect the ratings of primary insurers.[6] We expect $\beta > 0$ $and$ $\gamma > 0$.

[6] We did not include firm-fixed effects in the model because that operation will lose about 75% of insurer-year observations where an insurer has no rating downgrades during the sample period. In addition, we believe the control of previous ratings information in the regression can capture most firm-specific effects.

To construct the insurer-year panel data about ratings downgrades for primary insurers and reinsurers, we start with all US P/C insurers that file with NAIC and have Financial Strength ratings from A.M. Best. For $\mathrm{PDown_{it}}$, we assign a dummy variable equal to 1 when there is a rating downgrade in year *t*. For each insurer, we collect their unaffiliated reinsurance transaction data from NAIC Schedule F and obtain the ratings information for these reinsurers from A.M. Best, Moody's, and S&P reinsurer ratings. If any of the reinsurers of insurer *i* are downgraded by any of the rating agencies between the previous rated date and the current rated date of insurer *i*, we assign the value of 1 to $\mathrm{RDown_{it}}$.

In regard to the spread of credit risk from downgraded reinsurers to primary insurers, it is logical that a higher percentage of reinsurance recoverable from downgraded reinsurers will have a greater negative effect on a primary insurer's rating. To test this hypothesis, we include $\mathrm{RDownRec_{it}}$ in the regression. This variable is constructed as follows. For insurer *i* at year *t*, we calculate its sum of reinsurance recoverable at *t-1* from all downgraded reinsurers, then scale this by insurer *i*'s surplus at *t-1* to measure the relative size of the default risk from downgraded reinsurers. We restrict our focus only to the unaffiliated reinsurance transactions out of the concern that subsidiary insurers within the same insurance group often receive the same rating, and affiliated insurers' risks are interconnected in much more complicated ways than simply through the explicit reinsurance transactions.

In addition to reinsurance arrangements, a primary insurer's rating may be downgraded because of a host of other factors that affect the default risk and the firm's financial strength. We follow the insurance rating literature to select control variables $\mathrm{X_{it}}$. We first conduct an ordered probit regression model, with the dependent variable being the numerical conversion of A.M.

Best rating categories.[7] The explanatory variables include all Financial Analysis and Surveillance Tracking (FAST) scores, Best's Capital Adequacy Ratio (BCAR), and a few other variables mentioned in Best's Credit Rating Methodology (2009) and other insurer insolvency and rating studies (Cummins et al., 1995; Doherty and Phillips, 2002; Doherty et al., 2011; Kartasheva and Park, 2011). The first round results show that not all variables are significant in the model, and many variables show high correlation with each other and create possible multicollinearity problems. Hence, we keep only significant variables from this probit regression model and use them as control variables in our main regression model (1).

The selected set of control variables from the probit regression model and their definitions are presented in Table 4. These variables include investment yield, net premiums written to surplus ratio, reinsurance recoverable to surplus ratio, reserve to surplus ratio, junk bond investment to surplus ratio, BCAR (Best's Capital Adequacy Ratio), log(Asset), proportion of catastrophic risk exposure, combined ratio, a dummy variable indicating whether the insurer (or its parent) is publicly traded, a dummy variable for single unaffiliated company, and firm age. Because the dependent variable of the regression model (1) is not the rating itself but the change in rating (downgrade), we include the difference between year *t-1* and year *t* of these selected variables as control variables. Therefore, the two dummy variables and the firm age variable are dropped from the model. Lastly, we include the previous A.M. Best Rating in $X_{it}$ to control possible heterogeneity in rating changes for the different rating categories. For example, the stronger ratings, such as A++ and A+, could be more sensitive to any risk changes than B or C ratings because rating agencies could be more stringent in the awarding of the strongest ratings. On the other hand, it is also possible that firms with strong ratings tend to put more efforts into

[7] We converted the A.M. Best rating as follows: A++=13, A+=12, A=11, … and D=1.

maintaining their current ratings, so these firms may have persistent ratings than firms with weak ratings.

Table 5 shows the summary statistics of variables used in model (1). During the study period, 3.3 percent of primary insurers have been downgraded. The average ratio of reinsurance recoverable from downgraded unaffiliated reinsurers to policyholders' surplus is 2.9 percent.

The regression results of model (1) are shown in Table 6.[8] The key variables of interest are RDown and RDownRec. The signs of both coefficients are positive, but only the RDownRec is significant. This result suggests that a primary insurer is more likely to be downgraded when its contracted reinsurer(s) is(are) downgraded, and the increased reinsurance risk is precisely captured because the likelihood of downgrade is positively correlated with the magnitude of increased default risk from downgraded reinsurers, which is measured by RDownRec.

In this analysis, we only analyze unaffiliated reinsurance transactions because the ratings of affiliated companies within a group are usually the same, and even if they are different, the risk of interconnectedness between subsidiaries cannot be summarized solely through reinsurance transactions. However, we acknowledge that the primary insurers that have access to affiliated reinsurance transactions may be less impacted by downgrading of unaffiliated reinsurer counterparties because they can diversify risk among affiliated and unaffiliated reinsurers. In contrast, unaffiliated single companies that only have access to unaffiliated reinsurance transactions will be more adversely impacted by the downgrading of unaffiliated reinsurers. To test this hypothesis, we conduct one more regression by including an interaction term of a single company dummy variable and RDownRec. The result is presented in the last column of Table 6. Once we include this interaction term, the RDownRec becomes insignificant and the interaction

[8] The number of observations used in the regression of table 6 is smaller than the one in Table 4 because we lose all observations of year 2002 due to the use of lagged one period variables in the regression, and we lose some observations in other years due to the use of first difference in explanatory variables.

term is positive and significant, which suggests that the increased reinsurance risk has more impact on single unaffiliated insurers than on the subsidiaries of an insurance group.

The coefficients of the control variables all carry the expected signs: a primary insurer's downgrading is negatively associated with an increase in BCAR ratio and firm size, and positively associated with an increase in premium over surplus ratio, reinsurance recoverable over surplus ratio, combined ratio and reserve over surplus ratio. Although not significant, an increase in catastrophic risk exposure and junk bonds to surplus ratio is positively associated with downgrades, and an increase in investment yield is negatively associated with downgrades. Lastly, the previous Best's Rating carries a significant negative coefficient, suggesting that stronger insurers are less likely to be downgraded than weaker insurers.

The results in this section provide evidence on the interconnectedness between primary insurers and reinsurers and rating agencies' ability to properly incorporate the increased risk from reinsurance recoverable. Since this result also holds after controlling for the changes in combined ratio, it reasonably excludes contamination of the reverse causality effect, where the loss suffered by a primary insurer may affect the reinsurers' risk.

### *5.2. The impact of reinsurer rating downgrades on primary insurers' stock price*

Since systemic risks and adverse shocks to an industry are usually first captured by the stock market, in this section we examine the link between the reinsurer ratings downgrades and primary insurers' stock price in the event study framework. We have shown in the previous section that counterparty reinsurers' risk adversely affects primary insurers' financial ratings. Similar adverse effects should also appear in the stock market, should market participants perceive the interconnectedness between reinsurers and primary insurers. Here, stock market analyses provide an additional advantage over the ratings downgrade analyses, since impacts of adverse events are usually more directly reflected in short-term stock price movements. Since reinsurance downgrades can be triggered by unexpected losses from primary insurers, one might argue that negative stock movements of primary insurers may not be the result of reinsurance downgrades but the cause. The event study method can actually address the problem rather nicely. Given that there is lag time between primary insurers' loss events and reinsurers' downgrades, the large loss event of primary insurers which triggered a reinsurer's downgrade should have already been absorbed in the primary insurer's stock price by the time of the downgrade event. Therefore, changes in value of stocks of primary insurers following a reinsurer's downgrade are most likely attributable to the reinsurer's downgrade.

We assess the market reaction of primary insurers to the news of reinsurers' downgrading. The first analyses (Table 7, Panel A) present the stock reaction of counterparty primary insurers of the downgraded reinsurer(s), which measures the direct impact of reinsurer downgrades. The second analyses (Table 7, Panel B) present the negative spillover effects of reinsurer downgrades, i.e., the reaction of non-counterparty primary insurers (insurers that do not have reinsurance arrangements with the downgraded reinsurers). We conduct a standard event study utilizing the market model (MacKinlay, 1997) to measure abnormal returns.[9]

Table 7 shows that reinsurer downgrade events have a strong, statistically significant negative impact on the stock prices of counterparty primary insurers, with an average CAR -1.50% for the (-15, +15) days window (Panel A). This suggests that increases in reinsurance risk brings additional risk to the primary insurers and therefore reduces stock value.

[9] See Boehmer, Musumeci, and Poulsen (1991) and Cowan (1992) for the explanation of event study methodology and statistical significance tests. To address the concern of the cross-sectional correlation caused by clustering of firms around single event date, we also report the Portfolio Time-series CDA t-test in the table (Brown and Warner, 1980; Chandra, Moriarity, and Willinger, 1990).

In addition to the direct effects on counterparty primary insurers, we are aware of the possibility that the lack of transparency in the reinsurance market may create a contagion effect in the primary insurer market in the case of reinsurance company failures. That is, a reinsurer's failure could have negative effects even on primary insurers with no direct business relationships with the problematic reinsurers. To test this layer of risk, we investigate whether the reinsurance credit risk information is transparently delivered to the capital market by examining the stock reactions of primary insurers with no direct credit risk exposure to the downgraded reinsurers. The result shows that reinsurer downgrade announcements also have significant externalities, or spillover effects, on the stocks of non-counterparty primary insurers, with a negative CAR -0.48% for the (-15, +15) days window (Panel B), the magnitude of which is smaller compared to these events' impact on counterparty primary insurers.

There are two possible interpretations on the negative reaction of non-counterparty primary insurers. One is that the negative reaction could represent pure contagion effects caused by opacity: the market irrationally re-prices all insurers regardless of their relationship with the downgraded reinsurers. Alternatively, it could be information-based: the market worries about the indirect impact of downgraded reinsurers through retrocession spirals. Because we do not have access to the reinsurance and retrocession transactions between global reinsurance companies, testing these two alternative hypotheses are out of the scope of this study. However, the fact that the contagion effect is only about 30% of direct effect suggests that the reinsurance transaction is not a complete black box to capital market, but is reasonably transparent.

### *5.3. Robustness Check*

We conducted a robustness check regarding whether the above results hold or become stronger for "threshold rating downgrades." Following Halek and Eckles (2010), we define a threshold rating downgrade as losing an A- (A.M. Best), an Aa3 (Moody's), or an AA- (S&P). For ratings downgrade analyses, we find no significant result for this particular set of threshold downgrading.[10] In regard to the stock market reaction, for counterparty primary insurers, the announcing effect of threshold downgrading is similar to the overall sample, but we do find a stronger contagion effect for threshold downgrading announcements.

To address the issue of potential high correlation of firm returns when the event day and industry are the same, we run an event study by forming a portfolio of firms for each downgrade announcement and use portfolio returns instead of individual stock returns.[11] A similar conclusion is drawn for contagion effects (with a little stronger result), but we find a little weaker negative result for direct effects on counterparty primary insurers.

**6. Scenario Analysis of Large Reinsurance Companies' Insolvency**

In this section, we examine how bad things could get in case of large reinsurer insolvency. Although there was no major reinsurer insolvency historically, in the wake of the collapse of insurance giant AIG and other giant financial institutions, it is imperative that we improve our understanding of the dynamics and anticipate the scenarios of large reinsurer insolvency in the future.

Although the previously mentioned Group of Thirty's "stress test" concludes that the impact of reinsurance risk would be limited because 20% of global reinsurance capacity only

[10] If we further apply a lower threshold, i.e., for A.M. Best and S&P, the rating moves below A- (to B++ or lower, or to BBB or lower), and for Moody's, rating moves to Baa1 or lower, then an increase in reinsurance recoverable from counterparty reinsurers with threshold downgrading increases a primary insurer's likelihood of being downgraded. Meanwhile, the coefficient of reinsurance recoverable from threshold downgrading is higher than if it is from non-threshold downgrading, suggesting that the default risk of primary insurance companies increases more when the counterparty reinsurance company's financial condition is seriously impaired.
[11] See Ghosh and Hilliard (2010) for more discussions on cross-dependency issues caused by clustering of firms around single event date.

corresponds to about 2-2.5% of gross total premiums, the high concentration of reinsurance portfolios (as shown in Table 3) suggests that the failure of one major reinsurer could still pose serious risks to some primary insurers. In addition, the impact of top global reinsurers is not negligible due to the highly concentrated reinsurance market. The dependence on unaffiliated reinsurance could appear to be small as is argued in the Group of Thirty (2006) and Swiss Re (2003), but the high affiliated reinsurance dependency found in Table 2 suggests that if a company within a group assuming significant portions of affiliated reinsurance gets hit by the insolvency of unaffiliated reinsurers, broader impacts could be felt throughout the insurance industry through the affiliated reinsurance chain.

In this section, we run scenario analyses by allowing one of the top three reinsurers (Swiss Re, Munich Re, and Berkshire Hathaway) to become insolvent, which causes counterparty primary insurers to be unable to fully recover from this reinsurer failure. Because part of the recoverable can be paid off even with complete liquidation of reinsurers, we run multiple scenario analyses where the recoverable are defaulted by 100%, 50%, 30%, or 10%. We examine the effects of this recoverable default on the primary insurers' ratings downgrades and insolvencies using 2009 data. We use Swiss Re as an example to describe our scenario analyses.

To examine the impact of the insolvency of Swiss Re on primary insurers' ratings, we use the same rating probit regression model in Table 4 of section 5.1. First, we run the rating regression with the original surplus level and get the ratings estimate for each insurer. Second, we calculate the hypothetical surplus of primary insurers by assuming that 100%, 50%, 30%, or 10% of their reinsurance recoverable from Swiss Re will default. Next, we calculate all explanatory variables using the hypothetical surplus. Fourth, we estimate the hypothetical rating of the primary insurer by plugging new hypothetical explanatory variables into the fitted model presented in Table 4. We then compare the original estimated ratings with the estimated hypothetical ratings to draw a conclusion on ratings downgrades.[12]

Table 8 presents the scenario analysis of the fall of major reinsurers and the likely impacts on primary insurers' ratings. The number of downgraded insurers as a result of the reinsurance recoverable default is presented. Since we can only include those insurers with an A.M. Best rating and no missing explanatory variables in the ratings regressions, the total number of insurers used in this analysis is 1,367. The result shows that the impact of major reinsurers' insolvency on US property-casualty insurers is not serious. Even under the extreme and unlikely assumption of 100% recoverable default, fewer than 35 insurers would be downgraded. The impact of Swiss Re's insolvency on US insurers is the strongest; 32 insurers out of 1,367 insurers (2.41%) would be downgraded if assuming 100% default from Swiss Re. Under the more realistic assumption of a 30% default rate, less than 1% of insurers will be downgraded when one of the top three reinsurers is insolvent. If the default rate is set to 10%, only one insurer would be downgraded if Munich Re or Swiss Re becomes insolvent, and no insurer would be affected by Berkshire Hathaway's insolvency.

To assess how many primary insurers would become insolvent as a result of reinsurer insolvency, we conduct a scenario analysis similar to the downgrade analysis. Using Swiss Re as an example again (see Figure 1), we first calculate the hypothetical surplus of primary insurers (insurer A-1, insurer A-2, insurer C, and insurer D) if their unaffiliated reinsurer−Swiss Re– becomes insolvent. If the new surplus of any insurer is negative, we treat this firm as insolvent.

[12] We compare the hypothetical ratings with the original estimated ratings instead of the actual ratings because the difference between actual and hypothetical estimated ratings contains both the increased risk and unavoidable modeling error. A comparison of estimated ratings both before and after the reinsurer insolvency event will return a more consistent result.

However, this criterion is too strict for insolvency because many firms declare bankruptcy before they reach a negative surplus. Insurance regulators in the US start to monitor an insurer closely if its surplus drops below 200 percent of risk-based capital (RBC). Therefore, we use the 200 percent RBC level as a conservative criterion of insolvency. That is, once a firm's hypothetical surplus goes below 200 percent of its RBC, we record the firm as an insolvent company.

Tracking the direct impact of Swiss Re's insolvency on its counterparty primary insurers is not sufficient to assess its overall impact on the insurance industry, because the insolvent primary insurers may also have assumed reinsurance, i.e., a chain effect may exist. Therefore, a primary insurer's insolvency as a result of Swiss Re's insolvency may make more insurers become insolvent through affiliated and unaffiliated reinsurance transactions.

To examine this chain effect, we estimate the total reinsurance recoverable that may be subject to default for a primary insurer by adding (1) its unaffiliated reinsurance recoverable from Swiss Re, and (2) its reinsurance recoverable from other contracted affiliated and unaffiliated reinsurers that are hypothetically insolvent as a result of Swiss Re's insolvency. For example, as shown in Figure 1, if insurer A-1 becomes insolvent due to collapse of Swiss Re (direct effect), and it has assumed reinsurance from its affiliated insurer A-2 and unaffiliated insurer C, then the total effect of Swiss Re on Insurer A-2 becomes b+c, and the total effect on insurer C is f+e. If Insurer C becomes insolvent as a result of the first round chain effect, and if it had assumed reinsurance from insurer D, then the final effect on insurer D is g+h.

For simplicity, we assume that the same proportion of recoverable can be collected from all insolvent reinsurers. For example, under the 30% recovery scenario, we assume that insurer A-1 can only recover 30% of recoverable from Swiss Re when Swiss Re becomes insolvent. If, unfortunately, this puts insurer A-1 into insolvency, then insurer A-2 and insurer C, which had ceded business to Insurer A-1, can now only collect 30% of reinsurance recoverable from insurer A-1. If this also puts insurer C into insolvency, then we assume insurer D can only collect 30% from insurance C. We repeat this process until we reach a point where the number of insolvent insurers does not increase any more.

In each analysis, we did not count the downgrades or insolvency of the subsidiaries of Munich Re, Swiss Re, and Berkshire Hathaway under Munich Re's, Swiss Re's, and Berkshire Hathaway's insolvency scenarios, respectively.

Table 9 presents the number of insolvent insurers as a result of reinsurance recoverable default. The study sample of Panel A includes all US property-casualty insurers that have a surplus greater than 200% RBC in 2009. If using negative surplus to define insolvency, fewer than 10 insurers out of 2,492 will become insolvent even under the extreme assumption of 100% reinsurance loss. The chain effect was also minimal. Only one more insurer would become insolvent when they lose 100% recoverable from both Swiss Re and the nine additional insolvent insurers resulting from Swiss Re's insolvency. The number of insolvent insurers doubles if we apply a more conservative criterion − 200% RBC, but this number is still small relative to the size of the sample. Fewer than 30 insurers would become insolvent with and without the chain effect considered in all three cases, even with the assumption of 100% loss of recoverable from insolvent reinsurers. The number drops quickly as we reduce the default rate to 50%, 30%, and 10%. Only two insurers would become insolvent if Munich Re goes bankrupt and the primary insurers suffer a 10% loss in recoverable. The number is one and three, respectively, for Swiss Re and Berkshire Hathaway. In an unreported analysis, we also track the sum of total assets of the insolvent insurers. In any one of the major reinsurers insolvency scenario, the total assets of the resulting insolvent firms are smaller than one percent of total industry assets.

We provide one more analysis in Panel B of Table 9 to make the insolvency analysis results comparable to the downgrading analysis in Table 8. Here we conduct the analysis for the same 1,367 insurers used in the downgrade scenario analysis. Since the sample is restricted to rated insurers, the average size of insurers in Panel B is larger than that of insurers in Panel A. Once we limit our interest to only those rated insurers, the number of firms that will hypothetically go bankrupt drops dramatically. Under the negative surplus criterion of insolvency, no insurer will become insolvent if Munich Re were to become insolvent. When Swiss Re defaults on 50% of any of its reinsurance obligation, one insurer would become insolvent. The number would be two when Berkshire defaults on 100% of its reinsurance obligation. The number of insolvent insurers slightly increases if we apply the 200% RBC criterion, but it is still minor, with fewer than 15 insurers becoming insolvent in each case.

One major concern we have before we can conclude that the systemic risk caused by reinsurer collapse seems to be minor is that we have not considered reinsurance spiral cases in which multiple reinsurers' financial conditions deteriorate simultaneously due to the complex retrocession transactions among reinsurers. The risk of reinsurance spiral has been pointed out as a possible source of systemic risk (Cummins and Weiss, 2010). We consider two extreme cases: all three big reinsurers, Swiss Re, Munich Re, and Berkshire become insolvent altogether, and the most extreme case where all unaffiliated reinsurers become insolvent at the same time. The last two rows of Table 8 and Table 9 show the number of downgraded and insolvent insurers when they can only collect part of their unaffiliated reinsurance from insolvent reinsurers.

If all three reinsurers were to collapse at the same time, 70 out of the 1,367 insurers with ratings (5.12% of the sample) would be downgraded with 100% loss assumption, 9 insurers (0.1% of the sample) would delete capital, and 48 (3.6% of the sample) insurers' surplus over RBC ratio would fall below 200%. Under the most extreme crisis scenario with 100% loss of all unaffiliated reinsurance assumption, out of the 1,367 firms with ratings, 248 insurers (18.15% of the sample) would be downgraded, 164 (11.99% of the sample) would delete capital, and 307 (22.45% of the sample) insurers' surplus over RBC ratio would fall below 200%. This can be quite a large shock to the economy but is only an apocalypse scenario. With a more realistic assumption of either a 30% or 10% default rate, less than 5 percent of insurers would become insolvent. The impact on the economy as a whole would be manageable. Results from Panel A of Table 9 when using the whole sample of 2,492 firms are comparable to that of panel B.

## 7. Conclusion and Discussion

In this paper, we examine systemic risks posed by the interconnectedness of the insurance sector through global reinsurance companies. Our goal is two-fold. The first is to provide empirical evidence of the interconnectedness between reinsurers and US property-casualty insurers. The second is to present the first detailed examination on the likely impact of major global reinsurer insolvency on the US property-casualty insurance industry.

There have been concerns about the complexity of the reinsurance transaction network and its resulting opacity, but our results suggest that the risk transitions from reinsurers to primary insurers are fairly well-recognized both by rating agencies and capital market participants. We document that the downgrade of reinsurers increases the likelihood of downgrading for counterparty primary insurers. We also find that primary insurers' stock prices react negatively to the downgrade of reinsurers in the event study framework. These results provide evidence that there is a close interconnectedness between the insurance sector and the reinsurance sector, and the market has well recognized it.

The next question we address is how bad things could get if major global reinsurer(s) collapse. We consider multiple scenarios where top global reinsurers become insolvent. The results suggest that it is reasonable to conclude that the systemic risk caused by reinsurance transactions is relatively small. Even under an extreme assumption of a 100% reinsurance recoverable default by one of the top three global reinsurers, only about two percent of insurers would be downgraded, and one percent of insurers would become insolvent.

Our study of interconnectedness and worst scenario analyses only serves as the first step in analyzing possible systemic risk imposed by the reinsurance sector. There are many other factors that should be considered and addressed when reaching final conclusions. The first is macroeconomic conditions and major loss shocks that may affect both primary insurers and reinsurers. If certain macroeconomic conditions or major loss shocks are the cause of reinsurer insolvency, it is very likely that primary insurers will also be affected. Second, the negative effects detected from past downgrading events may only serve as a lower limit of major reinsurer solvency cases. The market in the past has only experienced the insolvency of several small reinsurers. Shocking news such as major global reinsurer(s) failure could panic the market, magnifying the contagion effect even further as we have seen in the recent financial crisis. Third, the impact of affiliated insurer insolvency on other affiliated insurers within the same group is not fully addressed in this paper. Although we include affiliated reinsurance transactions in our scenario analysis, firms within the same group are connected through many channels other than reinsurance transactions. Collapse of affiliated reinsurers may have a more significant impact on a primary insurer than unaffiliated reinsurers because of the concentration of intra-group reinsurance arrangements and the sharing of the same corporate culture, risk preferences, and corporate governance mechanisms.

## References

Acharya, Viral V., John Biggs, Matthew Richardson, and Stephen Ryan. 2009. On the Financial Regulation of Insurance Companies. *NYU Stern School of Business, working paper.*

A.M. Best Company. 2010. Global Reinsurance: 2009 Financial Review, Best's Special Report, April 12 (Oldwick, NJ).

Best's Credit Rating Methodology. 2009. Global Life and Non-Life Edition. *A. M. Best Company*.

Billio, Monica, Mila Getmansky, Andrew W. Lo, and Loriana Pelizzon. 2011. Econometric Measures of Systemic Risk in the Finance and Insurance Sectors. *MIT Sloan Research Paper No. 4774-10; NBER Working Paper No. 16223; AFA 2011 Denver Meetings Paper; CAREFIN Research Paper, No. 12/2010. Available at SSRN: http://ssrn.com/abstract=1571277.*

Bell, Marian, and Benno Keller. 2009. Insurance and Stability: The Reform of Insurance Regulation. *Zurich Financial Services Group (Zurich, Switzerland).*

Boehmer, E., J. Musumeci and A. Poulsen, 1991. Event-Study Methodology under Conditions of Event-induced Variance. *Journal of Financial Economics*, 30(2): 253-272.

Brown, Stephen J., and Jerold B. Warner. 1980. Measuring Security Price Performance. *Journal of Financial Economics* 8 (3):205-258.

Chandra, Ramesh, Shane Moriarity, and G. Lee Willinger. 1990. A Reexamination of the Power of Alternative Return-Generating Models and the Effect of Accounting for Cross-Sectional Dependencies in Event Studies. *Journal of Accounting Research* 28 (2):398-408.

Cole, Cassandra R., and Kathleen A. McCullough. 2006. A Reexamination of the Corporate Demand for Reinsurance. *The Journal of Risk and Insurance* 73 (1):169-192.

———. 2008. A Comparative Analysis of US Property and Casualty Reinsurers and Insurers. *Risk Management and Insurance Review* 11 (1):179-207.

Cowan, A., 1992. Nonparametric Event Study Tests. *Review of Quantitative Finance and Accounting*, 2: 343-358.

Cummins, J. 2007. Reinsurance for Natural and Man-Made Catastrophes in the United States: Current State of the Market and Regulatory Reforms. *Risk Management and Insurance Review* 10 (2):179.

Cummins, J.David, Scott E. Harrington, and Robert Klein. 1995. Insolvency experience, risk-based capital, and prompt corrective action in property-liability insurance. *Journal of Banking and Finance* 19 (3-4): 511-527.

Cummins, J. David, and Mary A. Weiss. 2000. The Global Market for Reinsurance: Consolidation, Capacity, and Efficiency. *Brookings-Wharton Papers on Financial Services* 2000:159-222.

———. 2004. Consolidation in the European Insurance Industry: Do Mergers and Acquisitions Create Value for Shareholders? The Brookings/Wharton Conference: Public Policy Issues Confronting the Insurance Industry.

———. 2010. Systemic Risk and the US Insurance Sector. *Temple University, Working Paper, Available at SSRN: http://ssrn.com/abstract=1725512*.

Cummins, J. David, and Xiaoying Xie. 2008. Mergers and Acquisitions in the US Property-Liability Insurance Industry: Productivity and Efficiency Effects. *Journal of Banking & Finance* 32 (1):30-55.

Doherty, Neil A., Anastasia V. Kartasheva, and Richard D. Phillips. 2011. Information effect of entry into credit ratings market: The case of insurers' ratings. *Journal of Financial Economics* Forthcoming.

Doherty, Neil A., and Richard D. Phillips. 2002. Keeping up with the Joneses: Changing Rating Standards and the Buildup of Capital by U.S. Property-Liability Insurers. *Journal of Financial Services Research* 21:55-78.

Feldblum, Sholom. 2002. Reinsurance Accounting: Schedule F. *Casualty Actuarial Society Forum,* Sixth Edition.

Geneva Association, Special Report of the Geneva Association Systemic Risk Working Group. 2010. Systemic Risk in Insurance: An Analysis of Insurance and Financial Stability. (Geneva, Switzerland, March 2010.

Ghosh, Chinmoy, and James I. Hilliard. 2010. The Value of Contingent Commissions in the Property-Casualty Insurance Industry: Evidence from Stock Market Returns. *Journal of Risk and Insurance*: forthcoming.

Grace, Martin F. 2010. The Insurance Industry and Systemic Risk: Evidence and Discussion. *Networks Financial Institute Policy Brief No. 2010-PB-02.*

Halek, M., and D. Eckles. 2010. Effects of Analysts' Ratings on Insurer Stock Returns: Evidence of Asymmetric Responses. *Journal of Risk and Insurance* 77 (4): 801-827.

Harrington, Scott E. 2009. The Financial Crisis, Systemic Risk, and the Future of Insurance Regulation. *Journal of Risk and Insurance* 76 (4):785-819.

IMF. 2004. Global Financial Stability Report, World Economic and Financial Surveys: Market Developments and Issues. *(Washington: International Monetary Fund, April)*.

Kartasheva, Anastasia V., and Sojung Park. 2011. Real Effects of Changing Rating Standards for Catastrophic Risks. *Working paper, the Wharton School, University of Pennsylvania.*

MacKinlay, A. Craig (1997), Event studies in economics and finance," Journal of Economic Literature 35, 13-39.

McDonnell, William. 2002. Why Some Insurers Fail: Practical Lessons from Recent Cases in Europe. *FSA Occasional Paper December 2002 (London, U.K. )*.

Reynolds Porter Chamberlain LLP. 2007. "Hasta la vista baby" - Special Termination Clauses. *Reinsurance Update*:1-6.

Rossi, Marie-Louise, and Nicholas Lowe. 2002. Regulating Reinsurance in the Global Market. *Geneva Papers on Risk & Insurance - Issues & Practice* 27 (1):122--133.

Schwartzman, Joy A. 2008. The Game of 'Pass the Risk': Then and Now. in Risk Management: The Current Financial Crisis, Lessons Learned and Future Implications (Schaumburg, IL: The Society of Actuaries).

Sharma, Paul, et al. 2002 Report: . Prudential Supervision of Insurance Undertakings. *Conference of the Insurance Supervisory Services of the Member States of the European Union (London, U.K.)*.

Swiss Re. 2003. Reinsurance - A Systemic Risk? *Sigma No. 5/2003 (Zurich, Switzerland)*.

The Group of Thirty. 2006. Reinsurance and International Financial Markets (Washington, D.C.).

**Table 1 Frequency of Reinsurer Ratings Upgrades and Downgrades, 2002-2010**

| | S&P | | | Moody's | | |
|---|---|---|---|---|---|---|
| | **N** | **Upgrades** | **Downgrades** | **N** | **Upgrades** | **Downgrades** |
| **2002** | 101 | 0 | 39 | 118 | 0 | 62 |
| **2003** | 112 | 2 | 56 | 112 | 0 | 31 |
| **2004** | 114 | 2 | 9 | 118 | 4 | 27 |
| **2005** | 120 | 17 | 15 | 119 | 14 | 7 |
| **2006** | 121 | 19 | 17 | 121 | 18 | 2 |
| **2007** | 129 | 25 | 3 | 117 | 7 | 0 |
| **2008** | 133 | 3 | 5 | 113 | 26 | 6 |
| **2009** | 130 | 23 | 22 | 101 | 0 | 37 |
| **2010** | 138 | 9 | 7 | 94 | 1 | 1 |
| **Total** | | 100 | 173 | | 70 | 173 |

**Table 2 Dependence of US Property-Casualty Insurers on Reinsurance by Reinsurer Type**

**Panel A. Ceding Insurers, All Types of Reinsurers**

| Year | Total Ceded Premiums | Total Net Recoverable | Direct Premiums Written (DPW) | Surplus | Total Ceded Premiums /DPW | Total Net Recoverable / Surplus |
|---|---|---|---|---|---|---|
| **2002** | 320,464 | 561,798 | 402,471 | 304,803 | 79.62% | 184.32% |
| **2003** | 349,209 | 610,754 | 443,484 | 365,349 | 78.74% | 167.17% |
| **2004** | 364,980 | 640,440 | 463,514 | 413,152 | 78.74% | 155.01% |
| **2005** | 388,210 | 729,528 | 476,461 | 481,048 | 81.48% | 151.65% |
| **2006** | 395,824 | 716,290 | 494,105 | 516,245 | 80.11% | 138.75% |
| **2007** | 402,798 | 717,355 | 496,606 | 554,372 | 81.11% | 129.40% |
| **2008** | 405,683 | 739,650 | 486,857 | 506,222 | 83.33% | 146.11% |
| **2009** | 400,790 | 735,134 | 473,167 | 559,895 | 84.70% | 131.30% |

**Panel B. US Affiliated Reinsurer**

| Year | Ceded Premiums | Net Recoverable | % Total Ceded Premiums | % Total Net Recoverable | Ceded Premiums /DPW | Net Recoverable / Surplus |
|---|---|---|---|---|---|---|
| **2002** | 236,331 | 372,242 | 73.7% | 66.3% | 58.72% | 122.13% |
| **2003** | 257,192 | 405,367 | 73.6% | 66.4% | 57.99% | 110.95% |
| **2004** | 276,220 | 430,375 | 75.7% | 67.2% | 59.59% | 104.17% |
| **2005** | 300,778 | 501,696 | 77.5% | 68.8% | 63.13% | 104.29% |
| **2006** | 307,760 | 508,772 | 77.8% | 71.0% | 62.29% | 98.55% |
| **2007** | 313,543 | 519,032 | 77.8% | 72.4% | 63.14% | 93.63% |
| **2008** | 313,967 | 531,621 | 77.4% | 71.9% | 64.49% | 105.02% |
| **2009** | 309,899 | 535,319 | 77.3% | 72.8% | 65.49% | 95.61% |

**Panel C. Alien Affiliated Reinsurer**

| Year | Ceded Premiums | Net Recoverable | % Total Ceded Premiums | % Total Net Recoverable | Ceded Premiums /DPW | Net Recoverable / Surplus |
|---|---|---|---|---|---|---|
| **2002** | 16,031 | 24,499 | 5.0% | 4.4% | 3.98% | 8.04% |
| **2003** | 20,688 | 31,578 | 5.9% | 5.2% | 4.66% | 8.64% |
| **2004** | 22,518 | 36,492 | 6.2% | 5.7% | 4.86% | 8.83% |
| **2005** | 25,198 | 44,670 | 6.5% | 6.1% | 5.29% | 9.29% |
| **2006** | 26,247 | 46,405 | 6.6% | 6.5% | 5.31% | 8.99% |
| **2007** | 26,261 | 47,534 | 6.5% | 6.6% | 5.29% | 8.57% |
| **2008** | 26,606 | 54,464 | 6.6% | 7.4% | 5.46% | 10.76% |
| **2009** | 27,941 | 53,867 | 7.0% | 7.3% | 5.91% | 9.62% |

**Panel D. US Unaffiliated Reinsurer**

| Year | Ceded Premiums | Net Recoverable | % Total Ceded Premiums | % Total Net Recoverable | Ceded Premiums /DPW | Net Recoverable / Surplus |
|---|---|---|---|---|---|---|
| **2002** | 40,519 | 92,469 | 12.6% | 16.5% | 10.07% | 30.34% |
| **2003** | 40,887 | 97,311 | 11.7% | 15.9% | 9.22% | 26.64% |
| **2004** | 36,519 | 95,243 | 10.0% | 14.9% | 7.88% | 23.05% |
| **2005** | 32,062 | 96,503 | 8.3% | 13.2% | 6.73% | 20.06% |
| **2006** | 31,755 | 90,075 | 8.0% | 12.6% | 6.43% | 17.45% |
| **2007** | 30,504 | 82,647 | 7.6% | 11.5% | 6.14% | 14.91% |
| **2008** | 32,272 | 82,258 | 8.0% | 11.1% | 6.63% | 16.25% |
| **2009** | 31,896 | 79,970 | 8.0% | 10.9% | 6.74% | 14.28% |

**Panel E. Alien Unaffiliated Reinsurer**

| Year | Ceded Premiums | Net Recoverable | % Total Ceded Premiums | % Total Net Recoverable | Ceded Premiums /DPW | Net Recoverable / Surplus |
|---|---|---|---|---|---|---|
| **2002** | 18,985 | 47,240 | 5.9% | 8.4% | 4.72% | 15.50% |
| **2003** | 22,338 | 49,310 | 6.4% | 8.1% | 5.04% | 13.50% |
| **2004** | 21,409 | 47,677 | 5.9% | 7.4% | 4.62% | 11.54% |
| **2005** | 21,956 | 49,738 | 5.7% | 6.8% | 4.61% | 10.34% |
| **2006** | 21,520 | 40,617 | 5.4% | 5.7% | 4.36% | 7.87% |
| **2007** | 23,962 | 38,525 | 5.9% | 5.4% | 4.83% | 6.95% |
| **2008** | 24,750 | 40,637 | 6.1% | 5.5% | 5.08% | 8.03% |
| **2009** | 23,312 | 34,395 | 5.8% | 4.7% | 4.93% | 6.14% |

Note: Based on industry aggregates, but professional property-casualty reinsurers are excluded from the analysis. We define "professional reinsurer" using A.M. Best's definition. That is, if a firm's reinsurance assumed from unaffiliated firms is more than 75 percent of the sum of the reinsurance assumed from affiliates and its direct premiums written, then it is defined as a professional reinsurer (Cole and McCullough, 2008).

**Table 3 Diversification of Reinsurance Portfolios- Herfindahl Index by Type of Reinsurer for US P/C Firms (Professional Reinsurers Excluded)**

| Year | By Reinsurance Premiums Ceded | | | | | By Net Reinsurance Recoverable | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Mean** | | | | | | | | | | |
| Year | All Reinsurers | US Affiliated Reinsurer | Alien Affiliated Reinsurer | US Unaffiliated Reinsurer | Alien Unaffiliated Reinsurer | All Reinsurers | US Affiliated Reinsurer | Alien Affiliated Reinsurer | US Unaffiliated Reinsurer | Alien Unaffiliated Reinsurer |
| 2002 | 0.679 | 0.924 | 0.893 | 0.569 | 0.426 | 0.657 | 0.925 | 0.880 | 0.543 | 0.484 |
| 2003 | 0.670 | 0.928 | 0.870 | 0.571 | 0.409 | 0.653 | 0.924 | 0.889 | 0.533 | 0.486 |
| 2004 | 0.662 | 0.930 | 0.880 | 0.564 | 0.384 | 0.643 | 0.924 | 0.888 | 0.529 | 0.468 |
| 2005 | 0.650 | 0.928 | 0.872 | 0.551 | 0.387 | 0.635 | 0.926 | 0.868 | 0.524 | 0.440 |
| 2006 | 0.641 | 0.922 | 0.888 | 0.543 | 0.371 | 0.636 | 0.923 | 0.882 | 0.525 | 0.462 |
| 2007 | 0.637 | 0.924 | 0.894 | 0.543 | 0.361 | 0.639 | 0.921 | 0.877 | 0.528 | 0.466 |
| 2008 | 0.636 | 0.927 | 0.897 | 0.536 | 0.359 | 0.637 | 0.923 | 0.879 | 0.529 | 0.442 |
| 2009 | 0.636 | 0.929 | 0.877 | 0.548 | 0.352 | 0.639 | 0.925 | 0.872 | 0.532 | 0.449 |
| **Median** | | | | | | | | | | |
| 2002 | 0.814 | 1 | 1 | 0.506 | 0.311 | 0.729 | 1 | 1 | 0.490 | 0.395 |
| 2003 | 0.778 | 1 | 1 | 0.502 | 0.280 | 0.719 | 1 | 1 | 0.471 | 0.405 |
| 2004 | 0.771 | 1 | 1 | 0.496 | 0.256 | 0.696 | 1 | 1 | 0.461 | 0.359 |
| 2005 | 0.737 | 1 | 1 | 0.473 | 0.252 | 0.683 | 1 | 1 | 0.444 | 0.333 |
| 2006 | 0.731 | 1 | 1 | 0.463 | 0.226 | 0.687 | 1 | 1 | 0.448 | 0.348 |
| 2007 | 0.725 | 1 | 1 | 0.461 | 0.219 | 0.685 | 1 | 1 | 0.457 | 0.350 |
| 2008 | 0.707 | 1 | 1 | 0.467 | 0.215 | 0.680 | 1 | 1 | 0.446 | 0.315 |
| 2009 | 0.718 | 1 | 1 | 0.483 | 0.216 | 0.686 | 1 | 1 | 0.440 | 0.349 |
| **Number of Ceding Firms** | | | | | | | | | | |
| 2002 | 2163 | 1264 | 203 | 1571 | 967 | 2168 | 1298 | 221 | 1571 | 861 |
| 2003 | 2159 | 1235 | 197 | 1544 | 1021 | 2178 | 1284 | 231 | 1563 | 920 |
| 2004 | 2180 | 1227 | 215 | 1520 | 1095 | 2212 | 1291 | 249 | 1567 | 988 |
| 2005 | 2202 | 1235 | 239 | 1499 | 1164 | 2263 | 1298 | 264 | 1597 | 1087 |
| 2006 | 2233 | 1235 | 250 | 1532 | 1233 | 2298 | 1304 | 279 | 1623 | 1174 |
| 2007 | 2259 | 1257 | 248 | 1558 | 1257 | 2303 | 1321 | 279 | 1618 | 1162 |
| 2008 | 2301 | 1267 | 293 | 1564 | 1298 | 2353 | 1335 | 311 | 1661 | 1259 |
| 2009 | 2313 | 1299 | 297 | 1566 | 1272 | 2357 | 1360 | 312 | 1645 | 1215 |

**Table 4 Rating Determinants – Ordered Probit Regression Model, 2002-2009**

| Variables | Definition | Expected Sign | Estimates |
|---|---|---|---|
| Investment Yield | Annualized investments return based on average invested assets | + | 0.0271*** |
| | | | [0.005] |
| NPW/PHS | Net premiums written to surplus ratio | - | -0.0018*** |
| | | | [0.000] |
| Reinsurance Recoverable/PHS | Reinsurance recoverable to surplus ratio | - | -0.0023*** |
| | | | [0.000] |
| Reserve/PHS | Reserve to surplus ratio | - | -0.0033*** |
| | | | [0.000] |
| Junk Bond/PHS | Total junk bonds in asset to surplus ratio | - | -0.0068*** |
| | | | [0.002] |
| BCAR | Best's capital adequacy ratio | + | 0.0009*** |
| | | | [0.000] |
| Log(Asset) | Log value of insurer's admitted assets | + | 0.3624*** |
| | | | [0.007] |
| CAT risk | The proportion of catastrophic risk exposure: defined as direct premiums written in homeowners, farmowners, auto physical damage, commercial multiperil, or inland marine in AL, FL, MS, SC, or TX to total premiums written | - | -0.4113*** |
| | | | [0.068] |
| Combined Ratio | Underwriting expense/ net premiums written + loss and loss adjustment expenses incurred/ premiums earned | - | -0.0008*** |
| | | | [0.000] |
| Public | Dummy variable equal to 1 if the insurer (or its parent) is publicly traded, 0 otherwise | + | 0.5758*** |
| | | | [0.023] |
| Single | A dummy variable equal to 1 for single unaffiliated company, 0 otherwise | - | -0.2779*** |
| | | | [0.031] |
| Age | Firm age | + | 0.001*** |
| | | | [0.000] |
| Intercept | | | 0.15 |
| | | | [0.142] |
| Number of Observations | | | 11,808 |
| Likelihood Ratio | | | 5,673.4 |

Note: standard errors are in brackets. ***, significant at the 1% level; **, significant at the 5% level; *, significant at the 10% level.

**Table 5 Summary Statistics of Variables Affecting Rating Downgrades**

| Variable | Definitions | Mean | STD | Min | Max | 1% | 99% |
|---|---|---|---|---|---|---|---|
| PDown | 1 if primary insurer's A.M. Best rating downgrades in year t. 0 otherwise. | 0.033 | 0.179 | 0 | 1 | 0 | 1 |
| Δ Investment Yield (%) | Change in Investment Yield from year t-1 to year t. | -0.111 | 2.005 | -39.7 | 52.8 | -3.2 | 3.3 |
| Δ CAT risk | Change in the proportion of catastrophic risk exposed lines of business from year t-1 to t. | 0.000 | 0.038 | -1 | 1 | -0.067 | 0.070 |
| Δ NPW/PHS (%) | Net premiums written to surplus ratio change from year t-1 to year t. | -6.733 | 41.35 | -727 | 686 | -127 | 108 |
| Δ Reinsurance Recoverable/PHS (%) | Reinsurance recoverable to surplus ratio change from year t-1 to year t. | -2.004 | 42.60 | -659.9 | 604.9 | -134.6 | 126.5 |
| Δ Reserve/PHS (%) | Reserve to surplus ratio change from year t-1 to year t. | -1.632 | 33.72 | -637 | 1285 | -79 | 77 |
| Δ Junk Bond/PHS (%) | Total junk bonds in asset to surplus ratio change from year t-1 to year t. | -0.062 | 3.718 | -75.68 | 134.0 | -8.97 | 9.41 |
| Δ BCAR | Best's Capital Adequacy Ratio change from year t-1 to year t. | 7.082 | 75.56 | -842.9 | 872 | -203.4 | 204.3 |
| Δ Log Asset | Log (Asset) change from year t-1 to year t. | 0.075 | 0.182 | -2.828 | 2.768 | -0.353 | 0.697 |
| Δ Combined Ratio (%) | Combined ratio change from year t-1 to year t. | 0.515 | 76.92 | -114 | 120 | -114 | 120 |
| Best Rating(t-1) | Numerical conversion of Best’s rating in year t-1. | 10.22 | 1.556 | 2 | 13 | 6 | 13 |
| RDown | 1 if reinsurer rating downgrades between the primary insurer's previous rating date and the current rating date. 0 otherwise. | 0.049 | 0.217 | 0 | 1 | 0 | 1 |
| RDownRec | The proportion of reinsurance recoverable from the downgraded reinsurers to the surplus of the primary insurer. | 0.029 | 0.124 | 0 | 3.939 | 0 | 0.533 |
| Single | 1 if a primary insurer is an unaffiliated single insurer. 0 otherwise. | 0.157 | 0.364 | 0 | 1 | 0 | 1 |
| Single * RDownRec | Interaction term of RDownRec and Single. | 0.003 | 0.045 | 0 | 2.611 | 0 | 0.082 |

## Table 6 The Impact of Reinsurer Rating Downgrades on Primary Insurer Rating Downgrades, 2003-2009

| Variables | Expected Sign | (1) | (2) |
|---|---|---|---|
| RDown | + | 0.033 | -0.010 |
| | | [0.321] | [0.327] |
| RDownRec | + | 0.660** | 0.353 |
| | | [0.290] | [0.372] |
| Single | | | 0.061 |
| | | | [0.184] |
| Single * RDownRec | + | | 1.681** |
| | | | [0.810] |
| Δ Investment Yield | - | -0.027 | -0.027 |
| | | [0.027] | [0.027] |
| Δ CAT risk | + | 1.514 | 1.532 |
| | | [1.461] | [1.465] |
| Δ NPW/PHS | + | 0.006*** | 0.006*** |
| | | [0.002] | [0.002] |
| Δ Reinsurance Recoverable/PHS | + | 0.002 | 0.002 |
| | | [0.001] | [0.001] |
| Δ Reserve/PHS | + | 0.013*** | 0.013*** |
| | | [0.002] | [0.002] |
| Δ Junk Bond/PHS | + | -0.021 | -0.023 |
| | | [0.018] | [0.018] |
| Δ BCAR | - | -0.002** | -0.002** |
| | | [0.001] | [0.001] |
| Δ Log Asset | - | -1.212*** | -1.209*** |
| | | [0.339] | [0.342] |
| Δ Combined Ratio | + | 0.009*** | 0.009*** |
| | | [0.002] | [0.002] |
| Best Rating(t-1) | - | -0.111*** | -0.109*** |
| | | [0.040] | [0.041] |
| Constant | | -2.169*** | -2.190*** |
| | | [0.426] | [0.441] |
| Number of Observations | | 7,739 | 7,739 |
| Likelihood Ratio | | 219.24 | 225.27 |

Note: Standard errors are in brackets. ***, significant at the 1% level; **, significant at the 5% level; *, significant at the 10% level.

## Table 7 The Impact of Reinsurer Rating Downgrades on Primary Insurer Stocks

**Panel A. Counterparty Primary Insurers**

| Days | N | Mean CAR | Median CAR | Variance adjusted z-stat | | Generalized sign z-test | | Portfolio Time-series CDA t-test | |
|---|---|---|---|---|---|---|---|---|---|
| (0,0) | 5038 | -0.13% | -0.11% | -2.261 | * | -1.821 | * | -1.585 | $ |
| (-1,+1) | 5038 | -0.14% | -0.21% | -1.786 | * | -2.356 | ** | -0.969 | |
| (-5,+5) | 5038 | -0.46% | -0.18% | -0.595 | | 0.858 | | -1.649 | * |
| (-10,+10) | 5038 | -0.83% | -0.35% | -2.054 | * | 0.238 | | -2.156 | * |
| (-15,+15) | 5038 | -1.50% | -0.73% | -4.343 | *** | -1.905 | * | -3.199 | *** |
| (-10,-1) | 5038 | -0.32% | -0.14% | -0.168 | | 0.914 | | -1.204 | |
| (-15,-1) | 5038 | -0.73% | -0.33% | -2.444 | ** | -1.567 | $ | -2.221 | * |
| (-1,+5) | 5038 | -0.37% | -0.23% | -2.092 | * | -1.623 | $ | -1.648 | * |
| (-1,+10) | 5038 | -0.35% | -0.17% | -1.592 | $ | 0.604 | | -1.186 | |
| (-1,+15) | 5038 | -0.61% | -0.45% | -2.974 | ** | -1.708 | * | -1.758 | * |

## Table 8 Scenario Analysis: Number of Hypothetically Downgraded Insurers

| | 100% Loss | 50% Loss | 30% Loss | 10% Loss |
|---|---|---|---|---|
| Munich Re | 19 | 11 | 8 | 1 |
| Swiss Re | 32 | 12 | 4 | 1 |
| Berkshire | 17 | 9 | 7 | 0 |
| All three | 70 | 36 | 19 | 3 |
| Any-unaffiliated | 248 | 153 | 95 | 37 |

Note: Total number of insurers is 1,367.

## Table 9 Scenario Analysis: Number of Hypothetically Insolvent Insurers

Panel A. Whole Sample

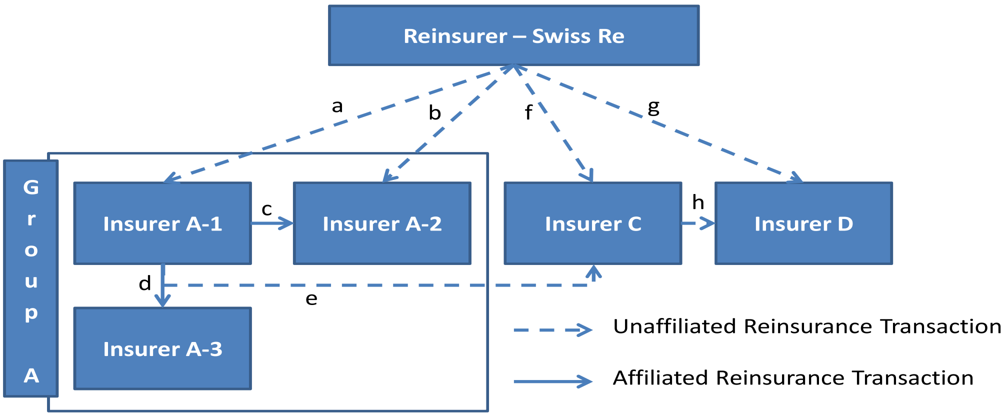
| | | 100% Loss | | 50% Loss | | 30% Loss | | 10% Loss | |
|---|---|---|---|---|---|---|---|---|---|
| | | Direct Effect | Chain Effect | Direct Effect | Chain Effect | Direct Effect | Chain Effect | Direct Effect | Chain Effect |
| Munich Re | Negative Surplus | 5 | 5 | 3 | 3 | 3 | 3 | 1 | 1 |
| | RBC 200% | 17 | 20 | 8 | 8 | 5 | 5 | 2 | 2 |
| Swiss Re | Negative Surplus | 9 | 10 | 4 | 4 | 0 | 0 | 0 | 0 |
| | RBC 200% | 25 | 28 | 17 | 19 | 6 | 7 | 1 | 1 |
| Berkshire | Negative Surplus | 5 | 7 | 1 | 1 | 1 | 1 | 0 | 0 |
| | RBC 200% | 17 | 22 | 7 | 8 | 5 | 6 | 2 | 3 |
| All three | Negative Surplus | 28 | 31 | 8 | 8 | 6 | 6 | 1 | 1 |
| | RBC 200% | 57 | 98 | 29 | 31 | 18 | 19 | 6 | 7 |
| All-unaffiliated | Negative Surplus | 199 | 261 | 83 | 94 | 36 | 36 | 6 | 6 |
| | RBC 200% | 290 | 451 | 170 | 205 | 101 | 115 | 33 | 34 |

Panel B. Ratings Downgrade Analysis Sample

| | | 100% Loss | | 50% Loss | | 30% Loss | | 10% Loss | |
|---|---|---|---|---|---|---|---|---|---|
| | | Direct Effect | Chain Effect | Direct Effect | Chain Effect | Direct Effect | Chain Effect | Direct Effect | Chain Effect |
| Munich Re | Negative Surplus | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RBC 200% | 3 | 6 | 1 | 1 | 0 | 0 | 0 | 0 |
| Swiss Re | Negative Surplus | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 |
| | RBC 200% | 6 | 9 | 4 | 6 | 2 | 3 | 0 | 0 |
| Berkshire | Negative Surplus | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | RBC 200% | 8 | 12 | 1 | 2 | 1 | 2 | 1 | 2 |
| All three | Negative Surplus | 7 | 9 | 1 | 1 | 1 | 1 | 1 | 1 |
| | RBC 200% | 21 | 48 | 7 | 8 | 3 | 4 | 1 | 2 |
| All-unaffiliated | Negative Surplus | 80 | 164 | 26 | 45 | 8 | 8 | 0 | 0 |
| | RBC 200% | 127 | 307 | 57 | 96 | 26 | 40 | 6 | 7 |

Note: Total number of insurers in Panel A is 2,492; total number of insurers in Panel B is 1,367.

**Figure 1 Illustration of the Chain Effect**




**Direct Effect:** Unaffiliated reinsurance with the insolvent reinsurer (Swiss Re here) − a, b, f, g.

**Chain Effect:** Unaffiliated reinsurance with the insolvent reinsurer (Swiss Re) + Unaffiliated and affiliated reinsurance with any insolvent insurer resulting from the insolvency of Swiss Re. For example, if A-1 becomes insolvent due to Swiss Re (direct effect), the chain effect on Insurer A-2 is b+c, and the chain effect on insurer C is f+e. If Insurer C becomes insolvent as a result of the first round chain effect, the final effect on insurer D is g+h.

# The Impact of Income Inequality on Life Insurance Demand Through Quantile Regression Model

CAI Chao[1], ZUO Yang[2], XUE Wei[1]
[1]School of Statistics, Shandong Institute of Business and Technology, yantai, China, 264005
[2]School of Politics and Law, Shandong Institute of Business and Technology, yantai, China, 264005

**Abstract:** Employing the methods of quantile regression, and taking 102 municipality and prefecture-level cities of China as the research subjects, the article makes an empirical study on the impact of income inequality on life insurance demand. The results show that: in the low quantile sites and high quantile sites, income inequality has a significant negative impact on life insurance demand，and in the low quantile sites the impact of income inequality on life insurance demand is more serious in central region and western region. In addition, while choosing the two income gap indicators, Theil index and the most affluent 50% of the population share of total income to do robustness tests, results show that the results analyzed through these two income inequality indicators can fairly meet the analysis results as Gini coefficient is selected as income inequality indicators.
**Keywords:** Life Insurance Demand; Income Inequality; Quantile Regression (key words)

## I.引言

自 20 世纪 80 年代以来，中国经济取得了巨大成就，但在经济发展过程中，中国的收入差距日益扩大，根据尹虹潘等(2011)[1]的测算，Gini 系数在 2000 年为 0.418，已超过国际警戒线，到 2005 年上升到 0.479，2009 年进一步达到了 0.482。大量的研究发现，收入差距给社会和人民生活带来诸多问题，那么其是否会对寿险市场的发展、消费者的寿险需求产生影响呢？

一些学者认为收入差距具有负的公共物品特征，收入差距越大，人们受到的负面影响越大，寿险需求越低，如粟芳(2004)[2]、杨晓华(2010)[3]和杨晓荣等(2010)[4]]等研究发现收入差距的扩大会抑制寿险需求。而有些学者则认为收入差距对保险需求影响较小，收入差距与保险需求呈正相关，如梁波(2006)[5]和彭记德(2007)[6]等。粟芳(2004)[7]和孙小素(2006)[8]利用世界各国的保险密度和 Gini 系数，首先按照人均 GNP 将各国分为低收入国家、中等收入国家和高收入国家，然后分别做回归分析，结果显示：在低收入国家，收入差距对保险需求有正向影响；在中等收入国家，收入差距对保险需求有负向影响；而在高等收入国家，收入差距与保险需求不相关。

然而，上述文献关于收入差距对寿险需求影响的讨论结果各不相同，而且都是基于均值回归的方法。当作为被解释变量的寿险保费收入的数据分布中存在厚尾或异常值，均值回归方法则难以奏效，而且均值回归方法只提供一条回归曲线很难具有代表性。Koenker 等(1978)[9]提出的分位数回归能够克服均值回归的局限，能够描述被解释变量整个条件分布特征，给出多条回归曲线，从而揭示解释变量对被解释变量在各个分位点处的影响，提供比均值回归更多的有用信息。本文以中国 102 个直辖市和地级市为研究对象，旨在揭示中国收入差距对寿险需求的影响，采用分位数回归模型，考察在不同分位点处收入差距对寿险需求的影响，实证结果表明：分位数回归模型更加细致、准确地描述了中国收入差距对寿险需求的影响。

## II.指标选取与统计描述

### A.指标选取

为刻画收入差距对寿险需求的影响，需要两类指标：一类为寿险需求指标，主要包括：寿险保费收入、人均寿险保费收入（寿险密度）等，反映一个国家或地区寿险发展水平。另一类为不平等指标，主要包括：Gini 系数、Theil 指数等，反映一个国家或地区收入分配差距状况。

对于寿险需求指标，本文选取寿险保费收入作为衡量指标，它代表了一个国家或地区寿险发展水平。

对于不平等类指标，本文主要选取 Gini 系数、Theil 指数和最富裕的 50%人口所占全部人口总收入份额这三个指标，其中后两个指标用于稳健性检验。康璞等(2009)[10]和王艳明(2010)[11]指出基于分组数据计算的 Gini 系数都是对真实 Gini 系数的一个估计，而运用微观数据计算则可以得到一个比较精确的估计。为此本文利用微观数据，运用 Anand(1983)[12]提出的一个简化公式

$$Gini = \frac{2}{n^2\mu}\sum_{i}^{n} i y_i - \frac{n+1}{n} \tag{1}$$

[基金项目]本文获山东工商学院青年科研基金项目(2011QN028)的资助。

进行 Gini 系数计算。式中，$\{y_i\}$为一个样本量为 $n$ 的“微观数据”组成的有序样本，$\{y_i\}$满足 $y_1 \le y_2 \le \cdots \le y_n$， $\mu = \frac{1}{n}\sum_{i}^{n} y_i$ 为样本均值。

此外，除了核心解释变量收入差距指标之外，本文选取了寿险需求中通常采取的解释变量（见表 1），如 GDP、寿险公司数量和地区等作为解释变量。

本文使用的微观数据来源于中国综合社会调查数据（CGSS2006）中居民收入抽样调查数据。该数据采用分层四阶段不等概率抽样方法，以个人为样本单位进行调查，共调查了全国 28 个省市的 10151 个样本单位，其中居民收入数据缺失 1932 个样本单位，最终有 8219 个有效样本单位供我们研究使用，共计算得到 102 个直辖市和地级市的 Gini 系数。与基尼系数相对应的各直辖市和地级市的寿险保费收入、GDP、寿险公司数量的数据来自 2006 年中国保险年鉴和各省市 2006 年统计年鉴。

表 1 报告了各变量的描述统计结果。寿险保费收入统计结果表明：各直辖市和地级市寿险发展呈现出非均衡发展态势，如：防城港寿险保费收入的自然对数只有 4.422，而上海寿险保费收入的自然对数则高达 9.693，后者是前者的 2.2 倍。Gini 系数统计结果表明：温州高达 0.662，均值也达到 0.438，意味着中国居民收入差距问题非常严重，中国经济高速增长的成果未能完全被社会各阶层共享。Theil 指数和最富裕 50%人口所占收入份额这两个收入差距指标也证实了这一点。GDP 统计结果表明：各直辖市和地级市经济呈现出非均衡发展态势，如：陇南 GDP 的自然对数只有 4.306，而广州 GDP 的自然对数则高达 9.624，后者是前者的 2 倍左右。寿险公司数量在各地区也不尽相同，防城港和陇南等地区只开设寿险公司 1 家，而北京开设了 29 家寿险公司。在所 102 个直辖市和地级市中，37 个属于东部地区，占样本量的 37.2%。

## B.统计描述

表 1　变量的统计描述

| 变量名称 | 符号 | 均值 | 标准差 | 最小值 | 最大值 |
|---|---|---|---|---|---|
| 寿险保费收入 | *Pi* | 6.588 | 1.030 | 4.422 | 9.693 |
| Gini 系数 | *Gini* | 0.438 | 0.083 | 0.129 | 0.662 |
| Theil 指数 | *Theil* | 0.390 | 0.150 | 0.116 | 0.948 |
| 50%富裕人口所占收入份额 | *Ratio* | 0.796 | 0.055 | 0.578 | 0.932 |
| GDP | *Pcgdp* | 6.327 | 1.061 | 4.306 | 9.624 |
| 寿险公司数量 | *Number* | 5.824 | 3.913 | 1 | 29 |
| 地区（东部=1，中西部=0） | *Area* | 0.372 | 0.486 | 0.000 | 1.000 |

注：（1）寿险保费收入和 GDP 都取自然对数；（2）东、中、西部按照《新中国六十年统计资料汇编》中的三大地区的划分方法划分。

# III.实证分析

## A.计量模型设计

### 1)均值回归模型

以对数寿险保费收入 $Pi$ 作为被解释变量，以基尼系数 $Gini$ 、GDP 的对数 $Pcgdp$ 、寿险公司数量 $Number$ 作为解释变量，为控制地区之间寿险需求的差异，引入地区控制变量 $Area$ ，建立回归模型：

$$Pi = \beta_0 + \beta_1 Gini + \beta_2 Pcgdp + \beta_3 Number + \beta_4 Area + \varepsilon \qquad (2)$$

### 2)分位数回归模型

均值回归模型中，除了解释变量和控制变量外，还有一些难以计量的变量并入随机扰动项，引起计量模型存在较大的误差或异方差性，这时均值回归很难具有代表性。而 Koenker 等(1978)提出的分位数回归可以较好刻画解释变量对寿险保费收入分布的位置、尺度和形态的影响，从而提供更多有用信息。与均值回归模型(2)对应的分位数回归模型分别表述为

$$Pi(\tau) = \beta_{0,\tau} + \beta_{1,\tau} Gini + \beta_{2,\tau} Pcgdp + \beta_{3,\tau} Number + \beta_{4,\tau} Area + \varepsilon_\tau \qquad (3)$$

式中， $\tau(\tau \in (0,1))$ 为分位点；回归系数 $\beta_{0,\tau}, \beta_{1,\tau}, \beta_{2,\tau}, \beta_{3,\tau}$ 和 $\beta_{4,\tau}$ 都是 $\tau$ 的函数。

## B.回归结果与讨论

### 1)均值回归和分位数回归结果讨论

表 2 报告了均值回归和分位数回归估计结果。均值回归模型的结果显示 Gini 系数的估计系数为负值，且在 5%的显著性水平上显著，这说明随着收入差距的上升，寿险需求在不断减少。根据 2007 年世界经济发展指标的报告，中国 2005 年人均 GNP 为 6600 美元，已成为中等收入国家，我们的研究表明寿险需求随着收入差距的扩大不断减少，这与粟芳(2004)和孙小素(2006)的研究相吻合。GDP 和寿险公司数量的系数均为正值，且在 10%的显著性水平上显著，这意味着经济发展对寿险需求具有促进作用，即随着经济的发展，寿险需求不断增加；寿险公司在一个地区开设的越多，说明寿险供给越大，竞争机制越完善，寿险供给增加和竞争机制的完善都会促进寿险需求的增加。地区控制变量的系数显著为正，这意味着东部地区和中西部地区的寿险需求存在差异，且东部地区的寿险需求大于中西部地区。

**表 2　均值回归和分位数回归估计结果**

| | 常数项 | Gini 系数 | GDP | 寿险公司数量 | 地区 |
|---|---|---|---|---|---|
| 均值回归 | 2.696*** | -1.009** | 0.601*** | 0.083*** | 0.143* |
| 分位数回归 | | | | | |
| 0.1 | 2.306** | -0.215* | 0.604*** | 0.079*** | 0.224 |
| 0.2 | 1.306** | -0.789* | 0.794*** | 0.051*** | 0.185 |
| 0.3 | 1.558*** | -0.783* | 0.779*** | 0.051*** | 0.058 |
| 0.4 | 1.623*** | -0.741 | 0.773*** | 0.051*** | 0.050 |
| 0.5 | 1.345*** | -0.316 | 0.804*** | 0.048*** | -0.022 |
| 0.6 | 1.502*** | -0.218 | 0.771*** | 0.058*** | 0.008 |
| 0.7 | 1.611*** | -0.301 | 0.781*** | 0.047*** | -0.014 |
| 0.8 | 2.132*** | -0.818 | 0.770*** | 0.038*** | -0.034 |
| 0.9 | 3.478*** | -1.908* | 0.647*** | 0.041** | 0.222 |

注： ***、**、*分别表示回归系数在 1%、5%、10%的显著水平下显著。

分位数回归模型的结果显示 Gini 系数的估计系数在 0.1、0.2、0.3 和 0.9 分位点显著为负，而且在 0.9 分位点系数为-1.908，绝对值最大，这说明在低分位点和高分位点随着收入差距的不断扩大，寿险需求在不断减少，且在高分位点收入差距对寿险需求的影响最大。GDP 的系数在各分位点均显著为正且在中位点最大，这说明经济发展对寿险需求具有促进作用，而且在中位点影响最大。寿险公司数量在各分位点均显著为正且随着分位点的增加呈递减趋势，说明寿险公司的增加对寿险需求具有促进作用，而且在低分位点寿险供给增加和竞争机制的完善对寿险需求的促进作用最大。地区控制变量的系数在分位点均不显著，这意味着在各分位点东部地区和中西部地区的寿险需求并不存在差异。

### 2)稳健性检验

为检验实证结果的稳健性，分别采用 Theil 指数和 50%富裕人口的收入份额为收入差距指标，继续研究收入差距对寿险需求的影响。表 3 报告了分别以 Theil 指数和 50%富裕人口的收入份额两个指标作为核心解释变量的均值回归和分位数回归估计结果。与表 2 中的结果相比，由表 3 中均值回归结果可知，随着收入差距的扩大寿险需求不断减少，而且其他解释变量的方向和显著性没有改变；表 3 中分位数回归结果表明：在低位点和高分位点两个收入差距指标对寿险需求仍为负向影响，而且其他解释变量的方向和显著性也没有改变。综上所述，以不同指标度量的收入差距并不影响收入差距与寿险需求之间的关系的，本文的

结果具有较强的稳健性。

**表 3　稳健性检验结果**

| | 常数项 | Theil 指数 | GDP | 寿险公司数量 | 地区 |
|---|---|---|---|---|---|
| 均值回归 | 2.466*** | -0.584** | 0.603*** | 0.081*** | 0.159* |
| 分位数回归 | | | | | |
| 0.1 | 2.131** | -0.748* | 0.592*** | 0.077*** | 0.276 |
| 0.3 | 1.460*** | -0.468* | 0.767*** | 0.052*** | 0.072 |
| 0.5 | 1.290*** | -0.204 | 0.802*** | 0.047*** | -0.017 |
| 0.7 | 1.315*** | -0.293 | 0.837*** | 0.034*** | 0.048 |
| 0.9 | 2.893*** | -0.857* | 0.651*** | 0.050*** | 0.254 |
| | 常数项 | 50%富裕人口所占收入份额 | GDP | 寿险公司数量 | 地区 |
| 均值回归 | 3.587*** | -1.667** | 0.600*** | 0.082*** | 0.146* |
| 分位数回归 | | | | | |
| 0.1 | 3.864*** | -2.657** | 0.615*** | 0.072*** | 0.292* |
| 0.3 | 2.234*** | -1.172* | 0.764*** | 0.052*** | 0.074 |
| 0.5 | 1.547* | -0.454 | 0.808*** | 0.047*** | -0.023 |
| 0.7 | 1.889** | -0.516 | 0.785*** | 0.043*** | -0.009 |
| 0.9 | 5.044*** | -2.728* | 0.577*** | 0.086** | 0.082 |

注： ***、**、*分别表示回归系数在 1%、5%、10%的显著水平下显著。

**3)进一步讨论**

中国东、中、西地区的收入差距较大，东部地区收入差距大于中西部地区（以 Gini 系数为例，东部地区 Gini 系数均值为 0.443，中西部地区为 0.436），为此引入地区变量与收入差距的交叉乘积项，更详细的刻画不同地区收入差距对寿险需求的影响。均值回归和分位数回归结果见表 4。由表 4 知，地区和 Gini 系数的交叉乘积项的均值回归系数显著为正，这说明东部地区 Gini 系数对寿险需求的影响较中西部地区要小，即中西部地区收入差距对寿险需求影响更加严重。地区和 Gini 系数的交叉乘积项的分位数回归系数只有在分位点为 0.2 时才显著为正，这说明在低分位点中西部地区收入差距对寿险需求影响更加严重。东部地区和中西部地区之间收入差距系数的差异反映了不同地区寿险需求机制不同，中国寿险需求在地区上存在着分割。

表 4 中 GDP 和寿险公司数量前的系数虽与表 2 中的结果有细微差异，但在各分位点上均显著为正，说明 GDP 和寿险公司数量对寿险需求呈正向影响，这一结果具有稳健性。

表 4 不同地区的均值回归与分位数回归结果

| | 常数项 | Gini 系数 | GDP | 寿险公司数量 | 地区*Gini 系数 |
|---|---|---|---|---|---|
| 均值回归 | 2.755 *** | -1.148** | 0.600*** | 0.084*** | 0.325* |
| 分位数回归 | | | | | |
| 0.1 | 2.151 ** | -1.184 | 0.634 *** | 0.077 *** | 0.376 |
| 0.2 | 1.441 ** | -0.980** | 0.789 *** | 0.052 *** | 0.391* |
| 0.3 | 1.556 *** | -0.786 | 0.779 *** | 0.052 *** | 0.114 |
| 0.4 | 1.639 *** | -0.843 | 0.778 *** | 0.050 *** | 0.112 |
| 0.5 | 1.301 ** | -0.282 | 0.809 *** | 0.047 *** | -0.085 |
| 0.6 | 1.493 *** | -0.214 | 0.772 *** | 0.059 ** | 0.016 |
| 0.7 | 1.602 *** | -0.355 | 0.789 *** | 0.042 *** | 0.009 |
| 0.8 | 2.087 *** | -0.765 | 0.773 *** | 0.037 *** | -0.074 |
| 0.9 | 3.867 *** | -2.425** | 0.616 *** | 0.045 ** | 0.548 |

注： ***、**、*分别表示回归系数在 1%、5%、10%的显著水平下显著。

# Ⅳ.结论与启示

本文对比了分位数回归与均值回归，发现前者比后者提供更多有用信息，并采用 Theil 指数和 50%富裕人口的收入份额为收入差距指标，验证了收入差距对寿险需求呈负向影响是稳健的。

实证结果表明：第一，均值回归回归结果显示，收入差距的扩大会抑制寿险需求，这与粟芳(2004)和孙小素(2006)的研究相吻合。第二，分位数回归结果显示，在低分位点和高分位点上收入差距对寿险需求有显著的负向影响。因此政府应采取措施改革收入分配制度，减少收入差距,促进寿险需求增加。第三，无论是均值回归还是分位数回归，经济发展和寿险公司的增加都对寿险需求具有促进作用，可见经济的发展和寿险市场竞争机制的完善是促进寿险需求增加的重要动力。第四，在地区方面存在着收入差距的跨层次效应，随着收入差距的扩大，东部地区收入差距对寿险需求影响减弱，也即中西部地区收入差距对寿险需求影响更加严重。

当然本文的研究没有验证收入差距影响寿险需求的机制，这些将需要进一步的研究来探讨和完善。

**参考文献:**

[1] Yin Hongpan,Liu Shuling. China's overall gini coefficient change trend-based on 2000-2009 data the national population subdivision algorithm [J]. China's population science, 2011, (4): 11-20.
尹虹潘, 刘姝伶. 中国总体基尼系数的变化趋势-基于 2000-2009 年数据的全国人口细分算法[J]. 中国人口科学, 2011, (4):11-20.
[2] Su Fang. Income demand for insurance mechanism of the effect of [J]. Journal of Jiangxi University of finance and economics, 2004, (4): 13 to 15.
粟芳. 收入对保险需求的影响机制研究[J]. 江西财经大学学报, 2004, (4): 13-15.
[3] Yang Xiaorong, Zhou Ailan. The income gap and life insurance needs to the relevant analysis-in ningxia as an example [J]. China's collective economy, 2010 (11):-21.
杨晓荣, 周爱兰. 收入差距与寿险需求的相关分析-以宁夏地区为例[J]. 中国集体经济, 2010, (11): 20-21.
[4] Yang Xiaohua. Personal insurance needs and income relationship-Beijing example [J]. J, d.c. economy, 2010, (4): 278-279.
杨晓华. 人身保险需求与收入关系分析-北京市为例[J]. 特区经济, 2010, (4): 278-279.
[5] Liang Bo. The income gap demand for insurance influence of empirical [J]. Contemporary managers, 2006, (16): 22-23.
梁波. 收入差距对保险需求影响的实证[J]. 当代经理人, 2006, (16): 22-23.
[6]Peng Jide.The income gap between urban and rural areas in xinjiang demand for insurance analyzing the impact of [J]. J xinjiang finance and economics, 2007, (1): 69-72.
彭记德. 新疆城乡收入差距对保险需求影响的实证分析[J]. 新疆财经, 2007, (1): 69-72.
[7] Su Fang. Income distribution of fairness and insurance market development of correlation analysis [J]. Financial research, 2004, 30 (1): 70-79.
粟芳. 收入分配的公平性与保险市场发展的关联分析[J]. 财经研究, 2004, 30(1): 70-79.
[8]Sun Xiaosu. Income disparity on the insurance

market development analyzing the impact of [J]. Science and technology information development and economic, 2006, 16 (9): 146-147.
孙小素. 收入差距对保险市场发展影响的实证分析[J]. 科技情报开发与经济, 2006, 16(9): 146-147.
[9]Koenker R., Bassett G..Regression Quaniiles[J]. Econometrica, 1978, 46: 33-50.
[10]Kang Pu, Jiang Cuixia. Poverty and income inequality measure with the parameters of the parameters of the method [J]. Economic and technological economic research number, 2009, (5): 120-131.
康璞, 蒋翠侠. 贫困与收入分配不平等测度的参数与非参数方法[J]. 数量经济技术经济研究, 2009, (5): 120-131.
[11] Wang Yanming. Gini coefficient of the comparison of the calculation methods [J]. Statistics and decision-making, 2010, (5): 157-159.
王艳明.Gini 系数测算方法之比较[J]. 统计与决策, 2010, (5): 157-159.
[12]Anand S. Inequality and Poverty in Malaysia Measurement and Decomposition[M]. New York Oxford University Press, 1983: 33-36.

# 基于分位数回归的收入差距对寿险需求的影响分析

蔡 超[1]，左 杨[2]，薛 伟[1]
[1]统计学院，山东工商学院，烟台，中国， 264005
[2]政法学院，山东工商学院，烟台，中国， 264005

**摘 要：**运用分位数回归分析方法，以中国 102 个直辖市和地级市为研究对象，对收入差距与寿险需求之间的关系进行了细致准确的描述，结果表明：在低分位点和高分位点上收入差距对寿险需求有显著的负向影响，而且在低分位点中西部地区收入差距对寿险需求的影响更加严重。另外，选择 Theil 指数和最富裕的 50%人口所占收入份额这两个收入差距指标进行稳健性检验，结果表明这两个收入差距指标的分析结果与以基尼系数作为收入差距指标的分析结果一致。

**关键词：**寿险需求；收入差距；分位数回归
[中图分类号]F840; F224　　[文献标识码]A

# Analysis on the Subsidy System of China's Policy Agricultural Insurance

**FENG Wenli SU Xiaopeng**
Hebei University of Economics and Business, 050061

Abstract: The government subsidy is an important booster for the development of agricultural insurance in China. At present, China's agricultural insurance premium subsidy is about to enter a promotion period of wide range.However,there are many practical problems in practice of the inadequate subsidy legislation, irrational subsidy mechanism, single subsidy mode, narrow subsidy scope, insufficient subsidy size, and less efficiency. This paper explores the China's agricultural insurance subsidies from the perspective of theory and practice, answers the practical questions such as "why subsidize", "how subsidize" , "what subsidize" and "how much subsidize", and look forward to be of some help to the practice of China's agricultural insurance subsidies.
Keywords: agricultural insurance; government subsidies; subsidies scale

## 绪言

2007年以来，财政部根据党中央、国务院有关精神，按照“政府引导、市场运作、自主自愿、协同推进”的原则，实施了中央财政农业保险保费补贴政策，与各级财政共同支持农业保险取得了快速发展。2007-2011年我国农业保险保费收入是 51.84 亿元、110.7亿元、133.9亿元、135.7亿元和173.28亿元，分别是没有实施保费补贴政策的2006年的 6.13 倍，13.09 倍，15.83 倍、16.04倍和20.48倍。据瑞士再保险公司统计，2008年底我国农业保险保费收入16亿美元，约占全球农险保费收入的 10%，保费规模已上升至仅次于美国的全球第二位。政府保费补贴，使得农业保险这个曾一度濒临停办的险种跃为我国财险业第三大险种。很显然，政府补贴是我国农业保险发展的重要助推器。

农业保险保费补贴试点五年来，政府对农业保险补贴问题一直给予高度重视。2012年中央一号文件在“科技兴农”主题中，进一步提出要扩大农业保险险种和覆盖面，鼓励地方开展优势农产品生产保险。财政部也及时发出通知，决定进一步加大中央财政对农业保险的支持力度，采取增加保费补贴品种、扩大保费补贴区域、支持提高保障水平等一系列新举措，对于开办农业保险的省、直辖市、自治区不再设限，只要按照要求申请就给予财政补贴。这意味着我国政策性农业保险补贴试点期结束了，将进入大范围推广时期。

但目前，我国关于农业保险补贴问题的理论研究还比较少，在农业保险保费补贴实践中也还存在补贴立法不完善、补贴机制不合理、补贴方式单一、补贴范围狭窄、补贴规模不足和补贴效率较低等问题。在农业保险补贴大范围推广前期，本文从理论和实践角度探讨农业保险补贴“为什么补”、“如何补”、“补什么”、“补多少”、“补的效率如何”，“怎样补得更好”等亟待解决的现实问题，以期对我国的农业保险补贴的实践工作能有些许帮助。

## 一、政府补贴农业保险的原因

对于“政府为什么补贴农业保险”，国内外学者从很多角度进行了解释。Ahsan，Ali和Kurian（1982）认为农业保险会增加产出，特别是在那些以增加食物供给为政策目标的欠发达国家，保险的公共补贴是必要的。Wright和Hewitt(1994)提出，私人保险很难克服农业风险系统性特征产生的经营困难，

历史上尝试使用商业保险经营农业保险的试验无一幸存，基本上都是靠政府直接经营或者间接经营的。Mishra（1996)提出，由于管理费用、道德风险和逆向选择等原因，农业保险的经营成本比较高，保险费大于农民的风险管理费用，如果政府不提供保费补贴，农场主投保可能就不划算。Hazzel（2000）认为，由于农业和非农业部门之间存在紧密联系，农业保险所带来的最终利益是外在的——全社会的，因此政府直接经营或大量补贴是农业保险发展的必要条件。Glauber 和 Collins(2002)认为,美国私营农作物保险市场和其他农业支持计划运作良好,但是假如取消政府补贴,农业保险市场能否依然存在则具有不确定性。Goodwin 和 Smith（1995）、Knight 和 Coble（1997）及 B.J.Sherrick etal（2004）认为，农业保险的需求弹性很低，其数值范围大致在 0.2～0.92 之间，农业保险费率较高、农户收入偏低、多元化风险管理手段以及农业保险的准公共产品属性等都会导致农业保险需求不足，为了提高农业保险的参与率，政府对农户投保进行保费补贴就显得尤为必要。

在国内，学者们主要从农业保险的特殊属性和市场失灵角度来论证农业保险补贴的必要性。郭晓航(1986)在国内首次提出农业保险属于政策性保险，国家应从政策性这一角度考虑给予农业保险适当的支持。刘京生（2000）认为，农业保险除具有经济性、商品性、互助性、契约性和科学性等商业保险共同的特性外，农业的弱质性、基础地位以及社会效益等决定了农业保险还具有一些其他特性，不可能完全按照商品经济的等价交换原则来经营。国家采取财政、金融、税收等手段补贴农业保险是国际通行的做法。庹国柱和王国军(2002)认为农业保险是一种介于私人物品和公共物品之间的准公共物品，必须由政府经营或者国家财政支持商业保险公司经营，服务于政府给定的经济和社会政策。代表公共利益的政府对农业保险应该给予必要的政策扶持和财政激励。冯文丽和林宝清(2003)及冯文丽（2004）认为，农业保险经营中面临的系统性风险、信息不对称问题以及供给和需求两方面的双重正外部性，导致了农业保险市场失灵，因此政府需要对农业保险进行补贴以支持其发展。黎已铭（2005）反对将农业保险市场失灵作为农业保险经营困境的理论解释，他从风险管理和保险理论角度出发，提出农业风险的弱可保性是农业保险经营困境的重要原因，并提出实行统保和法定强制保险、对投保农民和经营机构实行政策性补贴等提高可保性的对策。冯文丽和苏晓鹏（2008）认为，农业保险补贴可在一定程度上解决农业保险价格难题。李海军（2009）从博弈论角度对政府为什么补贴农业保险进行了分析，认为在政策性农业保险的参与主体（包括政府、保险公司和农民）间的四种博弈策略组合中，只有在政府提供财政补贴的情况下，才能实现社会总效用最大化。

综上所述，尽管国内外学者论证政府补贴农业保险原因的角度和理论依据不同，但都殊途同归地得出了一致性的结论：农业保险是政策性险种，纯商业化经营难以为继，必须由政府提供补贴才能实现持续经营。

**二、政府补贴农业保险的依据**

在农业保险发展较好的国家，都是立法先行，为农业保险补贴提供法律保障和依据，即“依法补贴”。以美国为例，政府的补贴工作和保险公司的业务经营均严格按照在保险法之外专门制定的农业保险法律来试验和不断完善的，并且能够随着社会发展和新问题涌现而不断修正。1938 年制定了《联邦农作物保险法》，对开展农业保险的目的、农业保险的性质、开展办法、经办机构等作了明确规定，并依法建立了联邦农作物保险公司，为政府开展农业保险业务提供了法律依据。1980 年，修订了《联邦农作物保险法》，首次规定对农作物保险进行保费补贴，鼓励私人保险公司申请参与 FCIC 的农作物保险和再保险并提供管理费补贴。1994 年，颁布了《克林顿农作物保险改革法》，取消了“特别灾害救助计划”，建立了农作物保险巨灾保险计划，对农业保险实行事实上的强制参加，提高了农业保险的保费补贴率。2000 年，颁布了《农业风险保障法》，规定在以后 5 年中拨款 82 亿美元用于农作物保险计划，其中

80%专门用于保费补贴,再次提高了对高保障保险的保费补贴率。2008年的《食品、水土保持和能源法》(简称《2008年农场法》)对农业保险的保费补贴水平和管理费补贴水平进行了调整。

目前，我国《保险法》、《渔业法》、《林业法》等相关法律，均没有对农业保险加以定位。《农业法》只是原则性地提到："国家逐步建立和完善政策性农业保险制度。鼓励和扶持农民和农业生产经营组织建立为农业生产经营活动服务的互助合作保险组织，鼓励商业性保险公司开展农业保险业务"。推行农业保险所依据的，在中央政府层面，只有国务院《关于促进生猪生产发展稳定市场供应的意见》，以及财政部《中央财政种植业保险保费补贴管理办法》、《中央财政养殖业保险保费补贴管理办法》和保监会发布的一些指导意见；在地方政府层面，主要是省、市、县级政府发布的规范性、执行性的文件。总的来看，这些相关规定层级偏低，系统性、权威性不强，协调力和稳定性不够。目前，法律及实施细则的缺失已经造成农业保险业务经营和监督管理方面的诸多困难，成为当前发展农业保险的主要障碍之一。

## 三、政府补贴农业保险的机制

我国政策性农业保险保费补贴实行的是"层层补贴+倒补贴联动机制"：要求中央、省、市、县四级财政（对于省管县是三级财政）均出资补贴保费，而且必须在农民缴足保费、基层财政补贴到位之后，中央和省级财政的补贴才会随之落实。这种补贴方式的设计意图在于避免地方政府的道德风险和"钓鱼"问题，但同时也导致各地农业保险的覆盖面直接与县级政府财力相关：如果县级财力不足，就会限制省级财政、中央财政的补贴金额。从各地情况看，县级财政一般担负着 10%-20%的中央保费补贴的配套任务。对那些缺乏财力的地（市）、县来说，保险覆盖面越大，本级财政的保费补贴负担越沉重，因此不愿意扩大农业保险补贴范围。有的县整体不参保，或人为控制参保范围，甚至出现农民积极缴纳保费、县政府为了规避补贴责任却退回农民所缴保费的情况。还有个别县为达到不出配套补贴资金的目的，以不支付县级农业保险补贴为条件挑选具体经办业务的保险公司。2010年，全国农业保险出现停滞的迹象，在一定程度上与这种不适当的"补贴层层有份"的规定有关。

## 四、政府补贴农业保险的方式

财政补贴，是一种影响相对价格结构，从而可以改变资源配置结构、供给结构和需求结构的政府无偿支出。按照此定义，凡是国家对农业保险提供的影响相对价格、改变供求结构的政府无偿支出，都可以列为农业保险的补贴方式。一般来讲，政府补贴农业保险的方式主要有六种:（1）资本金支持，指国家出面设立国有农业保险企业或其他类型的农业保险组织，专门负责经营多风险或一切险农业保险，为农业生产者提供农业保险服务，相应地，财政依法为这些组织提供资本金；（2）保险费补贴，指政府对农户应缴纳农业保险费给予补贴，以增加农户的支付能力，扩大农业保险的实际需求；（3）经营管理费用补贴，指政府对农业保险经营主体所发生的经营管理费用给予的补贴；（4）再保险支持，是指由国家的农业保险公司或是由农业部或财政部直接对农业保险经营主体提供农业保险再保险业务所发生的一切费用支出；（5）税收优惠，指政府对农业保险经营主体所承担的税负给予一定的优惠,以吸引社会资本参与农业保险经营；（6）农业巨灾风险准备基金，一般由政府相关机构、农业保险公司及行业协会三方牵头组成，将分散在社会各个方面的力量和资金聚合起来，用于防范巨灾风险，维护保险人和被保险人利益，政府对基金一般都会给予一定的财政拨款。

目前，我国农业保险补贴的方式比较单一。中央政府只对农民缴纳的保费进行补贴；经营管理费用补贴只有少数省市（如北京市和江苏省等）实施；中央财政尚未为农业保险经营组织或地方政府提供再保险，农业保险经营组织均通过商业渠道分出再保险；税收优惠力度不大，政策性农险业务免缴营业税和印花税，种植业保险 25%的巨灾风险准备金可税前列支，农业保险所得税纳税基数

按 90％计算；尚未建立全国范围的农业巨灾风险准备基金；中央财政也尚未为任何农业保险组织提供资本金支持。

**五、政府补贴农业保险的范围**

农业保险补贴范围是指哪些保险标的纳入政府财政补贴的范围。美国为 150 多种农作物提供保费补贴，基本上达到了“能补则补”，具体包括：玉米，大豆，小麦，棉花，高粱，土豆，向日葵，葡萄，花生，干豆，苹果，甜菜，大麦，水稻，洋葱，西红柿，小米，核桃，辣椒和燕麦等，其中，玉米、大豆、小麦和棉花等重要农作物获得的保费补贴数额位居前四名。

与美国相比，我国财政补贴的种植业险种和养殖业险种非常有限。根据财政部金融司公布的 2012 年 2 号文件《关于进一步加大支持力度，做好农业保险保费补贴工作的通知》（以下简称《农险补贴通知》）规定，中央财政补贴险种扩展为 15 个，包括水稻、玉米、小麦、油料作物、棉花、马铃薯、青稞、天然橡胶、森林、能繁母猪、奶牛、育肥猪、牦牛、藏系羊和糖料作物。各地根据实际情况，享受中央财政补贴品种有所不同。例如河北省有小麦、玉米、棉花、奶牛、能繁母猪 5 个品种享受中央财政补贴；宁夏自治区则只有奶牛和能繁母猪享受中央财政补贴，种植业方面没有品种入选；北京和上海则没有一个险种享受中央补贴，农业保险保费补贴全部由地方财政支持。另外，有些地方财政还会选择部分具有地方特色的品种予以保费补贴，其中多为高效经济作物。例如，山东省的蔬菜大棚、苹果、奶牛和渔业等高附加值项目；内蒙古的马铃薯等和安徽省的草莓等（具体见表 1）。

**表 1：我国部分农业保险试点地区政府补贴险种**

| 试点地区 | 中央财政补贴品种 | 地方财政补贴品种 |
|---|---|---|
| 山东省 | 小麦、玉米、棉花、能繁母猪 | 蔬菜大棚、苹果、奶牛、渔业等高附加值项目 |
| 河北省 | 小麦、玉米、棉花、奶牛、能繁母猪 | |
| 辽宁省 | 玉米、水稻、大豆、花生 | 日光温室 |
| 吉林省 | 玉米、水稻、大豆 | 烟叶、花生和葵花籽等 |
| 黑龙江省 | 小麦、玉米、水稻、大豆、能繁母猪、奶牛 | |
| 黑龙江垦区 | 小麦、玉米、水稻、大豆、大麦、能繁母猪、奶牛 | 马铃薯、亚麻、杂豆、白瓜籽等经济作物 |
| 江苏省 | 水稻、小麦、油菜<br>棉花、玉米、奶牛、能繁母猪 | 桑蚕、林木、生猪、家禽、农机、设施农业、渔船和渔民互助等 |
| 内蒙古 | 玉米、小麦、大豆、油菜籽、葵花籽、能繁母猪、奶牛 | 马铃薯 |
| 宁夏 | 奶牛和能繁母猪 | 设施农业、小麦、水稻、玉米、压砂西瓜、脱水蔬菜、葡萄、葵花、苹果、番茄、枸杞、长红枣等 |
| 浙江省 | 水稻、油菜 | 大棚蔬菜、露地西瓜、柑橘树、林木、生猪、鸡、鸭、鹅、淡水鱼、能繁母猪、奶牛、公益林 |
| 安徽省 | 水稻、玉米、小麦、油菜、棉花、大豆、能繁母猪、奶牛 | 草莓、高山蔬菜种植、大棚蔬菜等 |
| 北京市 | 无 | 玉米、小麦、种猪、生猪、奶牛、西瓜、苹果、梨、桃等 18 个品种 |

| | | |
|---|---|---|
| 上海市 | 无 | 2009 年市级财政给予补贴的农业保险险种为 20 个 |

**数据来源：**国务院发展研究中心金融所《中国农业保险：现状、问题与政策》课题组：《中国农业保险：现状、问题与政策》，2010 年 7 月。

## 六、政府补贴农业保险的规模

### （一）近年来我国的农业保险补贴额度

2007 年，我国中央财政首次列支 21.5 亿元的预算额度，在全国 6 省区推行政策性农业保险保费补贴试点，揭开了中央政府补贴农业保险的序幕，这使得 2007 年农业保险保费收入猛增为 51.8 亿元，比 2006 年增长 504%。2008、2009 和 2010 年，中央政府分别列支 60.5 亿元、79.8 亿元和 103.2 亿元的农业保险保费补贴额度。截止到 2011 年，中央财政累计拨付农业保险保费补贴资金达 260 多亿元，预算安排资金年均增长 46%左右；作为中央财政补贴配套资金，地方各级财政到 2011 年底止，累计拨付农业保险保费补贴近 200 亿元。

### （二）以美国经验比例测算的我国农业保险补贴额度

2010 年，美国联邦政府对农业保险的保费补贴支出为 47 亿美元，当年美国农业 GDP 为 1764 亿美元。经过测算可知，美国联邦政府农业保险补贴总额占美国农业 GDP 的比例为 2.7%。如果按照 2.7%的美国经验比例来测算，我国 2007-2010 年的农业增加值分别为 28627.0 亿元，34000.0 亿元、35477.0 亿元和 40497.0 亿元，那么我国 2007-2010 年农业保险补贴的总规模应该分别为 772.93 亿元，918 亿元，957.88 亿元和 1093.42 亿元。

**表 2：2007-2010 年我国农业保险补贴规模测算　单位：亿元**

| | 农业增加值 A | 农业保险补贴 B=A×2.7% |
|---|---|---|
| 2007 | 28627.0 | 772.93 |
| 2008 | 34000.0 | 918 |
| 2009 | 35477.0 | 957.88 |
| 2010 | 40497.0 | 1093.42 |

**数据来源：**2011 年统计年鉴。

### （三）假设不同的保障水平和补贴比例测算农业保险补贴规模

1.假设保障水平为 70%,补贴比例为 80%时的保费补贴规模

假设对我国稻谷、小麦、棉花、玉米、豆类、薯类、牛、羊、猪等 23 种主要农作物和牲畜全部投保，保障水平为市场价格的 70%，中央、省、市、县四级政府提供的保费补贴比例总计为 80%。这种假设下农业保险保障水平和补贴比例较高，因此测算的补贴额度应该是最高的，为 1644.4 亿元（具体测算过程请参见表 3。

**表 3：2010 年我国农业保险保费补贴应补规模**

| 种类 | 产量 A（万吨）（万头） | 单位价格 B（元/吨）（元/头） | 总价格 C =A×B（万元） | 保险金额 D =C×70%（万元） | 纯保费 E =D×6%（万元） | 保费补贴 F =E×80%（万元） |
|---|---|---|---|---|---|---|
| 稻谷 | 19576.1 | 2840 | 55596124 | 38917286.8 | 2335037.208 | 1868029.766 |
| 小麦 | 11518.1 | 2200 | 25339820 | 17737874 | 1064272.44 | 851417.952 |
| 玉米 | 17724.5 | 2500 | 44311250 | 31017875 | 1861072.5 | 1488858 |
| 豆类 | 1896.5 | 4447 | 8433735.5 | 5903614.85 | 354216.891 | 283373.5128 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 薯类 | 3114.1 | 2300 | 7162430 | 5013701 | 300822.06 | 240657.648 |
| 棉花 | 596.1 | 10170 | 6062337 | 4243635.9 | 254618.154 | 203694.5232 |
| 花生 | 1564.4 | 9600 | 15018240 | 10512768 | 630766.08 | 504612.864 |
| 油菜籽 | 1308.2 | 4540 | 5939228 | 4157459.6 | 249447.576 | 199558.0608 |
| 芝麻 | 58.7 | 10600 | 622220 | 435554 | 26133.24 | 20906.592 |
| 甘蔗 | 11078.9 | 800 | 8863120 | 6204184 | 372251.04 | 297800.832 |
| 甜菜 | 929.6 | 470 | 436912 | 305838.4 | 18350.304 | 14680.2432 |
| 烟叶 | 300.4 | 18000 | 5407200 | 3785040 | 227102.4 | 181681.92 |
| 蚕茧 | 87.3 | 30000 | 2619000 | 1833300 | 109998 | 87998.4 |
| 苹果 | 3326.3 | 5660 | 18826858 | 13178800.6 | 790728.036 | 632582.4288 |
| 柑橘 | 2645.2 | 3500 | 9258200 | 6480740 | 388844.4 | 311075.52 |
| 梨 | 1505.7 | 3000 | 4517100 | 3161970 | 189718.2 | 151774.56 |
| 葡萄 | 854.9 | 5000 | 4274500 | 2992150 | 179529 | 143623.2 |
| 香蕉 | 956.1 | 4000 | 3824400 | 2677080 | 160624.8 | 128499.84 |
| 橡胶 | 69 | 28100 | 1938900 | 1357230 | 81433.8 | 65147.04 |
| 牛 | 10626.4 | 7000 | 74384800 | 52069360 | 3124161.6 | 2499329.28 |
| 肉猪出栏 | 66686.4 | 1500 | 100029600 | 70020720 | 4201243.2 | 3360994.56 |
| 猪年底头数 | 46460 | 1500 | 69690000 | 48783000 | 2926980 | 2341584 |
| 羊年底只数 | 28087.9 | 600 | 16852740 | 11796918 | 707815.08 | 566252.064 |
| 总计 | | | 489408714.5 | 342586100.2 | 20555166.01 | 16444132.81 |

数据来源：2011 年统计年鉴

2. 假设保障水平为 70%，补贴比例为 60%时的保费补贴规模

假设对我国稻谷、小麦、棉花、玉米、豆类、薯类、牛、羊、猪等 23 种主要农作物和牲畜全部投保，保障水平为市场价格的 70%，由中央和省两级政府提供的保费补贴比例为 60%。在这种假设下测算的 2010 年我国农业保险保费补贴额度应为 1409.5 亿元。（具体测算过程与表 3 相同，只是用 60%的保费补贴比例替换了 80%的保费补贴比例）。

3. 假设保障水平为 60%，补贴比例为 60%时的保费补贴规模

假设对我国稻谷、小麦、棉花、玉米、豆类、薯类、牛、羊、猪等 23 种主要农作物和牲畜全部投保，保障水平为市场价格的 60%，由中央和省两级政府提供的保费补贴比例为 60%。在这种假设下测算的 2010 年我国农业保险保费补贴额度应为 1057.1 亿元。（具体测算过程与表 3 相同，只是用 60%的保障水平替换了 70%的保障水平，用 60%的保费补贴比例替换了 80%的保费补贴比例）。

**（四）我国农业保险保费补贴规模偏小的原因分析**

从上述测算中可以看出，2010 年我国农业保险保费补贴规模应为：（1）以美国经验比例（农业保险保费补贴占农业 GDP 的比例为 2.7%）测算应为 1093.4 亿元；（2）假设对 23 种重要农作物和牲畜全部投保，保障程

度 70%，补贴比例 80%，保费补贴总额应为 1644.4 亿元；（3）假设对 23 种重要农作物和牲畜全部投保，保障程度 70%，补贴比例 60%，保费补贴总额应为 1409.5 亿元；（4）对 23 种重要农作物和牲畜全部投保，保障程度 60%，补贴比例 60%，保费补贴总额应为 1057.1 亿元。可见，无论如何测算，2010 年我国农业保险保费补贴的“现实规模”（中央财政补贴额度 103.2 亿元）都不足农业保险保费补贴“理想规模”（1093.4 亿元、1664.4 亿元、1409.5 亿元和 1057.1 亿元）的十分之一。

我国农业保险保费补贴“现实规模”与“理想规模”差距较大的原因在于：（1）我国农业保险的参与地区有限，投保率较低，目前大概为 30%左右；而美国则已经大范围推开，参与率已经达到 80%左右，在对我国保费补贴“理想规模”的测算中也是假定 100%参与的。（2）我国农业保险的补贴品种有限，目前只有 15 种作物和畜禽，不像美国仅农作物已经达到 150 多种，几乎“能补则补”。（3）我国农业保险的保障水平较低，目前主要是保物化成本，保险金额较低，从而导致保费和保费补贴均较少。美国则是保产量和保收入，在对我国保费补贴“理想规模”的测算中也是假定保收入的，保险金额较高，从而保费及保费补贴也较高。

**八、政府补贴农业保险的效率**

农业保险补贴效率一直是政府非常关心的问题。在美国，很多学者质疑政府补贴农业保险的效率，认为政府补贴最终使保险公司获得了超额利润。虽然我国政府补贴农业保险仅有五年的时间，但补贴效率问题也开始显现，主要表现在以下几个方面：

（1）农业保险的参与率较低。尽管，目前我国农业保险保费补贴比例较高，达到了 80%左右。但我国农业保险的参与率或覆盖率目前仍然维持在较低水平，说明农业保险补贴政策还未达到政策目标，效率不高。2009 年全国播种面积为 237959 万亩，农业保险承保面积为 66173 万亩，全国农业保险的覆盖率为 27.81%。其中西藏、贵州、重庆、甘肃、海南、宁夏、广东、广西、云南、陕西、山西、青海、天津和江西等 14 个省、区、市的农业保险覆盖率在 10%以下；西藏、贵州、重庆、甘肃、海南和宁夏等六省、市、区的农业保险覆盖率在 1%以下。

(2)投保人的道德危险和逆选择等信息不对称问题比较突出。例如，在能繁母猪保险中，投保人骗保的方式五花八门：从外地收购廉价死猪带上保险耳标后索赔；未保险的能繁母猪死亡后借保险耳标进行索赔；用胶粘贴右耳重复索赔；对需要淘汰的能繁母猪不积极治疗或蓄意宰杀进行索赔等等。陕西省咸阳市 2007 年能繁母猪的赔付率为 47.87％，而到 2009 年赔付率上升为 166.9％，短短三年时间，赔付率足足翻了四番！

（3）基层政府和保险公司的委托-代理问题开始显现。目前受种种条件制约，农业保险仍需借助行政力量推行，保险公司承保、理赔主要通过乡、镇或村委会办理，因种植面积、养殖数量核实难度较大，存在农户或村委会虚报统计数据套取财政资金的风险。保险赔款也由基层政府转发，存在扣减款项、抵缴保费、赔款与国家救助资金平衡使用等问题。同时，也有少数保险公司搞虚假承保和理赔，套取国家财政补贴资金。

**九、完善我国农业保险补贴制度的建议**

**（一）加快立法，使农业保险补贴法制化**

针对我国农业保险立法不完善的情况，建议尽快组织制定《农业保险条例》，规范农业保险市场和经营体制，避免政府支持农业保险的随意性，或因财政困难而忽视对农业保险的支持。具体的立法重点包括：第一，明确建立政策性农业保险制度的原则、目标、保险范围、保险机构经营原则、管理机构及其职责；第二，规定农业保险的组织形式、承办保险机构和再保险机构的资质规定、保险代理人和查勘人员资格和执业规定等；第三，明确政策性农险的险种范围、费率制订程序和方法、保险合同格式、合同相关方的权利义务；第四，规定承办政策性农险机构的保险资金管理方式、投资管理渠道和比例；第五，规范政府责任，包括明确农业保险的主管部门，建立部门合作机制，确立财政补贴长效机制；明确政策性农险的监管原则和

监管要点、监管程序等。第六，明确政策性农业保险与纯商业性农业保险的边界和关系。

其中，农业保险立法中的财政补贴长效机制具体包括：规定农业保险总规模盯住一种经济指标（如农业增加值）的一定比例，避免农业保险补贴“有钱时补，没钱时不补”的政策随意性；规定采用具体的农业保险补贴方式（从资本金支持、保费补贴、经营管理费用补贴、再保险补贴、税收优惠及农业巨灾风险准备基金这六种补贴方式中选择）；对农业保险补贴的标的范围、风险责任明确界定；对农业保险补贴比率及差异性标准进行规定；对提高农业保险参与率的强制投保机制和信贷联动机制进行规定；等等。

### （二）减少农业保险补贴的政府层级

根据国外农业保险补贴经验，一般都是中央政府独自进行保费补贴或者由中央政府和省两级财政进行补贴，还没有听说超过两级补贴的国家。例如，美国和日本，只有中央政府出资补贴农业保险，美国的州、县和日本的府、道、县都不出资。加拿大的农业保险是各省独立举办，他们是由中央和省两级财政进行补贴。鉴于我国“层层补贴”机制对扩大农业保险覆盖面产生的不利影响，建议有关部门借鉴国际经验，探讨研究在我国实施由中央和省两级财政对农业保险进行补贴的可行性。如果受我国国情所限，不能实现两级财政补贴机制，可考虑进一步提高中央财政农业保险保费补贴比例，综合考虑各地经济发展实力和财政承担能力，实行有所差别的保费补贴比例，对于中西部经济欠发达地区，中央财政保费补贴比例应提高至不低于 70%；对于经济相对发达地区，中央财政保费补贴比例应提高至不低于 50%。

### （三）增加农业保险补贴方式

第一，应在适当的时候考虑试行农业保险经营管理费用补贴，激励保险公司增加供给。但是必须注意到，根据国外经验，农业保险经营管理费用补贴容易导致保险公司获得额外的利润，容易引起风险责任淡化、保险工作效率不高的问题。同时，在采用经营管理费补贴这种方式时，一定要合理测定不同地区的政策性农业保险业务的费用率，根据费用情况的差异，实行差别费用补贴比例。

第二，加强对农业保险的税收优惠。通过立法应明确规定在对农业保险业务免去营业税的同时，减免所得税。减免的税收转入农业巨灾风险准备金，用作应对农业大灾补偿的积累。同时，国家应对经营农业再保险业务的机构提供税收优惠，即对农业再保险业务减免营业税和所得税。

第三，加快建立财政支持的农业巨灾风险分散机制。尽快推动在保费补贴之外建立单独预算的农业巨灾保险准备基金及财政支持的巨灾再保险保障体系，形成由中央和地方财政共同支持的、保险人参与的多层次农业巨灾风险转移分担机制，拓展农业可保风险范围，提高保险业抗御农业巨灾风险的能力。对于农业巨灾风险基金，建议有关部门在充分吸收各方意见及一些地区试点经验的基础上，加快对设立农业巨灾风险基金的操作性设计，包括巨灾基金的规模测算、筹资方式、各级政府和保险公司的出资比例、资金的使用范围、管理体制与监控等。对于财政支持的巨灾再保险保障体系，建议政府对经营农业保险再保险业务的保险公司提供补贴，支持保险公司与国内外再保险企业积极合作。

### （四）扩大农业保险补贴规模

在我国农业保险补贴比率已经较高，没有可能进一步提高的情况下，扩大农业保险补贴规模只能依靠扩大农业保险补贴地区、扩大农业保险补贴标的范围和提高农业保险保障水平。（1）扩大农业保险补贴地区。令人欣慰的是，根据财政部2012年2号文件规定，中央财政保费补贴区域将在现有补贴区域基础上，进一步扩大至全国，这在一定程度上可增加我国农业保险补贴规模。（2）扩大农业保险补贴标的范围。针对现阶段我国农业保险补贴标的种类远小于美国150多种的现实情况，建议适当扩大财政补贴农业保险标的的范围，授予各省根据当地实际情况灵活确定补贴品种的权限，将各地大面积种植、并对促进现代农业发展有重要意义的经济作物和设施蔬菜，对稳定人民菜篮子工程、增加农户收入具有重要意义的畜禽等纳入补贴范围。（3）提高保障水平。在条件和经验

成熟后，可以将保障水平由“保成本”提高到“保产量”或“保收入”，以提高农业保险金额，从而提高农业保险保费总额和保费补贴总额。

### （五）采用多种方式提高农业保险效率

1.利用强制投保提高农业保险覆盖率。世界上农业保险运行比较成功的国家，投保都存在一定的强制性。一方面，通过强制投保能够在足够大的领域内分摊风险，避免逆向选择，降低农业保险费率；另一方面，通过适度强制投保，可以减少保险公司经营农业保险的费用支出。这两个方面都有利于降低财政补贴成本。美国从1939年到1993年的50多年里，虽然政府提供了大量补贴，但农作物保险的覆盖率却一直停留在较低水平。只是在1994年政府采取有条件的强制措施后，才使农作物保险的覆盖率进一步提高。因此，我国在适度补贴农业保险的同时，应采取强制性、区域性投保措施，以增加我国农业保险的有效需求，保证必要的覆盖率。但是，在强制投保的制度设计上，应注意避免强制投保演变成乱摊派。

2. 利用经济手段提高农业保险覆盖率。1994年，美国将农业保险和其它救灾政策及优惠金融政策结合在一起，迅速提高了农业保险覆盖率。我国也可在农村金融组织不断健全和发展的基础上，建立农业信贷和农业保险的联动机制。在初期阶段，可对参加农业保险的农户在贷款额度和利率等方面给予一定的优惠，鼓励农民参加农业保险。待条件成熟时，进一步将是否参加保险作为贷款发放的条件之一。此外，还可将农业保险与各种农业直补政策挂钩，不购买政策性农业保险就不能获得政府的其他补贴，以此提高农业保险的覆盖率。

3.采取多种措施控制投保人的道德风险和逆选择问题。第一，推行整体承保，例如某农户如果投保，必须将其所有的田块一起投保，不允许部分投保；第二，鼓励和支持种植业、养殖业的专业合作社和生产互助组织整体投保,并对达到一定规模的投保单位，给予一定的费率优惠；第三，通过调整保险期限来消除逆选择，如美国曾推出 3 年期小麦和棉花保险，减少了农户在次年和第三年的逆选择，也降低了保险公司的销售成本；第四，赋予保险公司一定的费率调整权限，对于道德风险高发地区，可适度调高费率；第五，积极开发和推广创新型保险产品，用农业气象指数保险、区域产量指数保险等保险产品，替代传统的农业保险产品，既可以减少道德风险，又有利于降低理赔成本。

4.严格执行保监会提出的农业保险承保理赔“五公开，三到户”规定，防控基层政府和保险公司的委托代理问题。“五公开，三到户”规定是指“惠农政策公开、承保情况公开、理赔结果公开、服务标准公开、监管要求公开”和“承保到户、定损到户、理赔到户”。“五公开，三到户”通过公开保险公司的承保理赔服务标准，一方面可以督促保险公司提高服务水平，另一方面可以防止保险公司和基层政府通过虚假承保和理赔套取国家财政资金，挪用农民保险赔款。

## 参考文献

[1]Ahsan,S.,A.Ali,and N. Kurian.Toward a Theory of Agricultural Insurance[J].*Amer. J. Agricultural Economics*, 64（August 1982）,p.520-529.

[2]Wright B.D. and Hewitt J.A.All risk Crop Insurance:Lessons from Theory and Experienee[A].*Eeonomiesof Agricultural Crop Insurance:Theory and Evidence,* edited by D.L.Hueth and W.H,Furtan.Boston,MA:Kluwer Academic Publishers,1994.

[3]Mishra,P.K.Agricultural Risk,Insurance and Income:A Study of the Impact and Design of India’s Comprehensive Crop Insurance Scheme[M].Aldershot:Avebury,1996.

[4]Glauber,J.W.,and K.J.Collins.Crop Insurance,Disaster Assistance,and the Role of the Federal Government in Providing Catastrophic Risk Protection[J].*Agricultural Finance Review*, Fall,2002, p.81-101.

[5]Goodwin, B. K., and V. H. Smith.The Economics of Crop Insurance and Disaster Aid[M].Washington,DC:The AEI Press, 1995.

[6]Knight,T.O.,and K.H.Coble.Survey of U.S. Multiple Peril Crop Insurance Since 1980[J].*Review of Agrieultural Eeonomies,*1997,19(1),128-156.
[7]Sherrick B.J.,et.al, Factors Influene in Farmers' Crop Insurance Decisions[J].*Amer. J. Agr. Eeon.*Feb.86 (2004),p.103-114.
[8]郭晓航.论农业政策性保险，中国保险学会的学术讨论会会议论文，北京,1986.
[9]刘京生.中国农村保险制度论纲[J].中国社会科学出版社，2000.
[10]庹国柱,王国军.中国农业保险与农村社会保障制度研究[M].首都经济贸易大学出版社，2002.
[11]冯文丽,林宝清.我国农业保险短缺的经济分析[J].福建论坛,2003(6).
[12]冯文丽.我国农业保险市场失灵与制度供给[J].金融研究,2004(4).
[13]黎已铭.农业保险性质与农业风险的可保性分析[J].保险研究,2005(11).
[14]冯文丽,苏晓鹏.农业保险价格难题及政府补贴机制[J].价格理论与实践,2008(9).
[15]李海军.我国政策性农业保险发展问题研究[D].山东农业大学,2009.
[16]冯文丽.农业保险补贴制度供给研究[M].中国社会科学出版社，2011.

# 我国政策性农业保险补贴制度分析

冯文丽　苏晓鹏

金融学院,河北经贸大学，050061

**摘要**：政府补贴是我国农业保险发展的重要助推器。目前，在我国农业保险保费补贴即将进入大范围推广时期，实践中也还存在补贴立法不完善、补贴机制不合理、补贴方式单一、补贴范围狭窄、补贴规模不足和补贴效率较低等现实问题。本文从理论和实践角度探讨我国农业保险补贴“为什么补”、“如何补”、“补什么”、“补多少”、“补的效率如何”，“怎样补得更好”等亟待解决的现实问题，以期对我国农业保险补贴的实践工作能有些许帮助。

**关键词**：农业保险；政府补贴；补贴规模

**作者简介**：
冯文丽（1974-），女，河北经贸大学教授，硕士生导师。
苏晓鹏（1972-），男，河北经贸大学副教授，硕士生导师。
联系地址：河北省石家庄市学府路 47 号河北经贸大学金融学院　050061
联系电话：13303296091
电子邮箱：fengwen0909@sina.com

# Research on the Interactive Relationship between Life Insurance and Savings under Inflation—Based on VAR Model

JIA Shibin SHANG Ying

School of Economics, Hebei University, Baoding, China, 071002

**Abstract:** Based on the monthly time series data from January 2001 to April 2012, this paper studied the relationship between life insurance and savings under the interference with inflation and interest rates in China, using VAR model. The result shows that inflation increases the difficult of life insurance developments, and inhibits the demand of persons for life insurance. The persons are more inclined to choose savings to deal with the uncertainty of the future. In the long term, they will develop in the same direction, but in the short term, the substitution effect will be more obvious. As we see, life insurance and savings has a complex relationship. But generally speaking, life insurance and savings exists co-integration relationship.

**Key words:** life insurance; savings; VAR model; substitution effect; income effect

## I.引言

随着我国经济的发展和人民生活水平的不断提升，人们的保险意识越来越强。人们购买保险，不仅出于规避各种风险的考虑，更是为了实现一生财富的合理配置。人身保险作为保险的重要组成部分，兼具着保障、储蓄、投资的多重功能，其一，可以对因保险事故而产生的经济损失进行一定的补偿，其二，对未发生保险事故的，可以类似储蓄一样一次或多次连本带息地进行给付，其三，还可以成为一种投资工具。可见，人身保险具有储蓄的特征，并且是一种更高级形式的储蓄（张冀，2010）。人身保险与储蓄之间表现的是一种双向关系：第一，替代效应，由于人们当期收入的有限性，二者之间会呈现此消彼长的发展态势；第二，收入效应，伴随人们收入的增加、储蓄的增加、保费收入也会增加，两方面因素共同决定了人身保险与储蓄的互动关系。再加上通货膨胀、利率等外界因素的干扰，关系会变得更为复杂。

受传统观念的影响，目前人们对储蓄的依赖仍远高于对人身保险的需求。最新资料统计，2011 年 4 月，我国个人储蓄存款已达 322326.92 亿元，而人身保险保费收入仅为 4168.98 亿元，说明在人们心目中，储蓄——这种自我保障形式仍然是人们应对未来风险、满足未来消费的最稳妥方式。但是，我们也会发现，二者之间的差距有不断缩小的趋势，2001 年 1 月，个人储蓄存款数额约为人身保险费收入的 800 多倍，到了 2011 年 12 月这一差距下降到不足 80 倍，这也正说明人们已逐渐意识到保险的优越性，人身保险在人生财富规划中的作用在不断提升。因此，人身保险和储蓄均可视为人们规划一生财富、平滑一生消费的有效选择。尤其在目前通货膨胀的压力下，人们如何实现理性消费、降低通胀带来的潜在损失、合理安排收支，更成为广为关注的话题。

## II.国内外相关文献评述

人身保险与储蓄有着密切的联系，早期关于二者之间关系的研究是从消费—储蓄模型开始的，Borch(1962)就是利用该模型讨论了人寿保险和储蓄的关系，认为人寿保险优于传统储蓄决策，其可以带来更高的未来预期收入，进而稳定人们的未来消费。Yarri(1965) 又进一步运用效用函数分析了连续时间情形下，生命周期中的保险、消费和储蓄决策问题，他提出了寿险不确定理论，指出可以通过人寿保险规避风险，降低由不确定性而造成的经济损失，并证明了在没有财富约束的条件下，保险计划优于储蓄计划，更能实现消费的 Pareto 最优。Hakansson(1969)同样利用效用函数分析了保险、储蓄、投资的关系，得出人们只有在购买保险的情况下才能实现最优储蓄和投资的结论。Somervil（2004）利用最大化原则，对连续时间序列下保险、消费和储蓄的关系进行了分析，通过对比存在保险和不存在保险两种情形，指出消费和储蓄的最优组合路径会受保险的影响，并且它们共同决定了所能规避风险的程度。

关于保险和储蓄决策，还会受到许多其它外界因素的影响。Houthakke（1959）指出传统保险需求下降的一个最重要原因就是通货膨胀的存在。David（1979）也认为不同的通货膨胀预期会导致人身保险成本改变，从而影响人们的投保决策。Neumann（1969）却提出了相反的观点，通过对美国 1946-1964 年影响储蓄性人身保险的相关因素：通货膨胀、个人收入、出生率、已婚人口数、城镇人口数等进行分析，指出通货膨胀并没有对储蓄性人身保险产生显著的影响。另外，Michael（2000）指出了家庭收入情况会影响人们的保险和储蓄决策，收入较为不稳定的家庭更倾向于进行个人储蓄，而收入较稳定的家庭则会以保险替代储蓄来规避

未来风险的发生。

国内关于保险和储蓄的研究，多以社会保险中养老保险与储蓄之间的关系为主（袁志刚和宋铮，2000；龙志和和周浩明，2000；蒲晓红，2003；张翠珍，2006；石阳和王满仓，2010；蒋云赟，2010）等，并且大部分研究认为二者之间是一种替代关系。而关于人身保险与储蓄关系的实证研究则较少，王琪和王寒（2009）虽然分析了保险对于个人消费和储蓄决策的影响，但只是基于最优控制模型的理论分析，未给出实证检验。栾存存(2004) 曾运用 ECM 模型分析了保险业和金融机构存款余额以及国民可支配总收入三者之间的长期和短期动态模型。钱珍（2008）也运用 VAR 模型对经济增长、城镇居民储蓄、保险和可支配收入的联动关系进行了分析，认为它们之间存在长期协整关系，并且短期内储蓄的脉冲响应会影响保费收入增长。但是，这些研究均是针对整个保险业而建立的模型，关于通货膨胀下人身保险与储蓄的动态关系研究，国内却鲜有实证研究。

基于此，本文从一种新的视角出发，以通货膨胀为切入点，寻求人身保险与储蓄之间的均衡关系，探索人们理性消费和储蓄的最佳路径，以实现人生财富的合理配置。

# III.指标描述及样本统计

## A.指标描述

出于对未来医疗、养老、教育等方面的顾虑，人们会更倾向于积攒一部分资金用于缓解未来的各种压力，而选取的主要方式即为人身保险和储蓄。那么，人们究竟如何选取，二者之间存在怎样的互动关系，正是本文研究的重点。本文采用 VAR 模型分析了我国人身保险与储蓄之间的互动关系，并在此基础上探讨了通货膨胀因素的影响。通货膨胀对人们的储蓄和保险决策产生影响，主要通过三种途径：价格效应、替代效应和收入效应。

第一，价格效应。价格效应会使人身保险的成本增加，价格提高，从而抑制人们对保险的需求，减少人身保险保费收入。另外，价格效应更会引起其它商品价格的提升，针对以往的同样消费，必然会增加人们的购买成本，从而使储蓄余额减少；但是，从另一个角度来看，正是由于商品价格的提升，也会降低人们的消费需求，出于预防动机，人们有意愿通过储蓄来应对更高的通胀预期，从而增加储蓄。张建华和孙学光（2009）也曾指出了通货膨胀对我国储蓄的两面性影响。总之，价格效应对人身保险与储蓄之间关系的影响是不确定的。

第二，替代效应。通货膨胀的替代效应是建立在价格效应基础之上的，同时通过银行利率进行传导。因此，为了更全面的分析二者之间的互动关系，本文又引入了利率变量。当利率上升时，通货膨胀下的储蓄会增加，进而人们以储蓄来替代保险；当利率下降时，人们储蓄动机不再明显，很可能转向投保计划，以当期支出换取未来收入。可见，通货膨胀背景下人身保险与储蓄产生替代的方向是不确定的。

第三，收入效应。通货膨胀会引起财富的贬值，生活水平的下降，因此，长期来看，为了保持人们满意指数的刚性需求，必然要提高人们的收入水平。收入效应会使人们更有动力理性安排个人财富，通过投保和储蓄方式使资金保值增值，应对通货膨胀的影响。此时，人身保险保费和储蓄存款数额亦都会提升。

可见，人身保险与储蓄之间存在着复杂的关系，而且会受到外界各种因素（通货膨胀、利率、收入水平等）的干扰。鉴于统计数据的有限性，在此，仅将人身保险、储蓄，连同通货膨胀和银行一年期存款利率两个影响因素纳入了 VAR 模型分析中，对应的变量依次为人身保险保费收入、储蓄存款[①]、居民消费价格指数和利率。由于本文选取的是月度数据，前三者都有很明显的季节变动因素，我们用 X-11 方法中的乘法原则进行了季节调整。同时，为了消除异方差，对前两者作自然对数变换，最终获得变量依次表示为 $LNLI_t$、$LNSAVE_t$、$P_t$ 和 $R_t$。

## B.样本统计

本文选取了2001年1月~2012年4月全国层面的月度时序数据，共148个样本。主要变量的描述性统计如表1所示。其中，人身保险保费收入来源于中国保险监督管理委员会网站，利率来源于中国人民银行网站官方公布，储蓄存款和居民消费价格指数来源于国研网的宏观月度数据库。本文运用Eviews6.0软件进行分析。

[①] 研究储蓄与保险的关系，一般是选取居民个人储蓄存款变量，不包括企业和国家储蓄。

1 样本数据统计

| 变量 | 均值 | 最大值 | 最小值 | 标准差 | 样本数 |
|---|---|---|---|---|---|
| 人身保险保费收入（万元） | 27976216 | 1.06E+08 | 768609.0 | 22612725 | 148 |
| 储蓄（亿元） | 160422.0 | 327346.1 | 66547.31 | 73332.68 | 148 |
| 居民消费价格指数 | 1.116540 | 1.291063 | 1.015000 | 0.082932 | 148 |
| 利率（%） | 2.473871 | 4.140000 | 1.980000 | 0.635996 | 148 |

## Ⅳ.VAR 模型设计及实证分析

### A.人身保险与储蓄之间的关系检验

#### 1)协整检验与误差修正模型

由于时间序列数据通常是不平稳的，为了避免由于单位根问题而产生虚假回归，在做回归分析之前，首先通过 ADF 检验方法对选取的各个变量进行单位根检验，检验结果如表 2 所示。

表 2 ADF 单位根检验结果

| 变量 | ADF 值 | 1%临界值 | 概率值 | 结果 |
|---|---|---|---|---|
| $LNSAVE_t$ | -0.663901 | -3.490210 | 0.8504 | 非平稳 |
| $LNLI_t$ | -3.287786 | -3.484198 | 0.0176 | 非平稳 |
| $P_t$ | 1.830943 | -3.484198 | 0.9998 | 非平稳 |
| $R_t$ | -1.680947 | -3.484653 | 0.4384 | 非平稳 |
| $\Delta LNSAVE_t$ | -3.764743 | -3.490210 | 0.0043 | 平稳 |
| $\Delta LNLI_t$ | -11.69304 | -3.484653 | 0.0000 | 平稳 |
| $\Delta P_t$ | -5.833970 | -3.485115 | 0.0000 | 平稳 |
| $\Delta R_t$ | -6.829400 | -3.484653 | 0.0000 | 平稳 |

注：ADF 单位根检验的临界值水平选取为 1%。

经检验，所有变量均存在一个单位根，是 I(1)过程，满足协整检验的条件。接下来，本文采用 Engle 和 Granger 于 1987 年提出的 EG 两步法，来检验通货膨胀背景下，人身保险与储蓄之间是否存在长期的协整关系。

第一步，对变量进行 OLS 回归，表达式为：

$$LNLI_t = -1.66 + 1.75LNSAVE_t - 2.03P_t + 0.03R_t + U_t \quad (1)$$

各个回归系数的 t 统计量依次为-2.84、17.76、 -3.66、1.09。

第二步，对残差 $U_t$ 进行单位根检验，判断是否存在协整关系。结果显示，在 1%的临界值水平下，残差序列存在单位根的概率值为 0.0029，其是平稳序列，说明在通货膨胀影响下，人身保险与储蓄之间存在长期协整关系。根据 Granger 定理，一组具有协整关系的变量一定可以建立误差修正模型（ECM）。通过回归，剔除不显著因素，最终得到 ECM 表达式为：

$$\Delta LNLI_t = 0.05 - 1.10\Delta LNSAVE_{t-2} - 1.12\Delta LNSAVE_{t-3} - 3.07\Delta P + 0.14ECM_{t-1}$$

[1] (2)

各个回归系数的 t 统计量依次为 4.38、-2.04、-2.04、-3.63、3.50。

其中，

$$ECM_{t-1} = LNLI_{t-1} + 1.66 - 1.75LNSAVE_{t-1} + 2.03P_{t-1} + 0.03R_{t-1} \quad (3)$$

是非均衡误差。

误差修正模型既能够体现变量之间的长、短期关系，又能够体现误差修正项对 $\Delta LNLI_t$ 的修正速度。虽然人身保险与储蓄、通货膨胀、利率之间存在着长期协整关系，但在短期内也会出现暂时偏离均衡状态的现象，并且会通过误差修正项以一定的速度对短期偏离进行修正。在该模型中，误差修正系数为正[1]，误差修正项以 14%的比例对下一年度的 $\Delta LNLI_t$ 产生影响。

关于储蓄与人身保险的关系，从长期来看，收入效应占据了主导地位。随着人们生活水平的提高，用于储蓄和购买人身保险的资金都在不断增加，二者协同发展（协整回归式中，LNSAVE 的回归系数显著为正）。说明人们意识到，储蓄并不是规划一生财富的唯一途径，人身保险也具有着重要的作用。我国人身保险获

[1] 一般讲，在误差修正模型中，不要剔除误差项(ECM)中的任何原水平变量，否则会影响长期关系表达式，但允许根据 t 统计量的显著性，剔除差分变量。在此，利率因素没有通过显著性检验，可能是因为自相关的存在，从而无法分析，关于利率的影响会进一步在脉冲响应函数和方差分解中进行分析。

[1] 如果讨论的是两个变量的协整关系，则误差修正系数必为负，如果两个以上的变量存在协整关系，则误差修正项系数不一定为负。

得的快速发展，与经济发展、人们生活水平的不断提升有着密切的联系，这也正是收入效应的有力体现。从短期来看，由于人们的收入水平有限，储蓄与人身保险之间的替代效应更为明显（误差修正模型中，滞后 2-3 期 $\Delta LNSAVE_t$ 的回归系数均显著为负），并且受传统观念影响的程度较深，人们会以储蓄来替代人身保险的购买，对储蓄的依赖性依然较强。总之，从我国来看，购买人身保险，仍是需要建立在一定的生活水平基础之上，当拥人们有了更多的收入，满足了一定消费水平、储蓄水平之后，才有更大的动力选择其它方式规划未来的生活，人们通过投保人身保险平滑未来消费、应对各种风险还仅是处理额外增加的部分收入的一种有效途径。对于低收入阶段或低收入群体，人们更倾向于以最稳妥的方式（必要的消费、储蓄）来安排当期收入，而没有动力或实力通过保险规划未来。这也是为什么高收入群体比低收入群体投保率更高的原因。

从通货膨胀与人生财富规划的关系来看，不论是长期还是短期关系，人身保险与通货膨胀之间均是一种负向发展的关系（协整关系式中 P 与误差修正模型中 $\Delta P_t$ 的系数均显著为负）。根据前面分析，通货膨胀对人身保险的影响（不通过利率）可以表现为收入效应和价格效应，收入效应增加保费收入，而价格效应减少保费收入，这种负向关系说明通货膨胀的价格效应更为明显。一方面，从长期来看，面对通货膨胀引起的保险成本增加和资金贬值风险，人们购买人身保险的热情会有所降温，而期望以其它更高回报率的投资方式来替代未来保险规划；另一方面，从短期看，收入水平基本保持不变，而通货膨胀会增加人们用于日常消费的资金支出，为了维持原有生活水平（这种假设是基于人们的刚性需求），人们只有选择以牺牲储蓄或保险的形式来满足基本的消费需求。可见，在我国，通货膨胀会对人们的财富规划决策具有深远的影响。

### 2)Granger 因果检验

通过上述分析，证实了人身保险与储蓄之间存在着长期和短期的互动关系。为了更进一步明确二者之间的因果关系，本文借助 Granger 因果检验工具对其进行分析，检验结果如表 3 所示。

结果显示，在检验期 25 期内，人身保险均表现为储蓄的 Granger 原因，而储蓄仅在滞后 1-2 期内，表现为人身保险的 Granger 原因。说明在相当长的时期内，人身保险的变动都是导致储蓄变动的 Granger 原因，其包含了储蓄变动的相关预测信息。而储蓄变动对人身保险变动的预测作用却非常有限，仅在前两期内存在。尽管 Granger 检验显著性的滞后阶数不同，但是我们有理由认为人身保险与储蓄之间确实存在相互影响，只是影响的效果不同。前面误差修正模型关于通货膨胀下，人身保险和储蓄的长短期关系，并没有体现出任一时刻二者之间的动态互动关系，为了更加清晰的刻画它们的动态变化过程以及通货膨胀产生的影响，本文继续通过 VAR 模型中的脉冲响应和方差分解进行分析。

3　人身保险与储蓄之间的 Granger 因果检验

| 原假设 | 滞后期 K、F 统计量及相应（P 值） | | | | | | |
|---|---|---|---|---|---|---|---|
| | K=1 | K=2 | K=5 | K=10 | K=15 | K=20 | K=25 |
| $LNSAVE_t$ 不是 $LNLI_t$ 的原因 | 7.131 (0.009) | 2.647 (0.075) | 1.520 (0.190) | 0.785 (0.643) | 1.080 (0.388) | 0.920 (0.566) | 1.172 (0.311) |
| $LNLI_t$ 不是 $LNSAVE_t$ 的原因 | 11.360 (0.001) | 7.774 (0.001) | 2.578 (0.030) | 1.751 (0.081) | 1.674 (0.074) | 1.587 (0.085) | 1.541 (0.098) |

注:显著性水平为 10%，K、F、P 分别代表滞后期选择、F 统计量值和相伴概率。

## B.人身保险与储蓄的 VAR 模型分析

### 1)VAR 模型建立

在做脉冲响应和方差分解之前，首先要建立 VAR 模型，VAR 模型是自回归模型的联立形式，在此将人身保险、储蓄、通货膨胀、利率四个变量均视为内生变量纳入 VAR 模型设计中。在做 VAR 模型过程中，一个关键因素就是滞后阶数的选取，通过 Lag Length Creteria 得知，在判断滞后阶数的 6 种方法中，有 4 种均显示有 3 个滞后阶数[①]，因此，选择建立 3 阶的 VAR 模型，得到相应的 VAR(3)。接下来，对 VAR(3)的稳定性进行检验，因为只有稳定的 VAR 模型才能建立脉冲响应函数，通过 Ar Roots Gragh 得知，所有单位根均在单位圆内，可以进行脉冲响应分析。

### 2)脉冲响应分析

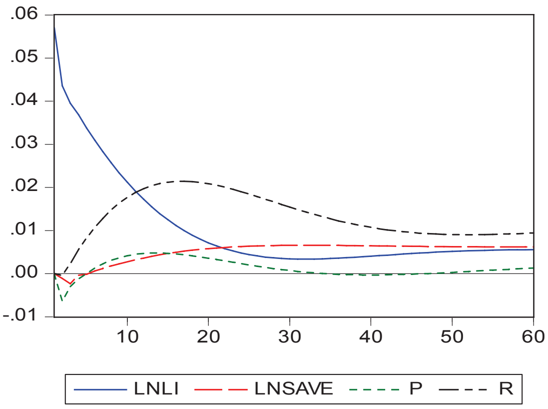
[①] 6 种方法包括 logL、LR、FPE、AIC、SC、HQ，其中 LR、FPE、AIC、HQ 均显示存在 3 阶滞后。

脉冲响应函数描述的是在随机误差项（新息）上施加一个标准差大小的外部冲击后，对内生变量的当期值和未来值所带来的影响，其能够比较直观地刻画出变量之间的动态相互作用。图 1、图 2 分别给出了各变量一个标准差大小的冲击对人身保险和储蓄的脉冲响应函数组合图，其中横坐标表示冲击作用的期间（60 个月），纵坐标表示人身保险和储蓄的变化程度。曲线表示个变量冲击的脉冲响应函数。由于 VAR(3)系统存在稳定性，这种波动最终都会回到均衡状态。

可以看出，在本期分别给人身保险和储蓄自身一个标准差冲击后，均会迅速引起各自当期值的显著增加，随后缓慢减退，直至近 20 期时恢复均衡。当在本期给人身保险和储蓄一个相互的冲击后，波动趋势不再一致，但都具有滞后性，并从第二期开始反应。人身保险对储蓄的一个标准差冲击的反应，表现为负向作用，直至约 25 期后转为正向影响并开始回落，约 60 期后逐渐收敛于 0。说明短期内，由于储蓄额的增加，人们有了更多的生活保障，在一定程度上解除了后顾之忧，使得通过投保转移风险的动机会被削弱，储蓄对人身保险产生替代作用；但此后，人们会逐渐意识到这种短视行为，进而会增加对人身保险的需求，来转移风险，更合理的规划一生的财富。而储蓄对人身保险的一个标准差冲击的反应，却始终表现为正向作用，并约在 15 期时出现峰值，35 期后恢复均衡。起初储蓄的增加是源于传统观念的影响，人们即使拥有了人身保险来转移风险，仍然会继续储蓄，因为获得赔偿或给付是未来的事情，在短期内人们不会意识到其巨大的保障和储蓄功能；此后，储蓄继续增加，是由于人身保险在规避医疗、养老、教育等各种风险，降低由此而产生的经济损失方面开始发挥了重要的作用，有利于人们的储蓄存款平稳增长。

在本期给通货膨胀一个标准差冲击，人身保险和储蓄的反应都会从下一期开始，不同的是前者在短期内会出现显著的负向影响，并在第 3 期最低，第 8 期后转为正向影响，30 后恢复均衡；而后者除一些微小波动外，基本表现为正向影响。说明在短期，由于通货膨胀带来的各种商品成本的增加，会使人们消费增加，人们有动机放弃购买保险，通过更多储蓄应对更高通胀预期；此后，人们对通胀产生了一定的适应性，对人身保险的需求会有所增加。但通货膨胀冲击却并没有降低人们的储蓄动机，当然这也可能是通货膨胀通过利率效应而产生的，因为通货膨胀一般会与利率的提升相伴随，人们愿意储蓄。

本期利率的一个标准差冲击对人身保险和储蓄的作用也各有不同，极短期内利率对人身保险的影响并没有明显趋势，第 4 期以后才出现了显著的正向影响，并在 40 期后消失。这主要是因为利率变动的不确定性以及其预测的难度，其受政策、国际经济环境、国内经济形势等众多因素影响；但是人身保险是长期性保单，其定价受利率的影响非常明显（20 世纪 90 年代我国出现的利差损便是深刻的教训），所以在对未来利率变化没有明确的判断之前，保险业不会也不能轻易调整定价利率以及评估利率，导致了前 4 期的没有显著变化。但是经过一段的市场观察和分析，利率预期比较明确的话，保险业必须做出调整，应对市场竞争，利率上调，保险产品价格降低，需求上升；再有准备金提取额度降低，大量的资金可以用于拓展业务方面，这两个方面均会推动人身保险需求的上升，体现出利率对人身保险的正向影响。值得关注的是，在前 10 期利率对储蓄的冲击却表现为负向，并在第 2 期最低，该结论似乎与现实（当利率上升时，人们的储蓄意愿更强；当利率下降时，人们会采用额外消费或保险等其它方式代替储蓄）相违背，这是什么原因呢？可能是出于人们的观望心理，认为利率有进一步看涨空间；也可能出于人们已做出的短期消费计划，对其进行调整需要一定的反应期间，因此，短期内利率冲击的吸储能力并不强。但经过一段时间后，预防性储蓄动机会使储蓄增加最终并恢复均衡状态。



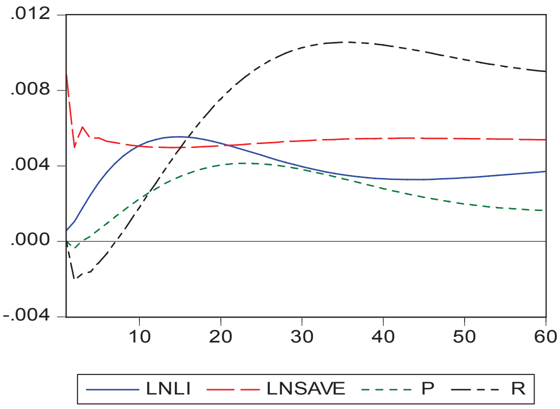




图 1　VAR 模型变量分别对 LNLI 和 LNSAVE 的脉冲响应函数图

**3)方差分解分析**

方差分解表示的是变量预测误差的方差由不同新息冲击所影响的比例，反映了各新息对VAR 模型中内生变量的相对重要性。本文采用方差分解分析了人身保险、储蓄、通货膨胀、利率分别对 LNLI 和 LNSAVE 的贡献程度，结果如表 4 和表 5 所示。

从发展趋势来看，人身保险对储蓄的影响程度要大于储蓄对人身保险的影响程度（在同一期，表 5 中 LNLI 列数值一般大于表 4 中 LNSAVE 列数值），并且人身保险业的自身决定程度要高于银行储蓄（在同一期，表 4 中 LNLI 列数值一般高于表 5 中 LNSAVE 列数值），说明人身保险较之储蓄具有更强的自我发展、自我完善能力，我国保险业发展具有着广阔的前景，人们对人身保险需求也会逐渐被引入理性化。另外，通货膨胀冲击虽然对人身保险和储蓄存在影响，但相比 VAR 系统中其它影响因素，贡献率最低，而且对储蓄的影响程度比人身保险更低一些（在同一期，表 5 中 P 列数值比表 4 中 P 列数值小），相反利率对人身保险影响程度却低于储蓄（在同一期，表 4 中 R 列数值比表 5 中 R 列数值小）。但是，利率对人身保险和储蓄的贡献率会逐步增强，甚至会显著高于其它因素的影响。

# V.结论与政策建议

## A.本文结论

人身保险与储蓄都是人们应对未来不确定风险、稳定收入的有效方式，因此，它们之间存在着密切的联系，并会受到诸如通货膨胀、利率等外界因素的干扰。本文利用误差修正和VAR 模型对研究了 2001 年 1 月~2011 年 12 月通货膨胀背景下，人身保险与储蓄之间的互动关系。可以得出以下几点结论：（1）人身保险与储蓄之间存在长期协整关系，并且滞后 1-2 期内，人身保险与储蓄互为 Granger 原因，而更高滞后期内，仅存在人身保险对储蓄的单向 Granger 原因，也就是说二者之间存在着相互的关联和影响（2）从短期来看，基于有限的收入水平和传统的消费观念，人们依然更倾向于用储蓄替代人身保险，运用储蓄方式来应对未来各种风险的发生和维持固有的消费水平。但是，随着人们对收入水平和保险认识的不断提升，人们对人身保险的需求会不断增加，保险作为规划一生财富的另一有效途径会逐渐被人们所关注，收入效应会使人身保险与储蓄协同发展。总之，人们对保险的需求还是以一定收入水平为基础的。（3）通货膨胀对人身保险与储蓄之间的关系存在影响，通货膨胀对人身保险的价格效应更为明显，抑制了人们的保险需求，但增加了人们储蓄存款，很可能是通货膨胀通过利率的传导效应造成的，因为通货膨胀一般会与利率的提升相伴随，人们愿意储蓄。总体上讲，通货膨胀使人身保险和储蓄之间具有更强的替代作用。（4）人身保险业依靠自身发展的程度要高于银行储蓄，说明人身保险业较之储蓄具有更强的自我发展、自我强化能力，因此，人身保险也有条件成为人们规避风险、合理规划一生财富的重要方式之一。

## B.政策建议

根据本文对人身保险与储蓄互动的分析，可以看出，保险作为一种资产配置方式，与储蓄一样具有着重要意义。但是，从目前来看，人身保险的作用并没有得到充分的发挥，尤其面临近年来通货膨胀的冲击，给保险行业的投资回报带来了更大的压力，使得人身保险发展相当程度上受到了阻碍。并且人们购买人身保险一般是建立在较高收入水平基础之上的，所以低收入群体比高收入群体参保率会更低。但事实上，低收入群体往往比高收入群体更需要获得保险的保障，这样才能更好的转移风险，稳定收入。之所以出现上述问题，一方面是因为我国保险业发展时间比较短，发展尚不成熟，在发展过程中存在着各种问题。另一方面是因为人们固有的观念和对保险的认识偏差，再加上通胀的压力，人们的选择会更加谨慎，更愿意选择传统的储蓄来应对未来的不确定性。但这是一种短视行为，因此，为了使得人们能够更合理的规划一生财富，更加稳定未来生活，需要从以下几方面来进行改善：首先，大力发展保险业，强化人身保险的三大功能：即保障功能、储蓄功能和投资功能，提高保险业应对通货膨胀等外界风险的能力，提高保险行业的竞争程度，完善保险市场竞争机制，加强人身保险业务结构调整，打造满足不同阶层消费者需求的多样化保险产品。其次，增强人们的风险意识，加大保险宣传力度，提升人们对保险的正确认识：保险并不是有钱人的奢侈品，更不是“骗人的”工具，使人们真正意识到保险对于每个人在规避风险、规划生活中的重要性，激发人们潜在的保险需求，改变人们“以储蓄为大”的思想。最后，控制社会中的不良因素，比如过高的通货膨胀、不正规的保险宣传、不合理的市场竞争等，其均会影响人身保险业和银行储蓄的健康、协调发展，同时政府制定利率政策、货币政策时也要考虑到时滞（滞后期）的影响。

表 4 LNLI 的预测方差分解 （%）[①]

| T | S.E. | LNLI | LNSAVE | P | R |
|---|---|---|---|---|---|
| 1 | 0.055 | 100.00 | 0.00 | 0.00 | 0.00 |
| 2 | 0.068 | 97.96 | 0.61 | 0.61 | 0.82 |
| 3 | 0.077 | 94.84 | 1.22 | 2.98 | 0.96 |
| 4 | 0.083 | 93.68 | 1.74 | 3.76 | 0.82 |
| 5 | 0.089 | 93.20 | 1.64 | 3.86 | 1.30 |
| 6 | 0.094 | 92.05 | 1.93 | 3.61 | 2.41 |
| 7 | 0.098 | 90.93 | 2.19 | 3.32 | 3.56 |
| 8 | 0.101 | 89.24 | 2.31 | 3.11 | 5.34 |
| 9 | 0.105 | 87.00 | 2.39 | 3.04 | 7.57 |
| 10 | 0.108 | 84.48 | 2.47 | 3.12 | 9.93 |

表 5 LNSAVE 的预测方差分解（%）

| T | S.E. | LNSAVE | LNLI | P | R |
|---|---|---|---|---|---|
| 1 | 0.010 | 100.00 | 0.00 | 0.00 | 0.00 |
| 2 | 0.010 | 98.82 | 0.44 | 0.01 | 0.73 |
| 3 | 0.011 | 86.94 | 0.70 | 0.21 | 12.2 |
| 4 | 0.013 | 83.81 | 2.19 | 0.20 | 13.8 |
| 5 | 0.014 | 82.52 | 3.36 | 0.20 | 13.9 |
| 6 | 0.015 | 79.96 | 5.82 | 0.26 | 14.0 |
| 7 | 0.016 | 77.93 | 8.47 | 0.50 | 13.1 |
| 8 | 0.017 | 75.77 | 11.47 | 0.90 | 11.9 |
| 9 | 0.018 | 73.04 | 14.56 | 1.63 | 10.8 |
| 10 | 0.018 | 69.69 | 17.62 | 2.65 | 10.0 |

[①] T 栏表示预测期间，预测期选择 10 期，S.E.栏表示相对于不同预测期的变量的预测误差，其它几栏表示源于某个特定的新息所引起的方差占内生变量总方差的百分比。

参考文献:
[1] Borch K. Equilibrium in a Reinsurance Market[J]. Econometrica, 1962, 30(6): 424~444.
[2] Yarri M E. Uncertain Lifetime, Life Insurance, the Theory of Consumer[J]. Review of Economic Studies, 1965, 32(5): 137~150.
[3] Hakansson N H. Optimal Investment and Consumption Strategies under Risk, and Uncertain Lifetime and Insurance[J]. International Economic Review, 1969, 3(10): 443~466.
[4] Somervil. Insurance, Consumption, and Saving: A Dynamic Analysis in Continuous Time [J]. The American Economic Review, 2004, 94 (4):1130~1140.
[5] Houthakker H H. Protection Against Inflation. Joint Economic Committee, 86th Congress, U.S. 1959:127
[6] David F. Babbel. Measuring Inflation Impact on Life Insurance Costs[J]. The Journal of Risk and Insurance, 1979, 46(3): 425~440.
[7] Neumann Seev. Inflation and Saving through Life Insurance [J]. The Journal of Risk and Insurance, 1969, 36 (5): 567~582.
[8] Michael G. Palumbo. Estimating the Effects of Earnings Uncertainty on Families' Saving and Insurance Decisions [J]. Southern Economic Journal, 2000, 67(1): 64~86.
[9] Yuan Zhigang and Song Zheng. The Age Structure of the Population, the Pension Insurance System and Optimal Saving Rate[J]. The Journal of Economics Research, 2000(11): 24-33.
袁志刚, 宋铮. 人口年龄结构、养老保险制度与最优储蓄率[J]. 经济研究, 2000(11): 24-33.
[10] Long Zhihe and Zhou Haoming. An Empirical Study on the Urban Household Preventive Deposit in China [J]. The Journal of Economics Research, 2000(11): 33~38.
龙志和, 周浩明. 中国城镇居民预防性储蓄实证研究[J]. 经济研究, 2000(11): 33~38.
[11]Pu Xiaohong. The Savings Effect of Pension Insurance[J]. The Journal of Contemporary economics research, 2003(4): 56~59.
蒲晓红. 养老保险的储蓄效应[J]. 当代经济研究, 2003(4): 56~59.
[12]Zhang Cuizhen. The effect of social Pension Insurance to Urban Household Savings in China [J]. China Social Security Forum, 2006(9).
张翠珍. 中国社会养老保险对城镇居民储蓄的影响[J]. 中国社会保障论坛, 2006(9).
[13]Shi Yang and Wang Qingcang. The effect of Pay-as-you-go Pension Insurance to savings—An Empirical Study Based on Panel Data [J]. The Journal of Quantitative and Technical Economics, 2010(3): 97~106.
石阳, 王满仓. 现收现付制养老保险对储蓄的影响——基于中国面板数据的实证研究[J]. 数量经济技术经济研究, 2010(3): 97~106.
[14]Jiang Yunyun. The Empirical Research on out effect of Pension Insurance to the national savings in China—the perspective of intergenerational accounting system simulation estimates.
蒋云赟. 我国养老保险对国民储蓄挤出效应实证研究——代际核算体系模拟测算的视角[J]. 财经研究, 2010(10):14~24.
[15]Wang Qi and Wang Han. Personal Insurance, Consumption and Savings Decisions [J]. The Journal of Insurance Research, 2009 (5): 81~88.
王琪, 王寒. 个人保险、消费和储蓄决策[J]. 保险研究, 2009 (5): 81~88.
[16]Luan Cuncun. The Analysis of Insurance Industry Growth in China [J], The Journal of Economics Research,2004(1): 25~32.
栾存存. 我国保险业增长分析[J], 经济研究, 2004(1): 25~32.
[17]Qian Zhen.The long-term Linkage Effects Analysis of Development of the Economic Growth, Consumer and Insurance — Based on the VAR model and impulse response function [J]. Statistics and Information Forum, 2008(7): 50~54
钱珍. 经济增长、居民消费与保险发展的长期联动效应分析——基于 VAR 模型和脉冲响应函数的研究[J]. 统计与信息论坛, 2008(7): 50~54.
[18]Zhang Jianhua and Sun Guangxue. Error Correction Model and Analysis of Household Savings Deposits in China. [J]. The Journal of Quantitative and Technical Economics, 2009(4):129~138.
张建华, 孙学光. 我国居民储蓄存款误差修正模型与分析[J]. 数量经济技术经济研究, 2009(4):129~138.

# 基于VAR模型的人身保险与储蓄的联动关系分析

贾士彬，尚颖

河北大学经济学院，河北大学，保定，中国，071002

**摘要：**本文通过VAR模型分析方法，采用2001年1月至2012年4月的月度数据，研究了在通货膨胀因素的干扰下，我国人身保险与储蓄的联动关系。实证结果表明，通货膨胀加大了人身保险业发展难度，抑制了人们对人身保险的需求，使人们更倾向于选择储蓄方式应对未来的不确定性。长期看，人身保险与储蓄同方向互动发展，但短期看，二者替代效应更明显。可见，人身保险与储蓄之间的联动关系是复杂的。但总体上讲，人身保险与储蓄之间存在着长期协整关系。

**关键词：**人身保险；储蓄；VAR模型；替代效应；收入效应

# Insurance Development and Consumption
# —An Analysis Based on Chinese Provincial Panel Data

Lv Xueliang[1 2], Li Xiaogang[1]
[1] College of Economics, Qingdao University, Qingdao, China, 266071
[2] College of Fianace, University of International Buseness Economics, Beijing, China, 100084

**Abstract:** The influence of financial development on economic growth is a hot topic in the study of economics, and as insurance is an important part of the financial system, its role in economic development also attracts more and more atteniton. Firstly, based on the Solow model with insurance development, this paper constructs a basic model of the relationship between insurance development and consumption combined with Diamond's OLG model. Secondly, using the provincial level panel data during 1999-2010 in China , the paper does some empirical analyses. The research shows that, in the long run, as a whole there is significant positive relationship between insurance development and consumption growth,. Ihelife insurance has an significant effect on consumption growth, while non-life insurance has no significant effect on consumption growth. The life insurance industry has a bigger effect on consumption growth than non-life insurance industry.

**Keywords:** Insurance Developmen; Life Insurance; Non-life Insurance; Consumption

## Ⅰ.引言

面对当前世界经济增长减缓，出口不容乐观的情况，我国政府从 2009 年底的中央经济工作会议开始，以“调结构、稳增长、扩内需”作为目前的工作方向，把目光转向扩大我国居民的消费需求，拓展经济发展空间。如何促进消费增长、扩大内需就成为在理论和实践需要迫切回答的问题。那么作为金融体系重要组成部分的保险业能够为消费增长做出多大贡献呢？

从总量上看，我国的保险业发展迅速（如图 1），虽然增速有一些波动，但平均增长速度较高。

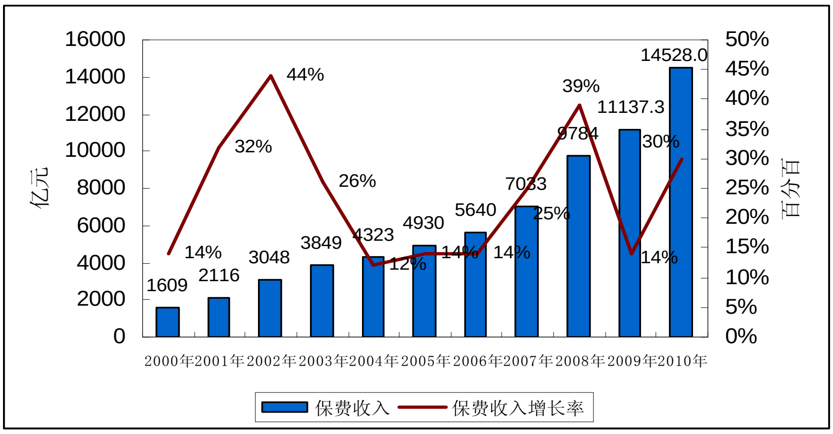



**图 1 2000 年—2010 年保费收入和增幅对比图**
**资料来源：根据 2011 年中国保险年鉴计算得出**

从结构上看寿险业务和财险业务本身存在一些不同，其发展速度有些差异。从图 2 中可以看出财险业务的比例明显小于寿险业务，本世纪初二者的差距并不大，随后寿险业务的比例迅速变大，而财险业务的比例则变小。近几年虽然二者的比例略有波动，但总体来说寿险业务占的比例依然较大，明显要超过财险。

保险具有风险保障、储蓄替代、资产投资的功能。其对于经济增长的作用途径有三条：首先，能够影响储蓄转化为投资的比例，进而影响资本的边际生产率，影响生产，从而对消费需求产生影响；其次，保险可以影响私人储蓄率和边际消费倾向，从而直接影响消费需求；最后，保险业的发展发挥着重要的风险保障的功能，促进了资本市场发展和金融制度改革，使金融结构和社会融资得到优化，增加了社会就业，直接对经济增长和消费需求的扩大做出了贡献。

保险业的迅速发展，以及其对经济增长产生的重要作用，已经引起了广大学者的关注。学术界对保险业发展与经济增长的关系做了较多的研究。曹乾、何建敏 (2006)研究发现，保险业发展和经济增长之间存在协整关系，但二者之间不存在 Granger 因果关系。而谢利人 (2006)的研究结果表明财产保险市场的发展对经济增长起到负向作用，而人身保险市场发展对经济增长才具有正向作用。庞楷 (2009)却发现相反的结果，他指出人身保险的影响不显著，而财产保险则具有显著的正效应。吴洪、赵桂芹(2009)对省级面板数据的研究表明，保险业在经济中等和较差的地区对经济的促进作用明显。胡宏兵、郭金龙 (2010)运用 Bootstrap 仿真检验显示保险发展与经济增长具有双向因果关系。黄英君、陈晔婷 (2012)基于向量自回归模型的研究表明，保险业发展对经济增长的影响不显著，经济增长对保险业发展起到促进作用。

与之相比，现阶段对保险业发展与居民消费关系的研究相对较少，保险业发展对居民消费的影响作用尚无统一的结论。而基于省级面板数据对保险业发展与居民消费关系的分析，目前国内暂时还没有。本文先从理论出发，基于修正的 Solow 模型（Webb,et al,2002）以及 Diamond（1965）所建立的世代交替模型（OLG）构建保险业发展与居民消费关系的理论框架。在理论的基础上，从保险业整体发展、寿险与非寿险两个方面选取保险深度作为衡量保险业发展的指标，对我国省级 1999-2010 年间的面板数据的相关变量进行实证研究，分析保险业发展对居民消费的影响。

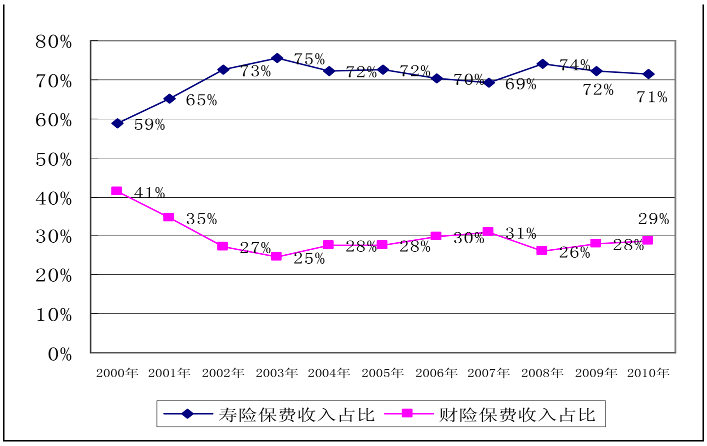



**图 2　2000 年—2010 年寿险和财险保费收入占比对比图**
**资料来源：根据 2011 年中国保险年鉴计算得出**

## Ⅱ. 文献综述

国外对保险业发展与居民消费的关系的研究开始较早。Borch (1962)是最早开始这方面的研究的学者之一，他运用储蓄—消费模型探讨了寿险和储蓄的关系，认为寿险可以稳定被保险人的未来消费，从而对消费需求产生影响。他利用十六个工业化国家 1951 年—1960 年间的数据，基于生命周期模型检验了保险对消费支出的影响，实证结果表明，保险对居民消费的影响不确定，从时间序列来看，保险对居民消费起到了促进作用，但从截面数据来看，保险对居民消费起到负的效应。Arrow (1963)在 1963 年的研究表明保险能够增加长期消费，保险可以使人们根据计划而进行消费，这样人们能够在较长的时间调节自己的消费，从而使长期的消费增加。Yaari (1965)分析了处于不同阶段的寿险需求状况，认为寿险可以降低家庭收入的不确定性，保险可以优化储蓄和消费计划，从而实现消费的最优化。Fledstein (1974)在 1974 年扩展了生命周期模型，他认为社会养老保险能够大幅度地提高居民消费。他认为，养老保险会降低提前退休人员退休后的收入，从而使得消费减少，同时养老保险具有收入再分配作用，这种作用使得居民的总消费水平提高。实证结果表明，养老保险较大地促进了居民消费的增长。Outreville (1990)对 55 个发展中国家的保险市场研究表明，尽管保险业与经济增长存在关系，但保险业发展对宏观经济的影响很小。Blake (2004)在 2004 年基于应该 1948 年—

1994年间的数据实证分析了各种财富当前和前一期的价值和回报率对消费的影响，实证结果表明，国家养老保险会增加居民消费，而私人保险则会导致更多的储蓄，从而降低消费。Aydede (2007)应用土耳其1970年—2003年间的数据，基于扩张的生命周期模型，并将其他可能影响居民消费的因素，如劳动力参工率、人口结构、通货膨胀等，纳入到模型中。他的实证结果显示土耳其的保险计划对居民消费有显著的正效应。Agnes (2007)运用面板数据对孟加拉国居民消费数量与收入水平关系进行了研究，研究结果表明居民资产数量的积累以及受教育程度的长短会进一步影响消费总量，教育对居民消费会产生重要的影响。

国内学者对保险发展与居民消费的关系的研究起步较晚，钱珍 (2008)对经济增长、居民消费和保险发展的研究发现，经济增长、居民储蓄、消费和保险发展之间存在着动态协整关系，保险发展从长期看对经济增长和储蓄有正向冲击作用，但无论长期还是短期保险增长对经济发展的影响都较弱。这一点与后来的几位学者的研究结果不同，张冀 (2010)的研究表明，在长期，人身保险对经济增长的促进作用显著，对居民消费的长期稳定性具有显著性影响。高明、郭姝辛 (2011)对张冀的观点表示赞同，他们的研究认为保险业发展对居民消费的长期稳定性具有显著影响，但在短期内主要以抑制经济波动为主，对居民消费的推动效果不明显。保险业发展对居民消费主要起到稳定性作用，而未完全实现促进消费需求的作用。胡颖、谢君来 (2011)的研究认为养老保险对于消费的促进作用较为显著，但是系数较小，养老保险对于促进消费的贡献有限，失业保险和医疗保险的支付额与消费之间有着较不显著的正向关系。这得到范馨 (2011)的研究的支持，他认为社会医疗保险支出和居民消费支出之间存在长期稳定的均衡关系，消费与医疗保险之间呈正向相关关系，保险支出对消费水平的增长由促进作用。

综上所述，现阶段对保险业发展与居民消费关系的研究存在着分歧，并没有统一的结论。一方面这源于衡量保险业发展的指标选取不一致，另一方面是由于所使用的研究方法不同所造成的。本文首先通过理论研究探讨保险业发展与居民消费之间的关系，为后文的实证分析打下基础。然后，使用1999-2010年间的中国省级的面板数据，对保险业发展与居民消费的关系进行实证分析。同时考虑到寿险和非寿险的不同，他们对于居民消费的影响可能会有所差异，因此本文还分别分析了寿险业和非寿险业对居民居民消费的影响。

# Ⅲ. 保险业发展与居民消费关系的理论分析

## A. 修正的 Solow 模型

根据 Webb,et al (2002)提出的修正的 Solow 模型，假设劳动力以不变的速率 n 增长，生产技术以不变的速率 g 增长，即有 $L_{(t)} = L_{(0)}e^{nt}$ ，$A_{(t)} = A_{(0)}e^{gt}$ 。生产函数满足柯布道格拉斯形式，即有：

$$Y_{(t)} = A_{(t)}K_{(t)}{}^{\alpha}L_{(t)}{}^{1-\alpha}(0 \le \alpha \le 1)$$

其中$Y_{(t)}$、$K_{(t)}$、$L_{(t)}$分别表示 t 时期的产出、资本和劳动力，并且生产函数满足以下条件 dY/dK>0,dY/dL>0, $d^2Y/dK^2 < 0$ ，$d^2Y/dL^2 < 0$，以及稻田条件。为了考察金融市场对经济增长的影响，Webb.et al,对生产函数进行了修正，引入金融发展变量$Z_{(t)}$，新的生产函数变为：

$$Y_{(t)} = Z_{(t)}A_{(t)}K_{(t)}{}^{\alpha}L_{(t)}{}^{1-\alpha}(0 \le \alpha \le 1) \tag{1}$$

$Z_{(t)}$代表金融市场发展程度，根据 Webb,et al 在2002年提出的模型，$Z_{(t)}$的影响因素为银行业发展和保险业发展，其中保险业发展又可以分为寿险业发展和财险业发展。因而，他将$Z_{(t)}$的具体形式表示为：

$$Z_{(t)} = Z_{(0)}\exp(B_{(it)} + PL_{(it)} + LF_{(it)})$$

其中$B_{(it)}$表示银行业发展状况，$PL_{(it)}$表示财险业发展状况，$LF_{(it)}$表示寿险业发展状况。$PL_{(it)} + LF_{(it)}$表示保险业发展状况，可用$I_{(it)}$表示，即有$I_{(it)} = PL_{(it)} + LF_{(it)}$。

根据上述方程（1）可以得出人均收入函数为：

$$y_{(t)} = f(k_t) = Y_{(t)}/L_{(t)} = Z_{(t)}A_{(t)}K_{(t)}{}^{\alpha}L_{(t)}{}^{-\alpha} = Z_{(t)}A_{(t)}k_{(t)}{}^{\alpha}\ (0 \le \alpha \le 1) \tag{2}$$

其中$y_{(t)}$、$k_{(t)}$分别表示人均收入和人均资本存量。根据上式先取对数再求导可得：

$$\mathring{y}_{(\mathrm{it})} = \beta_0 + \beta_1 \mathring{B}_{(it)} + \beta_2 \mathring{PL}_{(\mathrm{it})} + \beta_3 \mathring{LF}_{(it)} + \beta_4 \mathring{k}_{(it)} + \sum_{i=5}^{6} \beta_i X_{(it)} + \varepsilon_{(it)}$$

由于$I_{(it)} = PL_{(it)} + LF_{(it)}$，因而上式也可以表述为：

$$\mathring{y}_{(\mathrm{it})} = \beta_0 + \beta_1 \mathring{B}_{(it)} + \beta_2 \mathring{I}_{(\mathrm{it})} + \beta_3 \mathring{k}_{(it)} + \sum_{i=4}^{5} \beta_i X_{(it)} + \varepsilon_{(it)}$$

其中$\mathring{y}_{(\mathrm{it})}$表示 i 省人均收入增长率，$\mathring{k}_{(it)}$表示 i 省人均资本存量增长率，$X_{(\mathrm{it})}$为其他影响居民消费的变量，为控制变量，包括居民可支配收入，教育程度。外生技术$A_{(t)}$的变化率用系数$\beta_0$来表示。变量$\varepsilon_{(\mathrm{it})}$为随机干扰项。从上式中可以看出，保险业发展会对经济增长产生影响，而经济增长会影响居民可支配收入，从而引起消费需求的变化。因此，保险业发展会对居民消费产生影响。

## B. OLG 模型与居民消费

Samuelson(1958)在一个较简单的世代交替模型（OLG）中提出了关于社会保障、货币和利率的原理。我们以一般的 Diamond 模型 为基础，推导出保险业发展与居民消费的关系。假设人口依然以不变的速率 n 增长，则$L_t = (1+n)L_{t-1}$，生产技术仍然以不变的速率 g 增长，即$A_t = (1+g)A_{t-1}$。设$C_{1t}$与$C_{2t}$分别代表年轻人与老年人在 t 时期的消费，假设在 t 时期出生的代表性个体的效用为不变相对风险厌恶型的，则有：

$$U_t = \frac{C_{1t}^{1-\theta}}{1-\theta} + \frac{1}{1+\rho}\frac{C_{2t+1}^{1-\theta}}{1-\theta}$$

其中ρ为贴现率，θ为相对风险厌恶系数。

**1）家庭行为**

在 t 时刻出生的代表性个体的消费满足：

$$C_{1t} + \frac{1}{1+r_{t+1}} C_{2t+1} = A_t \omega_t \tag{3}$$

其中$\omega_t$为每单位有效劳动的工资，$r_t$为真实利率，且$\omega_t = f(k_t) - k_t f'(k_t)$，$r_t = f'(k_t)$。构造拉格朗日函数：

$$L = \frac{C_{1t}^{1-\theta}}{1-\theta} + \frac{1}{1+\rho}\frac{C_{2t+1}^{1-\theta}}{1-\theta} + \lambda[A_t\omega_t - (C_{1t} + \frac{1}{1+r_{t+1}} C_{2t+1})]$$

解该拉格朗日函数得到：

$$C_{2t+1} = (\frac{1+r_{t+1}}{1+\rho})^{\frac{1}{\theta}} C_{1t}$$

代入方程式（3）得到：

$$C_{1t} + \frac{(1+r_{t+1})^{\frac{1-\theta}{\theta}}}{(1+\rho)^{\frac{1}{\theta}}} C_{1t} = A_t \omega_t$$

整理该式得到：

$$C_{1t} = \frac{(1+\rho)^{\frac{1}{\theta}}}{(1+\rho)^{\frac{1}{\theta}} + (1+r_{t+1})^{\frac{1-\theta}{\theta}}} A_t \omega_t$$

令$s(r_t) = \dfrac{(1+r)^{\frac{1-\theta}{\theta}}}{(1+\rho)^{\frac{1}{\theta}} + (1+r_{t+1})^{\frac{1-\theta}{\theta}}}$表示收入被储蓄的部分，则有：

$$C_{1t} = [1 - s(r_{t+1})] A_t \omega_t \tag{4}$$

**2）保险业发展与居民消费**

因为$\omega_t = f(k_t) - k_t f'(k_t)$，而根据方程式（2）有$f(k_t) = Z_{(t)} A_{(t)} k_{(t)}^{\alpha}$，所以可以得出：

$$\omega_t = (1-\alpha) Z_{(t)} A_{(t)} k_{(t)}^{\alpha}$$

代入方程式（4）可以得到：

$$C_{1t} = [1 - s(r_{t+1})](1-\alpha) Z_{(t)} A_{(t)}^{2} k_{(t)}^{\alpha}$$

对上式先取对数再求导可得：

$$\mathring{C}_{(\mathrm{it})} = \sigma_0 + \sigma_1 \mathring{B}_{(it)} + \sigma_2 \mathring{PL}_{(it)} + \sigma_3 \mathring{LF}_{(it)} + \sigma_4 \mathring{k}_{(it)} + \sum_{i=5}^{6} \sigma_i X_{(it)} + \varepsilon_{(it)}$$

由于$I_{(it)} = PL_{(it)} + LF_{(it)}$，因而上式也可以写成：

$$\mathring{C}_{(\mathrm{it})} = \sigma_0 + \sigma_1 \mathring{B}_{(it)} + \sigma_2 \mathring{I}_{(it)} + \sigma_3 \mathring{k}_{(it)} + \sum_{i=4}^{5} \sigma_i X_{(it)} + \varepsilon_{(it)}$$

其中$\mathring{C}_{(\mathrm{it})}$表示 i 省的居民消费增长率，$\mathring{B}_{(it)}$、$\mathring{I}_{(it)}$、$\mathring{PL}_{(it)}$、$\mathring{LF}_{(it)}$分别表示 i 省的银行业发展状况、保险业发展状况、财险业发展状况、寿险业发展状况。$\mathring{k}_{(\mathrm{it})}$表示 i 省人均资本存量增长率，$X_{(\mathrm{it})}$为控制变量，即为其他影响居民消费的变量，包括居民可支配收入和教育程度。$\varepsilon_{(\mathrm{it})}$为随机干扰项。外生技术$A_{(t)}$的变化率用系数$\sigma_0$来表示。从上式可以看出，保险业发展对居民消费会产生直接的影响。

# Ⅲ. 保险业发展与居民消费关系的实证分析

## A. 样本指标的选取和数据的说明

**1）居民消费**

本文以各地区人均居民消费实际增长率作为衡量居民消费的指标，是按各区 1985 年不变价格生产总值价格平减指数调整平减得到的实际值，并把人均居民消费实际增长率作为被解释变量。

**2）银行业发展**

国内学者王毅[1](2002)的研究结果表明，货币化比重指标不能准确地衡量我国的金融深化程度，而应该采用全部金融资产/GDP。本文选取金融机构全部存贷款总额与地区国内生产总值比例作为金融相关率 FIR，并以 FIR 的对数作为衡量银行业发展的指标，这个比例反映了金融机构的存贷款的能力，能够有效地衡量银行业发展的状况。

**3）保险业发展**

本文选取保险深度、寿险保险深度以及财险保险深度分别作为衡量保险业发展状况、寿险业发展状况以及非寿险业发展状况的指标。之所以不选取保险密度而选取保险深度，是因为与保险密度相比，保险深度能够剔除地域以及人口的影响，因而能够更精确的反映保险业的发展程度。

**4）其他变量**

模型中涉及到的其他变量包括资本存量、技术进步、以及控制变量。由于居民可支配收入会影响居民消费，而 Agnes[2](2007)、Webb,et al[3](2002)等的研究都表明受教育程度会影响居民消费决策，因此将居民可支配收入和受教育程度也作为本文的控制变量。本文以全社会固定资产投资的实际增长率作为衡量资本存量变化率的指标，按单豪杰[4](2008)计算出的以 1952 年为不变价格的固定资产形成价格指数平减得到的实际值；以城镇居民人均可支配收入实际增长率作为衡量居民可支配收入变化率的指标，是按各地区 1985 年不变价格生产总值价格平减指数平减得到的实际值。以普通高中入学率作为衡量受教育程度状况的指标。

各变量的含义以及计算方法如表 1 所示。本文选取 1999-2010 年间的各省级数据进行分析，由于西藏藏族自治区 2007 年之前没有人身保险的数据，全部保险数据仅为财产保险数据，因此本文剔除西藏，仅选取其他 30 个省、自治区、直辖市 1999-2010 年间的数据。其中保险深度、寿险保险深度、财险保险深度的数据来自《中国保险年鉴》（1998-2011），个别地区个别年份的数据来自中国保险业监督管理委员会官方网站和各地区统计局官方网站公布的数据。各变量增长率的计算方法按表中所注公式计算，居民消费和城镇居民人均可支配收入数据来自《中国统计年鉴》(2000-2011）、各省市统计年鉴（2011）以及 CCER 金融数据库。资本存量增长率以各地区全社会固定资本投资总额进行计算，全社会固定资产投资总额的数据来自于《中国统计年鉴》(2000-2011）、各省市统计年鉴（2011）和 CCER 金融数据库。金融机构存贷款总额的数据是根据《中国区域经济统计年鉴》（2000-2011）整理得到的，部分数据来自中国社会科学院金融研究所网站上的区域经济数据以及 CCER 金融数据库。

表 1 中，高中入学率的计算方式为：Recruit=普通高中招生人数/普通初中毕业人数；金融相关率的计算方式为：FIR=金融机构存贷款总额/GDP

[1] 王毅。用金融存量指标对中国金融深化进程的衡量[J]。金融研究。2002（1）

[2] Agens,R.Q.(ed.). Poverty Transition , Shocks, and Consumption in Rural Bangladesh: Preliminary Results form a Longitudinal Household Survey[J].Chronic Poverty Reserch Centre Working Paper.2007,105

[3] Webb.I,M.F.Grace,&H.D.Skipper, The effect of banking and insurance on the growth of capital and output[J]，Center for Risk Management and Insurance,Working Paper,2002

[4] 单豪杰。对中国资本存量 k 的再估计[J]。数量经济技术经济研究。2008（10）

**表 1　变量解释及计算方法**

| 变量 | 变量含义 | 变量计算 |
|---|---|---|
| c | 人均居民消费实际增长率 | $Ln\,\mathrm{Re}\,al\mathrm{C}_t - Ln\,\mathrm{Re}\,al\mathrm{C}_{t\text{-}1}$ |
| LFIR | 金融相关率对数 | $LnFIR$ |
| Ldepth | 保险深度对数 | $Ln(\mathrm{Premium/GDP})$ |
| Lldepth | 寿险保险深度对数 | $Ln(Life\mathrm{Premium/GDP})$ |
| Lpdepth | 财险保险深度对数 | $Ln(\mathrm{Pr}\,operty\mathrm{Premium/GDP})$ |
| y | 人均可支配收入实际增长率 | $Ln\,\mathrm{Re}\,al\mathrm{DPI}_t - Ln\,\mathrm{Re}\,al\mathrm{DPI}_{t\text{-}1}$ |
| k | 资本存量实际增长率 | $Ln\,\mathrm{Re}\,alGDIc_t - Ln\,\mathrm{Re}\,alGDIc_{t\text{-}1}$ |
| g | 高中入学率对数 | $Ln\,\mathrm{Re}\,cruit$ |

## B. 面板数据的初始检验

**1）变量的单位根检验**

应用 Eviews6.0 对各个变量的平稳性进行检验，根据表 2 和表 3 所示的检验结果，人均居民消费实际增长率 c、保险深度对数 Ldepth、寿险保险深度对数 Lldepth、金融相关率对数 LFIR、人均可支配收入实际增长率 y、资本存量实际增长率 k 以及高中入学率 g 的所有检验的 p 值都很小为 0，所有检验都拒绝原假设，所以人均居民消费实际增长率 c、保险深度对数 Ldepth、寿险保险深度对数 Lldepth、金融相关率对数 LFIR、人均可支配收入实际增长率 y、资本存量实际增长率 k 以及高中入学率 g 都是零阶单整即 I(0)的。财险保险深度对数 Lpdepth 的所有检验的 p 值都很大且接近 1，因而可以认为单位根检验接受原假设，即财险保险深度对数并不是零阶单整的

**表 2　变量的平稳性检验结果（零阶差分形式）**

| 检验方法 | | c | Ldepth | Lldepth | Lpdepth |
|---|---|---|---|---|---|
| LLC 检验 | 统计量 | -11.0352 | -9.60993 | -10.3930 | 2.55613 |
| | p 值 | 0.0000 | 0.0000 | 0.0000 | 0.9947 |
| | 样本容量 | 324 | 320 | 321 | 328 |
| IPS 检验 | 统计量 | -7.08874 | -4.65592 | -5.47711 | 3.93434 |
| | p 值 | 0.0000 | 0.0000 | 0.0000 | 1.0000 |
| | 样本容量 | 324 | 320 | 321 | 328 |
| ADF-Fisher 检验 | 统计量 | 155.668 | 118.333 | 127.303 | 39.0331 |
| | p 值 | 0.0000 | 0.0000 | 0.0000 | 0.9836 |
| | 样本容量 | 324 | 320 | 321 | 328 |
| PP-Fisher 检验 | 统计量 | 197.441 | 108.743 | 151.838 | 39.6088 |
| | p 值 | 0.0000 | 0.0001 | 0.0000 | 0.9805 |
| | 样本容量 | 330 | 330 | 330 | 330 |

**表 3　变量的平稳性检验结果（零阶差分形式）**

| 检验方法 | | LFIR | y | k | g |
|---|---|---|---|---|---|
| LLC 检验 | 统计量 | -15.1384 | -14.3256 | -6.96547 | -9.62942 |
| | p 值 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| | 样本容量 | 295 | 321 | 325 | 293 |
| IPS 检验 | 统计量 | -9.15649 | -9.24542 | -3.13720 | -5.79567 |
| | p 值 | 0.0000 | 0.0000 | 0.0009 | 0.0000 |
| | 样本容量 | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | | 295 | 321 | 325 | 293 |
| ADF-Fisher 检验 | 统计量 | 185.089 | 188.679 | 93.2374 | 137.196 |
| | p 值 | 0.0000 | 0.0000 | 0.0039 | 0.0000 |
| | 样本容量 | 295 | 321 | 325 | 293 |
| PP-Fisher 检验 | 统计量 | 245.836 | 227.681 | 110.855 | 162.737 |
| | p 值 | 0.0000 | 0.0000 | 0.0001 | 0.0000 |
| | 样本容量 | 300 | 330 | 330 | 300 |

由于财险保险深度对数的零阶差分形式的单位根检验结果不好，继续对其进行一阶差分形式的单位根检验。根据表 4 的检验结果，所有检验的 p 值都小于 0.05，因而所有检验都拒绝原假设，即所有检验的结果都显示财险保险深度对数是一阶单整即 I(1)的。

**表 4 财险深度对数的平稳性检验结果（一阶差分形式）**

| 检验方法 | 统计量 | P 值 | 样本容量 |
|---|---|---|---|
| LLC 检验 | -14.4400 | 0.0000 | 297 |
| Breitung t-stat | -9.11455 | 0.0000 | 267 |
| IPS 检验 | -9.05633 | 0.0000 | 297 |
| ADF - Fisher | 185.649 | 0.0000 | 297 |
| PP - Fisher | 241.854 | 0.0000 | 300 |

上述分析表明，人均居民消费实际增长率 c、保险深度对数 Ldepth、寿险保险深度对数 Lldepth、金融相关率对数 LFIR、人均可支配收入实际增长率 y、资本存量实际增长率 k 以及高中入学率 g 都是零阶单整即 I(0)的，而财险保险深度对数则是一阶单整即 I(1)的。

**2）变量的协整检验**

由于人均居民消费实际增长率 c、保险深度对数 Ldepth、寿险保险深度对数 Lldepth、金融相关率对数 LFIR、人均可支配收入实际增长率 y、资本存量实际增长率 k 以及高中入学率 g 都是零阶单整即 I(0)的，所以有必要对他们进行协整关系检验。对 c、Ldepth、LFIR、y、k 以及 g 进行 Kao 检验和 Pedroni 检验，检验结果如表 5 所示。由检验结果可知 Kao 检验的 p 值为 0.01 小于 0.05，检验结果拒绝原假设，因而变量之间存在协整关系。Pedroni 检验的 pp 检验和 ADF 检验法都拒绝原假设，因而也可以认为变量间存在协整关系。

**表 5 保险深度与各变量的协整检验结果（Kao 检验和 Pedroni 检验）**

| 检验方法 | 检验假设 | 统计量名称 | 统计量值 | P 值 |
|---|---|---|---|---|
| Kao 检验 | H0：ρ = 1 | ADF | -2.324604 | 0.0100 |
| Pedroni 检验 | H0：ρ = 1<br>H1 ：(ρi = ρ)< 1 | Panel v-Statistic | -2.912008 | 0.9982 |
| | | Panel rho-Statistic | 3.840431 | 0.9999 |
| | | Panel PP-Statistic | -14.67775 | 0.0000 |
| | | Panel ADF-Statistic | -1.958256 | 0.0251 |
| | H0：ρ = 1<br>H1 ：(ρi = ρ)< 1 | Group rho-Statistic | 5.664210 | 1.0000 |
| | | Group PP-Statistic | -21.23535 | 0.0000 |
| | | Group ADF-Statistic | 0.340306 | 0.6332 |

对 c、Lldepth、LFIR、y、k 以及 g 进行 Kao 检验和 Pedroni 检验，检验结果如表 6 所示。由检验结果可知 Kao 检验的 p 值为 0.0101 小于 0.05，检验结果拒绝原假设，因而变量之间存在协整关系。Pedroni 检验的 PP 检验值都为 0，而 ADF 检验值都比较小，因而可以认为两种检验方法法都拒绝原假设，因此也可以认为变量间存在协整关系。

对各个变量之间的协整关系分别进行 Johansen Fisher 检验，检验结果如表 7 所示。显示，所有变量间的 Johansen Fisher 检验的 p 值都很小，检验结果都显示拒绝原假设，即变量间存在着明显的协整关系。

**3）模型选择的 Hausman 检验**

模型的选择需要考虑样本的不同个体之间是否存在差异，不同时点是否存在差异，他们的影响是固定效应的还是随机效应的。本文选取的是我国除西藏外的 30 各省市自治区 1999-2010 年 12 年间的数据进行分析，从时间上看，时间跨度比较大，而且各年的天气自然环境、政策因素等各有不同，因而时点之间是有差异的；从个体上看，我国 30 各省市自治区地理位置不同，文化风俗都存在着差异，而且各地区的政府政策不同，因而个体之间存在着差异。

数据在时间和个体之间都存在着差异，因而

不适合建立混合估计模型（Pooled Regression Model），本文只需要考虑固定效应模型和随机效应模型。应用 Hansman 检验对两个模型进行检验，检验结果如表 8 所示。从检验结果中我们可以看出，p 值都显著小于 0.05，接受原假设随机影响模型中个体影响与解释变量不相关，所以可以将模型设定为固定模型。

**表 8 居民消费增长率与各变量的 Hausman 检验**

| 检验结果 | 统计量 | 自由度 | P 值 |
|---|---|---|---|
| Ldepth | 10.637394 | 1 | 0.0011 |
| Lldepth | 9.115588 | 1 | 0.0025 |
| Lpdeth | 3.897165 | 1 | 0.0484 |
| Lldepth 及 Lpdepth | 8.236859 | 2 | 0.0163 |

根据上述分析，个体时点固定效应模型更适合，因此，本文的估计模型为：

$$c_{it} = \alpha_i + \beta x_{it} + \beta_1 LFIR_{it} + \beta_2 y_{it} + \beta_3 k_{it} + \beta_4 g_{it} + u_{it}$$

其中 $c_{it}$ 为第 i 个省市自治区在第 t 年的人均居民消费实际增长率；$x_{it}$ 为第 i 个省市自治区在第 t 年的保险业发展指标；$LFIR_{it}$ 为第 i 个省市自治区在第 t 年的金融相关率对数；$y_{it}$ 为第 i 个省市自治区在第 t 年的人均可支配收入实际增长率；$k_{it}$ 为第 i 个省市自治区在第 t 年的资本存量实际增长率；$g_{it}$ 为第 i 个省市自治区在第 t 年的国内生产总值增长率。$\alpha_i$、$\beta_i$ 都是个体时期变量，其取值只受到截面单元不同的影响；$u_{it}$ 为随机干扰项，满足相互独立，零均值和同方差。

## C. 模型估计结果

### 1）保险业发展对居民消费影响的回归检验

根据前面建立的固定效应模型，对人均居民消费实际增长率 c、保险深度对数 Ldepth、金融相关率对数 LFIR、人均可支配收入实际增长率 y、资本存量实际增长率 k 以及高中入学率 g 的面板数据进行分析，回归结果如表 9 所示。

从表 9 中的回归结果中可以看出，除了常数项、人均可支配收入实际增长率 y 以及高中入学率对数 g 的 p 值都小于 0.05，回归结果比较显著外，其他变量的 p 值都要远远大于 0.05，这说明回归结果并不显著。另外 $R^2$ 和调整的 $R^2$ 都比较小，模型的拟合程度并不很好。这说明该回归模型并不理想，需要对其进行改进。由于本文主要考察保险业发展对居民消费的影响，而银行业的发展与保险业的发展可能具有比较强的相关性，对各变量之间的相关关系进行检验，检验结果如表 10 所示。

**表 7 变量间协整关系的 Johansen Fisher 检验**

| 协整向量 | 原假设 | Fisher 联合迹检验 | | Fisher 联合 λ-max 检验 | |
|---|---|---|---|---|---|
| | | 统计量 | p 值 | 统计量 | p 值 |
| c 与 Ldepth | 0 个协整向量 | 271.2 | 0.0000 | 200.7 | 0.0000 |
| | 至少 1 个协整向量 | 201.6 | 0.0000 | 201.6 | 0.0000 |
| c 与 Lldepth | 0 个协整向量 | 296.9 | 0.0000 | 210.9 | 0.0000 |
| | 至少 1 个协整向量 | 225.4 | 0.0000 | 225.4 | 0.0000 |
| c 与 LFIR | 0 个协整向量 | 185.4 | 0.0000 | 150.9 | 0.0000 |
| | 至少 1 个协整向量 | 131.9 | 0.0000 | 131.9 | 0.0000 |
| c 与 y | 0 个协整向量 | 215.1 | 0.0000 | 159.5 | 0.0000 |
| | 至少 1 个协整向量 | 180.4 | 0.0000 | 180.4 | 0.0000 |
| c 与 k | 0 个协整向量 | 163.1 | 0.0000 | 117.5 | 0.0000 |
| | 至少 1 个协整向量 | 152.9 | 0.0000 | 152.9 | 0.0000 |
| c 与 g | 0 个协整向量 | 227.4 | 0.0000 | 158.9 | 0.0000 |
| | 至少 1 个协整向量 | 188.4 | 0.0000 | 188.4 | 0.0000 |
| c 与 Lldepth、Lpdepth | 0 个协整向量 | 639.1 | 0.0000 | 527.2 | 0.0000 |
| | 至少 1 个协整向量 | 234.7 | 0.0000 | 192.5 | 0.0000 |
| | 至少 2 个协整向量 | 137.9 | 0.0000 | 137.9 | 0.0000 |

根据检验结果，金融相关率与保险深度的相关系数达到了 0.62，可以认为两者间的相关性较大，因而可以将银行业发展从模型中剔除。同样的，受教育程度与保险深度的相关系数为 0.6，两者之间的相关性也较大，同样可以将受教育程度从模型中剔除。受教育程度与保险深度之间的相关性较大的原因可能是教育会增加个人对保险的认识和了解，提高抵御风险的能力，从而会影响人们购买保险。受教育程度越高，对保险的认识了解越多，从而认同、购买保险的可能性越大，反之受教育程度越少，对保险缺乏认识，购买保险的可能性就小。剔除金融相关率对数 LFIR 和受教育程度 g 的回归结果如表 11 所示。

从表 11 的回归结果中可以看出，所有变量的 p 值都要小于 0.05，保险深度对数对居民消费增长率的影响是非常显著的，都是在 5%的水平下显著。从加权统计量来看，尽管 和调整后的 都不大，但 F 统计量和 D.W 值都比较好，这说明回归模型的拟合程度较好，残差无序列相关，从整体上说，该模型的回归效果显著。保险深度对数的系数为 2.5，t 统计量和 p 值都很显著，这说明保险深度对数越大，则居民消费增长率越大。

从上文的分析可以得出，在剔除了银行业发展和受教育程度这两个变量后，模型回归的结果显著，且回归结果充分说明了保险业发展对居民消费增长有促进作用，而且促进作用明显。实证结果验证了理论分析的结果，都表明保险业发展能够有效地促进居民消费增长。因而我国的居民消费增量与保险业发展之间存在长期稳定的均衡增长趋势，从长期看，保险业整体

**表 10　各变量之间的相关系数**

| | c | Ldepth | LFIR | y | k | g |
|---|---|---|---|---|---|---|
| c | 1.000000 | 0.130944 | -0.016134 | 0.167572 | 0.197451 | 0.200094 |
| Ldepth | 0.130944 | 1.000000 | 0.620114 | 0.041763 | 0.203631 | 0.601871 |
| LFIR | -0.016134 | 0.620114 | 1.000000 | -0.001321 | -0.145571 | 0.293574 |
| y | 0.167572 | 0.041763 | -0.001321 | 1.000000 | 0.143454 | 0.123113 |
| k | 0.197451 | 0.203631 | -0.145571 | 0.143454 | 1.000000 | 0.331602 |
| g | 0.200094 | 0.601871 | 0.293574 | 0.123113 | 0.331602 | 1.000000 |

**表 11 剔除 LFIR 和 g 后保险深度对居民消费影响的回归结果**

| 变量 | 系数 | 标准误差 | t 统计量 | P 值 |
|---|---|---|---|---|
| $\alpha$ | 3.602726 | 0.796516 | 4.523107 | 0.0000 |
| Ldepth | 2.513084 | 0.831287 | 3.023126 | 0.0027 |
| y | 0.281814 | 0.066348 | 4.247527 | 0.0000 |
| k | 0.054364 | 0.025167 | 2.160105 | 0.0315 |
| $R^2$ | 0.217940 | | F 统计量 | 2.847705 |
| 调整的 $R^2$ | 0.141408 | | D.W 值 | 1.986044 |

**表 9 保险深度对居民消费影响的回归结果**

| 变量 | 系数 | 标准误差 | t 统计量 | P 值 |
|---|---|---|---|---|
| $\alpha$ | -9.779954 | 3.341009 | -2.927245 | 0.0037 |
| Ldepth | -0.165830 | 0.999590 | -0.165898 | 0.8683 |
| LFIR | 1.505523 | 1.711604 | 0.879598 | 0.3797 |
| y | 0.274586 | 0.063022 | 4.357011 | 0.0000 |
| k | 0.009216 | 0.025860 | 0.356371 | 0.7218 |
| g | 4.202371 | 0.966793 | 4.346713 | 0.0000 |
| $R^2$ | 0.257771 | | F 统计量 | 3.319707 |

发展对居民消费增长表现出显著的正向关系。

**2）寿险与非寿险业发展对居民消费影响的回归检验**

从上文的分析可知，在不考虑银行业发展和受教育程度的影响下，保险业发展对居民消费增长有促进作用，而且促进作用明显。由于保险业中寿险业务和非寿险业务在机制上存在的特有的差别，它们对居民消费的影响也可能存在一定的差异。应用上述固定效应模型对寿险深度、财险深度以及居民消费的面板数据进行分析，其回归结果如表 12 所示。

从表 12 中的回归结果中可以看出，除了常数项、人均可支配收入实际增长率 y 以及高中入学率对数 g 的 p 值都小于 0.05，回归结果比较显著外，其他变量的 p 值都要远远大于 0.05，这说明回归结果并不显著。模型的拟合程度并不很好，这说明该回归模型并不理想，需要对其进行改进。根据上文的分析，我们发现保险深度与金融相关率及受教育程度之间的相关性较大，上文将银行业发展和受教育程度从模型中剔除了。同样的，为了考察各变量之间的相关性，对各变量之间的相关系数进行检验，检验结果如表 13 所示。

**表 12 寿险深度和财险深度对居民消费影响的回归结果**

| 变量 | 系数 | 标准误差 | t 统计量 | P 值 |
|---|---|---|---|---|
| $\alpha$ | -11.98922 | 4.009289 | -2.990361 | 0.0030 |
| Lldepth | 0.254470 | 0.776048 | 0.327905 | 0.7432 |
| Lpdepth | -1.734310 | 1.258457 | -1.378124 | 0.1691 |
| LFIR | 2.012914 | 1.740885 | 1.156259 | 0.2484 |
| y | 0.280073 | 0.062631 | 4.471810 | 0.0000 |
| k | 0.003899 | 0.026172 | 0.148997 | 0.8816 |
| g | 4.443704 | 0.991542 | 4.481609 | 0.0000 |
| $R^2$ | 0.262009 | | F 统计量 | 3.286565 |
| 调整的 $R^2$ | 0.182288 | | D.W 值 | 2.093277 |

**表 13 各变量间的相关系数**

| | c | Lldepth | Lpdepth | LFIR | y | k | g |
|---|---|---|---|---|---|---|---|
| c | 1.000000 | 0.014076 | 0.156043 | -0.016134 | 0.167572 | 0.197451 | 0.200094 |
| Lldepth | 0.014076 | 1.000000 | 0.460868 | 0.727294 | -0.079833 | -0.086032 | 0.342577 |
| Lpdepth | 0.156043 | 0.460868 | 1.000000 | 0.503030 | 0.072030 | 0.266905 | 0.601873 |
| LFIR | -0.016134 | 0.727294 | 0.503030 | 1.000000 | -0.001321 | -0.145571 | 0.293574 |
| y | 0.167572 | -0.079833 | 0.072030 | -0.001321 | 1.000000 | 0.143454 | 0.123113 |
| k | 0.197451 | -0.086032 | 0.266905 | -0.145571 | 0.143454 | 1.000000 | 0.331602 |
| g | 0.200094 | 0.342577 | 0.601873 | 0.293574 | 0.123113 | 0.331602 | 1.000000 |

从表 13 中的检验结果中可以看出，金融相关率与寿险保险深度的相关系数达到了 0.727，与财险保险深度的相关系数为 0.5，可以认为金融相关率与寿险保险深度之间的相关性很大，而与财险保险深度间的相关性较大，因而可以将银行业发展从模型中剔除。同样的，受教育程度与财险保险深度的相关系数为 0.6，两者之间的相关性也较大，同样可以将受教育程度从模型中剔除。剔除金融相关率对数 LFIR 和高中入学率对数 g 后的回归结果如表 14 所示。

根据表 14 显示的回归结果可知，尽管 $R^2$ 和调整的 $R^2$ 都不大，但 F 统计量和 D.W 值都很较都比较好，这说明回归模型的拟合程度较好，残差无序列相关，从整体上说，该模型的回归效果比较显著。常数项 $\alpha$ 、寿险保险深度对数 Lldepth、人均可支配收入实际增长率 y 以及资本存量实际增长率 k 的系数的 p 值都小于 0.05，表明在 5%的水平下这些变量的系数的值都是显著的。

寿险深度对数的系数为正值，其值为 1.968，且其 t 统计量较大，p 值为 0.0054，说明寿险深度对数越大，居民消费增长率就越大。从而表明寿险业发展对居民消费增长具有促进

**表 14 剔除 LFIR 后寿险深度和财险深度对居民消费影响的回归结果**

| 变量 | 系数 | 标准误差 | t 统计量 | P 值 |
|---|---|---|---|---|
| $\alpha$ | 4.981084 | 0.896114 | 5.558538 | 0.0000 |
| Lldepth | 1.968163 | 0.702762 | 2.800613 | 0.0054 |
| Lpdepth | 0.382630 | 1.225912 | 0.312118 | 0.7552 |
| y | 0.282494 | 0.066370 | 4.256356 | 0.0000 |
| k | 0.051172 | 0.025584 | 2.000175 | 0.0463 |
| $R^2$ | 0.220167 | | F 统计量 | 2.789042 |
| 调整的 $R^2$ | 0.141227 | | D.W 值 | 1.986441 |

作用，且作用效果明显。相对于寿险深度对数，财险深度对数的系数的 t 统计量较小，而且其 p 值为 0.7552，尽管其系数也为正值，但其值仅为 0.38，这说明非寿险业发展对居民消费增长虽然也有促进作用，但这种促进效果不明显。与寿险业发展相比，非寿险业发展对居民消费增长的影响并不显著。

**3）实证分析结论**

根据上文的实证研究结果，可以得到如下分析结论：

（1）控制人均可支配收入、资本存量等变量，我国的居民消费增量与保险业发展之间存在长期稳定的均衡增长趋势，从长期看，保险业整体发展对居民消费增长表现出显著的正向关系。

（2）长期内寿险业发展对居民消费增长有显著的影响，而非寿险业发展对居民消费增长的影响并不显著。

（3）寿险和非寿险对于居民消费的影响程度不同，寿险业的发展对于居民消费的影响程度更大

# Ⅳ. 结束语

论文在金融发展与经济增长关系的现有研究基础上，从理论和实证两方面对保险发展与居民消费的关系进行较深入了的分析，并给出了相应的政策建议。

论文就以下方面丰富和拓展了相关研究的内容：

（1）对索洛模型进行了拓展，将保险业发展引入模型中，并结合时代交替模型（OLG 模型），构建了保险业发展与居民消费关系的基本模型。

（2）利用省级面板数据进行研究，从区域经济视角分析了保险业发展对于居民消费增长的影响。

（3）研究了寿险业和非寿险业发展对于居民消费增长的作用。

非寿险业发展并没有显著地促进居民消费增长的原因是，我国的商业保险还比较落后，居民家庭投保率比较低。前文的分析说明了我国保险业发展存在着一定的阻力，其中居民保险意识较差以及保险产品结构不合理是当前阻碍保险业发展的两个主要的原因。

根据上述问题，本文提出几点建议。首先，深化保险体制改革，完善我国的保险制度。从上文的回归结果看出，保险业发展与居民消费增长呈现正相关关系，保险业发展是推动居民消费增长的重要原因，所以我国必须要加快保险体制改革的步伐，通过促进保险业的发展，为居民消费增长，从而为经济持续增长提支持。其次，不同区域采取不同的保险政策。对不同的区域采取不同的保险政策，对中西部地区多一些政策优惠。国家在制定宏观经济政策时，必须要充分考虑各省际的差异，做到具体问题具体分析，对不同的区域采取不同的宏观政策。最后，加强宣传教育，提高保险意识。加强对保险知识的宣传教育，提高保险意识，让大众了解保险的功能和本质属性。同时为了提高公众的风险意识，应该利用各种渠道开展保险宣传和风险教育，让人们认识到保险的重要性以及利民性，从而在整个社会范围内树立良好的保险意识。

# References

[1]. Cao Qian, He Jianmin. Interaction between insurance and economic growth - theoretical hypotheses and empirical research[J].Shanghai Finance. 2006(3); 45-47

曹乾，何建敏。保险增长与经济增长的互动关系—理论假说与实证研究[J]。上海金融，2006（3）；14-16.

[2]. Xie Liren. Empirical Analysis of the Insurance Development and Economic Growth[J]. Quest, 2006(8);45-47

谢利人。保险发展与经济增长关系的实证分析[J]。求索，2006（8）；45-47.

[3]. Pang Kai. Empirical analysis of the insurance industry on economic growth - based on the modified Solow model[J]. Insurance Studies, 2009(7);31-36 庞楷。保险业对经济增长影响的实证分析—基于修正的 Solow 模型[J]。保险研究，2009（7）；31-36

[4]. Wu Hong, Zhao Guiqin. Insurance development, financial synergy and economic growth - based on the provincial panel data study[J]. Economic Science, 2009(3);61-72

吴洪，赵桂芹。保险发展、金融协同和经济增长—基于省级面板数据的研究[J]。经济科学，2009（3）；61-72.

[5]. Hu Hongbing, Guo Jinlong. China insurance development and economic growth relationship test - An Empirical Analysis Based on Bootstrap Simulation Approach[J]. Macroeconomic Studies.

.胡宏兵，郭金龙。中国保险发展与经济增长关系检验—基于 Bootstrap 仿真方法的实证分析[J]。宏观经济研究，2010（2）；41-65

[6]. Huang Yingjun, Chen Yeting. China Insurance Industry Development and Economic Growth - Empirical Analysis Based on VAR Model [J]. Insurance Studies. 2012(1);36-41

黄英君，陈晔婷。中国保险业发展与经济增长关系研究—基于 VAR 模型的实证分析[J]。保险研究，2012（1）;36-41.

[7]. Borch, K. Equilibriumin a reinsurance market. Econometrica[J], 1962，30（6）； 424-444

[8]. Arrow Kenneth J. Uncertainty and the welfare economies of medical care[J].American Economic Review[J].1963，56（8）；941-973.

[9]. Yaari M E. Uncertainty lifetime,life insurance,the theory of consumei[J].Review of Economic Studies.1965,32（5）；137-150.

[10]. Feldstein M.Social security,induced retirement and aggregate capital accumulation[J].Journal of Political Economy.1974,82（5）；905-926.

[11]. Outreville.J Francois. The economic significance of insurance markets in developing countries[J].The Journal of Risk and Insurance.1990,63（2）；487-498.

[12]. Qian Zhen. Economic growth, consumer and insurance long-term development of the linkage effect analysis - based on the VAR model and impulse response function [J]. Statistics and Information Forum, 2008, 23(7);50-54

钱珍。经济增长、居民消费与保险发展的长期联动效应分析—基于 VAR 模型和脉冲响应函数的研究[J]。统计与信息论坛，2008,23（7）；50-54

[13]. Zhang Ji. VEC model of life insurance and consumer empirical analysis [J]. Economic Review, 2010(6); 122-129

张冀。基于 VEC 模型的人身保险与消费的实证分析[J]。经济评论，2010（6）；122-129

[14]. Gao Ming, Guo Shuxin. The development of the insurance industry research on consumer behavior - based on the VEC model analysis [J]. Insurance Studies, 2011(11); 43-36

高明，郭姝辛。保险业发展对居民消费行为研究—基于 VEC 模型的实证分析[J]。保险研究，2011（11）；43-46

[15]. Fan Xin. Social health insurance on the level of consumption [J]. Public Financial Research, 2011(5); 43-46

范馨。社会医疗保险水平对居民消费水平的影响[J]。财政研究，2011（5）；43-46

[16]. Webb.I,M.F.Grace,&H.D.Skipper, The effect of banking and insurance on the growth of capital and output[J]，Center for Risk Management and Insurance,Working Paper,2002

[17]. Paul.A.Samuelson. An exact consumption—Loan model of interest with or without the social contrivence of money[J].Journal of Political Economy，1958,66（6）；46-50

[18]. David Romer. Advanced Macroeconomics (second edition) [M]. Shanghai University of Finance and Economics Press, 2003; 65-68

戴维·罗默。高级宏观经济学（第二版）[M]。上海财经大学出版社，2003；65-68

[19]. Blake. The impact of wealth on consumption and retirment behaviur in the UK[J].Applied Financial Economics,2004,14（8）；55-76

[20]. Pujari,A.K.(ed.).Analysing Household Consumption Pattern in Orissa. Working Paper Series,2004.

[21]. Shan Haojie. The Chinese capital stock k estimates: 1952 to 2006 [J]. The Journal of Quantitative& Technical Economics. 2008(10);17-31

单豪杰。对中国资本存量 k 的再估算：1952~2006 年[J]。数量经济技术经济研究。2008（10）；17-31

# 保险业发展与居民消费

## —基于省级面板数据的分析

吕学梁[1 2]，李小刚[1]

[1]经济学院，青岛大学，青岛，中国，266071

[2]金融学院，对外经济贸易大学，北京，中国，100084

**摘　要：**金融发展对于经济增长和运行的影响是经济学研究的重要主题，而作为金融体系重要组成部分的保险业，其发展对于经济发展的作用也日益受到理论界的重视。论文在金融发展与经济增长关系的现有研究基础上，首先在理论上对索洛模型进行拓展，将保险发展引入模型中，并结合 Diamond 的 OLG 模型，构建了保险发展与居民消费关系的基本模型。然后，使用我国 1999-2010 年间的省级面板数据进行了实证分析。研究表明，我国保险业整体发展对居民消费增长表现出显著的正向关系。长期内寿险业发展对居民消费增长有显著的影响，而非寿险业发展对居民消费增长的影响并不显著，寿险业发展对于居民消费增长的影响程度更大。

**关键词：**保险业发展；寿险；非寿险；居民消费

# The Operational Risk Measurement of Auto Insurance Based on Topological Data Model

CHEN Dihong, GUI Fen, SHEN Jianmei

School of Finance and Statistics, Hunan University, Changsha, China, 410079

**Abstract:** Operational risk is one of the key risks to the solvency of property insurance company. However, due to the lack of historical data and imperfect models, the current management to operation risk in the insurance company is still in identifying stage. Meanwhile, auto insurance premium is the largest portion in the business of general insurance companies. Based on this situation，this paper analyzes the form of the operational risk in the core business processes of auto insurance, and measures this risk by the topological data model and Monte Carlo. The results show the loss severity distribution has fat tail characteristics, and operational risk events have the characteristic of high frequency, however, the fat tail characteristics of total losses distribution is not obvious. They provide the basis for economic capital allocation and management of operational risk.

**Keywords:** operation risk; Topological data model; the total loss distribution

## Ⅰ.引言

操作风险事件具有低频率/高损失强度的特点，其带来的损失经常被称为“灾难性损失”，由操作风险引起的一系列重大案件震惊了国际金融界，例如著名的英国巴林银行破产事件，2001 年美国安然公司丑闻等典型事例，因此度量和管理操作风险具有重要的现实意义。根据评级机构 BEST 对美国财产保险公司 1969-2002 年的数据统计研究表明，所有的财险公司的破产与经营失败都与管理不善有关，操作风险已经成为对财险公司偿付能力威胁最大的风险[1]。

从我国车险市场现状来看，车险业务增速快、占比高但盈利能力低，因此车险经营效益的好坏，直接影响到财产保险公司的盈利状况及发展甚至是生存问题。2011 年 3 月 28 日针对车险的不规范操作引发的“霸王条款”，保监会发布通知，要求各保监局及保险行业协会就商业车险产品的管理制度、条款、费率厘定、承保理赔服务流程及服务标准进行调研[2]。可见对车险操作风险的管理已引起监管者的高度重视。我国学者最早从 1999 年开始引进了操作风险的概念，但是目前对保险企业操作风险度量的研究成果还很少，特别是对车险的操作风险度量的研究，我国学者基本还没开始这项工作。

关于车险，国外学者的研究较多体现在费率上。Rosen berg(1992)[3]认为若纳入交通肇事记录与驾驶行为等因素，对风险较低的优良驾驶员给予费率优惠，则可以降低意外的出险机率与损失程度。Cripe 和 Hunter（1992) [4]探讨个人汽车保险费率应采用哪些风险分类因子。国内学者对车险的研究主要集中在探讨车险的费率厘定、完善承保理赔制度等方面，基本没有看到分析和度量车险操作风险的文献。冯方圆（2010）[5]对比英美做法，分析我国车险制度存在的缺陷，提出从构建科学的费率浮动机制、规范车险市场、优化信息平台三个方面去完善我国车险制度的设想；张茵（2007）[6]利用广义线性模型，分析从人因素在机动车辆保险费率厘定中的重要性。

关于操作风险度量模型的研究，因新巴塞尔协议的推动，银行业在操作风险研究领域始终处于领先地位。Alexander, C (2001)[7]建议在对相关性损失频率建模的过程中，考虑使用多变量泊松分布，但这种方法的缺陷是只对两种频率分布的累加具有可操作性。Giudici(2004)[8]等对贝叶斯网络在操作风险度量中的应用进行了研究。记分卡方法是新巴塞尔协议推荐的高级计量方法之一，相关研究也较多，但其更适合于对未来风险进行估计。赵蕾（2007）[9]借助影响图度量寿险公司的操作风险，但局限是样本数据不足，

且没有考虑操作风险事件在不同业务线上损失具有差异性。

综上所述，笔者将基于拓扑数据模型的影响图方法应用于车险业务操作风险的度量上，具有较强的理论意义和现实意义。文章通过分析车险业务中的操作风险，利用数学领域的拓扑数据模型来识别其在承保、理赔等业务管理及流程中存在的损失风险，对其进行操作风险度量，并配置经济资本，为财险公司的操作风险管理提供依据。.

# Ⅱ.风险分析

## A.车险业务特点

自 2006 年交强险制度实行以来，车险的覆盖面迅速扩大，车险市场呈现以下三个特点：（1）增速较快。2009 年全国财产险保费收入 2992.9 亿元，同比增长 22.35%；车险保费收入 2155.61 亿元，同比增长 26.61%，车险保费增速明显超过财产险的总保费增长速度。（2）占比较高。从表 1 可以看出，财险市场上市场份额较高的前四家公司的车险业务占比均超过了 71%。（3）盈利能力有待改善。从全国范围看，车险业务的简单赔付率（简单赔付率=赔款金额÷保费收入）在 50%左右，部分公司甚至高达 71.8%，车险的赔款金额占公司总赔款的比率也都超过了 71%，车险业务效益状况有待改善。

车险业务规模大，对财产险公司实现可持续性的快速发展起着举足轻重的作用，而车险业务的盈利状况却不容乐观，因此在保证车险业务规模的前提下，如何实现盈利水平的提高成为各家财险公司关注和研究的重点。笔者通过识别和度量车险核心业务流程中的操作风险，达到提高车险盈利能力的目的。

## B. 车险操作风险分析

操作风险的定义分别在 Solvency II 与巴塞尔新资本协议中有较明确的描述。在 Solvency II 中操作风险是指内部管理或流程不当等原因而可能产生的风险。在巴塞尔新资本协议中，操作风险按风险来源分类细分为四个部分：（1）人员；（2）系统；（3）流程；（4）外部事件，因为该分类便于管理者识别操作风险，从而实现在源头上管理操作风险，所以本文采用巴塞尔新资本协议中的定义作为度量操作风险的基础。结合上述四种分类及操作风险特征，笔者将基本的车险业务流程划分为核保核赔流程、资金运用流程、财务流程和单证管理流程，后文引入拓扑数据模型识别和度量车险业务的操作风险也是基于上述流程。

表 1 2009 年财产保险公司保费及赔款情况
（亿元人民币）

| | 财产险保费 | 车险保费 | 车险占比 | 总赔款支出 | 车险赔款 | 赔款占比 | 车险简单赔付率 |
|---|---|---|---|---|---|---|---|
| 人保财险 | 1194.64 | 855.28 | 71.59% | 716.78 | 513.46 | 71.63% | 60.03% |
| 平安产险 | 386.12 | 294.6 | 76.30% | 163.55 | 117.86 | 72.06% | 40.01% |
| 太保产险 | 342.28 | 254.49 | 74.35% | 177.53 | 138.26 | 77.88% | 54.33% |
| 中华联合 | 194.67 | 145.73 | 74.86% | 134.47 | 104.64 | 77.82% | 71.80% |

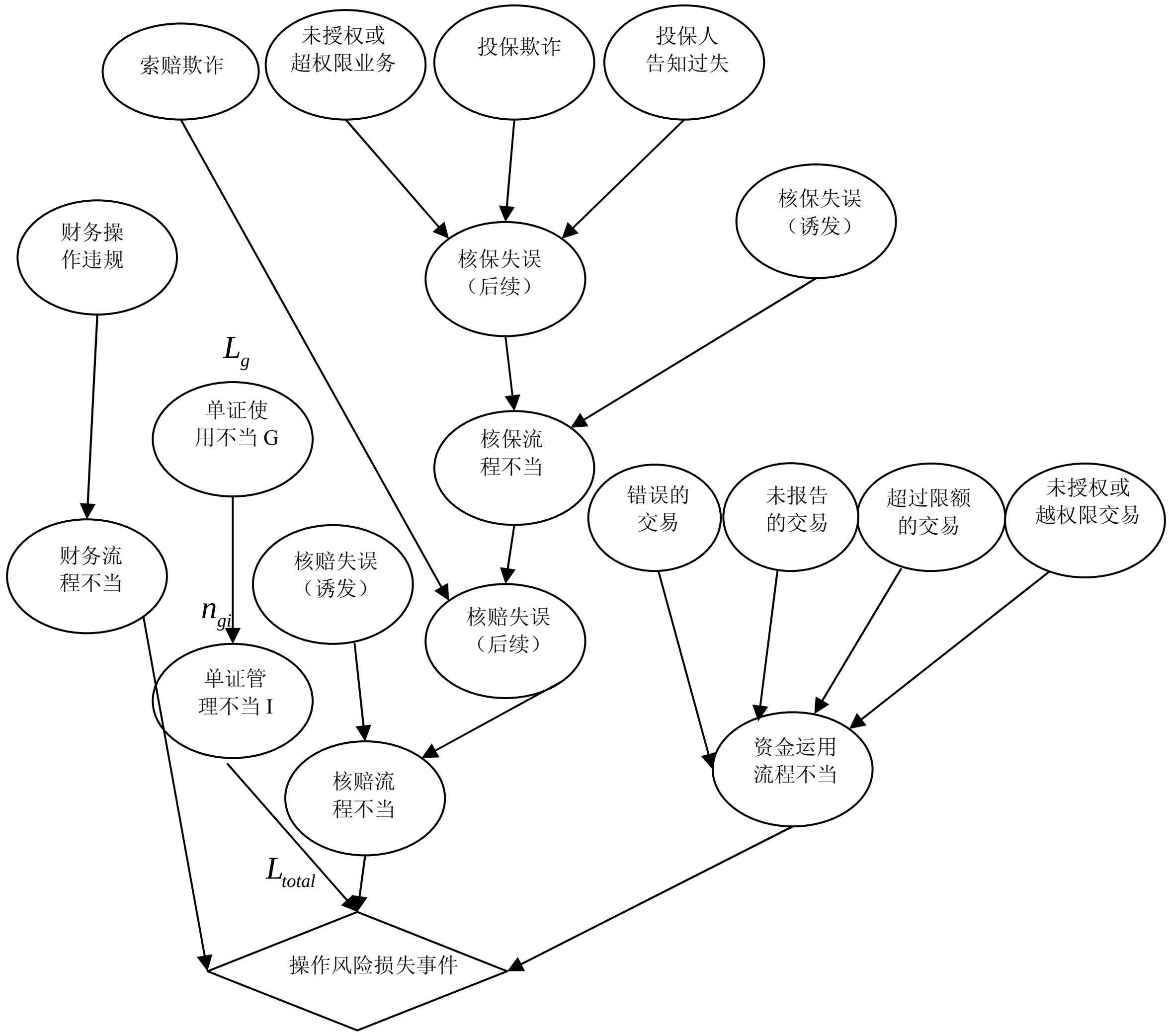
数据来源：《2010 年中国保险统计年鉴》

# Ⅲ.车险操作风险影响图及计算

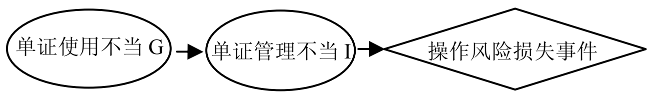
## A.车险核心业务流程的拓扑数据模型

拓扑学是研究连续性现象的一个重要数学分支，拓扑形成的一致且清晰简洁的空间结构可以反映数据间的关联性。将拓扑数据结构用于记录操作风险事件的发生过程，符合操作风险事件记录特点，利于挖掘操作风险历史数据的各种信息。如图 1 所示，笔者给出车险业务的核心流程的操作风险拓扑数据结构，构成有后续结点的影响图，即诱发原因与最终损失事件间至少有一个后续风险原因，之所以选择有后续结点的流程，是因为当后续流程完善和有效时，能很好的控制和减少因初始风险原因导致的操作风险损失，流程类风险因素在操作风险的管理中起着重要的作用。

选取单证管理流程对拓扑数据模型的应用进行具体说明，为方便叙述，对初始原因“单证使用不当”编号 G，后续原因“单证管理不当”编号 I。如下图 1，$L_g$ 表示诱发原因“单证使用不当”G 引起的操作风险初始事件的损失金额，$n_{gi}$ 代表后续原因“单证管理不当”对诱发原因 G 造成的损失的影响乘数，$L_{total}$ 表示所有前续原因引起的最终损失额。




财险公司操作风险影响图结点数据的计算分为三步：第一步计算影响图中每一条路径的损失强度分布；第二步计算每一条路径的频率分布；第三步将两者复合，计算操作风险总损失额分布。下面三节主要探讨操作风险初始分布、最终损失强度分布以及事件频率的选取及计算方法。



## B. 初始分布的选取

以路径 GI 为例，利用影响图度量操作风险的第一步是获取诱发原因 G 导致的初始损失额 $L_g$ 的分布 $f_{L_i}(l)$，理论上有两种方法可以获得 $f_{L_i}(l)$ 的分布：客观数据获得法，主观数据获得法。由前面分析可知，现阶段无法找到与财险公司操作风险相关的客观数据，因此只能依靠专家估计的主观数据。

分布形式的选取要综合考虑专家能否较为准确地给出估计值以及研究对象的风险特征。三角分布、变种三角分布、BetaPERT 分布和 General 分布是专家意见建模的分布中常用于来诱发原因初始估计初始损失的四种分布。在获得操作风险诱发原因初始损失分布主观概率时，笔者选择 BetaPERT 分布，这是基于下列几个原因：首先，BetaPERT 分布只需估计三个参数，减少专家估计的难度；其次 BetaPERT 分布形式可随参数的改变而灵活变化，可以适应不同操作风险的损失强度分布的多样性；最后，利用该分布得到的是一个完整的函数，便于计算。

BetaPERT 分布是一种由三个参数：最小值 a、最可能值 b 和最大值 c 决定的 beta 分布，但 BetaPERT 分布的均值假定为：$\mu=\dfrac{a+4b+c}{6}$，与 PERT 网络法中对均值的假定相同，所以称为 BetaPERT 分布。该分布的密度函数为：

$$BetaPERT(a,b,c)=\begin{cases}\dfrac{(\alpha+\beta-1)!}{(\alpha-1)!(\beta-1)!}\left(\dfrac{x-a}{c-a}\right)^{\alpha-1}\left(1-\dfrac{x-a}{c-a}\right)^{\beta-1} & 若 a<x<c\\ 0 & 其它\end{cases}$$

其中：$\alpha=\dfrac{(\mu-a)(2b-a-c)}{(b-\mu)(c-a)}$，$\beta=\dfrac{\alpha(c-\mu)}{(\mu-a)}$

由 BetaPERT 分布均值的计算公式可以看出，均值对最可能值 b 的敏感性四倍于对最小值 a 和最大值 c 的敏感性。BetaPERT 分布突出了最可能值对均值的影响，这也就是采用该分布的优势所在。

## C. 损失强度分布的计算

结合全概率公式与条件概率公式，以只有一个后续控制/流程类结点的 GI 路径为例，探讨每条路径的最终损失强度分布的计算。

受后续原因影响的操作风险事件可能有两种情况有 1、2 两种状况，因此分别研究其损失强度分布计算方法，再加总。情况 1：若流程原因 $i$ 的设计合理且被正确执行时，可以发现诱发原因 $g$ 导致的操作风险事故，这种情况记为事件 $G_{gi}$，其发生的概率为 $P(G_{gi})=q_{gi}$；情况 2：在流程 $i$ 设计是合理的且被正确执行时，仍无法发现初始原因 g 引发的操作风险事故，此时记为事件 $\overline{G}_{gi}$，概率为 $P(\overline{G}_{gi})=1-q_{gi}$。其中 $q_{gi}$ 与流程 $i$ 和诱发原因 $g$ 的种类有关。

在情况 1 下，存在两种 A、B 情况，第 A 种：单证管理流程 $i$ 设计没有漏洞并且被正确执行，此时，由诱发原因“单证使用不当”导致的操作风险事件将被发现，称为流程 g 有效，这时，该后续流程能缩小前续原因（即诱发原因）造成的损失，这个缩小倍数的概率密度函数为 $f_y(n_{gi}|yes)(n_{gi}<1)$；第 B 种：单证管理流程 $i$ 存在漏洞或者该流程没有被正确执行时，初始原因“单证使用不当”导致的操作风险事件将不能被发现，称为流程 $i$ 无效，这时，该后续流程会放大前续原因（即诱发原因）造成的损失，其扩大倍数的概率密度为 $f_y(N_{gi}|no)(N_{gi}>1)$。放大和缩小倍数统称为流程 $i$ 对前续损失的影响乘数。

为了便于获得分布函数形式，笔者假设上述影响乘数服从两点分布。且其两点的取值是 $f_y(n_{gi}|yes)$、$f_y(N_{gi}|no)$ 的均值，

设

$$E\left[f_y(n_{gi}|yes)\right]=n_{gi0}$$
$$E\left[f_y(N_{gi}|no)\right]=n_{gi1}$$

已知诱发原因 g 已引发操作风险损失的前提条件下，将流程原因 $i$ 对风险 g 造成损失的影响乘数记为随机变量 $C_{gi}$，其服从两点分布。设在上述情况下流程 $i$ 以概率 $P_i$ 有效，此时，其对诱发原因造成损失的影响乘数为 $C_{gi}=n_{gi0}$；同理，流程 $i$ 以概率 $1-P_i$ 失效，此时影响乘数 $C_{gi}=n_{gi1}$。其中 $P_i$ 只与流程 $i$ 的风险类型相关。

表 2　影响乘数 $C_{gi}$ 的两点分布

| $C_{gi\ i}$ | $n_{gi0}$ | $n_{gi1}$ |
|---|---|---|
| $P_r$ | $P_i$ | $1-P_i$ |

已知诱发原因“单证管理不当 g”已经造成的初始损失为 $L_g$，其分布只与诱发原因 g 有

关，为 $f_{L_g}(l)$。将情况 1 时最终损失额 $X_{gi}$ 的分布假设为 $F_{X_{gi}}(x)$，则：

$$F_{X_{gi}}(x)=P(X\le x)$$
$$=P(X\le x|C_{gi}=n_{gi0})P(C_{gi}=n_{gi0})+P(X\le x|C_{gi}=n_{gi1})P(C_{gi}=n_{gi1})$$
$$=P(L_g\le\frac{x}{n_{gi0}}|C_{gi}=n_{gi0})p_i+P(L_g\le\frac{x}{n_{gi1}}|C_{gi}=n_{gi1})(1-p_i)$$

乘数 $C_{gi}$ 与初始损失 $L_g$ 是没有相关性的，则

$$F_{X_{gi}}(x)=P(L_g\le\frac{x}{n_{gi0}})p_i+P(L_g\le\frac{x}{n_{gi1}})(1-p_i)$$
$$=F_{L_g}(\frac{x}{n_{gi0}})p_i+F_{L_g}(\frac{x}{n_{gi1}})(1-p_i)$$

对这个式子两边进行求导，可以得出情况 1 下的最终损失 $X_{gi}$ 的密度函数为：

$$f_{X_{gi}}(x)=f_{L_g}(\frac{x}{n_{gi0}})\frac{p_i}{n_{gi0}}+f_{L_g}(\frac{x}{n_{gi1}})\frac{1-p_i}{n_{gi1}}$$

在情况 2 时，因为后续流程不能发现诱发操作风险事件，则最终损失 $X_{gi}$ 的密度函数为诱发原因导致的初始损失的分布，即：$g_{X_{gi}}(x)=f_{L_g}(l)$。

综合情况 1 和 2，可以得出存在后续流程时，操作风险引起的最终损失强度分布的密度函数：

$$h_{X_i}(x)=\left[f_{L_g}(\frac{x}{n_{gi0}})\frac{p_i}{n_{gi0}}+f_{L_g}(\frac{x}{n_{gi1}})\frac{1-p_i}{n_{gi1}}\right]q_{gi}+f_{L_g}(l)(1-q_{gi})$$
$$=f_{L_g}(\frac{x}{n_{gi0}})\frac{p_iq_{gi}}{n_{gi0}}+f_{L_g}(\frac{x}{n_{gi1}})\frac{(1-p_i)q_{gi}}{n_{gi1}}+f_{L_g}(l)(1-q_{gi})$$

若某一个诱发原因后续存在多个后续流程类控制结点，此时可以看作情况 2 中流程结点 $i$ 作为增加一个新的后续流程结点的初始结点。新增结点的初始损失分布密度函数即为前部分最终损失强度密度函数，有两个以上的后续控制结点的计算方法依此类推。

拓扑数据模型记录规则和影响图的利用原则使得操作风险影响图中每条路径的损失强度分布是相互独立的。因此利用其独立性，结合每条路径的损失强度分布和频率分布，运用 Monte Carlo 等方法可以计算出车险业务的操作风险总损失额的分布形式。

### D. 频率分布

操作风险事件一旦被某个诱发风险原因触发后，都会导致一起操作风险损失事件，因此操作风险诱发风险原因的触发频率等于每条路径损失事件的发生频率，且各路径的触发频率是相互独立的。因此对每条路径的诱发操作风险事件的数量进行求和，便可得一年中由该诱发原因引起损失事件总件数。财险公司的车险业务量非常大，因此可以认为操作风险事件符合泊松分布，当然在以后客观数据积累比较丰富时可以用贝叶斯检验方法对这一假定进行检验和修正。

## Ⅳ.车险操作风险度量结果

### A.车险的影响图实例

因操作风险损失事件历史数据的不完整和缺乏系统性分类，笔者通过调查表的形式获取专家估计的主观经验数据，笔者定义的专家是在相关岗位工作至少三年的员工。调查表需获取以下几类主观数据：其一是诱发原因的初始 BetaPERT 分布的三个参数：最小值 a、最大值 b 和最可能值 c；其二是诱发原因的频率，根据前文假设，损失频率服从泊松分布，需要专家估计诱发原因触发频率的平均值 λ；其三是能发现前续原因引发的操作风险事件的比率 $q_{ij}$、后续流程环节的有效率 $P_i$ 以及影响乘数 $n_{ij}$。根据这些要求，综合前期的调查情况，笔者参考文献 9，制作调查表以获取样本数据，表 3 为调查表中单证管理流程的部分子样本。

**表 3　单证管理流程的部分子样本**

| 度量值 | 问卷描述 | 样本 1 | 样本 2 | 样本 3 | 样本 4 | 样本 5 |
|---|---|---|---|---|---|---|
| 1.频率 | 每 1000 次单证使用中发生“单证使用违规”的平均次数： | 5 | 10 | 5 | 10 | 100 |
| 2.最初损失 BetaPERT( a , b , c ) | “一次单证使用违规”给企业直接造成的最初损失：最小值 a 、最可能值 b 和最大值 c ： | 50/ 200/ 500 | 100/ 1000/ 3000 | 1000/ 5000/ 20000 | 100/ 500/ 5000 | 100/ 2000/ 1000 |
| 3.发现率 $q_{gi}$ | 如果单证管理制度设计科学并且被正确执行，有多少比例的“单证使用违规”可以被发现？ | 90% | 75% | 15% | 75% | 50% |

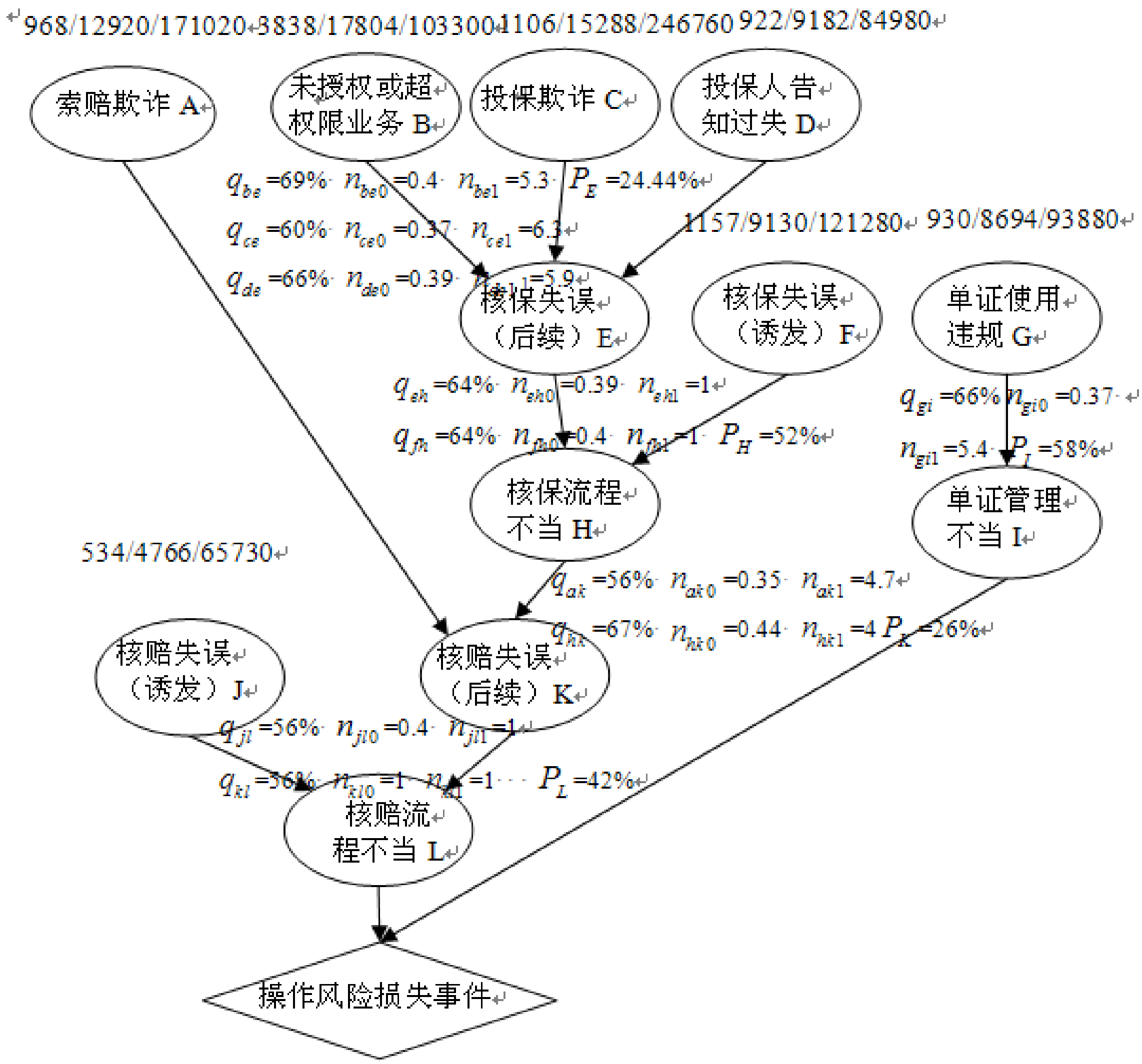
| | | | | | | |
|---|---|---|---|---|---|---|
| 4.后续流程环节 $i$ 的有效率 $P_i$ | 可以被发现的“单证使用违规”真正被发现的概率是多少？ | 40% | 75% | 15% | 85% | 50% |
| 5. $n_{gi0}$ | 每一次单证使用违规被发现后，经过处理，企业的最终损失将会减少为最初损失的倍数： | 0.05 | 0.2 | 0.5 | 0 | 0.3 |
| 6. $n_{gi1}$ | 每一次单证使用违规未被发现，未经过处理，企业的最终损失将会扩大为最初损失的倍数： | 2 | 2 | 1 | 2 | 10 |

调查表的发放对象是湖南省 8 家财险公司的车险部，共回收 76 份，有效的是 50 份，效度为 66%，效度不高的原因是剔除了填写不完整及非专家填写的调查表。专家普遍反映对数据需求可以理解和接受。调查范围为操作风险事件频发的业务流程，即：核保、理赔和单证管理。

为了避免披露保险公司的信息，案例分析中假设所有企业每年平均收到车险投保申请 100000 份，平均承保 90000 份，平均出险索赔 10000 份，并对每个结点进行编号。如下图所述，边缘结点分别是 A、B、C、D、F、G、J，从边缘结点到最终结点的路径共有 7 条，分别是 JL、AKL、BEHKL、CEHKL、DEHKL、FHKL、GI。本文利用简单的算术平均法归纳和整理了这 50 份有效的调查表，将 BetaPERT 分布的参数、乘数、$q_{ij}$ 及有效率等数据标在图 3 上。

## B.每条路径的损失强度

笔者借助 Matlab 软件辅助计算各路径的最终损失分布密度函数。对于每一条路径，依靠 Matlab 软件利用筛选法编写相关程序，运



行产生 100 个符合图 3 中七条边缘结点损失分布的随机数，将每个随机数作为一次操作风险事件被触发的初始损失额，按照前文的推导和假设，计算出后续流程影响后的最终损失额。

用只有一个后续结点的路径 GI 演示如何利用前一章第三节中的公式 1，由最初触发损失额计算出最终损失额。假设诱发原因 G 的初始损失额为 $x$，则后续结点 I 的最终损失额为：

$l=\left[xn_{gi0}P_I+xn_{gi1}(1-P_I)\right]q_{gi}+x(1-q_{gi})$。若是后续结点多于一个，则将每个后续结点之前产生的损失额作为该结点之前的初始损失额代入上式进行计算。

为提高后续拟合数据的精度，对于每条路径得到的 100 个最终损失额的数据样本，笔者使用 Easyfit 软件来拟合其损失强度密度函也都具有明显的厚尾特征，这说明车险的核心业务（核保、核赔、单证管理）的操作风险事件引发的损失大多集中在低额水平。

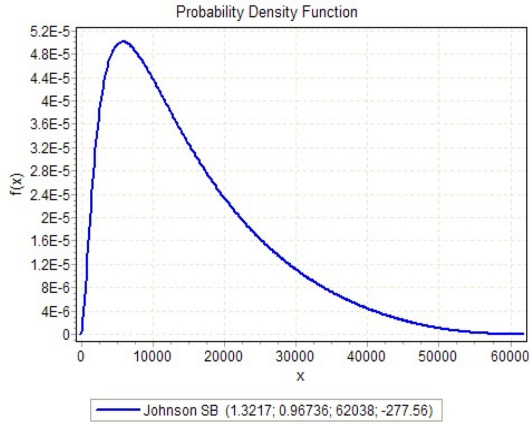



表 4 路径 GI 损失强度分布的参数及检验

| # | 分布 | 参数值 | K-S 检验 | | A-D 检验 | |
|---|---|---|---|---|---|---|
| | | | Statistic | Rank | Statistic | Rank |
| 1 | Johnson SB | γ=1.3217<br>δ=0.96736<br>λ=62038.0<br>ξ=-277.56 | 0.04365 | 1 | 0.26046 | 1 |
| 2 | Log-Pearson 3 | α=19.403<br>β=-0.18277<br>γ=12.875 | 0.05407 | 3 | 0.42597 | 3 |
| 3 | Weibull | α=1.5012<br>β=16110.0 | 0.04756 | 2 | 0.35485 | 2 |

数，并用 K-S 检验和 A-D 检验结果的拟合优度。

SB 分布、Log-Pearson3 分布、Weibull 分布，对其进行 K-S 检验和 A-D 检验，选取检验排名最优的 Johnson SB 分布，近似作为路径 GI 的损失强度分布函数，画出其密度函数曲线，并用图形直观的比较样本数据的累计分布和经验 Johnson SB 累计分布，如图 4 的密度函数曲线可以很直观的看出路径 GI 按照上述方式拟合，如表 4 所示,选取拟合效果最好的三种分布 Johnson，

因“单证使用不当”触发的操作风险事件的最终损失强度具有较强的厚尾性。以此类推，可以得出其他 6 条路径的最终损失强度的最优拟合分布，画出密度函数曲线图，

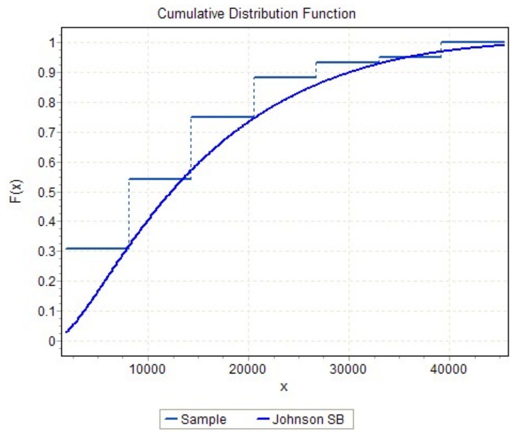



图 4 GI 路径的损失强度累计分布函数图及密度函数图

## C.损失频率

表 5 是通过调查表获取的车险操作风险损失频率的数据信息，从中可以看出作为触发原因的正常业务的核保 F 和核赔失误 J 发生的频率较低，这说明财险公司的车险承保理赔等核心业务处理系统还比较完善，核保核赔关键技术基本上能满足业务操作流程的要求；而在调查的七条路径中，由内、外部人为的欺诈或操作失误引起的操作风险损失事故的占比相对较高，其中索赔欺诈 A 和投保人告知过失 D 占操作风险初始事件的频率比例都是 25%以上。

表 5 频率分布数据

| | JL | AKL | BEHKL | CEHKL | DEHKL | FHKL | GI |
|---|---|---|---|---|---|---|---|
| 频率的均值 | 32 | 440 | 218 | 256 | 523 | 25 | 260 |
| 频率占比 | 1.82% | 25.08% | 12.43% | 14.60% | 29.82% | 1.43% | 14.82% |

## D.总损失额分布

根据前文笔者的假设，各个诱发原因每年的触发操作风险事件符合泊松分布，且由调查表已知均值的主观估计，可以得到各边缘结点的损失频率分布。每条路径的最终损失强度分布在第二节中已经得出了近似的分布形式，借助 Easyfit 软件实现 Monte Carlo 模拟的过程，计算案例一年中操作风险的总损失额的分布。

在得到各路径的损失发生频率的均值 λ 和损失金额分布的参数后，我们就可以利用 easyfit 软件进行模拟计算了。具体步骤如下：

1．每个路径产生一个符合其诱发操作风险事件频率分布的随机数 N，用其作为下一次迭代的次数；

2．按照该路径的最终损失强度分布的参数产生 N 个随机数，将其进行累加，作为该路径一年内产生总损失的一个样本数据；

3．将 7 条路径得到的总损失额进行相加，得到操作风险影响图在一个年度里操作风险总损失额的一个样本；

4．重复上述过程 100 次，得到 100 个可能的操作风险损失值，对其进行拟合并检验。

表 6 总损失额拟合检验最优的分布参数及检验值

| 分布 | 参数值 | K-S 检验 | | A-D 检验 | |
|---|---|---|---|---|---|
| | | Statistic | Rank | Statistic | Rank |
| Johnson SB | $\gamma$=0.5056<br>$\delta$=1.7856<br>$\lambda$=5.2401E+7<br>$\xi$=1.2294E+8 | 0.07737 | 1 | 0.4711 | 1 |

通过计算，由获取的 100 个年度总损失额的样本，运用 Easyfit 软件拟合其分布，并进行 K-S、A-D 拟合优度检验，Johnson SB 分布在两种检验排名中都是第一的（如表 6）。且两种检验方法无论是在 80%、90%、95%、98%和 99%的置信水平下，检验结果都是不能拒绝原假设，即样本数据服从 Johnson SB 分布。如图 5 所示，做出这 100 个样本的直方图和 Johnson SB 分布的密度曲线。

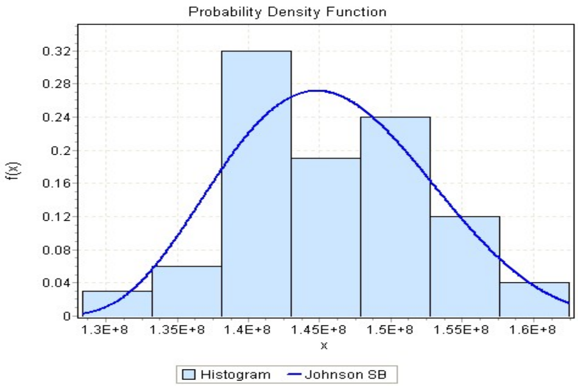



图 5　100 个样本的直方图和 Johnson SB 分布密度曲线

表 7 总损失分布的重要统计值

| 统计量 | 数值 | 百分位数 | 数值 |
|---|---|---|---|
| Sample Size | 100 | Min | 1.2836E+8 |
| Range | 3.4144E+7 | 5% | 1.3513E+8 |
| Mean | 1.4570E+8 | 10% | 1.3837E+8 |
| Variance | 4.5435E+13 | 25% (Q1) | 1.4013E+8 |
| Std. Deviation | 6.7406E+6 | 50% (Median) | 1.4532E+8 |
| Coef. of Variation | 0.04626 | 75% (Q3) | 1.5027E+8 |
| Std. Error | 6.7406E+5 | 90% | 1.5514E+8 |
| Skewness | 0.17355 | 95% | 1.5762E+8 |
| Excess Kurtosis | -0.38426 | Max | 1.6251E+8 |

我们可以从结果中得出表 7 的重要统计数据，如均值、标准差和各分位点的数值，特别需要说明的是偏斜度 0.17355，大于 0 表明该分布向右偏斜，操作风险总损失分布的厚尾性不明显。偏斜度较小，表明各财险公司在日常经营活动中对车险的操作风险预期损失进行规范后（即预期损失为操作风险损失分布的均值），需为非预期损失提取的经济资本的需求量较小。这与通常提及的操作风险的特征有一定偏差，原因是本文选取的操作风险度量对象是车险的核心业务流程，虽然各条路径的损失强度密度函数曲线都表现出很强的厚尾特征，但从财险公司整体操作风险损失事件来看，这部分损失属于高频率、低损失额事件，所以高频率使总损失额分布表现出较小偏斜度和较小变异系数，因此所需的经济资本较小。

## E.经济资本的计算

获得操作风险总损失额分布函数的重要目的是为财险公司车险业务提取合理的经济资本。文章的样本是湖南省 8 家财险公司的车险业务，虽然各公司面对的客户群是一样的，但因各自管理水平的不同，一年中操作风险损失事件也存在着差异，所以本文计算出的经济资本是针对财险公司车险业务的一个平均值。

在 99%的置信水平下，预期损失是操作风险损失分布的均值，那么需要提取的资本就是 99% 分位数减去均值。即：159754772-145312407=14442365，约为 1444 万元。根据在险价值（Value at Risk，简称 VaR）的含义，在平均提取 1444 万元的资本后，湖南省内各财险公司车险的核心业务系统（核保、理赔和单证管理）就可以抵御百年一遇的巨额操作风险损失。

# Ⅴ.结论与讨论

本文从操作风险的角度，通过借助拓扑数据模型定性分析了车险业务核保理赔与单证管理流程的操作风险的表现，利用调查表和Monte Carlo模拟定量对车险业务的操作风险进行度量，并为其配置经济资本，最后，文章实例计算的结果显示：在度量操作风险的过程中七条路径的损失强度分布都具有明显的厚尾性，且损失频率较高，但总损失额的分布厚尾性较小，偏斜度为 0.17355，配置的经济资本为 1444 万。分险种分别提取操作风险的经济资本及在财险公司全面风险管理层面上实现操作风险的度量是本论题进一步的研究内容。

# References

[1] Liu Xinxi and Gong Yisheng, A Study on Operation Risk and Management of China's Property Insurance Companies, Insurance Research,2009.7.
刘新喜,龚贻生.我国财险公司操作风险探析及其管理对策[J].保险研究,2009,(7).
[2] Xu Keqi, The Investigaton on the issue 'High Insurance Amount and Low Compensation' on Auto Insurance, China Youth Daily,2011-04-01.
徐可奇.被质疑为霸王条款 车险"高保低赔"引发监管调查[N]. 青年报,2011-04-01.
[3] Rosenberg, M. Automobile insurance reform in New Jesey:Moving Toward a New Pricing System[J].Journal of insurance regulation,1992,11(1):79-103.
[4] Cripe Frederick, F., Robert Hunter. Automobile Classification Systems: age, sex, marital status, and territory- are they unfairly discriminatory? [J].actuarial review, 1992,(8):356-382.
[5] Feng Fangyuan, A study on Improving China's Auto Insurance, China Insurnce,2010.4.
冯方圆.借鉴英美做法完善中国车险制度[J].中国保险,2010,(4):62-64.
[6]Zhang Yin, A Research on Auto Insurance Rating in Sight of Human Factors, Dissertation of Master, Hunan University, 2007
张茵.对加入从人因素的我国车险费率厘定的研究[D]:[湖南大学硕士学位论文].长沙:湖南大学,2007.
［7］Alexander, C., Statistical Model of Operational Risk Loss [M]. Operational risk,Pearson Education Limited, 2003.
[8] Giudici, P., Integration of Qualitative and Quantitative Operational Risk Data: A Bayesian Approach [M]. Operational Risk Modelling and Analysis, Risk Books, 2004.
[9] Zhao Lei, A Research on the Measurement of Operational Risk in Insurance Enterprises, Dissertation of Master, Kyoto University, 2007.
赵蕾.保险企业操作风险度量研究[D]:[同济大学经济与管理学院硕士学位论文].上海:同济大学,2007.

# 基于拓扑数据模型的车险操作风险度量

陈迪红，桂芬，沈建美
金融与统计学院，湖南大学，长沙，中国，410079

**摘　要：**操作风险是影响财险公司偿付能力的主要风险之一，但历史数据缺乏及模型不完善，使其管理仍处于识别阶段。在财险公司经营的多种业务中，机动车辆保险的占比最高，本文以其为研究对象，分析车险核心业务流程中操作风险的表现形式，借助拓扑数据模型及 Monte Carlo 模拟对其进行度量。度量结果显示损失强度表现出较强的厚尾性，事件频率具有高频性，但总损失额分布的厚尾特征不明显，这些结果为操作风险进行经济资本配置及管理提供了依据。

**关键词：**操作风险；拓扑数据模型；总损失额分布

# Mileage-Based Pricing in Vehicle Insurance Products: China as a Case Study

CHEN Dongmei [1*], Duan Baige[2**]

1.Department of Insurance, Fudan University School of Economics, 600 Guoquan Road, Shanghai, China, 200433

2. Department of Risk Management and Insurance, School of Economics, Nankai University, China

**Abstract:** Since there is no mileage statistics in the database of almost all property insurance companies in China currently, the paper proposes to study the impact of driving mileages on net premiums of vehicle insurance innovatively. The paper makes use of the data of 31 provinces, municipalities and autonomous regions in China from 2000 to 2009 and makes an empirical analysis to study the long-term stable equilibrium relationship between the accident losses and highway mileages by using the panel unit root test and co-integration test of econometric methods. The result shows that there is a significant positive correlation relationship between the accident losses and highway mileages. To some extent, the stable relationship can be regarded as a valid reference of the relationship between net premiums of vehicle insurance and driving mileages. Moreover, the paper proposes some feasible programs to consider the relationship between net premiums of vehicle insurance and driving mileages, and provides further proposal for mileage-based pricing in vehicle insurance products of China. The results of the paper have important theoretical significance and practical value for driving mileages to be introduced and developed into GLM pricing in China's vehicle insurance, and also provide a reference to settle our transportation, energy and environmental problems.

**Keywords:** generalized linear models; driving mileages; vehicle insurance; cross-subsidies; unit root test; co-integration test; positive externalities

[*] Dongmei Chen, Associate Professor and Director, Department of Insurance, Fudan University School of Economics, 600 Guoquan Road, Shanghai, China, 200433; Email:dmchen05@gmail.com; Phone: 0086-21-65643750, Fax:0086-21-65647719

[**] Baige Duan is a PhD student of Department of Risk Management and Insurance at the School of Economics, Nankai University majoring in Actuarial Science, Email: asabaigefsa@gmail.com

## 1. Introduction and Motivation

In the field of non-life actuarial science, insurance data often don't follow normal distribution, generalize linear models (GLMs) are very suitable for the analysis of such data. In the pricing of non-life insurance products, some estimation methods which were very early and have been widely applied are really the applications of GLMs, such as Bailey-Simon method, or minimum deviation method; the marginal summation method; least squares estimation method; and some other intuitive approaches; etc. The relevant literatures can refer to Brown(1988), Schmidt & Wünsche(1998), Mildenhall(1999), Feldblum & Brosius(2002), Fu & Wu(2007), etc. Recently, some relevant materials and monographs which based on the application of GLMs in the international non-life actuarial science have also been published in succession. de Jong & Heller(2008) first described how to apply GLMs for insurance data, which provided a lot of numerical illustrations and had a detailed analysis. The latest monograph can refer to Ohlsson & Johansson (2010), which described the various extensions of GLMs in detail, such as GAMs, and can be regarded as a useful supplement of de Jong & Heller(2008).

In the 1990s, GLMs were introduced into non-life insurance pricing by British actuaries. The following two decades, GLMs have achieved considerable development in the non-life pricing practices in many countries, and have been become the standard method currently. With the further opening up of China's insurance market, domestic insurance companies are bound to learn overseas advanced actuarial techniques. With the active and rapid development of China's property insurance market, China Insurance Regulatory Commission (CIRC) firsts began to consider the vehicle insurance that the main non-life insurance business, released the 2010(619) notice of property and casualty insurance, i.e. carry out the pilot reform of commercial vehicle insurance pricing mechanism in Shenzhen. Therefore, the market-oriented vehicle insurance rates once again become the focus of insurance industry. Facing the new challenges of vehicle insurance pricing and upgrade of underwriting capacity, property and casualty insurance companies should focus on how to efficiently analyze the impact factors of rates of vehicle insurance data, such as vehicle's factors, people's factors and regional factors, and analyze carefully the impact of various risk factors on loss frequency and loss severity significantly, so as to enhance pricing capabilities of vehicle insurance and identify profitable business by automated underwriting of GLMs, further to optimize the marketing strategy and flexibility to improve business structure. These studies are effective ways of property and casualty insurance companies to maintain the performance of solid growth in the fierce competition. However, through the discussion and exchange of the authors and some actuaries of domestic property and casualty insurance companies, it is generally agreed that driving mileage is positively correlated with the risk exposure of vehicle. The mileage factor should be considered in vehicle insurance pricing, but there is no mileage statistics in the database of almost all domestic property insurance companies currently. Faced with the situation, it has become an urgent problem of how to incorporate the factor into vehicle insurance pricing.

In addition, the traditional pricing model of vehicle insurance does not fully reflect the fairness of premiums and there have been the phenomenon of “high premium low compensation” in China. The reason is as follows. In the case of assuming other conditions remain unchanged, the risks of the low-mileage drivers are generally lower than the high-mileage drivers, yet their premiums charged are the same, which leads to a phenomenon that the low-mileage drivers provide cross-subsidies for the high-mileage drivers. Moreover, from an economics perspective, the model may also be prompted to increase the risks of the drivers by increasing mileages. That is, in the case of same premiums, the drivers would tend to increase mileages so as to make their own utility maximization. However, Mileage-based pricing of vehicle insurance product can not only reasonably reflect the insured’s insurance cost so as to show the fairness of premium charged, but also alleviate the traffic congestion effectively, reduce energy consumption, reduce environmental pollution and greenhouse gas emissions, and resulting in other comprehensive social benefits to some extent. Therefore mileage-based insurance has become a popular product in vehicle insurance market of developed countries in Europe and America.

In view of these motivations, the paper proposes to study the impact of driving mileages on net premiums of vehicle insurance innovatively. The paper makes use of the macro-statistics data of highway mileages, traffic accidents and the accident losses based on China Statistical Yearbook from 2001 to 2010, establishes the econometric model using the data of 31 provinces, municipalities and autonomous regions in China from 2000 to 2009 and makes an empirical analysis to study the long-term stable equilibrium relationship between the accident losses and highway mileages by using the panel unit root test and co-integration test of econometric methods. The result shows that there is a significant positive correlation relationship between the accident losses and highway mileages. To some extent, the stable relationship can be regarded as a valid reference of the relationship between net premiums of vehicle insurance and driving mileages. In vehicle insurance pricing based on GLMs, property and casualty insurance companies can make use of the available and specific vehicle’s, people’s and regional information, for example, they can select vehicle types, age of drivers, the respective district of vehicles as ratemaking variables, analyze the impact of these variables on loss frequency and loss severity. On this basis, they can determine the rates, develop vehicle insurance products with competitive advantage. When the expiration of insurance period, they can also make use of the difference between displayed mileages of vehicle odometer in the period of insurance and estimated average mileages [1] of econometric methods to adjust net premiums of vehicle insurance within a reasonable range

[1] The average mileage is calculated indirectly through the relationship between net premiums of vehicle insurance and driving mileage in the established econometric model.

of elasticity. Moreover, they can minute the actual driving mileages to the database of property and casualty insurance companies according to the insured's odometer information within the insurance period. Once the data are mature, driving mileages will be added to ratemaking variables and pricing based on GLMs. These studies have important theoretical support and practical reference for domestic property and casualty insurance companies to further explore the independent pricing based on GLMs in China's vehicle insurance, and provide an important theoretical basis for the insurance industry to develop new pricing software of property and casualty insurance.

## 2. Study of the Impacts of Highway Mileages on Accident Losses

### 2.1 Data Source and explanation

Modeling data of the paper derived from China Statistical Yearbook, the samples are annual data of 31 provinces, municipalities and autonomous regions in China from 2000 to 2009, including highway mileages, traffic accidents and the accident losses. In order to more clearly describe these data and further determine the specific form of the model reasonably, figure 1 and figure 2 show the corresponding three-dimensional maps of the accident losses (unit: million), highway mileages (unit: kilometer) and traffic accidents (unit: number) respectively. Among them, the left in figure 1 draws the accident losses of all regions at current prices according to China Statistical Yearbook, considering 2000 as the base period, the right in figure 1 draws the accident losses of all regions in 2000, which adjusted current prices to base period's prices drawn the retail price index by China Statistical Yearbook. In addition, two figures denote provinces using these digital 1-31 in order to facilitate the description. According to the order of China Statistical Yearbook, these digital denote Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia, Liaoning, Jilin, Heilongjiang, Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan, Guangdong, Guangxi, Hainan, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shanxi, Gansu, Qinghai, Ningxia, Xinjiang, respectively.

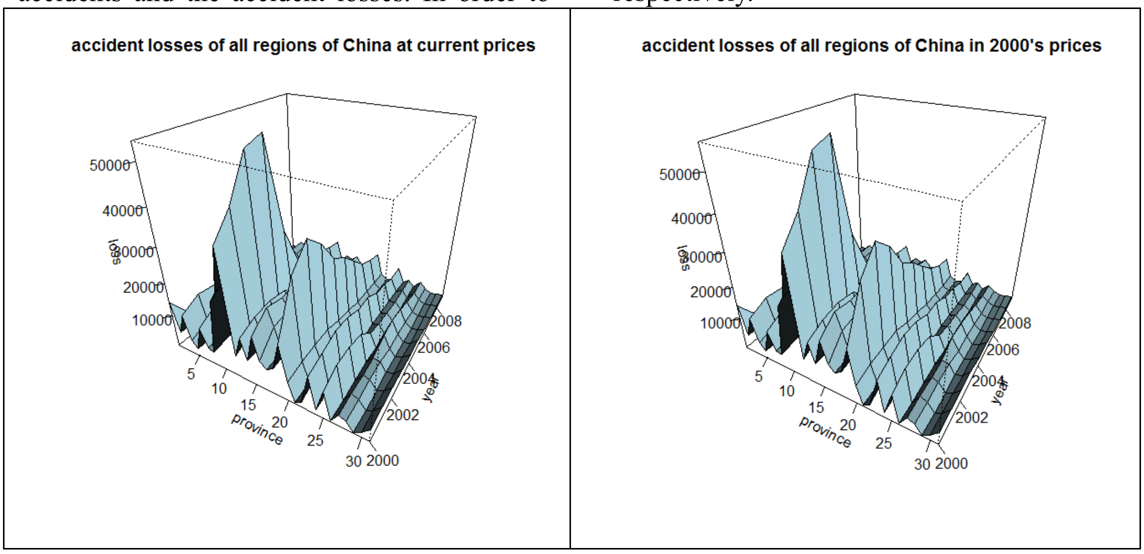



**Fig. 1 The Accident Losses in the 31 Regions of China (2000-2009)**

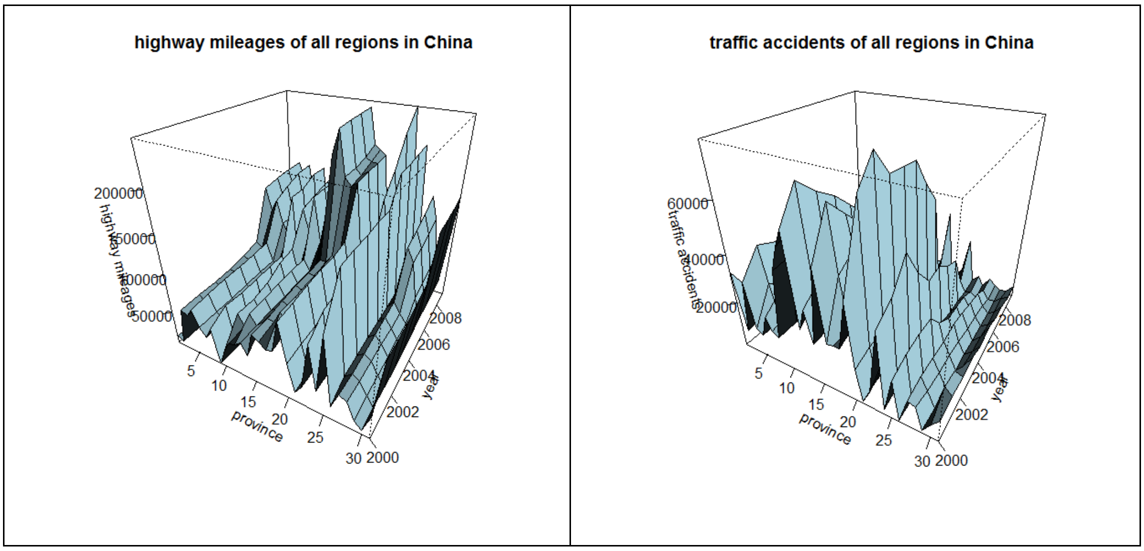



**Fig. 2 Highway Mileages and Traffic Accidents in the 31 Regions of China (2000-2009)**

## 2.2 Variable Selection and Model Description

### 2.2.1 The selection of dependent variable and explanatory variables

Given that the original intention of the paper is to study the impact of driving mileages on net premiums of vehicle insurance, so we select the accident losses after adjustment as dependent variable, highway mileages and traffic accidents are explanatory variables. These variables are expressed as $Loss$, $Mileage$, $Accidents$. Also, the actual macroeconomic variables sequences generally show such feature, i.e. with the changes in the values of explanatory variables, the difference in the value of dependent variable will be more generally. In order to eliminate the impact of increment heteroscedasticity that may arise, the paper uses the natural logarithms[2] of annual $Loss$, $Mileage$, $Accidents$ data of 31 regions, and further obtains the regional panel data sequences, including $\ln Loss$ 、 $\ln Mileage$ 、 $\ln Accidents$.

### 2.2.2 The selection of specific explanatory variables

In the actual modeling process, dependent variable not only is affected by the quantitative variables, but also may be subject to the qualitative factors. For example, it may need to consider the impact of gender, different historical periods, seasonal differences, regional differences and other factors according to the specific problem. Figure 1 shows that the accident losses of 31 regions are in the significant growth until 2003 and apparent downward trend after 2003. Figure 2 shows that highway mileages have been a significant increase after 2006, traffic accidents of almost all regions had been showed an upward trend before 2003 and declined slightly from 2003 to 2005, and a downward trend

2 Generally, in addition to solve the problem of heteroscedasticity, there are the following two aspects of the role of logarithmic variables mainly, the first is the nonlinear problems involving exponential functions and so on can be transformed into the linear problems that easy to deal with, and second is that if the logarithmic sequence is still non-stationary, then the result approaches the growth rate after difference and has certain economic implication.

generally after 2006. To demonstrate the overall characteristics, figure 3 shows the trends of annual the accident losses after adjustment, highway mileages and traffic accidents from 2000 to 2009 in China. Among them, the horizontal axis represents year, the primary vertical axis (on the left vertical axis) used to describe annual highway mileages, and the secondary vertical axis (on the right vertical axis) used to describe annual accident losses and traffic accidents[3]. From a macro perspective, figure 3 shows that these features are closely related to national economy, safety conditions of road and traffic, sound legal system of China. In addition, these features also are consistent with the development of China's vehicle insurance business. Before 2003, vehicle insurance rates are unified pricing based on several vehicle's factors; from January 2003 to July 2006, vehicle insurance rates for market-oriented reforms were implemented, a priori classification rate system was established based on some factors of people and vehicle; since July 2006, with the implementation of traffic accident compulsory liability insurance, rates were again returned to the unified model, and the classification rate system was further revised with a combination of vehicle, of people, of region and other factors.

In order to reflect these features, the paper adds a dummy variable ( $D$ ) to measure the change in the intercept of the model, adds the product of quantitative variables and a dummy variable to measure the change in the slope of the model. ( $\ln Mileage \times D$ , $\ln Accidents \times D$ ). And the dummy variable is defined as follows:

$$D = \begin{cases} 0, & 2000 \le t < 2006 \\ 1, & 2006 \le t \le 2009 \end{cases} \tag{1}$$

It is worth mentioned, the paper uses a single dummy variable to two explanatory variables both highway mileages and traffic accidents in measuring the changes in the intercept and slope of the model. The reason is as follows. The paper also applies the two dummy variables ( $D_1$ , $D_2$ ) and two product terms ( $\ln Mileage \times D_2$ , $\ln Accidents \times D_1$ ) showed by the following second and third formulas in the empirical analysis, and conducts the co-integration test and estimated parameters of the models. We choose the single dummy variable ultimately by further balancing the results of estimated parameters and important statistical indicators under the two approaches.

$$D_2 = \begin{cases} 0, & 2000 \le t < 2006 \\ 1, & 2006 \le t \le 2009 \end{cases} \tag{2}$$

$$D_1 = \begin{cases} 0, & 2000 \le t < 2003 \\ 1, & 2003 \le t \le 2009 \end{cases} \tag{3}$$

[3] The longitudinal coordinate scale of the secondary vertical axis is implemented of the conversion. i.e., located in inside coordinate scale used to describe the accident losses, located in outside coordinate scale used to describe traffic accidents. Therefore, we can draw accurately the trends of three variables over time in the same figure.

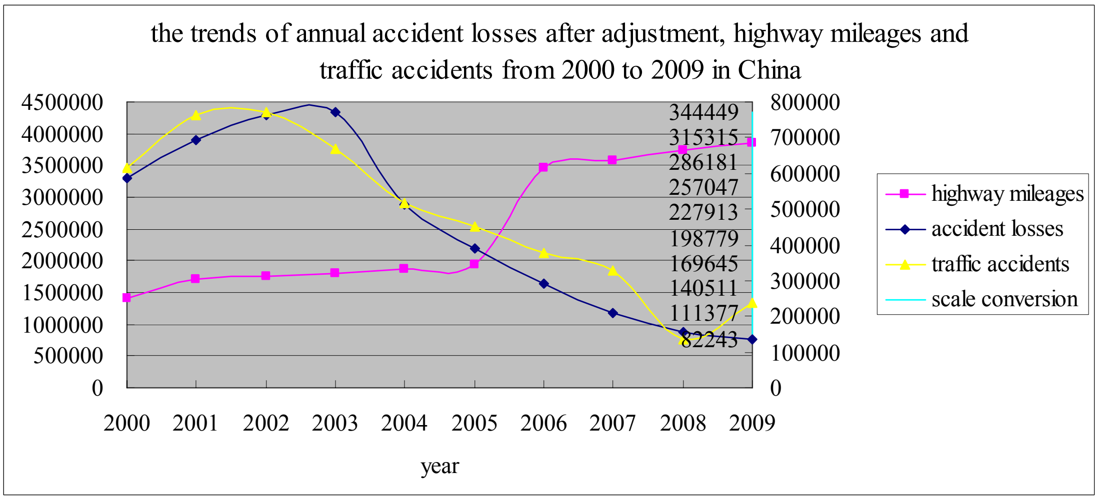



**Fig. 3 Annual Accidents Losses, Highway Mileages and Traffic Accidents of China (2000-2009)**

**2.2.3 The basic form of the model**

The panel data not only combine the characteristics of time series data and cross-sectional data, so as to increase the observations significantly and further improve the sampling accuracy of estimator, but also obtain more dynamic information than a single cross-sectional data by modeling. Moreover, we can get consistent parameter estimates and even efficient estimators in the fixed effects model of panel data. Therefore, the paper proposes to select the panel data for modeling. The basic forms of the optional models are as follows.

1. Pooled Model

According to the paper, the pooled model can be expressed as:

$$\begin{aligned}\ln Loss_{it} &= \alpha + \beta_1 \ln Mileage_{it} + \beta_2 \ln Accidents_{it} + \beta_3 D \\ &+ \beta_4 \ln Mileage_{it} \times D + \beta_5 \ln Accidents_{it} \times D + \beta_6 \ln Loss_{i,t-1} + \varepsilon_{it}\end{aligned} \tag{4}$$

2. Fixed Effects Model

The fixed effects model can be divided into three types, i.e. entity fixed effects model, time fixed effects model, time and entity fixed effects model. According to the paper, entity fixed effects model can be expressed as:

$$\begin{aligned}\ln Loss_{it} &= \alpha_i + \beta_1 \ln Mileage_{it} + \beta_2 \ln Accidents_{it} + \beta_3 D \\ &+ \beta_4 \ln Mileage_{it} \times D + \beta_5 \ln Accidents_{it} \times D + \beta_6 \ln Loss_{i,t-1} + \varepsilon_{it}\end{aligned} \tag{5}$$

According to the paper, time fixed effects model can be expressed as:

$$\begin{aligned}\ln Loss_{it} &= \gamma_t + \beta_1 \ln Mileage_{it} + \beta_2 \ln Accidents_{it} + \beta_3 D \\ &+ \beta_4 \ln Mileage_{it} \times D + \beta_5 \ln Accidents_{it} \times D + \varepsilon_{it}\end{aligned} \tag{6}$$

According to the paper, time and entity fixed effects model can be expressed as:

$$\begin{aligned}\ln Loss_{it} &= \alpha_0 + \alpha_i + \gamma_t + \beta_1 \ln Mileage_{it} + \beta_2 \ln Accidents_{it} + \beta_3 D \\ &+ \beta_4 \ln Mileage_{it} \times D + \beta_5 \ln Accidents_{it} \times D + \varepsilon_{it}\end{aligned} \tag{7}$$

Therein, the first-order lagged terms of dependent variable ( $\ln Loss_{i,t-1}$ ) is added to the model in the fourth and fifth formulas. Its purpose is to overcome the autocorrelation of dependent variable sequence. However, because of the autoregressive terms (AR) aren't emerge in the time fixed effects model, first-order lagged terms of dependent variable can't be added to the model in the sixth and seventh formulas.

3. Random Effects Model

The random effects model can be divided into three types, i.e. entity random effects model, time random effects model, time and entity random effects model. The basic forms of the corresponding models are the same as the fifth, sixth, seventh formulas. The only difference is that the distribution of intercept term (i.e. constant term) is not relevant to explanatory variables in random effects model, but the distribution of intercept term (i.e. constant term) is relevant to explanatory variables in fixed effects model.

### 2.3 Model Testing, Parameter Estimation and Analysis of Results

#### 2.3.1 Unit Root Test of Panel Data

As a result of the regression model using non-stationary economic variables can bring the problem of spurious regression, we first apply unit root test of panel data before modeling, so as to ensure each variable in the model is stable. There are many methods to conduct unit root test of panel data. According to the different scope of the application, these methods can be divided into two types. The first one is suitable for entity of panel data with the same root, and the second one is suitable for entity of panel data with the different root. Therein, the null hypotheses of the two types are with unit root, alternative hypotheses are without unit root. The paper selects LLC testing, IPS testing, In Choi testing (also known as Fish-ADF testing), Fisher-PP testing to apply unit root test on variables. In the four test methods, LLC testing is suitable for the same root, the other three methods are suitable for the different root. The test results of the paper are shown in table 1.

**Table 1 Unit Root Test of Panel Data**

| test methods / variables | LLC testing | IPS testing | Fisher-ADF testing | Fisher-PP testing |
|---|---|---|---|---|
| $Loss$ | -6.35（0.00）*** | 1.88（0.97） | 51.81（0.82） | 31.43（1.00） |
| $\ln Loss$ | 1.20（0.88） | 5.17（1.00） | 23.05（1.00） | 13.23（1.00） |
| $\Delta \ln Loss$ | -11.93（0.00）*** | -4.92（0.00）*** | 136.21（0.00）*** | 186.98（0.00）*** |
| $Mileage$ | 1.03（0.85） | 4.95（1.00） | 18.44（1.00） | 22.94（1.00） |
| $\ln Mileage$ | -1.35（0.09）* | 3.24（1.00） | 33.97（1.00） | 43.11（0.97） |
| $\Delta \ln Mileage$ | -23.40（0.00）*** | -8.74（0.00）*** | 190.60（0.00）*** | 239.78（0.00）*** |
| $Accidents$ | -7.34（0.00）*** | 1.91（0.97） | 46.78（0.92） | 40.77（0.98） |
| $\ln Accidents$ | 2.71（1.00） | 5.87（1.00） | 19.66（1.00） | 35.11（1.00） |
| $\Delta \ln Accidents$ | -13.75（0.00）*** | -8.14（0.00）*** | 201.20（0.00）*** | 266.17（0.00）*** |

Note: ***, **, * indicate that reject the null hypothesis at the significant level of one percent, five percents and ten percents respectively. The number on the left of parentheses indicates the value of corresponding statistics. The number in the parentheses indicates the accompanied probability of corresponding statistics. The notation ( $\Delta$ ) indicates the first-order difference of corresponding variable.

It can be seen from table 1, three variables and corresponding logarithm variables are not stable, i.e. there are unit root. However, the first-order differences of logarithm variables are stable, i.e. logarithm variables are first-order integration ( $I(1)$ ). Therefore, it is consistent with the requirement of co-integration test of panel data.

**2.3.2 Co-integration Test of Panel Data**

The co-integration test of the model can be divided into two types by different methods in panel data. The first one is the co-integration test of panel data based on the extended two-step method of Enger-Granger (EG) in the co-integration test of time series, and the constructed test statistic after the standardization follow standard normal distribution asymptotically. The typical methods are Pedroni co-integration test method and Kao co-integration test method. Therein, the former is a class of co-integration test for heterogeneous panel data, which allows the heterogeneity of the system among different entities, the latter is a class of co-integration test for homogeneous panel data. And the second one is the co-integration test of panel data based on the extended Johansen trace statistics. The typical method is Fisher co-integration test method, which is to construct a cumulative statistic with following the chi-square distribution by the values of co-integration test of entities, in order to develop co-integration test of panel data. The null hypotheses of the two types of methods are without the co-integration relationship, alternative hypotheses are with the co-integration relationship.

The three logarithmic variables are the process of first-order integration in our model, so we can further test whether the co-integration relationship or not between dependent variable and explanatory variables. Pedroni constructs seven statistics to test the co-integration relationship of panel data, these statistics are applied to determine whether co-integration relationships or not between $\ln Loss$ and $\ln Mileage$ , $\ln Loss$ and $\ln Accidents$ [4]. There statistics can be divided into two types. The first one is described by within-dimension, including four statistics, i.e. $Panel\ v$ 、$Panel\ \rho$ 、$Panel\ PP$ 、$Panel\ ADF$ , and the second one is described by between-dimension, including three statistics, i.e. $Group\ \rho$ 、 $Group\ PP$ 、 $Group\ ADF$ . These test results are shown in table 2.

[4] Test results show that there are co-integration relationships between two explanatory variables and dependent variable. As the purpose of the paper is to study the impact of driving mileages on accident losses, we only provide the test result of co-integration relationship between $\ln Loss$ and $\ln Mileage$ .

**Table 2 Test Results of Co-integration Relationship Between $\ln Loss$ and $\ln Mileage$**

| Test Statistic | The Value of Corresponding Statistic | Probability |
|---|---|---|
| *Panel v* Statistic | 2.58*** | 0.0049 |
| *Panel ρ* Statistic | -1.70** | 0.0441 |
| *Panel PP* Statistic | -4.73*** | 0.0000 |
| *Panel ADF* Statistic | -.3.43*** | 0.0003 |
| *Group ρ* Statistic | 1.52 | 0.9361 |
| *Group PP* Statistic | -.3.97*** | 0.0000 |
| *Group ADF* Statistic | -5.20*** | 0.0000 |

Note: ***, **, * indicate that reject the null hypothesis at the significant level of one percent, five percents and ten percents respectively.

It can be seen from table 2, six test results of the seven show that reject the null hypothesis, so we think that there is a co-integration relationship between $\ln Loss$ and $\ln Mileage$. In addition, the paper also uses Kao co-integration test method and Fisher co-integration test method, which reject the null hypothesis at the significant level of one percent respectively, i.e. there is a co-integration relationship between $\ln Loss$ and $\ln Mileage$. Therefore, we can assume that there is an equilibrium relationship of long-term stability between $\ln Loss$ and $\ln Mileage$, so as to apply regression analysis directly, can't also bring the problem of spurious regression.

#### 2.3.3 Model Testing and Parameter Estimation

The test methods to identify the types of panel data model are mainly F test and Hausman test. Therein, F test used to test that a set of panel data should be established of a pooled model or an entity fixed effects model. The null hypothesis is established of a pooled model, alternative hypothesis is established of an entity fixed effects model. Hausman test[5] used to test that a set of panel data should be established of a random effects model or a fixed effects model. The null hypothesis is established of a random effects model, alternative hypothesis is established of a fixed effects model. Our test results are shown in table 3 and table 4.

[5] Generally, Hausman test is not limited to test model and setting method of panel data. As long as involving the judgment of difference measurement of estimators in two estimation methods, we can also apply Hausman test method.

**Table 3 Results of F test**

| Test Statistic | Value of Statistic | Degrees of Freedom | Probability |
|---|---|---|---|
| F Statistic | 20.26 | （30,275） | 0.0000 |
| $\chi^2$ Statistic | 361.60 | 30 | 0.0000 |

**表 4 Results of Hausman Test**

| Null Hypothesis | Value of Statistic $Chi-Sq$ | Degrees of Freedom ( $Chi-Sq$ ) | Probability |
|---|---|---|---|
| Entity Effect and Regression Variables are not relevant | 48.03 | 4 | 0.0000 |

It can be seen from table 3 and table 4, we can establish an entity fixed effects model at the significant level of one percent. In addition, we also weigh the important statistical indicators among the entity fixed effects model, time fixed effects model and time and entity fixed effects model. Finally, we choice the entity fixed effects model. From the specific issues of the paper, due to study the relationship between accidents losses and highway mileages using 31 regions of China, and in order to further reflect the differences of geographical characteristics in different regions, so the entity fixed effects model is more appropriate than other models.

In sum, we choice the panel data model with regional fixed effects and variable intercept. The estimated results are shown in the following equation (8).

$$\begin{aligned}\ln Loss_{it} &= \underset{(0.27)}{0.97} + \alpha_i^* + \underset{(2.62)}{0.17}\ln Mileage_{it} + \underset{(7.81)}{0.31}\ln Accidents_{it} + \underset{(4.11)}{1.32}D \\ &\quad \underset{(-4.74)}{-0.17}\ln Accidents_{it}\times D + \underset{(24.99)}{0.97}\ln Loss_{i,t-1}\end{aligned} \tag{8}$$

$$R^2 = 0.9644 \quad DW = 1.82 \quad F-statistic = 188.14 \quad \text{Prob}(F\text{-}statistic) = 0.0000$$

As shown in equation (8), the term ( $\ln Mileage_{it} \times D$ ) doesn't appear in estimation formula. This is because that the regression coefficient is not significant by adding the explanatory variables into the model. In addition, the regional cross-section fixed effects coefficients are shown in table 5.

**Table 5 The Cross-section Fixed Effects Coefficients in 31regions of China**

| Region $i$ | $\alpha_i^*$ Estimate | Region $i$ | $\alpha_i^*$ Estimate |
|---|---|---|---|
| Beijing | -1.42 | Hubei | 0.25 |
| Tianjin | 0.84 | Hunan | 0.79 |
| Hebei | 0.98 | Guangdong | 2.54 |
| Shanxi | 2.25 | Guangxi | -0.68 |
| Inner Mongolia | 0.55 | Hainan | -1.38 |

| | | | |
|---|---|---|---|
| Liaoning | 0.06 | Chongqing | -0.14 |
| Jilin | 0.67 | Sichuan | 1.49 |
| Heilongjiang | 0.71 | Guizhou | -0.31 |
| Shanghai | -3.88 | Yunnan | -0.90 |
| Jiangsu | -0.34 | Tibet | -0.01 |
| Zhejiang | 0.62 | Shanxi | 1.88 |
| Anhui | -0.11 | Gansu | -0.52 |
| Fujian | 1.13 | Qinghai | -2.21 |
| Jiangxi | 1.63 | Ningxia | -2.35 |
| Shandong | 1.11 | Xinjiang | -3.21 |
| Henan | -0.04 | | |

As can be seen from the above estimates, the goodness of fit in the regression equation reaches 96.44%, which reflects the fit very well. The $t$ statistics of explanatory variables in the brackets of equation (8) also pass the test significantly. The $DW$ statistic is close to 2, which means the residual terms ( $\varepsilon_{it}$ ) with non-autocorrelation. The $F$ statistic is 188.14, and accompanied probability is 0.0000, which explain the differences among different regions to impact the model's setting significantly. Therefore, it is reasonable to use the panel data model with regional fixed effects and variable intercept.

From the national average level, we can also think that there is a long-term equilibrium relationship between accident losses and highway mileages. The coefficient of elasticity with accident losses on highway mileages is 5.41( $0.17/(1-0.97)=5.41$ [6]). i.e. if highway mileages increases by 1%, then accident losses will increase by 5.41%. Moreover, it can be seen from table 5, the fixed effects coefficients ( $\alpha_i^*$ ) of different regions are also significant differences. The result is consistent with the levels of economic development and the conditions of road traffic in different regions of China.

**2.3.4 Analysis of Results**

Compared with the analysis of time series data and cross-sectional data, the analysis of panel data using entity fixed effects model contains more the number of samples, and is more desirable for estimated effect of the model. The analysis of panel data not only can describe the overall general characteristic, but also can reflect the differences among different entities. Therefore, it can reflect the actual situation of research question more objectively. In this paper, we draw the conclusion that there is a significant positive correlation relationship between accident losses and highway mileages with both unit root test and co-integration test methods of panel data. These studies will provide a useful reference to consider the relationship between net premium of vehicle insurance and driving mileages in the next section.

## 3. Research Reference of Net Premium of Vehicle Insurance and Driving Mileages

Similar to the previous empirical results, if there is a significant positive correlation relationship between net premium of vehicle insurance and driving mileages, then study the relationship has particular benefits for the insured. It can provide an option to save net premium by reducing driving mileages and to choose optimal net premium level according their own characteristics. Moreover, it also has important theoretical significance and practical

[6] Due to rounding, calculate directly the formula is not equal to 5.41.

value for accuracy, adequacy and fairness of pricing for insurance companies. Combined with the econometric model of the given accident losses and highway mileages, and learned from overseas study of vehicle insurance costs and driving mileages, we will give some practical research ideas. These explorations will provide effective practice reference to consider driving mileages and to be introduced and developed into GLM pricing for actuaries in China's property insurance companies.

**3.1 Access to driving odometer information of the insured**

Since the late 1990s, non-life insurance practitioners have gradually changed the vehicle premium charges in Europe and United States and other developed countries. i.e. vehicle premiums were to be collected based on driving mileage, it was called pay as you drive. The research was initiated by Pascal Noel that research expert of PAYD products in the Brookings institute. Some summary of researches can refer Litman(2005), Ferreira & Minikel(2010), Victoria Transport Policy Institute(2011). The PAYD products need to use remote communication such as GPS, and other information transmission technology. At present, there are two different operation modes in practice of foreign insurance companies. The first mode is designed to install wireless devices in the insured vehicle by the pioneers of Progressive corporation in 1998, and to record driving odometer information such as when, how much mileage, how to driving, etc. and further to send the information to property insurance companies. The second mode is the operation mode of Milemeter corporation, which determine vehicle insurance rates according to ratemaking variables, such as age of the insured, region of insured vehicle, vehicle type, etc. As well as the mode can provide different range of mileages for the insured, so that the insured free select appropriate mileages range by their own situation. Moreover, it verifies mileages by true odometer in the expiration of insurance period. Intuitively, the first mode needs to invest high cost for property insurance companies. Therefore, the second mode has more reference to China's property insurance companies.

For vehicle insurance businesses of China's property insurance companies, the period of vehicle insurance products is relatively short, and usually is one year. When issued new policy or renewal policy, relevant staff can obtain odometer information of the insured within insurance period, and further record driving mileages to the database. The information has important practical value for actuaries to analyze the relationship of net premium of vehicle insurance and driving mileages, so as to add the driving mileages into GLM pricing. Therefore, we advocate and take the implementation program to obtain mileages information as soon as possible of property insurance companies. In addition, because access to this information takes some time, during the period, qualified companies can also be insured vehicle to be classified by region, people and types of vehicle, design a questionnaire survey or telephone inquiries to obtain mileage information. On this basis, under the new challenges of vehicle insurance pricing and underwriting capacity upgrade, property insurance companies can maintain the existing business through first design and develop the vehicle insurance business considering driving mileages. It maybe a useful attempt to seek the growth points of new business.

**3.2 The Ideas and Methods of Study the Relationship of Net Premium and Mileages**

**3.2.1 The econometric model of net premium, driving mileages and claims frequency**

Combined with research ideas of the second section, considered specific company, actuaries can establish an econometric model involving total insurance cost or total net premium (i.e. total losses cost)[7] with total driving mileages, total claims frequency and other explanatory variables based on all insured vehicles, so as to study the relationship between vehicle insurance net premium and driving mileages from the company's overall level. Moreover, actuaries can also create another econometric model involving insurance cost or net premium with average driving mileages, average claims frequency and other explanatory variables based on unit insured vehicle, which study the relationship from the company's average level. Regardless of based on overall level or based on average level, all two research ideas can calculate the corresponding elastic coefficient. It is noteworthy that, the derived result of the second section is that highway mileage increases by 1%, accident losses will increase by 5.41%. Therein, highway mileage is the length of highway transport routes of regional statistics, and it is an objective variable mileage, so it can't be directly considered as a specific mileage of underwriting vehicle or average mileage. Accident losses are converted into the amount of losses of regional statistics. Therefore, Quantitative analysis method used in the empirical analysis only provides a positive correlation relationship between highway mileages (as an objective indicator) and regional aggregate losses significantly. This relationship will be to provide a reference for the establishment of econometric model between vehicle insurance net premiums of property insurance company and driving mileages.

**3.2.2 Overseas studies on vehicle insurance costs and driving mileages**

Due to driving mileages statistics has been in the database of insurance companies in Europe and the United States and other developed countries. As a research expert of Berkeley, university of California, Edlin(1998) studies vehicle insurance premium of unit mileage. The results show that the elastic coefficient of vehicle insurance costs to driving mileages is between 1.42 and 1.85. In other words, driving mileages increases by 1%, insurance costs will increase by 1.42% to 1.85%. Once there is mileage statistics in the database of property insurance companies in China, we can learn from the research idea to study the elastic coefficient of vehicle insurance costs to driving mileages, and compare China's actual situation with the results of Edlin.

**3.2.3 Mileage-based GLM pricing in vehicle insurance**

Once obtained the mileage statistics, actuaries can also study the relationship between vehicle insurance net premiums and driving mileages directly in the GLM framework. In other words, based on known information, such as vehicle types, vehicle uses, driving districts, driving mileages, gender, age of driver, traffic accident records and driving behavior and other factors, they can select appropriate ratemaking variables, such as types of vehicle, age of driver, respective district of vehicles, driving mileages, and further create GLM of loss frequency and loss severity based on selected ratemaking variables respectively. The research not only can study the significance of the relationship between vehicle insurance net premiums and driving mileages, but also can further determine vehicle insurance rates on this basis.

In summary, we provide three ideas and methods to study the relationship between vehicle insurance net premiums and driving mileages. These methods mean that property insurance companies should obtain driving mileages information gradually. Until obtained mature data, they can incorporate driving mileages into ratemaking variables directly and develop GLM pricing for vehicle insurance products.

## 4. Further Proposal for Mileage-Based

[7] Total insurance cost of insured vehicles is different from total net premium. The former includes total losses cost, also includes additional costs and profits, however, the latter refers to total losses cost.

**Pricing**

Further study of mileage-based pricing in vehicle insurance products of China can be subdivided into the following four aspects.

First of all, for further empirical analysis, study the impacts of mileage on vehicle insurance net premium at the company's level. We should further obtain the relevant data of the domestic insurance companies, as well as collect driving mileage and other information in different regions and vehicle models through a questionnaire survey, use elastic analysis methods to study and test the correlation between traffic accidents losses and mileages.

Second, for theoretical model, we can also model the relationship between traffic accidents losses and mileages using appropriate statistical models and methods. The alternative approaches are as follows.

(1) Incorporate a mileage impact factor into generalized linear model pricing of vehicle insurance, as well as consider a variety of extended model in GLM, such as generalized additive model(GAM), generalized linear mixed models(GLMM), etc.

(2) Consider the general regression model, modeling of the relationship between per unit of driving mileage and per unit of net premium in vehicle insurance. (such as per unit of mileage should reflect the differences among the vehicle, driver and regional; mainly concern the mileage explanatory variable; use rate relative to consider other factors; etc)

(3) Bayesian statistical analysis models and methods, such as a variety of Bayesian nonlinear models for forecasting insurance loss payments; actuarial credibility theory; etc.

(4) Compare the pros and cons of these statistical models, study the similarities and differences, commit to regulate these models from an intuitive, consistent framework. For example, incorporate credibility theory into the GLM framework using more rigorous statistical methods.

Third, consider the differences of business structure among different property insurance companies, provide some possible suggestions of mileage-based pricing in practice.

Finally, study the positive externalities of mileage-based pricing in vehicle insurance. The optional programs are as follows.

(1) Use scenarios generation technique, intelligent algorithms and a variety of simulation methods, such as the MCMC simulation, Bootstrap method, etc; simulation analysis of the available date from domestic and overseas vehicle insurance.

(2) From an economic perspective, study the marginal private benefits and marginal social benefits of insurance companies, further investigate and discuss the positive externalities of mileage-based pricing in vehicle insurance from insurance, energy, transport and environment perspectives, as well as promote the insurance industry to participate in social management innovation.

(3) A Comparative study between mileage-based pricing model and traditional model of vehicle insurance.

## 5. Innovations and Conclusions

Since there is no mileage statistics in the database of almost all property insurance companies in China currently, the paper proposes to study the impact of driving mileages on net premiums of vehicle insurance innovatively. The paper makes an empirical analysis to study the long-term stable equilibrium relationship between the accident losses and highway mileages by using econometric methods of panel data. The result shows that there is a significant positive correlation relationship between the accident losses and highway mileages. These studies provide useful support and reference to consider the relationship between net premiums of vehicle insurance and driving mileages, and then make use of driving mileages to adjust net premiums of vehicle insurance within reasonable elastic range. In addition, the results of the paper have important theoretical significance and practical value for driving mileages to be introduced and developed into GLM pricing in China's vehicle insurance. As a further research direction, the study is intended to build a pricing model based on mileage of vehicle insurance products, so as to promote the independent development of intellectual property rights of mileage-based pricing in vehicle insurance products, upgrade of product structures, promote the reform of the commercial vehicle insurance premium management system of the China Insurance Regulatory Commission.

In the empirical analysis of the paper, four kinds of data processing and statistical analysis software, such as Excel, R software, Eviews7.0, Stata12.0 are used. Therein, these three-dimensional maps of figure 1 and figure 2 are drawn using R software; figure 3 shows that the trends of model variables containing three vertical axes over time using Excel; unit root test and co-integration test of panel data, model setting and parameter estimation results are obtained by using two econometric analysis software both Evies7.0 and Stata12.0. The outputs are basically the same. On the basis, we draw the main conclusions of the paper, i.e. highway mileages increase by 1%, accident losses will increase by 5.41%.

Compared with traditional pricing of vehicle insurance products without considering driving mileages, the proposed ideas and methods of vehicle insurance pricing in the paper have obvious advantages. These advantages are mainly reflected in the following four aspects. Firstly, the pricing method considering driving mileages has transmitted the loss cost of one kilometer more to the insured, making the insured may choose the optimal driving mileages to save premium, according to their own situation. Compared with the existing imposed fuel tax, vehicle purchase tax, environmental tax, fuel economy standards, traffic control and other external mandatory measures, the pricing method considering driving mileages provides am inherent power of financial incentive for the insured. It can be regarded as a new endogenous economic means. Secondly, the driving mileages of low-income families are less than of high-income families generally. Distinguished the insured by driving mileages not only can avoid cross-subsidies, but also conducive to realize social justice. In addition, it can also attract those uninsured low-income families to buy vehicle insurance products. Thirdly, for property insurance companies, on the one hand, the pricing method can promote actuaries to more accurately determine rates of vehicle insurance, and reasonably reflect the insurance cost for each insured so as to charged premiums more equitable. On the other hand, actuaries can have a quantitative analysis of each insured's driving conditions, in order to reduce the potential risk of loss and increase the company's underwriting profit. Fourthly, from the perspective of society as a whole, reducing vehicle's annual average mileages can decrease traffic congestion effectively, reduce vehicle collisions and insurance payments, decrease environmental pollution and greenhouse gas emission, enhance energy security and other comprehensive income. For some extent, it also help to establish a good public image of insurance companies in the low-carbon economic environment, and more conducive to the healthy and orderly development of insurance market.

## References

[1] Brown, R.L. Minimum Bias with Generalized Linear Models[J]. Proceedings of the Casualty Actuarial Society, 1998, 75(143):187-217.

[2] Choi In. Unit root tests for panel data[J]. Journal of International Money and Finance, 2001, (20): 249-272.

[3] de Jong, P., Heller, G.Z. Generalized Linear Models for Insurance Data[M]. Cambridge: Cambridge University Press, 2008 : 64-80.

[4] Edlin, A.S. Per-Mile Premiums for Auto

Insurance[R]. NBER working paper series, http://www.nber.org/papers/w6934, 1998, (1):1-40.

[5] Feldblum, S., Brosius, E. The Minimum Bias Procedures: A Practitioner's Guide[J]. Casualty Actuarial Society Forum, 2002, (1) :591-683.

[6] Ferreira, J.Jr., Minikel, E. Pay-As-You-Drive Auto Insurance In Massachusetts: A Risk Assessment And Report On Consumer, Industry And Environmental Benefits[R]. by the Department of Urban Studies and Planning, Massachusetts Institute of Technology, 2010.

[7] FU Lu-yang, Wu, C.S. General Iteration Algorithm for Classification Ratemaking[J]. Variance, 2007, 1(2):193-213.

[8] Im, K.S., Peasaran, M.H., Shin, Y. Testing for unit roots in heterogeneous panels[J]. Journal of Econometrics, 2003, 115: 53-74.

[9] Levin, A., Lin, C. F., Chu, C. Unit root test in panel data: asymptotic and finite-sample properties[J]. Journal of Econometrics, 2002, 108: 1-24.

[10] Litman, T. Pay-As-You-Drive Vehicle Insurance–Implementation, Benefits and Costs[R]. Victoria Transport Policy Institute, 2005(11) :1-13.

[11] Maddala, Wu, G.S. A comparative study of unit root tests with panel data and a new simple test[J]. Oxford Bulletin of Economics and Statistics, 1999, 61: 631-652.

[12] McCoskey, S., Kao, C. A residual-based test of the null of cointegration in panel data[J]. Econometric Reviews, 1998, 17: 57-84.

[13] Mildenhall, S.J. A Systematic Relationship between Minimum Bias and Generalized Linear Models[J]. Proceedings of the Casualty Actuarial Society 1999, 86, 393-487.

[14] Nelder, J.A., Wedderburn, R.W.M. Generalized Linear Models[J]. Journal of the Royal Statistical Society, Series A, 1972, 135(3): 370-384.

[15] Ohlsson, E., Johansson, B. Non-life Insurance Pricing with Generalized Linear Models[M]. European Actuarial Academy Series–Textbook, Springer-Verlag Berlin Heidelberg, 2010 : 39-135.

[16] Pedroni, P. Critical values for cointegration tests in heterogeneous panels with multiple regressors[J]. Oxford Bulletin of Economics and Statistics, 1999, 61: 653-678.

[17] Schmidt, K.D, Wünsche, A. Chain ladder, marginal sum and maximum likelihood estimation[J]. Blätter DGVM 1998, 23: 267-277.

[18] Victoria Transport Policy Institute. Pay-As-You-Drive Vehicle Insurance–Converting Vehicle Insurance Premiums Into Use-Based Charges[R]. TDM Encyclopedia, 2011(6).

# Empirical Study on Floating Rate of China’s Automobile Insurance

JI Caihong
School of Economics, Beijing Technology and Business University, Beijing, China, 100048

**Abstract:** In recent years, with rapid development of China's automobile industry and implementation of automobile compulsory insurance, China's automobile insurance developing rapidly and automobile insurance premium income growing steady. This paper summarized the history and status of China's automobile insurance. Via empirical analysis on China's automobile insurance floating rate, some problems in automobile insurance floating rate were revealed. Finally development proposals were given for floating rate development of China's automobile insurance.
**Keywords:** automobile insurance; floating rate; BMS; automobile insurance rate reform

## Ⅰ.引言

改革开放以来，我国人民生活水平日益提高，我国汽车产业发展迅速，汽车保有量和产销量迅猛增长，为我国车险业务的发展提供了广阔的空间。

2010 年底我国民用汽车拥有量 7802 万辆，同比增长 24.22%。1990 到 2010 年 21 年间，民用汽车拥有量从 551.36 万辆增加到 7801.83 万辆，年均增长 13.95%。 其中私人汽车拥有量由 1990 年 81.62 万辆增加到 2010 年的 5938.71 万辆，年均增长 23.40%。 我国汽车市场需求保持快速增长，汽车产业持续保持产销两旺的局面。2010 年全国汽车产量和销量分别为 1826.53 万辆和 1806 万辆，同比增长 32.40%和 32.37%。

随着我国汽车产业快速发展及机动车辆交强险的实施，我国车险业务发展迅速，保费收入稳步增长。近来交强险对外资保险公司解禁，势必给中国的车险市场带来巨大的冲击。

从目前我国的保险市场上看，财产保险市场业务结构以车险为主，车险保费占财产保险总保费收入 70%以上。2010 年财产保险保费收入 3895.69 亿元，同比增长 35.46%，其中机动车辆保险保费收入为 3004.15 亿元，同比增长 39.36%。 2010 年车险保费占财产保险保费百分比为 77.11%。

## Ⅱ. 我国车险浮动费率的发展与现状

我国车险产品费率经历了早期的统一费率，到 2003 车险费率全面市场化，之后又部分收紧，再到车险浮动费率进行改革试点，到目前的有条件的实施商业车险浮动费率的过程。

### A.早期的统一费率

长期以来我国车险一直采用政府统一制定的费率制度，投保人不管在哪家保险公司投保，只要条件相同，价格也基本相同。 最初的车险折扣系数是由国家统一规定实施的。

1995 年修订的《机动车辆保险条款》规定：一年无赔款，折扣率 10%；连续两年无赔款时，折扣率 15%；三年以上无赔款时，折扣率 20%。

1999 年，我国的车险费率折扣规则改为：无论连续无索赔时间多长，无索赔折扣优待一律为 10%。

### B.车险费率全面市场化

2001 年 10 月 1 日，车险产品费率改革试点正式启动，改革突破口选在广东省（包括深圳在内），车险费率由保险公司自主制订，监管部门审查备案。

广东省同一家保险公司，在不同城市可以实行不同的车险费率；在同一城市，各公司也可以实行不同的费率标准。

2002 年 10 月 28 日，我国对 1995 年颁布实施的保险法进行了修改，修改后的保险法规定保险公司可以自定保险条款费率。

2003 年 1 月 1 日，沿用多年的全国车险统一保险条款费率不复存在，车险费率全面市场化。各家保险公司开始自主开发厘订车险条款费率。

车险费率市场化前，国内车险基本是全行业盈利，但在 2003-2004 年的恶性竞争之下，全国车险两年连续亏损，“做得越多，亏得越

本文受北京工商大学青年教师科研启动基金项目资助

多”。

### C.车险费率逐步收紧

2006年，中国保险行业协会将车险条款和费率重新统一，同时为了遏制行业恶性竞争，监管部门还下达了车险优惠不得低于七折的“限折令”。

2006年7月1日，中国保险行业协会推出了包括车辆损失险和商业三者险的A、B、C三款商业车险产品，由中国人保、平安财险、太平洋财险等3家公司分别推出，其他保险公司可以选择三款中任一款。

至此，车险费率市场化告一段落。

### D.车险浮动费率试点

2009年9月出台的《北京地区机动车商业保险费率浮动方案》，规定自2010年1月1日起，在北京经营机动车商业保险的公司自主选择使用车险浮动费率。

2011年1月1日实施的《2011年度北京地区机动车商业保险费率浮动档次升降方案》，修改了按照连续没有发生赔款的年数等来确定浮动系数值的规定。

除北京外，深圳、厦门、江苏、大连等地也相继启动了车险浮动费率的试点工作。

### E.新一轮车险浮动费率改革

2012年3月8日，新一轮的车险条款费率改革方案出台，保监会发布《关于加强机动车辆商业保险条款费率管理的通知》（简称《通知》）。

《通知》规定，商业车险可以选择中国保险行业协会条款和费率，也可以在参考协会条款和费率的基础上，自主修订商业车险的条款和费率。

## Ⅲ. 我国车险浮动费率的实证分析

### A. 奖惩系统原理及评价因素

汽车保险奖惩系统（BMS, Bonus-Malus System），是依据风险在上一保险期的索赔记录来确定续保年度时应缴的保费。

如果被保险人在保险期限内有索赔，则在续保保费上给予一定的惩罚；如果被保险人在保险期限内没有索赔记录，则在续保时可以享受保费的折扣，给予一定的优待。

设BMS共有n个保费等级，一个完整的BMS包括三个要素：各个级别ci的保费水平πi (i=1,2,…,n)； 初始级别；转移规则，即依据历史赔案记录决定下一年所在折扣级别的规则。BMS体系可描述为一个马尔可夫链，转移规则可用转移概率来描述。

**1）基本的BMS模型**

基本BMS模型：只考虑上一年索赔次数的BMS。

被保险人的续期保费取决于他在上一年的保费等级和上一年的索赔次数，而与上一年以前的历史无关。

假设被保险人的索赔记录为一个马尔可夫链，若被保险人的索赔频率是稳定的（即被保险人的驾驶能力在一段时间内没有变化），则这个马尔可夫链是齐次的。

$T_k$：转移规则，$T_k(i)=j$：当索赔次数为$k$时，投保人将从保费级别$c_i$转移到保费级别$c_j$。

$T_k=(t_{ij}^{(k)})$，其中

$$t_{ij}^{(k)}=\begin{cases}1, & T_k(i)=j\\ 0, & T_k(i)\neq j\end{cases}$$

$M$：转移矩阵$(p_{ij})_{n\times n}$，$p_{ij}$：从保费级别$c_i$转移到保费级别$c_j$的一步转移概率。

$$p_{ij}=\Pr(Y_{t+1}=c_j\mid Y_t=c_i),$$

$$\sum_{j=0}^{n}p_{ij}=1,\quad i,j=0,1,2,...,n$$

$\pi^{(t)}$：时刻$t$各级别保单持有人的分布状况。

$$\pi^{(t)}=(\pi_1^{(t)},\pi_2^{(t)},\cdots,\pi_n^{(t)})$$

马尔夫夫链关系：$\pi^{(t+1)}=\pi^{(t)}\cdot M$

**2）BMS的稳态分布**

当时间$t\to\infty$时，由马氏链性质，各保费级别的保单分布比例将趋于稳定。

存在$\pi=(\pi_1,\pi_2,\cdots,\pi_n)$：稳定状态下的保单持有人的分布状况，满足：

$$\pi=\pi\cdot M,\quad \sum_i\pi_i=1$$

且有：$\lim\limits_{t\to\infty}\pi^{(t)}=\pi$。

**3）BMS的评价因素**

好的奖惩系统应具备如下条件：对投保人的逆向选择起到预测和抵制的作用；客观真实地评价每个被保险人的风险，并将风险大小通过保费水平体现出来。

评价BMS优劣的常用标准：

1. 稳定状态下的平均保费水平
2. 相对稳定平均水平
3. 对新投保人的隐性惩罚
4. 变异系数
5. 弹性
6. 最优期望自留额
7. 风险区分度

## B. 实证分析

根据我国 2007 年机动车商业保险行业基本条款 BMS，利用 BMS 评价指标对其进行实证分析。

**表 1. 机动车商业保险行业基本条款（2007）**

| 保费等级 | 内容 | 保费系数 |
|---|---|---|
| 1 | 连续 3 年没有发生赔款 | 0.7 |
| 2 | 连续 2 年没有发生赔款 | 0.8 |
| 3 | 上年没有发生赔款 | 0.9 |
| 4 | 新保或上年赔款次数在 3 次以下 | 1.0 |
| 5 | 上年发生 3 次赔款 | 1.1 |
| 6 | 上年发生 4 次赔款 | 1.2 |
| 7 | 上年发生 5 次及以上赔款 | 1.3 |

首先写出发生 0、1、2、3、4、5 及 5 次以上索赔时的转移规则（见表 2），进而得到转移概率矩阵 M。

**表 2. 转移规则**

| 保费等级 | 保费系数 | 一年后保费等级（按索赔次数分） | | | | |
|---|---|---|---|---|---|---|
| | | **0** | **1 或 2** | **3** | **4** | **≥5** |
| 1 | 0.7 | 1 | 4 | 5 | 6 | 7 |
| 2 | 0.8 | 1 | 4 | 5 | 6 | 7 |
| 3 | 0.9 | 2 | 4 | 5 | 6 | 7 |
| 4 | 1.0 | 3 | 4 | 5 | 6 | 7 |
| 5 | 1.1 | 3 | 4 | 5 | 6 | 7 |
| 6 | 1.2 | 3 | 4 | 5 | 6 | 7 |
| 7 | 1.3 | 3 | 4 | 5 | 6 | 7 |

转移概率矩阵：

$$
\begin{array}{cc}
 & \begin{array}{ccccccc} -30\% & -20\% & -10\% & 0\% & 10\% & 20\% & 30\% \end{array} \\
M = \begin{array}{c} -30\% \\ -20\% \\ -10\% \\ 0 \\ 10\% \\ 20\% \\ 30\% \end{array} &
\begin{pmatrix}
p_0 & 0 & 0 & p_1+p_2 & p_3 & p_4 & 1-\sum_{i=0}^{4} p_i \\
p_0 & 0 & 0 & p_1+p_2 & p_3 & p_4 & 1-\sum_{i=0}^{4} p_i \\
0 & p_0 & 0 & p_1+p_2 & p_3 & p_4 & 1-\sum_{i=0}^{4} p_i \\
0 & 0 & p_0 & p_1+p_2 & p_3 & p_4 & 1-\sum_{i=0}^{4} p_i \\
0 & 0 & p_0 & p_1+p_2 & p_3 & p_4 & 1-\sum_{i=0}^{4} p_i \\
0 & 0 & p_0 & p_1+p_2 & p_3 & p_4 & 1-\sum_{i=0}^{4} p_i \\
0 & 0 & p_0 & p_1+p_2 & p_3 & p_4 & 1-\sum_{i=0}^{4} p_i
\end{pmatrix}
\end{array}
$$

根据车险索赔次数样本数据进行拟合，估计出索赔次数概率。得到具体的转移概率矩阵。

$$
M = \begin{pmatrix}
0.77316039 & 0 & 0 & 0.20765098 & 0.01216693 & 0.00423828 & 0.00278342 \\
0.77316039 & 0 & 0 & 0.20765098 & 0.01216693 & 0.00423828 & 0.00278342 \\
0 & 0.77316039 & 0 & 0.20765098 & 0.01216693 & 0.00423828 & 0.00278342 \\
0 & 0 & 0.77316039 & 0.20765098 & 0.01216693 & 0.00423828 & 0.00278342 \\
0 & 0 & 0.77316039 & 0.20765098 & 0.01216693 & 0.00423828 & 0.00278342 \\
0 & 0 & 0.77316039 & 0.20765098 & 0.01216693 & 0.00423828 & 0.00278342 \\
0 & 0 & 0.77316039 & 0.20765098 & 0.01216693 & 0.00423828 & 0.00278342
\end{pmatrix}
$$

计算出稳态时各保费等级的分布比例（表 3）。

**表 3. 稳态时各保费等级的分布比例**

| | |
|---|---|
| $\pi_1$ | 0.46217748 |
| $\pi_2$ | 0.1355995 |
| $\pi_3$ | 0.1753834 |
| $\pi_4$ | 0.20765098 |
| $\pi_5$ | 0.01216693 |
| $\pi_6$ | 0.00423828 |
| $\pi_7$ | 0.00278342 |

计算 BMS 的评价指标。

1）稳定状态下平均保费水平

假设初始级别的保费为 100，则稳定状态下平均保费水平为 81.9588 元。

$$70\pi_1 + 80\pi_2 + 90\pi_3 + 100\pi_4 + 110\pi_5 + 120\pi_6 + 130\pi_7 = 81.9588(\text{元})$$

2）相对稳定状态水平 RSAL

反映了稳态时投保人在高折扣级别的集中程度，其值越小，说明投保人在高折扣级别越集中。

$$RSAL = \frac{\text{稳定平均水平} - \text{最低水平}}{\text{最高水平} - \text{最低水平}} = \frac{81.9588 - 70}{130 - 70} = 0.1993$$

3）对新投保人的隐性惩罚 ECL

反映了对新投保人的超额收费。

$$ECL = \frac{\text{进入时的保费} - \text{稳定保费水平}}{\text{稳定保费水平}} = \frac{100 - 81.9588}{81.9588} = 0.2201$$

4）变异系数

将第 i 年各折扣等级的概率分布与转移概率矩阵 M 相乘，得到第 i+1 年各折扣等级的概

率分布，计算变异系数，得到稳态时变异系数为 0.1580。

# Ⅳ.结论与建议

## A. 风险分级进一步细化

在推行车险费率浮动制时我们应多向国外借鉴，扩大风险因子的范围，充分考虑投保人的个人因素，调整车险保费收入内在结构，完善浮动费率的实施细则，建立综合考虑安全驾驶、客户忠诚度、无赔款优待等车险费率浮动因素的计算规则，实行差异化费率，达到保费与赢利同步增长的目的。

另外，我国幅员辽阔，各地区经济水平、地理环境、人口素质等影响风险水平的变量差异较大，因此要因地制宜，对不同地区应选择不同的风险分级变量，划分不同的组别，充分考虑各地区的差异性。

## B. 综合考虑各类因素

目前我国的机动车辆奖惩系统仅考虑索赔次数来调整后验保费，这会有失公平性与效率性。

浮动费率与以往的赔款次数相挂钩，存在有些被保险人出险次数多但理赔总金额少、有些被保险人虽然出险次数少但是理赔总金额很高的情况，难以形成良性的激励机制。从浮动费率促进车主提高驾车安全意识角度来说，不应笼统的按照赔款次数来确定浮动系数。

在厘定车险浮动费率应当参照国际做法，加入对索赔金额因素的考虑，选择合理的索赔次数和索赔金额的统计分布，这不仅对索赔金额小的投保人较为公平，也有利于保险公司对投保人进行正确的风险评估。

## C. 加大费率浮动的奖惩力度

我国车险的浮动费率对于奖惩两方面的力度都太温和。我国 2007 年交强险与商业车险费率上下浮动的最大幅度为 30%。相比国际数据，这是一个非常温和的浮动幅度。如德国、英国、日本、中国台湾地区的费率向下浮动幅度都达到甚至超过了基准费率的 50%，而对于出险者的惩罚力度达到了基准保费的一倍以上。温和的奖惩系统起不到充分的激励作用，也不利于费率与风险大小匹配的公平性原则。

我国需要制订严厉的惩罚与奖励费率，加大车险费率的浮动幅度，使得费率与风险相匹配，体现奖惩系统公平性的原则。这样一方面也可以鼓励被保险人用心开车，一方面可以在一定程度上规避车险的道德风险。

## D. 完善车险共享信息平台

现行我国车险信息平台的主要参与机构是保险行业协会、交管局以及经营车险业务的保险公司，信息平台的内容主要是以查询交通事故及理赔情况为主。

从长远考虑，车险信息平台应当加强与公安、交管、城管等部门的协作，通过多方位联合监管与资源共享构建一个大型的车险信息综合平台，这不仅能够提高投保人的防损意识，更有助于保险公司防范承保风险和道德风险。

在数据平台的建设上，应将车险数据在网上公开，做好后台的车险信息统计工作，对车险业务的出险情况进行详细的分类统计并分析，如不同年龄段、性别、婚姻状况、行车范围的出险概率等，为车险浮动费率的厘定提供精算基础。

# References

[1] Walhin J F,Paris J．Using Mixed Poisson Processes in Connection with Bonus－Malus System[J]．ASTIN Bulletin,1999,Vol．29(2):81－99．

[2] Albrecht P．On Some Statistical Methods Connected with The Mixed Poisson Distribution[J]．Scandinavian Actuarial Jour-nal,1982:1－14．

[3] Albrecht P．Laplace Transforms,Mellin Transforms and Mixed Poisson Processes[J]．Scandinavian Actuarial Journal,1984:58－64．

[4] Gossiaux A M,Lemaire J．Me′thodes d′ajustement de Distributions de Sinistres[J]．Bulletin of the Swiss Association of Actuar-ies,1981:87－95．

[5] Islam M,Consul P．A Probabilistic Model for Automobile Claims[J]．Bulletin of the Swiss Association of Actuaries,1992:85－93．

[6] Denuit M．A New Distribution of Poisson－Type for the Number of Claims[J]．ASTIN Bulletin,1997,27(2):229－242．

[7] Meng Shengwang，Yuan Wei．Accounting for individual over－dispersion in a bonus－malus automobile insurance syste[J]．ASTINBulletin,1999,29(2):327－337．

[8] Mengsheng Wang, Yuan Wei. Automobile insurance actuarial model and its application [J]. Mathematical statistics and management. 2001,20 (3) :60-65.
孟生旺，袁卫．汽车保险的精算模型及其应用[J]．数理统计与管理．2001,20(3):60-65．

[9] Meng Shengwang Insurance Pricing: Experience Rating System [M], China Financial Publishing House, 2004.
孟生旺. 保险定价：经验估费系统研究[M]. 中国金融出版社，2004.

[10] Caoming Hui, Miao Mingyue. Floating Rate System of Automobile third party liability insurance [J] China's urban economy, 2003, (10): 47 -49.
曹明辉, 缪明月. 机动车第三者责任险的浮动费率制度研究[J]. 中国城市经济，2003,(10):47-49.

[11] Di Na. BMS system harshness Comparison of China’s automobile insurance [J]. Statistical Research, 2005, (8) :48-52.
邸娜. 中国汽车保险奖惩系统的严厉性比较[J]. 统计研究，2005,(8):48-52.

[12] Shao Xueqing. Automobile insurance, Bonus-Malus System: BMS system [M], China Economic Publishing House, 2006.
邵学清. 机动车辆保险的奖惩机制－BMS 系统[M]. 中国经济出版社，2006.

[13] Xia Dong, Xiao Yugu, Meng Shengwang. Evaluation on China's automobile insurance BMS system [J]. Statistics and Decision, 2008, (15) :53-55.

夏冬，肖宇谷，孟生旺. 中国现行汽车保险奖惩系统的评　　　价[J]. 统计与决策，2008,(15):53-55.

# 我国车险浮动费率的实证研究

吉彩红

经济学院，北京工商大学，北京，中国，100048

**摘　要**：近年来，随着我国汽车产业快速发展及机动车辆交强险的实施，我国车险业务发展迅速，保费收入稳步增长。本文总结了我国车险费率改革的历史与现状，通过对我国的车险浮动费率进行实证分析，揭示了我国目前车险浮动费率中存在的问题，最后对我国车险浮动费率提出一些发展建议。

**关键词**：车险；浮动费率；奖惩系统；车险费率改革

# Insurability of Catastrophe Risk

TIAN Ling [1], XING Hongyang[1], GAO Jun [2]
[1] Economics and Management School, Wuhan University, Wuhan, China, 430072
[2] School of Economics and Management, Tsinghua University, Beijing, China, 100084

**Abstract:** In this paper, we discuss how the boundary of insurability for the catastrophe risk and give some advices to expand the boundary. Considering the facts of the decrease of catastrophe insurance relative to the increasing insurance market in the whole world, there are factors which have a negative influence on the insurance of catastrophe risk, such as ambiguity, low probability and large loss, hardness to pool the risk, constraits of solvency, the business targets and principles of the insurer, etc. To analysis the boundary of insurability for the catastrophe risk, we introduce the ruin theory and conclude that the boundary or the worst catastrophe risk to be insured is detremined by the premium loading, the insurer's financial solvency, as well as the risk aversion. To expand the bounbary of the insurability for catastrophe risk, we should lessen the ambiguity, strenthen the finacial ability, as well as reduce the loading rate.
**Keywords:** catastrophe riskst; insurability; ruin theory; boudary expansion for the insurability

## Ⅰ.引言

可保性是巨灾风险能否通过保险市场来转移的基础。一般来说，如果某种风险是不可保的，就意味着保险市场无法开发出能为保险公司所接受的保险产品来转移该风险；同时，对风险可保性特征进行分析，也是相关保险产品设计（包括承保条件、费率厘定、赔付约定以及其他相关条款）的基础。巨灾风险的可保性也就成为了巨灾保险的先决条件，研究巨灾风险的可保性也就显得尤为重要。

从国内外巨灾保险的现实情况来看，巨灾风险的可保性面临着严酷的现实考验。2002-2006 年间，全球范围内巨灾平均承保率为 35.1%，而 2007-2011 年则萎缩至 26.8%。而我国的巨灾保险覆盖率则更低：1998 年特大洪灾直接经济损失 2484 亿元，保险赔付 33.5 亿元；2008 年汶川地震直接经济损失达 8451 亿元，而保险赔付仅 18 亿。很显然，在经历了安德鲁飓风所导致的 15 家财险公司破产后，从保险公司到政府，从业界到学术界，人们开始重新审视巨灾风险的可保性。那么，1）巨灾风险究竟具备可保性吗？或者说哪些风险具备可保性呢？2）巨灾风险的可保性的理论基础是什么呢？3）巨灾风险的可保性边界是什么？4）通过何种措施可以扩大巨灾风险的可保性边界呢？5）结合我国特殊的国情和保险市场发展状况，我们应该如何扩大巨灾风险的可保性边界，以发挥保险市场的在巨灾风险方面的优化配置功能呢？

对于第一个问题，本文从风险可保性的定义出发，总结和梳理现有关于风险可保性的相关研究，重新考察风险可保性的内涵和前提条件，并结合保险市场的发展，着力说明风险可保性的动态性特征。在此基础上，结合巨灾风险特征分析，重点分析巨灾风险的可保性所面临的一系列问题。对于第二和第三个问题，本文结合巨灾风险的特征，将风险可保性的理论基础—破产理论应用到巨灾风险的可保性分析上来，并利用相关的结论推演出巨灾风险的可保性边界。对于第四个问题，本文则结合现有研究，审视各种措施对巨灾风险可保性边界的拓展程度，以图为我国巨灾保险制度建设提供理论参考。

## Ⅱ.巨灾风险可保性的内涵

商业保险运行的一个基本范围是：只有在可保性范围内，保险业才能对风险进行风险聚集（Risk Pooling）和风险转移（Risk Transfer）（Borch, et al., 1990）。因此，发挥保险市场对风险的优化配置功能，我们首先需要对巨灾风险的可保性有一个全面综合的认识，包括：1、什么是可保性风险，可保性风险具有哪些先决条件？2、巨灾风险是可保的吗？

所谓可保性风险，指的是可被保险人所接受的风险，也即可以向保险人转移的风险（魏华林，林宝清，2006）。更具体地说，保险人在既定条件约束下，根据保险精算原理，将那

些具有同质或相似风险汇集在一起，通过收取合理保费筹措保险基金来为风险个体转移风险，并实现保险人的经营目标。满足保险人要求的这些同质风险即为可保风险。这些约束条件包括两个方面：一是保险人内部约束，包括其偿付能力、认知能力以及管理能力等；二是保险人外部约束，包括相关法律法规、行业（市场）规范以及政府监管等。

从这个定义出发可以发现，风险可保性的内涵包括三个方面：第一，风险可保性是从保险人的角度来定义的，即风险可保性的主体特征；[1]第二，风险可保性与保险人所处的外部环境密切相关，尤其是相关制度与规范，即风险可保性的制度特征[2]；第三，风险可保性是动态变化的，即风险可保性的时间特征，由主体特征和制度特征的动态变化所决定的。主体特征是风险可保性的核心和基础，但风险可保性的动态性（时间特征）和社会性（制度特征）对巨灾风险的可保性特征都产生了重要的影响，这三个特征共同决定了风险可保性的两个先决条件：一是保险人的风险识别能力，指保险人能否预计风险发生的频度和强度；二是保险人能否对具体风险厘定费率（Giarini，1995；Freeman and Kunreuther，2003）。

然而，对于巨灾风险而言，巨灾风险本身的不可预测性很难满足风险可保性的第一个先决条件，而风险标的本身随机特征、保险人的偿付能力和管理能力等方面的局限性则限制了保险人的定价能力。

具体而言，巨灾风险至少存在着以下五个方面的问题影响其可保性：

1．巨灾风险的模糊性。风险模糊性（ambiguity）指的是囿于认知能力，保险人无法度量风险发生的客观概率和损失分布。巨灾风险的模糊性尤为严重，是人们无法对巨灾保险定价的主要原因之一。但是，巨灾风险的模糊性并不必然导致巨灾风险是不可保的，原因有三：第一，随着科学技术水平的提高，人们对巨灾风险有了更深的理解，不断发展的巨灾模型（Catastrophe Model）弱化了巨灾风险的模糊性（Grossi and Kunreuther，2005）；第二，保险人对其保险产品进行定价时，往往依据的是主观概率来厘定费率；第三，只要保险人对风险模糊性厌恶程度（ambiguity aversion）低于投保人，那么偏好差异可能会致使模糊性风险可能是可保的（Giboa and Schmeidler，1989；Kunreuther，et al.，1993）。

2．巨灾风险的低概率和高损失。一般来说，风险事故发生的概率越低，其可保性越小，即可保性风险存在门槛概率(threshold probability)(Kunreuther，1996)。然而，Eeckhoudt 和 Gollier(1996)和 Gollier(1997)则认为风险厌恶者更倾向于为低概率事件购买保险。巨灾风险事故发生的高损失是导致保险公司惧怕破产而不愿意提供巨灾保险产品的主要原因之一，也就是说，保险人对风险的厌恶产生了巨灾风险的可保性问题。但是，理论上来说，只要交易成本足够低、保险人的风险厌恶程度低于投保人，或者存在着完善的再保险市场和资本市场来转移或者分散风险，那么巨灾风险也可能是可保的。

3．巨灾风险无法聚合。保险人之所以能够提供风险的一个主要原因在于其能够聚合足够多的同质独立风险标的，运用大数定理降低保险人经营的不确定性，从而能够厘定保险费率。然而，巨灾风险事故发生的低概率使得保险人无法聚合足够多的风险标的，无法运用大数定理厘定保险费率。不过通过巨灾风险跨区域分散（Jaffee，2006；Cummins，2006）、巨灾风险跨时分散和长期保险（Jaffee，et. al，2010；Kunreuther and Michel‐Kerjan，2009）等方法，可以有效提高风险事故发生的概率，削弱巨灾风险难以聚合对其可保性的不利影响。

4．保险人的偿付能力\财务能力。根据精算破产理论，保险人的偿付能力(或者财务能力)是风险可保性边界的重要影响因素，保险人财务能力越强，在稳健经营原则下，其能够承保的风险范围就越广。由于集中、大范围以及正相关的损失，巨灾往往会导致保险人的巨额赔款支出，致使保险人现金流断裂甚至破产，因此也对保险人的财务能力（偿付能力）提出了更高的要求（石兴，2011）。

[1] Courbage 和 Liedtke（2003）从投保人的角度对可保风险进行了定义，即当一个消费者想要避免某一风险可能造成的损失时，且能够在私人保险市场中有效转移这一风险，那么该风险是可保的。实际上，该定义一个关键是保险市场能有效转移这一风险，与风险可保性的主体特征并无冲突。

[2] 当前我国在关于财产保险的法规中将巨灾列为保险公司的免责事项，这极大地影响了我国巨灾风险的可保性。

5．保险人的管理能力及经营原则。保险人管理能力及其经营原则对通过保费附加对风险可保性产生影响主要体现在对的影响上。首先，交易成本的增加会提高保费附加率；其次，保险人本身对风险的管理能力和偏好差异会导致不同的安全附加，同样会影响保费附加率。根据 Arrow(1965)和 Mossin (1968)，只要存在着保费附加，必然会导致不完全保险，保费附加越高，保险的免赔额就会越高。因此，高交易成本和保险人的风险厌恶可能会带来巨灾风险的可保性问题(Gollier，1997)。此外，保险人越高的经营稳健性要求意味着越低破产概率，也会影响其对其承包范围。

上述五个方面的问题都会导致巨灾风险存在着较为严重的可保性问题，而且这五个因素并非孤立地对巨灾风险可保性产生影响，要分析和评估上述因素的综合影响，就需要理解巨灾风险可保性的理论基础，探索巨灾风险的可保性边界。

# III.巨灾风险可保性理论基础

保险人对某种风险承保的最低要求是尽可能地避免由于理赔支付而导致其资金链断裂，即尽量保证低的破产概率。一般来说，保险人先设定一个破产概率，然后选择具有以下特征的风险标的承保，这些风险标的的理赔支出可能导致保险人破产的概率低于其设定的破产概率，此即为保险人维持其稳定运营的最低要求。运用精算理论计算出巨灾风险的破产概率，那些破产概率等于保险人最高破产概率的巨灾风险便构成了巨灾风险可保性的边界。

在具体计算巨灾风险破产概率的时候，我们并不需要计算个体风险的破产概率，而是借鉴 Bühlmann（1985）关于保费计算的上下（top-down）方法，着眼于整个保单组合必须的破产概率，即基于局和风险模型来计算巨灾风险的破产概率。这样的做的一个好处是我们无需考虑保险标的之间的相关性问题，更有利于计算出保险人能够承保的巨灾风险的随机特征。

## A．保险人盈余过程

假设保险人的盈余过程如下

$$U_t = u + ct - S_t \qquad (1)$$

其中，

$U_t$ = 保险人在 $t$ 时刻的资本金；

$u = U(0)$ = 保险人的初始资本金；

$c$ = 单位时间的保费收入；

$S_t = \sum_{n=1}^{N_t} X_n$ = 保险人从初始时刻到 $t$ 时刻的赔付总额，即 $S_t$ 是一个复合分布；

$N_t$ = 从初始时刻到 $t$ 时刻巨灾发生的次数，在这里，我们假设其服从强度为 $\lambda(\lambda>0)$ 的泊松过程，即 $N_t$ 的概率分布函数为

$$\Pr(N_t = k) = \frac{(\lambda t)^k}{k!} e^{-\lambda t} \qquad (2)$$

由(2)可知，$\mathrm{E}(N_t) = \lambda t$，因此，我们也可以通过 $\lambda$ 来表示巨灾的严重程度，$\lambda$ 越小意味着巨灾越严重。譬如，百年一遇的巨灾可以意味着着 $\lambda \times 100 = 1$，即 $\lambda = 0.01$，同样，五十年一遇的巨灾意味着 $\lambda = 0.02$。

$X_n$ = 第 $n$ 个理赔的赔付额，我们假设 $X_n$ 服从参数为 $\gamma(\gamma>0)$ 的指数分布，即 $X_n$ 的密度函数为

$$f(x) = \begin{cases} \gamma e^{-\gamma x}, & x \in [0, +\infty) \\ 0, & x \in (-\infty, 0) \end{cases} \qquad (3)$$

由(3)可知，巨灾所导致的赔付额的期望值为

$$\mathrm{E}(X) = \int_0^\infty x\gamma e^{-\gamma x} dx = 1/\gamma \qquad (4)$$

一般来说，巨灾越严重，那么赔付额的期望值就越高，因此，我们可以认为 $\gamma$ 是 $\lambda$ 的函数，且有

$$\frac{\partial \gamma(\lambda)}{\partial \lambda} > 0 \qquad (5)$$

保险人的保费收入 $ct$ 由公平保费和安全附加保费组成，令安全附加比率为 $\pi$，则有

$$\begin{aligned} ct &= (1+\pi)\mathrm{E}(S_t) = (1+\pi)\mathrm{E}\left[\mathrm{E}(S_t \mid N_t)\right] \\ &= (1+\pi)\sum_{k=1}^{\infty}\mathrm{E}\left[\left(\sum_{n=1}^{k} X_n \mid N_t = k\right)\Pr(N_t = k)\right] \\ &= (1+\pi)\sum_{k=1}^{\infty} k\mathrm{E}(X)\Pr(N_t = k) \\ &= (1+\pi)\lambda t/\gamma \end{aligned}$$

即

$$c = (1+\pi)\lambda/\gamma \qquad (6)$$

图 1 描述了上述巨灾所导致的保险人盈余过程的一个典型实现。随机变量 $T_i$ 表示第 $i$ 次巨灾发生的时刻。在没有巨灾时，保险人资本金以 $c$ 单位的速度递增，即图 1 中各斜线的斜率为 $c$。巨灾发生时，保险人的资本金则会因理赔支付而减少，减少额为理赔支付额。图 1 中，前三次巨灾所导致的理赔总额小于初始资本金与总保费收入之和，保险人仍处于稳定经

营状态中。但第四次巨灾的发生使 $X_1+X_2+X_3+X_4>u+cT_4$，即 $U_{T4}<0$，保险人破产。

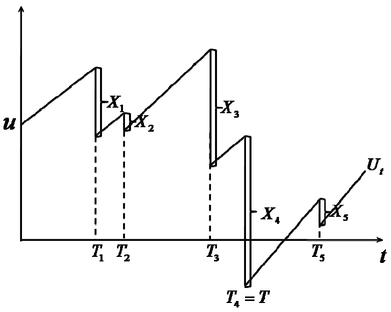



**图 1. 保险人盈余过程 $U_t$ 的一个实现形式**

## B. 调节系数 $R$ 与破产概率 $\Psi$

与其他盈利性机构一样，保险人（这里指的是商业保险公司）以利润最大化为目标。但同时，保险人还要确保其偿付能力以稳定经营和利润目标保障，并要求这些指标偏离其预期值的概率低于某一水平，即

$$\psi=\Pr\left[U_t<0,t\in[0,\infty)\right]<q \qquad (7)$$

为了计算破产概率 $\psi$，破产理论引入了调节系数，从而得出 $\psi$ 的上界。根据 Lundberg 不等式，可知破产概率的上界为[3]

$$\psi\le e^{-Ru} \qquad (8)$$

其中，$R$ 为调节系数。实际上，$R$ 也衡量了保险人的风险，即 $R$ 越大，保险人的破产概率 $\Psi$ 越小。

根据破产理论，调节系数 $R$ 是以下关于 $r$ 的方程的正数解[4]

$$\lambda+cr=\lambda M_X\left(r\right) \qquad (9)$$

其中 $M_X\left(r\right)$ 为单次理赔额 $X$ 的矩母函数。

结合式(3)、(6)和(9)，我们可得调节系数 $R$ 为

$$R=\frac{\gamma\pi}{1+\pi} \qquad (10)$$

将式(10)代入式(8)可得破产概率满足

$$\psi\le e^{-\gamma\pi u/(1+\pi)} \qquad (11)$$

由于破产概率 $q$ 是保险人能忍受的最高破产概率，因此，我们可以将 $e^{-Ru}=q$ 作为巨灾风险的可保性边界[5]，那些致使 $e^{-Ru}\ge q$ 的巨灾风险都是不可保风险，而那些满足 $e^{-Ru}<q$ 的风险则是可保风险。由于结合式(10)，我们可以将巨灾风险的可保性边界 $\underline{\lambda}$ 表述为

$$\gamma\left(\underline{\lambda}\right)=\left(1+\frac{1}{\pi}\right)\times\frac{1}{u}\times\left(-\ln q\right) \qquad (12)$$

巨灾风险可保性集合 $\Phi$ 为

$$\Phi=\left\{\lambda:\lambda>\underline{\lambda}\right\} \qquad (13)$$

式 (13) 表明，巨灾风险的可保性边界（$\underline{\lambda}$）越小，保险人可以承保的巨灾风险的范围就越大。根据式(5)和(12)，巨灾风险的可保性边界受保费附加 $\pi$、保险人初始资本金 $u$ 及其能忍受的最高破产概率 $q$ 等因素的影响：保费附加越高、保险人初始资本金 $u$ 越大、保险人能忍受的最高破产概率 $q$ 越高，则巨灾风险的可保性边界 $\underline{\lambda}$ 越小，保险人能承保的巨灾风险的范围就越大。

# Ⅳ. 巨灾风险可保性边界的拓展：政策与建议

按照可保性边界的分析，结合文中第二部分关于影响巨灾风险可保性因素的分析，我们可以采取一系列的措施来拓展巨灾风险的可保性边界。

在我们关于巨灾风险边界的分析中，忽略掉了一个至关重要的问题：我们假定巨灾风险是可测的，即 $\lambda$ 和 $\gamma\left(\lambda\right)$ 是事先知道的。但一个现实的问题是，我们无法确切地获知 $\lambda$ 的具体数值和 $\gamma\left(\lambda\right)$ 的具体形式，即存在着风险模糊性。在前面的分析中，我们认为 $\gamma$ 会随着衡量巨灾风险程度的参数 $\lambda$ 的增加而增加。但是，$\gamma$ 还与风险标的的抗灾能力和经济总量和分布状况密切相关：风险标的的抗灾能力越强，巨灾期望损失越小，$\gamma$ 就越大；经济发展水平越高，经济总量越大、在地理上越集中，巨灾期望损失越大。因此，通过加深对巨灾的认识、强化风险标的的抗灾性以及优化经济资源在地里上的分布都有助于保险人扩大巨灾风险的承保范围。此外，根据 Giboa 和 Schmeidler（1989），甄别出保险人和投保人之间的风险模糊性厌恶差异也有助于扩大巨灾风险的承保范围。

根据式(13)拓展巨灾风险的承保范围的关键在于如何降低其可保性边界 $\underline{\lambda}$。而根据式(12)，提高安全附加 $\pi$ 和初始资本金 $u$ 均能有

---

[3] Lundberg 不等式的证明具体请参考相关文献，譬如，Modern Actuarial Risk Theory（Kaas，et al.，2001）。

[4] 具体证明请参 Insurance Risk and Ruin（Dickson，2005）。

[5] 实际上，破产理论表明，当初始资本金 $u$ 越大，$\Psi$ 就越趋近 $e^{-Ru}$，在实务中 $e^{-Ru}$ 被当做破产概率的近似值。

效降低$\lambda$。

提高安全附加$\pi$是把双刃剑：一方面安全附加的提高必然会增强保险人的偿付能力，提高巨灾风险的承保范围；另一方面，安全附加的提高势必会导致保费的增加，即风险价格的提高，价格的提高势必会降低投保人的购买意愿，压抑巨灾保险的需求。因此，一个较为合理的方案是公共财政给予巨灾保险保费补贴，这样既不会削弱投保人购买巨灾保险的意愿，同时会增强保险人的偿付能力，扩大了巨灾风险的可保性边界。

同时，降低交易成本也可以扩大巨灾风险的可保性范围。降低交易成本从另外一个角度上来说也可以说是提高了保险人的保费收入，类似于提高了保费附加$\pi$，扩大了巨灾风险的可保性边界和保险人对巨灾风险的承保范围。

通过提高初始资本金$u$实际上是与保险人的偿付能力紧密结合在一起的。从图 1 中可以看出，虽然保险人在$T_4$时刻破产了，但是在$T_5$时刻其资本盈余则是正的，这就意味着只要保险人有丰富的融资渠道，放松保险人的资本约束均可以拓展巨灾风险的可保性边界，譬如建立巨灾债券来为保险公司融资就可以切实有效地扩大保险人的承保范围。

此外，通过再保险以及设计出合理的保险契约也能扩大保险人的承保范围。通过再保险将巨灾风险部分转移给再保险公司，或者采取分保或共保的方式均能有效地降低巨灾给保险人带来的期望损失，类似于提高了$\lambda$，能实际有效地扩大保险人的承保范围。

# References

[1] Arrow, K. J. , "Uncertainty and the welfare economics of medical care: reply (the implications of transaction costs and adjustment lags)", The American Economic Review, 1965, 55(1/2), 154－158.

[2] Bühlmann , "premium calculation from top down", ASTIN Bulletin, 1985, (15), 89－101.

[3] Courbage, C. and P. M. Liedtke , "On insurability, its limits and extensions", Insurance research and practice, 2003, 18(2), 44－49.

[4] Cummins, J. D. , "Should the government provide insurance for catastrophes?", Federal Reserve Bank of St. Louis Review, 2006, 88(4), 337－379.

[5] Dickson, D. C. M. , Insurance Risk and Ruin. Cambridge University Press, 2005.

[6] Eeckhoudt, L. , C. Gollier and H. Schlesinger , "Changes in background risk and risk taking behavior", Econometrica, 1996, 64(3), 683－689.

[7] Freeman, P. K. and H. C. Kunreuther , "Insurability and Environmental Risks", The Law and Economics of the Environment, Edward Elgar, 2003.

[8] Giarini, O. , "Insurability and the economic relevance of insurance: a historical economic perspective", The Geneva Papers on Risk and Insurance, 1995, (77).

[9] Gilboa, I. and D. Schmeidler , "Maxmin expected utility with non-unique prior", Journal of mathematical economics, 1989, 18(2), 141－153.

[10] Gollier, C. , "About the insurability of catastrophic risks", Geneva Papers on Risk and Insurance, 1997, 83177－186.

[11] Grossi, P. and C. C. Patel , Catastrophe modeling: A new approach to managing risk. Springer Verlag, 2005.

[12] Jaffee, D. M. , "WHY DO PRIVATE MARKETS FOR CATASTROPHE INSURANCE FAIL?", Federal Reserve Bank of St. Louis Review, 2006, 88(4), 381－385.

[13] Jaffee, D. , H. Kunreuther and E. Michel-Kerjan , "Long-Term Property Insurance", Journal of Insurance Regulation, 2010, 29(07), 167－187.

[14] Kass, R. , M. Goovaerts , J. Dhaene and M. Denuit , Modern Actuarial Risk Theory. Kluwer Academic Publishers, 2001.

[15] Kunreuther, H. , "Mitigating disaster losses through insurance", Journal of risk and Uncertainty, 1996, 12(2), 171－187.

[16] Kunreuther, H. , E. J. Johnson , J. Hershey and J. Meszaros , "Framing, probability distortions, and insurance decisions", Journal of risk and uncertainty, 1993, 7(1), 35－51.

[17] Kunreuther, H. and E. Michel-Kerjan , At war with the weather: Managing large-scale risks in a new era of catastrophes. The MIT Press, 2009.

[18] Mossin, J. , "Aspects of rational insurance purchasing", The Journal of Political Economy, 1968, 76(4), 553－568.

[19] Borch, K.H., Aase, K.K, and Sandmo, A., Economics of Insurance, the North-Holland Press, 1999.

[20] Shi, Xing, “The optimization of insurability for the catastrophe risks”, China Insurance，2011, 12, 8-18.
石兴，“自然灾害巨灾风险可保性之优化研究”,《中国保险》，2011年第12期，第8－18页。

[21] Wei, Hualin and Lin, Baoqing, The Insurance, China Higher Education Press, 2006.
魏华林、林宝清,《保险学》。高等教育出版社，2006年。

# 巨灾风险的可保性问题研究

田 玲[1]，邢宏洋[1]，高俊[2]
[1]经济与管理学院，武汉大学，武汉，中国，430072
[2]经济管理学院，清华大学，北京，中国，100084

**摘 要**：本文以近年来巨灾保险相对萎缩的现实为背景，通过界定风险可保性来分析巨灾风险的可保性内涵以及影响巨灾风险可保性的因素。在此基础上，本文基于破产理论找出了巨灾风险的可保性边界，并给出了拓展巨灾风险可保性边界的政策建议。本文认为，巨灾风险的模糊性、低频高损失、难以聚合以及保险人的偿付能力、管理能力和经营目标等因素都可能会影响巨灾风险的可保性。具体而言，巨灾风险的可保性边界主要由保险人的初始资本金和保费附加共同决定，初始资本金越大、保费附加越高，巨灾风险的可保性边界就越宽，保险人的承保范围就越大。因此，本文认为，通过增强风险标的的抗灾能力、提高保险人对巨灾风险认识、提高保险人的偿付能力、降低交易成本、对巨灾保险进行保费补贴、通过再保险市场转移风险、分保、共保、以及通过资本市场对巨灾风险进行融资均有助于扩大巨灾风险的可保性范围。

**关键词**：巨灾风险；可保性；破产理论；可保性边界拓展

# Main Behavior and Analysis on Cause of Market Failure in Fishery Insurance in China

LIU Haiying, JIA Xianfei, TONG Chunfen
School of Politics and Law, Ocean University of China, Qingdao, China, 266000

**Abstract:** Since China's reform and opening up, China has established a new policy on the development of fishery and the fishery has stepped into a fast-developing period. As an effective mechanism of managing and spreading fishery risk, fishery insurance has drawn more and more attentions under the condition of socialist market economy. This paper start from the basic productive features of fishery, deeply research and analysis the main behavior and the caused of market failure in fishery insurance. And based on the experiments about marine fishery policy insurance, this thesis proposes the strategies to perfect fishery insurance market in order to provide a theoretical basis and technical reference for sustainable development of fishery insurance in China.

**Key words:** Fishery insurance; Market failure; The demand of fishery insurance; The supply of fishery insurance

## Ⅰ.引言

渔业伴随人类的出现而出现，历史悠久，我国历来就是渔业大国，改革开放以后，我国确立了“以养为主，养殖、捕捞、加工并举，因地制宜，各有侧重”的发展方针，渔业进入发展的黄金时期，据《中国渔业年鉴》统计，渔业总产值在 1978 年仅有 22.1 亿元人民币（按当年价格计算），农业总产值达 1397 亿元，渔业总产值仅占农业总产值的 1.58%，而到 2008 年渔业总产值已经猛增到了 11445.13 亿元，全国农业总产值为 58002.15 亿元，约占农业总产值的 9.32%[1]。据有关报道, 2011 年全社会渔业经济总产值增加到 15005.01 亿元[2]。渔业的迅速发展为人民提供了食品，也为国民经济的发展提供了原材料，在大农业和我国的国民经济中占有相当重要的地位。同时，渔业又是世界上公认的高风险行业，我国不仅是渔业大国，也是世界上渔业自然灾害最为严重的国家之一，据统计，渔业自然灾害给渔业带来的损失每年高达 160 亿元, 我国每年渔业的死亡率远远超出煤矿、铁路、建筑等行业，成为名副其实的高危行业。渔业风险的存在，影响了渔业的健康稳定持续发展，客观上需要建立一种风险分散机制，而渔业保险作为一种专业化、市场化的风险分散和管理机制，在促进渔业发展，保障渔民收入和生活，维护社会稳定等方面发挥着举足轻重的作用。

## Ⅱ. 渔业风险的应对机制—渔业保险

### A. 风险与渔业风险

对于风险，国内外尚无统一明确的定义，国外风险管理学派最早对风险进行系统研究的是美国学者威雷特博士（1901），他在其博士论文《风险及保险经济理论》中将风险定义为：“所谓风险就是关于不愿发生的事件发生的不确定性之客观体现”，国内学者孙祁祥（1996）在其著作《保险学》中将风险界定为：“风险是一种客观存在的、损失发生具有不确定性的状态。”结合学者们的阐述，可将风险归纳为损失的不确定。

渔业开发利用的是海洋和内陆水域游动性生物资源，这些生物资源的生产活动环境较陆地而言有更大的不稳定性。渔业具有对于水体环境的高度依赖性、水体的隐蔽性、生产的季节性、鲜活水产品的易腐性等特性，因此其面临的风险也是多方面的。渔业风险是指在渔业生产和流通过程中，由于事先无法预料的各种因素的影响，使经营者的实际收益与预期收益发生背离的可能性[3]。渔业不仅面临着自然风险，如台风、赤潮、洪涝、干旱等风险，还面临着人为风险，如养殖业中的人为投毒，渔民为争夺渔业资源而发生的械斗，远洋捕捞业中的渔船碰撞、海盗袭击、外国扣押等，并且现在还面临着海洋生态环境恶化、海洋渔业资源的锐减等风险。

### B. 渔业保险

渔业风险的存在，给我国渔业发展带来巨大的损失，极大地制约了我国渔业的健康稳定发展，渔业保险作为分散和管理渔业风险的一种有效机制应运而生。我国的渔业保险最早出现于 1950 年，而后停办，1982 年恢复试办，

资助信息：本文系国家社会科学基金项目“政策转移框架下我国海洋渔业转型的运行机制研究”（项目编号 10BGL080）的阶段性成果。

当时中国人民保险公司(PICC)开办了农业保险项目的水产养殖险，同时颁布了《国内渔船保险条例》（试行）使得渔船保险和渔业捕捞的商业保险在我国逐步开展开来，九十年代以前，渔业保险的业务主要是靠中国人民保险公司独家经营，直到 1994 年中国渔船船东互保协会（后更名为中国渔业互保协会）成立，开始经营渔业互助保险。近年来，我国政府加大对渔业保险的支持力度，政策性渔业保险在我国逐渐发展起来。

葛光华（1997）对渔业保险作了如下定义：“渔业保险是指由保险机构为渔业生产者在水产养殖及捕捞作业生产的过程中，对遭受自然灾害和意外事故所造成的经济损失提供经济保障的一种保险。[4]”渔业保险属于保险的一种，但是由于渔业风险的高发性、系统性和巨灾性的特征，导致我国渔业保险的发展历程坎坷。我国渔业保险自从八十年代恢复试办以来，经历了商业性渔业保险、渔业互助保险、政策性渔业保险三个阶段,但始终没有形成稳定的渔业保险保障模式，到目前为止主要还是商业性渔业保险和中国渔业互保协会这两种形式。由于政策性渔业保险主要不是依靠价格机制和市场竞争来发展业务，而是靠国家政策和政府行政力量来发展壮大[4]，目前仍处试点阶段，尚未在全国推广。

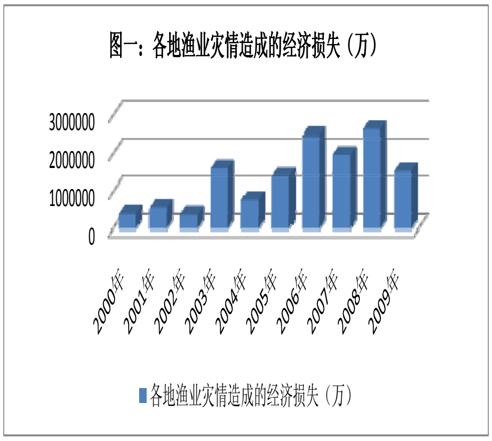
## III. 我国渔业保险市场失灵的表现

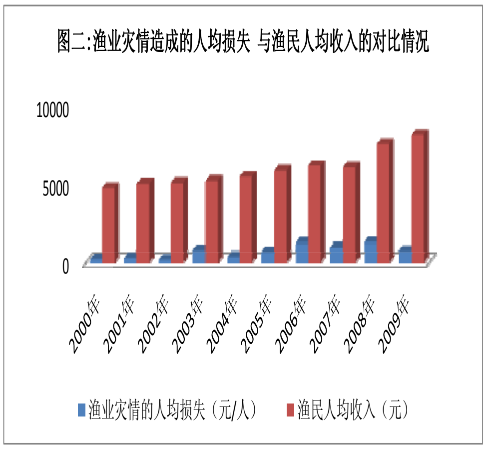
市场机制在资源配置中应起基础性作用，但在某些领域，这一作用却并不能得到充分发挥，导致在配置资源方面的失效。我国渔业保险市场不能充分提供渔业保险，对渔业保险资源进行优化配置，商业性保险公司经营渔业保险的失败，便是最好的例证。我国渔业保险存在市场失灵，其突出表现是供给有限，有效需求不旺，即供需两不旺。

### A. 渔业保险需求不旺

经济学中的需求是指，在一定的时期，在既定的价格水平下，消费者愿意并且能够购买的商品数量，即需求包含购买的欲望和能力两方面，借鉴冯登艳（2009）在其著作《新农村建设中的农业保险问题》中对农业保险需求的阐述，可将渔业保险的需求分为自然需求和有效需求两方面。自然需求就是指纯粹由渔业风险决定的渔业风险保障客观自然的需求，有效需求是则是指指渔民愿意购买，且有货币支付能力的购买需求。

当前我国渔业保险市场中自然需求旺盛，有效需求不足，由图一（来源：《中国渔业年鉴（2001—2010）》整理计算而成。）可看出我国渔业灾害造成的经济损失总体上呈递增趋势，从图二（来源：同图一）渔业灾害的人均损失与渔民人均收入的对比情况可得出，渔民面临的风险总体上呈上升趋势。由于渔业风险的高发性、系统性和巨灾性的特点，渔民都希望通过渔业保险来规避渔业风险，渔业保险存在着巨大的需求空间，但这仅仅是自然需求即购买的意愿，还无法转化为有效需求即有货币支付能力的购买需求。我国渔业保险需求不旺，主要表现在以下两个方面。



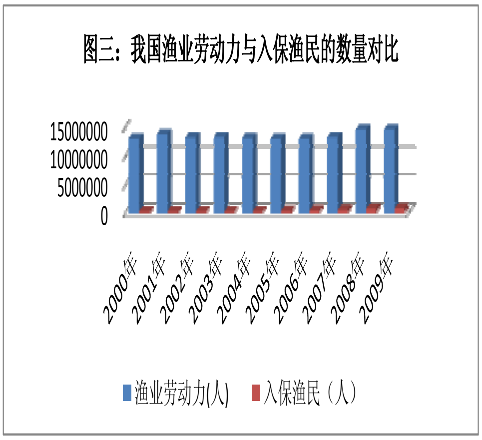



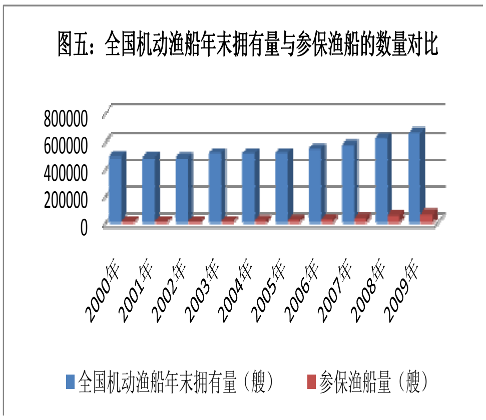

**1）渔民参保率与渔船参保率均较低**

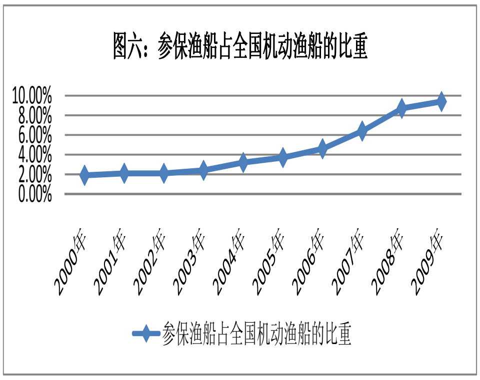
**1）我国渔民与渔船参保率均较低**

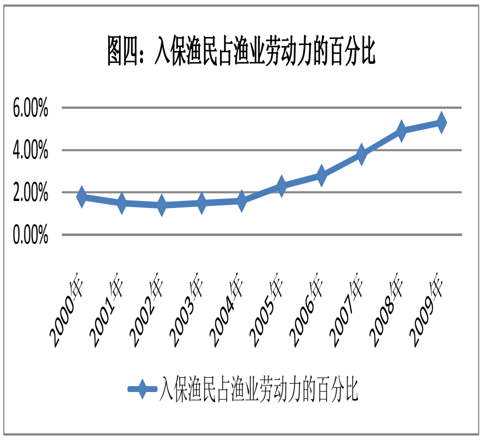
图三、图四（来源：同图一）为 2001—2009 年间渔业劳动力与入保渔民数量的对比，从图中可清楚地看出，从 2000 年到 2009 年入保渔民数量有所增长，但增长幅度不大，且入保渔民占当年渔业劳动力的比重非常小，尽管入保渔民占渔业劳动力的比重在缓慢增长，但参保率一直处于较低的水平, 至 2009 年，其参保率最高也没有超过 6%。另一方面，通过我国 2000—2009 年间，全国机动渔船年末拥有量与入保渔船量的对比分析(参见

图五、图六（来源：同图一），虽然渔船的参保率在十年间有了一定的增长，但是总体上仍处于较低的水平，到 2009 年为止，参保率最高还不到 10%。




**2）我国渔业保险密度和保险深度均处于极低水平**

保险密度是指按一国人口计算的人均保额，它反映一国国民参加保险的程度，而保险深度则反映了保险业在整个国民经济中的地位。本文中我国渔业保险密度用渔业保险费收入除以渔业人口来进行计算，我国渔业保险的深度用渔业保险费除以我国渔业国内总产值来进行计算。如表一所示，我国 2000 年的渔业保险密度仅为 3.2 元，2007 年以后，随着国家政策性渔业保险试点的开展，我国对政策性渔业保险试点进行了相应的财政补贴，2007、2008 年的渔业保险密度较前几年有了一定的增长，2009 的渔业保险密度比 2000 年增长了近十倍，但至 2009 年，渔业保险密度仅有 29.9 元。如表二所示，我国的渔业保险深度最高的年份仅为 0.2%，并且近年来不增反降，2009 年的渔业保险深度仅为 0.05%。

表一：我国渔业保险密度

| 年份 | 保费收入（万） | 渔业人口（人） | 保险密度 |
|---|---|---|---|
| 2000 年 | 6172 | 19398966 | 3.2 |
| 2001 年 | 6350.65 | 19422043 | 3.2 |
| 2002 年 | 6576.73 | 20441762 | 3.2 |

| | | | |
|---|---|---|---|
| 2003 年 | 8533.49 | 20742812 | 4.1 |
| 2004 年 | 10790.38 | 20984157 | 5.1 |
| 2005 年 | 13232.99 | 20676428 | 6.4 |
| 2006 年 | 22000 | 20400500 | 10.8 |
| 2007 年 | 32900 | 21115361 | 15.6 |
| 2008 年 | 50600 | 20961324 | 24.1 |
| 2009 年 | 62294.60 | 20845600 | 29.9 |

数据来源：《中国渔业年鉴（2001-2010）》整理计算而得。

**表二: 我国渔业保险深度**

| 年份 | 保费收入（万） | 渔业经济总产值（万） | 保险深度 |
|---|---|---|---|
| 2000 年 | 6172 | 2523819.21 | 0.20% |
| 2001 年 | 6350.65 | 20186187.15 | 0.03% |
| 2002 年 | 6576.73 | 21260025.41 | 0.03% |
| 2003 年 | 8533.49 | 57788311 | 0.01% |
| 2004 年 | 10790.39 | 6023777 | 0.20% |
| 2005 年 | 13233 | 7619075 | 0.20% |
| 2006 年 | 22000 | 85782936 | 0.03% |
| 2007 年 | 32900 | 95391290 | 0.03% |
| 2008 年 | 50600 | 103975019.07 | 0.05% |
| 2009 年 | 62294.6 | 114451251 | 0.05% |

**数据来源：《中国渔业年鉴（2001-2010）》，整理计算而得。**

## B. 渔业保险供给不足

渔业保险供给是指保险机构能够并愿意提供的渔业保险服务总量，渔业保险的供给水平取决于保险人的承保能力和渔业保险的经济效益。我国提供渔业保险的机构为中国渔业互保协会和商业性保险公司，但目前这两种形式均不能有效提供渔业保险，主要从以下两个方面来进行阐释。

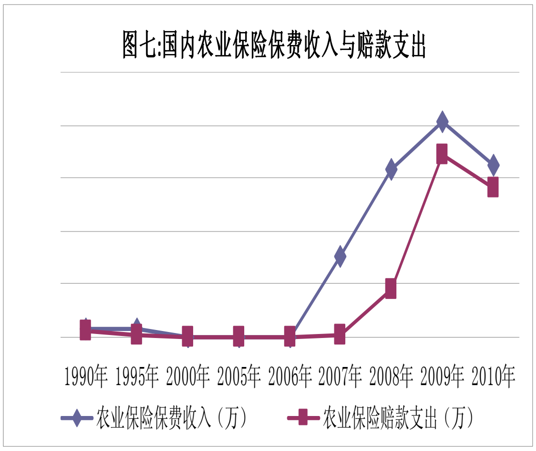
**1）商业性渔业保险业务逐年萎缩**

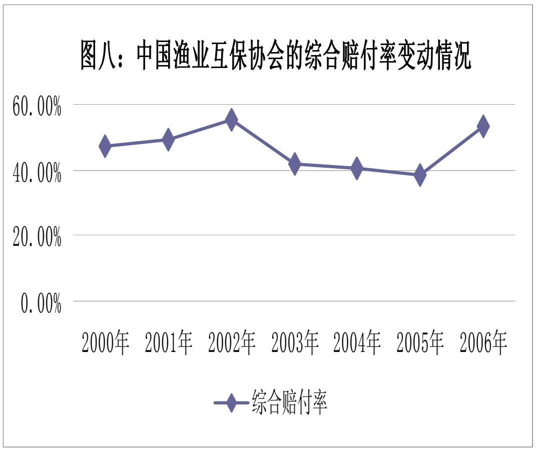
在商业性保险公司中，渔业保险业务包含在农业保险业务之中，1982 年以后，我国开始恢复试办渔业保险，中国人民保险公司(PICC)开办了农业保险项目的水产养殖险。图七（数据来源：《青岛统计年鉴》，整理计算而得）为国内农业保险保费收入与赔款支出的变动趋势，图中可以看出在 2006 年以前，农业保险业务逐渐萎缩，2007 年之后随着国家对农（渔）业保险的扶持力度不断加大，商业性农（渔）保险有了进一步的发展，但是从保费收入与赔款支出的对比情况来看，商业性保险公司的效益低下，不能有效提供渔业保险，在有些地区甚至退出了当地的渔业保险市场，目前尚存的商业性渔业保险仅限于渔船船东雇主责任险和大型渔船的渔船保险，使得小渔船、近岸渔船、木质渔船、老渔船等投保无门，而风险较大的养殖保险几乎趋于停办状态。

**2）中国渔业互保协会承保能力不足**

由于商业性渔业保险不能有效解决渔业保险的问题，借鉴其它渔业较发达国家的相关经验，我国于 1994 年 7 月成立了中国渔船船东

互保协会（后更名为中国渔业互保协会），成立之初起到了一定的作用，但是其互保主体缺乏法律保障，中央财政补贴力度小，保险责任范围单一且没有形成全国性的渔业互保体系等问题都制约着中国渔业互保协会的进一步发展。从图八（数据来源：同图一，2006 年以后《中国渔业年鉴》不再收录中国渔业互保协会的赔付情况）中可以清楚看出，中国渔业互保协会每年的综合赔付率平均都在 40%以上，综合赔付率较高，效益低下，遇到大灾年份，甚至可能入不敷出。据统计，我国每年因自然灾害致渔业损失高达 160 亿，仅仅靠不以营利为目的的中国渔业互保协会不能有效应对这样高额的风险，我国渔业保险的供给严重不足。




表三:中国渔业互保协会保费收入、赔款支出及综合赔付率

| 年份 | 保费收入(万) | 赔款支出(万) | 综合赔付率 |
|---|---|---|---|
| 2000 年 | 6172 | 2905.54 | 47.08% |
| 2001 年 | 6350.65 | 3101.37 | 48.84% |
| 2002 年 | 6576.73 | 3628.6 | 55.17% |
| 2003 年 | 8533.49 | 3612.63 | 42.33% |
| 2004 年 | 10790.39 | 4342.4 | 40.42% |
| 2005 年 | 13232.99 | 5093.43 | 38.49% |
| 2006 年 | 10747 | 5744 | 53.55% |

**数据来源：《中国渔业年鉴（2001-2010）》，整理计算而得。**

# Ⅳ. 我国渔业保险市场失灵的成因分析

## A.渔业保险是具有正外部性的准公共物品

经济理论上的公共物品是指可以提供社会成员公共使用或消费的物品，严格意义上的公共物品具有非竞争性和非排他性。依据这两种特性可以将公共物品分为纯公共物品和准公共物品两类，纯公共物品是指具有完全的非竞争性和非排他性，通常采用免费提供的方式，准公共物品是指具有优先的竞争性和局部的排他性，即超过一定的临界点，非竞争性和非排他性就会消失，拥挤就会出现。而准公共物品又可以分为两类：第一类是具有排他性和不充分竞争性的准公共物品；另一类是具有竞争性的特征，但非排他性不明显的准公共物品。

我国渔业从业人员必须交纳一定的保费来获得渔业保险，没有交纳保费的人没有获得渔业保险的资格，说明渔业保险具有竞争性的特点，而渔业从业人员通过交纳保费购买渔业保险不只保障自己的人身和财产安全，一定程度上也稳定了渔业生产，但是这一成果不能将没有购买渔业保险的人排除在外，并被其无偿占有。俞雅乖（2010 年）借鉴前人研究农业保险的经验，从公共物品非竞争性和非排他性两个特征出发，指出渔业保险应该是竞争性充分、

排他性不充分的准公共物品，并且具有正外部性，存在着利益外溢[5]。

同时，渔业保险具有正外部性，所谓正外部性是某个经济行为个体的活动使他人或社会受益，而受益者无须花费代价。渔业保险生产的正外部性导致渔业保险供给短缺，完善有效的渔业保险体系不仅对提供渔业保险的保险机构有益，对社会上所有人都是有益的，作为渔业保险的提供者来说，其边际收益低于社会边际收益，因此渔业保险机构从自身的利益出发减少渔业保险提供，导致有效供给不足；而渔业保险消费的正外部性导致渔业保险有效需求不足，个人购买渔业保险不仅保障自身利益，同时存在利益外溢，没有购买渔业保险的人也享受到这方面利益，因此选择购买渔业保险的人越来越少，“搭便车”的人越来越多，导致渔业保险有效需求不足。

### B.渔业保险经营中存在信息不对称

信息不对称是市场失灵的另一个重要原因，是指在社会政治、经济活动中，一些成员拥有其他成员无法拥有的信息，由此产生的交易关系和契约安排中的不公平和市场低效率的问题。在分析完全竞争市场时，通常假定市场信息是充分的、完全的，无论卖者还是买者，对价格、成本、收益和利润等信息都充分了解，并可以根据信息做出理性的决策。但是这些假定并非是完全现实的，一般情况下，信息是不完全的，至少消费者和生产者并不能确切地知道市场中商品价格分布的信息，并且完全的信息不是免费的，获取完全的信息要付出成本。

经营渔业保险的保险机构和渔民之间存在着信息不对称，保险机构的工作人员在保险精算、保费的设定、理赔等保险知识方面存在信息优势，而渔民的信息优势则表现在捕捞、养殖等方面。由于渔业保险的高风险性，渔业保险提供者为保证自身利益设置较高的保费，渔民中一部分人由于承受能力的限制退出渔业保险市场，而那些面临较大风险的渔民继续留在渔业保险市场内，渔业保险的提供者继续提高保费，导致更多的渔民退出，陷入一种恶性循环，最终渔业保险市场中留下的都是风险程度较高的投保者，从而导致渔业保险市场的失灵。

### C. 渔业风险具有系统性风险的特点，不具备理想的可保条件

系统性风险是指所有的标的之间的风险发生具有相关性，即某种风险发生会使得所有标的都会遭受不同程度或是同样的损失，这样一旦发生风险，损失将是大面积的、巨大的[6]。理想的可保条件是损失发生的概率较小且具有确定的概率分布，存在大量具有同质风险的保险标的，并且损失不能同时发生。而渔业风险如台风、赤潮等自然灾害，发生的概率较高，没有确定的概率分布，并且发生之后在其影响的范围内均会造成损失，同时我国渔业保险需求不旺，没有大量的同质风险标的来分散风险，不符合保险的“大数法则”和风险共担的原理，渔业的系统性风险破坏了渔业保险人在投保人之间，地区之间分散风险的能力。

## Ⅴ. 我国渔业保险市场失灵的解决思路：政府介入

我国渔业保险市场的失灵，单靠市场这只“看不见的手”已经很难有效推动我国渔业保险的健康稳定发展，渔业保险市场需要政府这只“看得见的手”的介入。政府可以综合运用法律、行政、经济（财政、税收、金融）等非市场化手段为渔业保险提供制度安排，在此着重探讨其财政激励机制。

### A. 政府对渔业保险进行财政补贴方式

**1）对渔民交纳的保费给予补贴**

按现行农业部实施政策性渔业保险试点的补贴比例来看，中央财政对渔船安全互助保险和渔民人身平安互助保险保费补贴比例为25%。

**2）直接对渔民进行补贴，并对没有索赔的投保渔民进行奖励**

直接对渔民进行补贴，提高渔民的购买能力，进而提高其对渔业保险的购买需求，如渔民没有索赔，则可以退还一部分保费作为奖励，在一定程度上减少道德风险的发生。

**3）对经营渔业保险机构的经营管理费用给予适当补贴**

适当补贴经营管理费用，降低保险机构提供渔业保险的成本，从而提高其提供渔业保险的积极性，更好得经营渔业保险业务。

**4）建立财政支持的巨灾风险基金制度**

巨灾风险基金是渔业保险继原保险、再保险之后的第三道屏障，平衡了灾年和平常年份的收支，从时间上分散渔业风险，为救灾和灾后重建提供稳定的资金来源，政府应以财政为后盾采取多种方式建立巨灾风险基金制度。

### B.我国渔业保险财政补贴试点的综合评价

**1）我国渔业保险财政补贴的实践**

2008 年我国农业部开始推行政策性渔业保险的试点工作，选取了辽宁、山东、浙江、江苏、广东、福建、海南等重点渔区开展中央财政保费补贴试点工作，具体实施工作由中国渔业互保协会牵头，有关省级互保机构共同参与。此次政策性渔业保险试点补贴对象为 20 马力以上的海洋机动渔船和海洋作业渔民，补贴的险种为渔船全损互助险和人身意外伤害险。渔船承保船舶价值的 80%，渔民人身最高补贴金额为 20 万元，保费补贴比例均为 25%。以山东省为例，2008 年，农业部安排中央财政补贴

专项资金 220 万元在山东省青岛、日照两市进行渔船财产政策性保险试点，山东省海洋与渔业厅安排转向资金 600 万元，在全省进行渔民雇主责任政策性保险试点。在中央和省惠渔政策的推动下，青岛市、日照市、东营市、潍坊市等四个地市分别给予了 10%—20%比例的配套，崂山区、即墨、城阳区、黄岛区、东营区、寿光、滨海区、昌邑等 8 个县市区分别给予了 10%—20%比例的配套。截至 2008 年 12 月底，各级财政补贴 830.6 万元，其中中央财政补贴 220.98 万元，省级财政补贴 416.29 万元，市级财政补贴 139.85 万元，县级财政补贴 53.48 万元，惠及渔船 2276 艘，占承保渔船的 38.02%，惠及渔民 50751 人，占承保渔民的 67.44%，拉动青岛、日照两地渔船保费同比增长 51.67%，拉动全省雇主险保费同比增长 105.36%，全省渔民人身保险展业实现翻一番。在 2008 年渔业政策性保险试点成功的基础上，2009 年农业部将继续安排中央专项资金 220 万元在青岛、日照两市进行渔船全损险保费补贴试点，补贴比例为 25%，山东省海洋与渔业厅继续调剂专项资金 900 万元，对省内参加渔业互保的渔民给予保费补贴，补贴比例为 20%。

**2）我国渔业保险财政补贴试点实施中的成效与不足**

中央政府对政策性渔业保险试点进行财政补贴，同时带动地方各级政府的财政投入，弥补了渔业保险保费设置下限与保费承担上限之间的空缺，拉动渔业保险的供给和需求，自 2008 年实施以来取得了良好效果，但也存在着缺点和不足。

1、财政补贴的承担主体单一

我国政策性渔业保险主要是由中国渔业互保协会牵头，省级渔业互保协会参与实施。中央财政补贴资金一般拨付给各省海洋与渔业局，再由海洋与渔业局划拨给各省的渔业互保协会，由互保协会具体运作，各省海洋与渔业局监督实施。承担主体单一，在一定程度上制约了政府财政补贴试点的进一步推广。

2、财政补贴的险种偏少

从我国政策性渔业保险试点的实施情况来看，政府并不是对所有的渔业保险险种都进行补贴，目前补贴的险种主要有渔船全损互助险和人身意外伤害险，而这远远不能有效满足渔民的实际需求。

3、财政补贴的渔业保险体系不完备

完备的保险体系应该至少有三重保障，原保险、再保险和巨灾风险基金制度，从 2008 年我国政策性渔业保险的试点情况来看，政府补贴还仅仅停留在原保险阶段，对于再保险和巨灾风险基金制度未进行筹备。

## C. 政策性渔业保险财政补贴机制的完善策略

**1）扩大财政补贴的地区、险种和规模**

进一步扩大财政补贴的地区和规模，实行规模经营，将更多渔业优势较为明显的地区纳入财政补贴的试点范围，并对不同地区实行区别对待，对渔业大省、渔业重点县加大扶持的力度，切勿搞“一刀切”。同时，进一步扩大财政补贴的渔业保险险种的范围，适当的增加渔民需求较大的险种，如水产养殖保险等。

**2）优化各级政府财政补贴比例**

目前，我国中央政府渔业保险的财政补贴比例为 25%,远远低于渔业保险较为完善国家的 50%-80%的补贴比例。保险费补贴额和补贴率主要取决于保险纯费率、保险保障水平高低、政府的政策目标和财力、渔民对保险产品的接受和购买能力[7]。在对各级政府财政实力和对渔民的承担能力进行深入了解的基础上，优化设计中央、省、市、县四级政府的财政补贴比例，规定省、市、县级政府财政补贴比例配套的最低标准，并将实施方案以制度化的形式确立下来。

**3)丰富财政补贴的承担主体**

在我国政策性渔业保险的试点中，承担和实施单位仅为中国渔业互保协会，应该进一步丰富财政补贴的承担和实施主体，充分发挥商业性保险公司的作用，并积极探索建立政策性渔业保险公司。

**4）进一步探讨财政补贴的模式**

中国渔业互保协会承担原保险，商业性保险公司承担再保险，并且采取多种形式建立起以政府财政为后盾建立巨灾风险基金制度，各级政府财政对保费及经营管理费用进行补贴，一旦灾害赔偿超出了保费的额度，由企业和政府按照比例进行分担，减轻渔业保险机构的负担。

## References

[1]Fishery Bureau of Agriculture Ministry. China Fishery Yearbook .Beijing: China Agriculture Press, 2009.

农业部渔业局.中国渔业年鉴.北京:中国农业出版社,2009 年.

[2]Fishery Bureau of Agriculture Ministry. The National Fishery Economy Statistical Bulletin in 2011. China Fishery News. 2012-4-18(1).

农业部渔业局.2011 年全国渔业经济统计公报.中国渔业报.2012-4-18(1).

[3]DONG Fangyong and XU Lei. Cause

Analysis and Management Strategies on Fisheries Risk. Chinese Fisheries Economics, 2003,5.
董方勇、徐磊.渔业风险的原因分析及防范对策.中国渔业经济,2003 年第 5 期.
[4]GE Guanghua and LOU Yong. The Present Status and Future on China Fishery Insurance. Chinese Fisheries Economy Research, 1997,6.
葛光华、楼永.中国渔业保险的现状及发展前景.中国渔业经济研究,1997 年第 6 期.
[5]YANG Hesong. On National Policy Fishery Insurance. Chinese Fisheries Economics,2005,2.
杨鹤松.浅谈政策性渔业保险.中国渔业经济,2005 年第 2 期.
[6]YU Yaguai. Scheme of Ocean Fishery Insurance: Policy Fishery Insurance based on Cooperative and Mutual Fishery Insurance. Rural Economy,2010,9.
俞雅乖.海洋渔业保险制度的模式选择:互保基础上的政策性渔业保险.农村经济,2010 年第 9 期.
[7]LIU Ting, PING Ying. Thinking and Policy Analysis of Policy-based Fishery Insurance Model in China—A Case Study in Medium and Small Sized Fisher. Jiangsu Agricultural Sciences,2010,2.
刘婷、平瑛.我国政策性渔业保险模式思考和政策分析—以中小型渔船保险为例.江苏农业科学,2010 第 2 期.
[8]Allan.H.Willett. The Economic Theory of Risk and Insurance. New York: The Columbia university press,1901.
[9]SUN Qixiang. Insurance. Beijing: The Peking University Press, 2009.
孙祁祥.保险学.北京:北京大学出版社,2009 年.
[10]FENG Dengyan, ZHANG Anzhong, MA Weiping.The Problems of Agricultural Insurance in New Rural Construction. Beijing: Intellectual Property Press,2009.
冯登艳,张安忠,马卫平.新农村建设中的农业保险问题.北京:知识产权出版社,2009 年.

# 我国渔业保险市场失灵的表现及成因分析

刘海英，贾宪飞，同春芬

法政学院，中国海洋大学，青岛，中国，266071

**摘要**：改革开放以来，我国确立了新的渔业发展方针，渔业进入快速发展的时期，渔业保险作为社会主义市场经济条件下分散和管理渔业风险的一种有效机制受到了越来越多的关注。本文从渔业生产的特性和渔业风险入手，针对介入渔业保险市场我国渔业保险市场失灵问题，指出渔业保险供给不足，需求不旺是我国渔业保险市场失灵的主要表现，然后分析了产生这一现状的原因，最后基于我国政策性海洋渔业保险试点情况提出了促进渔业保险市场发展的相关完善策略，以期为我国渔业保险市场的发展和研究提供理论借鉴和技术依据。

**关键词**：渔业保险；市场失灵；渔业保险供给；渔业保险需求

# The Level of China's Provinces’s Economic Development Impacted on the Commercial Insurance

## —An empirical analysis based on panel data

KOU Yefu[1], ZHANG Lin[2]
[1] China Institute for Actuarial Science, Central University of Finance and Economics, Beijing, China, 100081
[2] Insurance School, Central University of Finance and Economics, Beijing, China, 100081

**Abstract:** In this paper, we examine the role of the provincial economic development on the insurance industry with panel data, breaking the research methods of previous literature which focused on a particular area and draw pertinent conclusions. The study found that there are regional differences impact on the insurance industry among provinces in different economic development. level. Therefore, when insurance companies expand their business, they should select different strategies and ideas according to the level of economic development among provinces.
**Keywords:** Commercial insurance; Panel data; Per capita GDP

## Ⅰ.前言

近年来，中国保险业发展势头迅猛，保险规模不断扩大，保险险种和保险范围日益增大。目前，中国保险业增长速度比全球平均速度高两倍，每年20%-22%，保险密度和保险深度也有很大改观[1]。譬如，2010北京市的保险密度已高达3974元，保险深度达到了5%左右；河北省在2008-2009年保险深度增加了0.6个百分点；内蒙古在2007-2009年保险密度从404元/人增加到707元/人等，这样的增长速度不仅高于我国同期GDP的增长速度，而且高于世界保险业的平均增长速度，这些都说明当前我国保险业的快速发展。

实证研究发现以名义GDP检验经济增长是保费收入增长的Granger原因，但反之则不成立（曹乾、何建敏，2006）；而以实际值进行检验的结果表明，经济增长和保费收入增长之间不存在Granger因果关系。对河北省进行计量检验分析，得出结论是保险增长是经济增长的Granger原因，而经济增长却不是保险增长的Granger原因（张淑英、李鹏燕，2008）。本文根据面板数据，运用panal data的回归方法探讨经济发展对保险业发展的促进作用。

## Ⅱ. 数据来源与研究模型

### A. 数据来源

本文选取 2006 年到 2010 年 31 个省的人均保费收入和人均 GDP 的面板数据，研究保险业发展与经济增长的关系。人均 GDP 更能反映经济发展的成果，因为人均可支配收入在农村和城市的统计口径难以保持一致，且数据也很难得到；而保险在城乡之间发展也不平衡，如果用人均可支配收入来代替经济发展成果，容易产生质疑。所以本文选取了人均 GDP 作为研究对象。

（见附表一 2006-2010 年全国各省人均保

1 http://news.hexun.com/2011-10-25/134539829.html

费和人均 GDP 情况）

## B.数据处理

为了从实证的角度来研究经济增长和保险业的关系，本文利用面板数据分析了各省的经济发展水平对保险业的影响。本文共选取2006-2010年31个省市（不含港、澳、台地区）的人均保费收入作为研究对象，选取2006-2010年31个省市的人均GDP作为回归变量，共186个样本。因为两者都包含了价格因素，所以不再考虑通货膨胀的影响。人均保费收入和人均GDP分别是用保费收入和GDP除以总人口数得到的。由于选取的是内地31个省市的数据，以全国31个省市为研究对象，可以认为这31个省市代表了整个总体。

## C.研究模型[2]

面板数据简言之就是时间序列和截面数据的混合，严格地讲是对一组个体（如居民、国家、公司等）连续观察多期得到的资料。

假设：$y_{it}=\alpha_i+x_{it}\beta+u_{it}$，其中i=1，2，3…N，为截面标示，t=1，2，3…T，为时间标示，$x_{it}$ 为K×1解释变量，$\beta$ 为K×1系数列向量。

对于特定的个体i而言，$\alpha_i$ 表示那些不随时间改变的因素，而这些因素在多数情况下都是无法直接推测或难以量化的，如个人消费习惯、地区的经济结构、法律和产权制度等，一般被称其为“个体效应”。对个体效应的处理就形成了固定效应模型和随机效应模型，它们有效地解决了OLS由于不可观察因素导致回归结果有偏的问题。

我们在研究经济增长和保险业的关系时，除了人口数量和GDP影响保险业增长外，还存在很多非观测的因素，也就是潜在因素，如各省经济结构、文化、政策等因素也影响着保险业，这些非观测因素会导致估计结果的不准确，而面板数据可以控制和估计非观测效应。并且在样本区间内各省市的经济结构、人口素质等不可观测的特质性因素是固定不变的，因此采用固定效应模型。

## Ⅲ.实证分析

在Eviews6中回归时，北京、河北等31个省市分别赋予BEIJING、HEBEI等变量名，人均保费收入和人均GDP分别命名为insurance和GDPEP。接着对数据进行ADF检验和协整检验，发现数据都不存在单位根，两个变量均是一阶稳定的，且31个省人均保费收入和人均GDP之间存在协整关系，说明31个省人均保费收入和人均GDP之间的长期关系是稳定的。

然后利用计量软件Eviews6对面板数据进行回归，在回归中将截距选择项设为fixed effects（固定效应），表示每个个体都有不同的截距项，这就是所谓的固定效应模型，回归结果如下：

表二　回归结果

| | 系数 | P 值 | |
|---|---|---|---|
| 常量 | -281.37 | 0.0001 | |
| 人均 GDP | 0.04 | 0 | |
| 固定效应（截距） | | | |
| 北京 | 1309.62 | 湖北 | 12.39741 |
| 天津 | -625.0649 | 湖南 | 4.967531 |
| 河北 | -240.0226 | 广东 | -366.0811 |
| 山西 | 795.5956 | 广西 | -37.91991 |
| 内蒙古 | -518.2859 | 海南 | -75.47243 |
| 辽宁 | -272.8268 | 重庆 | 152.9829 |
| 吉林 | -84.3686 | 四川 | 247.4656 |
| 黑龙江 | 43.55155 | 贵州 | 123.3172 |
| 上海 | 492.4571 | 云南 | 132.7935 |
| 江苏 | -322.6414 | 西藏 | -153.3975 |
| 浙江 | -461.9448 | 陕西 | 77.85157 |
| 安徽 | 166.4037 | 甘肃 | 168.5334 |
| 福建 | -281.3933 | 青海 | -152.057 |
| 江西 | 18.6431 | 宁夏 | 51.68282 |
| 山东 | -406.5083 | 新疆 | 152.541 |
| 河南 | 47.18009 | | |

[2] 威廉·H·格林.计量经济分析(第五版).中国人民大学出版社，费剑平译.2007 年 7 月

相应的表达式为：

$$\hat{insurance} = -281.37 + 0.04\text{gdpep} + 1039.72d_1 - 625.0649d_2 + \ldots + 152.451d_{31} \quad (1)$$
$$\ldots\ldots R^2 = 0.96 \ldots\ldots SSE_u = 179.63$$

其中 $d_{\mathrm{i}}$（i=1，2，3…31）表示不同的个体，R-square较高，说明模型对样本的拟合程度高。

P值是验证系数是否显著的统计量，常量和人均GDP的P值分别为0.0001和0，说明系数的显著程度较高，所以人均保费和人均GDP的关系总体关系是成立的，也就是说一个地区的人均GDP增加1元，相应的该地区人均保费收入增加0.04元；不同的个体的系数差异较大，说明不同的个体的固定效应值也各不相同。

对个体效应进行检验：

原假设 $H_0 : a_1 = a_2 = \ldots = a_N$

F 检验统计量为：

$$F = \frac{(R_u^2 - R_r^2)/(n-1)}{(1-R_u^2)/(nT-n-k)}$$

，u代表固定效应模型，r代表混合数据模型[3]。

代入数据得 F=19.35 ＞ F(n-1，nT-n-k)=5.78。表示在0.01%的水平上拒绝原假设，所以不同个体之间存在显著差异，固定模型是有效的。

# Ⅳ. 主要结论与政策建议

## A. 主要结论

北京、上海、天津和重庆这四个直辖市大多是城镇人口，其经济结构和保险业务结构等与其它省份具有较大的差别，不具有可比性，所以我们主要讨论其余 27 个省、自治区的经济发展对保险业的影响。首先根据固定效应值将全国 27 个省份分成三组，每组九个省份。

3威廉•H•格林.计量经济分析(第五版).中国人民大学出版社，费剑平译.2007 年 7 月

我们发现人均 GDP 的排名总体成下降趋势，固定效应高的地区人均 GDP 排名靠后，固定效应低的地区人均 GDP 排名靠前。根据人均 GDP 的排名我们可将这 3 组分类为经济落后地区、经济中等地区、经济发达地区。

表三 27 省份的固定效应值和人均 GDP 排名情况

| 分组 | 省份 | 固定效应值 | 人均 GDP 排名 | 总和 | 平均值 | 方差 |
|---|---|---|---|---|---|---|
| 一 | 山西 | 795.5956 | 11 | 174 | 19.33 | 5.41 |
| | 四川 | 247.4656 | 21 | | | |
| | 甘肃 | 168.5334 | 26 | | | |
| | 安徽 | 166.4037 | 22 | | | |
| | 新疆 | 152.541 | 14 | | | |
| | 云南 | 132.7935 | 25 | | | |
| | 贵州 | 123.3172 | 27 | | | |
| | 陕西 | 77.85157 | 13 | | | |
| | 宁夏 | 51.68282 | 15 | | | |
| 二 | 河南 | 47.18009 | 16 | 143 | 15.89 | 3.93 |
| | 黑龙江 | 43.55155 | 10 | | | |
| | 江西 | 18.6431 | 20 | | | |
| | 湖北 | 12.39741 | 12 | | | |
| | 湖南 | 4.967531 | 17 | | | |
| | 广西 | -37.91991 | 23 | | | |
| | 海南 | -75.47243 | 19 | | | |
| | 吉林 | -84.3686 | 8 | | | |
| | 青海 | -152.057 | 18 | | | |
| 三 | 西藏 | -153.3975 | 24 | 61 | 6.78 | 4.37 |
| | 河北 | -240.0226 | 9 | | | |
| | 辽宁 | -272.8268 | 6 | | | |
| | 福建 | -281.3933 | 7 | | | |
| | 江苏 | -322.6414 | 2 | | | |
| | 广东 | -366.0811 | 3 | | | |
| | 山东 | -406.5083 | 5 | | | |
| | 浙江 | -461.9448 | 1 | | | |
| | 内蒙古 | -518.2859 | 4 | | | |

在上表中固定效应值排名和人均 GDP 在上表三中可以看出，固定效应值排名和人均 GDP 排名顺序在总体上是相反的。

## B.秩相关系数检验

从表三中观察发现检验固定效应值排名和人均 GDP 排名之间存在相反的序关系。

H0：固定效应值排序和人均 GDP 排序无直接相关关系；

H1：固定效应值排序和人均 GDP 排序有相关关系

α=0.005

表四，秩相关系数检验表

| 省份 | 固定效应排名 (1) | 人均 GDP 排名（2） | 差值 $d_i$ （3）=（1）-（2） | $d_i^2$ |
|---|---|---|---|---|
| 山西 | 1 | 11 | -10 | 100 |
| 四川 | 2 | 21 | -19 | 361 |
| 甘肃 | 3 | 26 | -23 | 529 |
| 安徽 | 4 | 22 | -18 | 324 |
| 新疆 | 5 | 14 | -9 | 81 |
| 云南 | 6 | 25 | -19 | 361 |
| 贵州 | 7 | 27 | -20 | 400 |
| 陕西 | 8 | 13 | -5 | 25 |
| 宁夏 | 9 | 15 | -6 | 36 |
| 河南 | 10 | 16 | -6 | 36 |
| 黑龙江 | 11 | 10 | 1 | 1 |
| 江西 | 12 | 20 | -8 | 64 |
| 湖北 | 13 | 12 | 1 | 1 |
| 湖南 | 14 | 17 | -3 | 9 |
| 广西 | 15 | 23 | -8 | 64 |
| 海南 | 16 | 19 | -3 | 9 |
| 吉林 | 17 | 8 | 9 | 81 |
| 青海 | 18 | 18 | 0 | 0 |
| 西藏 | 19 | 24 | -5 | 25 |
| 河北 | 20 | 9 | 11 | 121 |
| 辽宁 | 21 | 6 | 15 | 225 |
| 福建 | 22 | 7 | 15 | 225 |
| 江苏 | 23 | 2 | 21 | 441 |
| 广东 | 24 | 3 | 21 | 441 |
| 山东 | 25 | 5 | 20 | 400 |
| 浙江 | 26 | 1 | 25 | 625 |
| 内蒙古 | 27 | 4 | 23 | 529 |
| 合计 | - | - | - | 5514 |

根据公式 $r_s = 1 - \dfrac{6\sum d_i^2}{n(n^2-1)} = -0.68315$

$$T = r_s\sqrt{\frac{n-2}{1-r_s^2}} = -0.68315\sqrt{\frac{27-2}{1-0.4667}}$$
$$= -4.67733$$

其中 n=27，故在自由度为 25 的情况下，查表得 $T_{(25,0.005)} = 2.7874$

α=0.05 水平上拒绝 H0，所以固定效应值排序和人均 GDP 排序有相关关系，并且具有负相关关系。

固定效应值反映了人均保费收入与人均 GDP 之间的关系，即

1）人均 GDP 排名靠前的经济发达地区，如江苏、广东、山东等省份固定效应值排名靠后，说明江苏、广东、山东等省份的人均 GDP 的改善对保费收入增长的影响比较有限，其保险业发展已处于基本饱和状态。此组中，西藏是一个特例，其人均 GDP 仅仅是第 28 名，但其固定效应值较小，说明尽管其经济比较落后，但是经济发展对其人均保费收入的增长影响有限，保险业务发展的潜力仍然较小。

而人均 GDP 排名靠后的经济落后地区，如云南、甘肃、贵州等省份固定效应值排名靠前，说明云南、甘肃、贵州等省份的人均 GDP 的改善对保费收入增长的影响较大，随着经济的发展，其人均保费收入的增长潜力较大，需要保险公司大力关注和开发；同时其人均 GDP 排名的方差较大，说明各个省份之间经济发展对保险业发展的影响具有较大的差异。

根据固定效应值分为中间一组的 9 个省份，其人均 GDP 也处于中等水平。这说明对于经济中等地区，经济发展对于人均保费收入的提高和保险业务的拓展也处于中等水平。

2）保费收入和人均GDP之间存在线性关系。说明人均GDP的增长能够引起保费收入的增加，也即经济增长能推动保险业的发展，这点是和曹乾、何建敏通过实证研究发现“以名

义GDP检验经济增长是保费收入增长的Granger原因的结论是相似的”。但是，曹乾、何建敏的结论只是一种逻辑判断，而本文是在运用面板数据的基础上的实证分析，定量分析了人均保费收入和人均GDP的关系。

3）由于面板数据能反映不同个体之间的差异，所以得出不同省份的固定效应是不同的，也即经济发展对保险业的促进作用的大小也存在区域性差异，并且可以进行量化分析，为保险公司的业务拓展等提供了一个良好的研究视角；同时也为保监会、保监局等相关政府部门的保险业务监管等提供一种思路。

## *C.*政策建议

经济发展对保险业的发展存在区域性差异，对于经济发达省份、新型增长地区和经济落后地区，经济发展对保险业的影响有所不同。因此，各级政府和保险公司都应该根据各地的具体发展情况，差别对待不同的地区。根据本文的研究，当经济发展到一定程度后，经济增长对于保险业发展的促进作用就逐渐弱化。因此各个保险公司不应过于重视经济发达的省份，而更应该注重一些落后和中等发展程度等发展潜力较大的省份，应该根据自己的战略和各个地区的经济状况，确定发展思路，促进保险业的健康发展。

首先，对于江苏、广东、山东等高度发达地区，政府应该转移视角，不能仅靠国民收入的增长来拉动保险业增长，主要通过改善保险业的经营环境等为保险业的发展提供有利条件。而保险公司应增加产品创新，改变保险经营模式，调整保险业的产品结构，来促进保险业增长。

其次，对于新型增长和经济落后地区，政府应该加快经济发展步伐，增加人均GDP收入，通过经济的发展带动保险业的繁荣。保险公司也应根据区域差异性选择不同的经营策略，要增加投资力度，扩大宣传效果，以基本的投入来换取更多的保费收入，保险业各种投入要控制在成长阶段范围内。

最后，我国保险业发展滞后，远远没有达到发达国家的水平，即使北京等发达城市保险市场仍未完善，没有充分发挥保险对经济的功能和作用。因此，政府应该努力为保险业的长期可持续发展提供一个良好的政策环境。

## References

[1]http://news.hexun.com/2011-10-5/134539829.html

[2]Cao Jian, Hejian. Interactive Relationship Between Insurance and Economic Growth: Theoretical Hypothesis and Empirical Research, Shang Hai Financial, 2006(3)
曹乾，何建. 保险增长与经济增长的互动关系：理论假说与实证研究[J]. 上海金融，2006(3)

[3]Zhang Shuying, Li Pengyan, The Cointegration Analysis of Hebei Province’s insurance and economic development.Industry and Technology Forum, 2008(07)
张淑英，李鹏燕. 河北省保险发展与经济发展关系的协整分析[J]. 产业与科技论坛，2008(07)

[4]Wu Juan, The Insurance of West Impacted on Economic Growth- Ningxia Empirical Analysis. Guangxi University (Philosophy and Social Sciences) .2008 (9)
吴娟. 西部保险业发展对经济增长的影响-以宁夏为例的实证分析. 广西大学学报(哲学社会科学版). 2008(9)

[5]Feng Lan, Bao Shuangbao,Li Xiaolin, The insurance industry growth Impacted on economic growth: A Literature Review.Modern management science .2011(12)
凤兰，包双宝，李晓林. 保险业增长对经济增长的作用：一个文献综述. 现代管理科学. 2011 年第 12 期

[6]http://wenku.baidu.com/view/62ee2ad9d15abe23482f4d75.html, Panel data with stata

[7]http://wenku.baidu.com/view/a0a1fd2e0066f5335a81217f.html?from=rec&pos=3&weight=26&lastweight=26&count=5 , STATA and Panel data with stata

[8]http://www.doc88.com/p-192574625293.html

[9] William • H • Greene, Econometric Analysis (fifth edition). Renmin University of China Press, Fei Jianping Translation, 2007(7)
威廉·H·格林. 计量经济分析(第五版). 中国人民大学出版社，费剑平译. 2007 年 7 月
[10] Su Fang, Cai Wanke. The Empirical Research of Insurance Development Imapcted on Economic Stability - Based on The 46-Country Panel Data Analysis.Wuhan University of Technology .2011 (1)
粟芳，蔡万科. 保险发展对经济稳定作用的实证研究——基于 46 个国家的面板数据分析. 武汉理工大学学报. 2011 年 01 期 ；
[11] Wu Hong, Zhao Guiqin. Insurance Development, Financial Synergy and Economic Growth - Based on Provincial Panel Data. Economic Science .2011(3)
吴洪，赵桂芹. 保险发展、金融协同和经济增长——基于省级面板数据的研究. 经济科学. 2011 年第 3 期

表一 2006-2010 年全国各省人均保费和人均 GDP 情况

| 地区\年份 | 2006 | | 2007 | | 2008 | | 2009 | | 2010 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 人均保费 | 人均 GDP | 人均保费 | 人均 GDP | 人均保费 | 人均 GDP | 人均保费 | 人均 GDP | 人均保费 | 人均 GDP |
| 北京 | 2602.97 | 51345.86 | 3049.9 | 60298.9 | 3456.99 | 65575.22 | 3974.92 | 69248.03 | 4925.89 | 71934.66 |
| 天津 | 978.42 | 41513.86 | 1353.45 | 47109.96 | 1493.36 | 57134.44 | 1231.84 | 61244.87 | 1647.13 | 70996.16 |
| 河北 | 367.3 | 16624.53 | 259.77 | 19598.62 | 373.29 | 22910.83 | 411.19 | 24501.71 | 507.81 | 28350.56 |
| 山西 | 417.71 | 14455.14 | 979.22 | 17755.53 | 1409.16 | 21448.95 | 1753.79 | 21469.32 | 2088.34 | 25743.05 |
| 内蒙古 | 300.16 | 20626.83 | 406.44 | 26707.61 | 585.6 | 35199.46 | 707.28 | 40214.57 | 871.86 | 47213.42 |
| 辽宁 | 443.8 | 21785.34 | 525.84 | 25975.57 | 761.86 | 31679.1 | 799.93 | 35222.25 | 1037.3 | 42189.01 |
| 吉林 | 332.75 | 15700.04 | 427.8 | 19357.84 | 581.27 | 23504.39 | 674.81 | 26569.14 | 871.07 | 31557.47 |
| 黑龙江 | 411.14 | 16248.5 | 406.69 | 18577.41 | 656.66 | 21734.7 | 727.57 | 22443.81 | 895.34 | 27048.03 |
| 上海 | 2242.64 | 58249.26 | 2597.63 | 67244.4 | 3177.5 | 74504.41 | 3461.89 | 78326.13 | 3838.42 | 74548.45 |
| 江苏 | 666 | 28797.42 | 756.24 | 34122.6 | 1010.01 | 40355.31 | 1175.05 | 44604.92 | 1477.46 | 52641.62 |
| 浙江 | 610.2 | 31563.19 | 730.67 | 37062.71 | 955.54 | 41919.32 | 1038.8 | 44382.92 | 1267.49 | 50899.22 |
| 安徽 | 269.45 | 10004.09 | 329.84 | 12031.58 | 483.35 | 14428.13 | 582.62 | 16413.02 | 735.72 | 20748.59 |
| 福建 | 411.97 | 21314.92 | 505.72 | 25826.67 | 676.49 | 30030.55 | 750.64 | 33737.33 | 937.09 | 39905.55 |
| 江西 | 226.31 | 11109.77 | 261.12 | 13278.96 | 389.45 | 15843.3 | 422.23 | 17271.9 | 567.56 | 21180.49 |
| 山东 | 360.62 | 23525.82 | 452.77 | 27518.85 | 606.61 | 32847.54 | 715.47 | 35792.58 | 913.88 | 40853.65 |
| 河南 | 268.64 | 13163.11 | 345.68 | 16038.95 | 550.35 | 19109.69 | 595.96 | 20533.85 | 843.42 | 24552.05 |
| 湖北 | 282.45 | 13380.41 | 339.93 | 16377.26 | 555.33 | 19836.96 | 651.08 | 22659.27 | 873.49 | 27876.83 |
| 湖南 | 233.08 | 12123.42 | 316.77 | 14853.82 | 489.79 | 18111.29 | 543.94 | 20386.65 | 667.46 | 24410.53 |
| 广东 | 508.58 | 28576.7 | 662.08 | 33630.02 | 926.4 | 38554.81 | 995.61 | 40965.51 | 1179.73 | 44069.74 |
| 广西 | 170.73 | 10057.55 | 209.71 | 12213.53 | 277.15 | 14578.49 | 306.05 | 15978.5 | 414.18 | 20758.89 |
| 海南 | 211.96 | 12498.92 | 267.92 | 14842.25 | 352.1 | 17600.23 | 382.72 | 19144.4 | 552.06 | 23769.47 |
| 重庆 | 332.05 | 13914.64 | 442.75 | 16605.58 | 706.41 | 20407.4 | 855.89 | 22840.19 | 1113.07 | 27475.3 |
| 四川 | 294 | 10638.07 | 413.19 | 12996.67 | 607.37 | 15484.43 | 707.42 | 17289.29 | 951.86 | 21361.9 |
| 贵 | 130.92 | 6225.66 | 156.91 | 7666.43 | 210.79 | 9390.49 | 250.73 | 10301.95 | 352.49 | 13228.62 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 州 | | | | | | | | | | |
| 云南 | 212.55 | 8896.14 | 247.8 | 10572.71 | 364.05 | 12529.43 | 393.96 | 13497.59 | 512.16 | 15699.28 |
| 西藏 | 69.39 | 10347.33 | 94.36 | 12022.18 | 113.24 | 13757.84 | 138.26 | 15217.74 | 168.26 | 16874.73 |
| 陕西 | 311.05 | 12700.43 | 401.54 | 15360.97 | 578.89 | 19443.33 | 688.2 | 21659.07 | 893.68 | 27102.72 |
| 甘肃 | 218.18 | 8736.38 | 268.85 | 10326.33 | 370.79 | 12049.75 | 434 | 12853.77 | 571.64 | 16096.81 |
| 青海 | 159.12 | 11833.94 | 194.56 | 14444.75 | 254.55 | 18376.69 | 326.75 | 19401.94 | 456.48 | 23986.32 |
| 宁夏 | 318.54 | 12018.21 | 393.11 | 15067.38 | 514.65 | 19490.68 | 628.27 | 21646.03 | 833.38 | 26694.42 |
| 新疆 | 416.63 | 14854.93 | 504.15 | 16816.99 | 715.74 | 19632.11 | 725.87 | 19813.72 | 873.73 | 24884.19 |

数据来源：2007 年-2011 年中国统计年鉴

# 我国各省经济发展对商业保险的影响

## ——基于面板数据的实证分析

寇业富 [1]，张灵 [2]
[1] 中国精算研究院，中央财经大学，北京，中国，100081
[2] 保险学院，中央财经大学，北京，中国，100081

摘　要：本文利用面板数据考察了各省经济发展对保险业的作用，突破了以往文献关注于某一特定地区的研究方式；并运用 panal data 的回归方法得出相关结论。研究发现经济发展对保险业发展的影响存在区域性差异。因此，各大保险公司在拓展业务时，应根据各省的经济发展水平选择差异性的战略和思路。

**关键词：**商业保险；面板数据；人均 GDP;秩相关

# The Study on the local Government and Market Relationships of the Basic Service System of Agricultural Insurance: Based on a Survey in Yuxi Area of Yunnan Province

QIAN Zhenwei

The Department of Insurance, Yunnan University of Finance Economics,Kunming,650091;
The Postdoctoral Workstation of China Insurance Regulatory Commission,100033;

**Abstract:** Which to strengthen construction in the basic system of agricultural insurance service is the inevitable choice of agricultural insurance compliance management and standardize management, is the important carrier of playing the function of social management. From the research point of view, the relationship problems of local government, especially the government of countryside (town) and insurance companies in agricultural insurance basic system of service, has become the important base of agricultural insurance operation problem in theory and practice. The author analysis present situation of basic level service system of agricultural insurance in Yuxi area, summarizes its operation characteristics and difficulties. At last, the author put forward the countermeasures which perfect basic service system of agriculture insurance in Yunnan.

**Keywords:** Agricultural insurance; system of service of basic level; local government and marke

## 一、提出问题

农业保险基层服务体系是指支撑农业保险制度运行和开展各项服务的基础平台，是农业保险资源配置的基层组织体系。要贯彻落实党中央国务院支农惠农的农业保险政策，实现“应保尽保”的宏伟目标，需要实施一系列的战略举措，其中最重要的有两条：一是加大地方财政配套能力，填补制度缺失，使重要农产品都覆盖在农业保险制度之内；二是提高基层服务体系的制度执行能力，使农业保险政策得到有效贯彻和实施[1，P157]。从调研来看，当前我国农业保险基层服务体系建设中地方政府，尤其是乡（镇）政府和保险公司关系问题，已经成为农业保险经营中的重要基础理论和实践问题。

## 二、基层服务体系建设中地方政府与市场：基于集体行动逻辑理论

农业保险属于“准公共品”，带有很强的“公益性”。基层服务体系作为农业保险制度一个有机组成部分，也具有“准公共品”特性，存在外部性。公共产品的“囚徒困境”博弈模型表明市场微观主体（如保险公司）与社会利益之间存在着冲突。由于市场微观主体的有限理性和机会主义倾向，它对自身利益追求的选择将会导致低效率的“占优均衡策略”。市场微观主体的自由必须以效率的损失为代价，导致市场微观主体有限理性与社会低效率的困境，即理性有界的市场微观主体会陷入“社会陷阱”①②中去。为了能走出囚徒困境，就必须采取集体行动。然而奥尔森（Olson.M.）的集体行动的逻辑理论告诉我们“有限理性的、寻求自身利益最大化的微观主体不会采取行动以实现社会共同利益”③。这就是造成农业保险基层服务体系建设的“市场失灵”的基本原因。

此时，市场机制难以起到农业保险基层服务体系资源的有效配置，需要地方政府采取集体行动，以克服个人理性与社会

①所谓社会陷阱，是指个人理性与社会福利最大化之间的矛盾，是阿罗不可能定理的一个应用。盖瑞·J.米勒：《管理的困境——可层的政治经济学》，上海三联书店，2003 年，第 37 页。

②用中国古话说就是“一个和尚挑水喝，两个和尚抬水喝，三个和尚没水喝”。这是一个囚徒困境博弈，两个和尚挑水喝是他们二人的占优均衡策略；三个和尚不挑水，没水喝也是他们的占优均衡策略，虽然每一个和尚都需要喝水，与其他和尚的利益一致。

③奥尔森：《集体行动的逻辑》，陈郁等人译，上海三联书店，2007 年，第 2 页。

福利最大化之间的矛盾，即地方政府积极参与农业保险基层服务体系建设，以克服市场供给不足，走出集体行动逻辑陷阱①。但如果完全由政府提供业保险基层服务体系这个准公共产品，则又由于存在信息不足、保险知识的技术壁垒等也会导致地方政府失灵。面对农业保险基层服务体系建设中可能遇见的“双”失灵，需要正确处理好农业保险基层服务体系建设中地方政府与市场关系，既要发挥地方政府这只“看得见的手”对农业保险服务体系建设进行资源配置的积极作用，同时也要通过市场这只“看不见的手”，促进保险公司对农业保险的积极性，发挥市场配置资源的作用，以减少市场和政府的双失灵，提高农业保险资源配置效率，实现帕累托改进，降低农业保险服务体系建设的交易成本。正如沃顿商学院的 Kunreather 和 Linnerooth（2000）提出的那样，无论是私营保险市场，还是政府都不是农业风险管理的唯一主体，这种观点相信，政府与市场的密切合作才是解决问题的唯一途径。

## 三、农业保险服务体系建设现状及存在困难：基于对云南玉溪的调查

农业保险是“保险玉溪行动计划”②的重要组成部分，不仅险种较为齐全，而且基层服务体系建设走在全省前列，其中人保财险红塔区支公司于 2011 年被中国人保财险公司（总部）授予“农村保险示范县”荣誉称号。目前玉溪市有烤烟、烤烟“两黑病”保险③、农房、能繁母猪、奶牛、水稻、玉米、油菜、森林火灾等 10 余个三农险种。2011 年玉溪市农业保险保费收入达 2901 万元，其中烤烟保险和烤烟“两黑病”保险之和为 2055.6 万元，占农业保险保费收入的 70.8%，水稻、玉米、油菜等种植物承保比例较高，具体情况见表 1 和表 2。

### （一）玉溪农业保险基层服务体系建设的基本现状与特色

**1、建立了较为完善的基层服务网络**

目前，玉溪市的大部分农业保险由人保财险玉溪市分公司承保。该公司下设 9 个县区支公司，并在经济较发达的乡镇设立了乡镇营销服务站 51 个，保险机构全辖乡镇覆盖率达 70%。初步形成由营销服务部、服务站、服务点构成的三级“立体化”的农业保险服务网络。玉溪市分公司制定了《乡（镇）农业保险服务站点建设标准》，坚持“六个一”建设标准④。每个乡镇服务站点配备多名工作人员和办公设备，具体见表 3。服务站点的主要职能为服务，包括向农民宣传、介绍险种、解答被保险人疑问、接到报案后与相关部门协同勘察现场、核赔定损、赔付保险金、处理保险标的等。同时还在各行政村设置了“农险联络员”，由村干部兼任。

**2、建立了较为完善的服务流程**

人保财险玉溪市分公司建立了比较完善的农业保险服务流程。农民遭受农业损失后，可以向村委会的农险联络员或乡镇服务站报案，然后由保险公司的乡镇服务站点和乡（镇）政府的农业综合服务中心（由畜牧站、农技推广站、农业中心等机构合并而成）一起，依据相关保险责任判断标准，联合核赔定损。种养两业保险的具体服务流程，可分别参考玉溪市红塔区黄草坝村的油菜花保险和高仓镇的能繁母猪保险的服务流程，见图 2 和图 3。

---

①钱振伟、张艳等.创新政策性农业保险模式及其巨灾风险分散机制研究：基于对云南实践的调查[M].北京：经济科学出版社，2011 年：P48-49

②云南保监局把玉溪市作为保险业优先发展、创新发展、统筹发展的重点区域和辐射中心，2011 年与玉溪市政府联合，量身打造“保险玉溪行动计划”。“保险玉溪行动计划”是保险机制将自然灾害、社会灾害管理进行综合管理的有益探索，根据地区发展特点，整合行业力量，强化保险业对玉溪经济社会发展的参与度及渗透力。

③烤烟“两黑病”保险由玉溪市人民政府烟草产业办公室提出投保需求，其目的是转嫁玉溪市八县一区试种从津巴布韦引进烤烟新品种 KRK26 可能发生的烤烟黑胫病和根黑腐病（以下简称烤烟“两黑病”）风险，鼓励农民积极种植优质烤烟支持红塔集团改善卷烟品质结构，实施集团制定的“51518”品牌发展战略。

④ “六个一”建设标准：落实一个固定场所、悬挂一块招牌、配套一套办公设备、制定一套工作制度、配备一套工作台帐、设置一个宣传信息发布栏。

**表 1　2011 年玉溪市种植业农业保险总况**

| 作物名称 | 计划承保面积（亩） | 实际承保面积（亩） | 完成计划率 % | 保费规模 (万元) |
|---|---|---|---|---|
| 烤烟 | 710000 | 568000 | 80% | 1720.8 |
| KRK26品种 | 22840.6 | 18600 | 81.4% | 334.8 |
| 水稻 | 80000 | 52543 | 65.7% | 54.8 |
| 玉米 | 50000 | 79152.2 | 158.3%[①] | 79.2 |
| 油菜 | 120000 | 120000 | 100% | 138 |
| 合计 | 982840.6 | 837988.2 | 85.3% | 2327.6 |

数据来源于中国人保财险云南省玉溪市分公司

**表 2　2011 年玉溪市养殖业农业保险总况**

| 作物名称 | 养殖总数（头） | 承保数（头） | 承保比例 % | 保费规模 (万元) |
|---|---|---|---|---|
| 能繁母猪 | 191132 | 95410 | 49.9% | 572.46 |
| 奶牛 | 200 | 45 | 22.5% | 0.972 |
| 合计 | 191332 | 95455 | | 573.432 |

数据来源于中国人保财险云南省玉溪市分公司

**表 3　玉溪市红塔区春和镇和高仓镇三农服务站点情况**

| 站点名称 | 性别 | | 年龄段（岁） | 学历 | 办公面积（m²） | 基础设备 | 2011 年保费收入 |
|---|---|---|---|---|---|---|---|
| | 男 | 女 | | | | | |
| 春和镇服务站点 | 3 人 | 3 人 | 30-44 | 5 个高中，一个大专 | 51 | 传真机、打印机、电脑、办公桌等 | 426 万 |
| 高仓镇服务站点 | 1 人 | 3 人 | 24-39 | 4 个高中 | 48 | 电脑、打印机、办公桌等 | 345 万 |

数据来源于笔者与玉溪市红塔区春和镇和高仓镇的 PICC 保险站点调查交流整理

[①]玉米的实际承保面积之所以比计划承保面积多是因为红塔区大春旱情严重，为确保中心城区人畜饮水安全，水稻承保面积完不成，改为承保玉米所致。

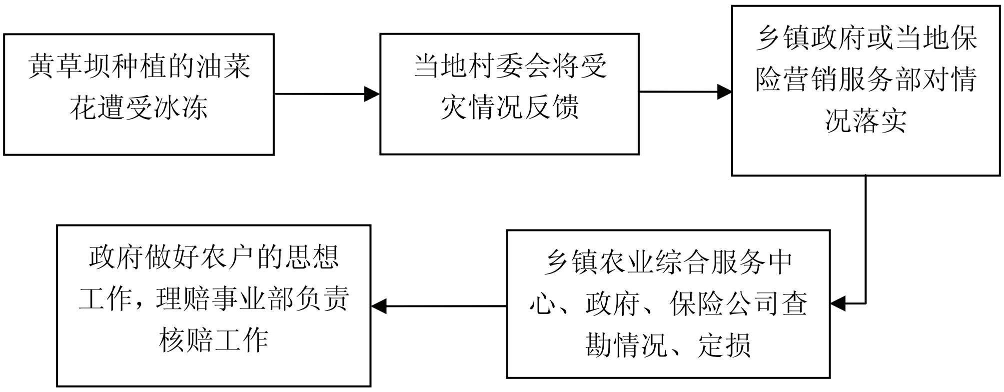



**图 2　黄草坝油菜花遭受冰冻春和镇农业保险服务站点对其处理的流程图**

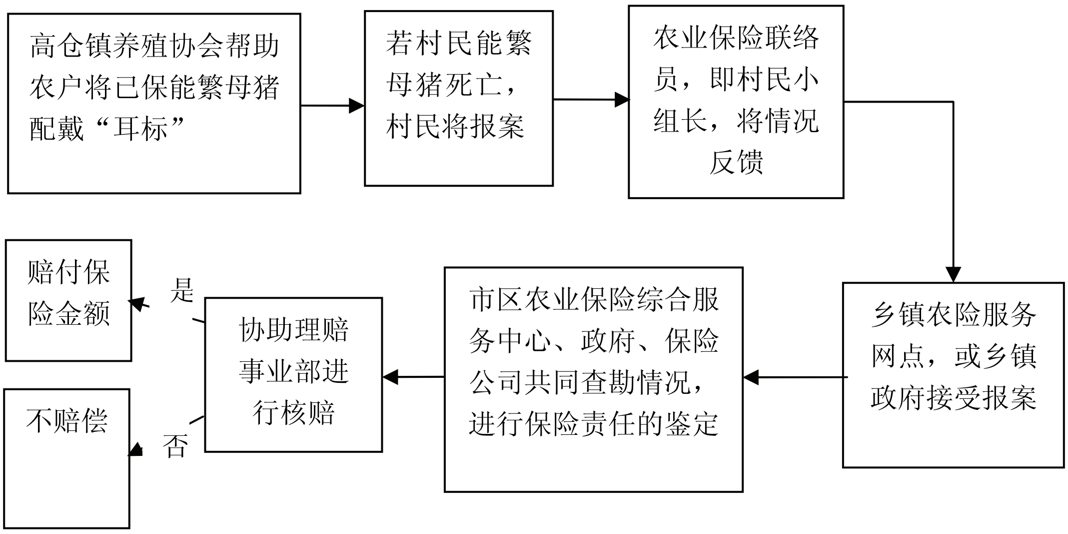



**图 3　高仓镇营销服务部对能繁母猪保险服务流程图**

## 3、建立了基层服务体系的评比激励机制

为充分发挥乡镇农险服务站点和村级农险兼职负责人的主观能动性，人保财险玉溪市分公司出台了《农业保险基层服务体系管理考核办法》（以下简称“办法”）。“办法”设置了考核指标体系，主要从保费规模、理赔情况、优质服务三个指标对相关人员进行考核。并面向所有服务站点设立年度一次的“保险先进乡”评比活动，对年度保费收缴工作特别突出、业务效益良好和服务落实到位的相关人员给予物质和精神奖励。

## 4、与农业专家一起科学设定保险赔偿标准

荀子曰：“假舟楫者，非能水也，而绝江河”。云南气候条件复杂，农作物各生长期间和受灾期间的价值估算复杂，而农业保险服务的时限性要求较强。为此，人保财险玉溪分公司借助当地农科院农作物专家的技术力量，聘请他们分别针对水稻、玉米、油菜等农作物的生长特点，确定它们在不同生长周期的价值，并按照其生长周期量身定做理赔方案，设定不同受灾时期的赔偿标准，其中水稻赔偿方案具体见表 4。这样既可以根据农作物实际受灾情况，给予合理经济赔偿，维护农民利益，体现了政策性农业保险的支农惠农的本质

属性，又可以有效防范道德风险，减少社会福利的损失，维护政策性农业保险制度的可持续发展。

**表 4 根据水稻生产期分类赔偿方案**

| | 移栽成活-分蘖期 | 拔节期-抽穗期 | 扬花灌浆-成熟期 | |
|---|---|---|---|---|
| 最高赔偿额 | 40%（84 元） | 70%（147 元） | 100%（210元） | |
| 损失率 | 抽样植株受损叶片总数/抽样植株标准叶片总数 | 抽样植株受损叶片总数/抽样植株标准叶片总数 | 冻灾（含8月低温度） | 暴雨、风灾、雹灾 |
| | | | 1-15%-结实率。<br>注：（1）结实率＝单株谷穗保满谷粒数÷单株谷穗谷粒总数。（2）正常结实率为85% | 单株谷穗损失谷粒数÷单株谷穗谷粒数 |
| 赔偿金额＝不同生长期的最高赔偿标准×损失率×受损面积×（1-免赔率10%） | | | | |

数据来源于玉溪市红塔区高仓镇的 PICC 保险站点调查交流

**（二）农业保险基层服务体系建设中面临的困难**

**1、基层服务体系中的部门联动机制不畅**

云南农业保险基层服务体系存在地方政府与市场边界不清，部门联动机制不畅，在乡(镇)政府农业综合服务中心没有设立“农险站”。乡（镇）基层政府应在农业保险基层服务体系这个准公共品的建设中承担起“引导作用”甚至是“主导作用”，与承保农险的保险公司建立联动机制，形成合力，一起完善基层服务体系建设工作，否则容易导致农业保险资源配置的“市场失灵”和“政府失灵”，例如由于查勘定损的农业技术比较高，能繁母猪死亡原因鉴定专业性强，当地乡镇农业综合服务中心人员把关不严，存在“见死即赔”现象。另外，在某些偏远地区，保险公司只能委托当地防疫工作人员进行查勘定损，而防疫人员由于收入较低，容易受利益趋动，同农户合谋，将埋下的病死猪挖起再卖，增加了道德风险。

**2、乡镇服务站点经营压力大**

乡镇服务站点的压力主要来自于两方面：一是服务成本的市场压力大，二是协助勘察定损的工作压力大。玉溪市红塔区属于经济较发达地区，其城边上的服务站点比较好，基本能够略有盈余。边远地区的服务站点一直处于亏损状态，如小石桥乡的服务站点。另外云南山区占国土面积的 94%，地形地貌复杂，出险地点分散，加之云南种养两业以个体农户经营为主，农业保险缺乏规模效应。如云南许多农户家里只养 1——2 头能繁母猪，规模养殖仅占 10%左右，每年七、八月份是猪死亡高峰期，这不仅造成农业保险服务成本高，而且导致基层服务人员协助查勘定损的工作压力大。协助查勘定损压力呈季节性变化，如油菜保险的查勘定损工作主要集中在每年 2、3 月份，能繁母猪保险的查勘定损主要集中在 7、8 月份。

**四、云南玉溪农业保险基层服务体系建设的对策建议**

要使农业保险制度得到有效贯彻和实施，提高制度的运行效率，就应理清农业保险基层服务体系建设中地方政府与市场的边界。建议地方政府和保险公司着力做好以下方面工作：

**（一）以“保险玉溪行动计划”为推手，推动地方政府参与农业保险基层服务体系建设**

经营农险的保险公司紧紧抓住“保险玉溪行动计划”契机，推动地方政府，特别是乡（镇）政府在农业保险基层服务体系建设中发挥“主导作用”。由相关职能部门，如农业局、林业局、财政局、保监局、气象局、保险公司和专家学者等组成农业保险工作协调领导小组，由分管农业的副市长任组长，

整合农技部门、农业病虫害监控防疫机构、气象预测监控机构、地质灾害监控机构等部门资源，通过天气预报、灾害预测、产量估算和收入估算等手段给予农业保险经营主体全面的技术支持，由乡镇政府联合保险公司共同建立三农保险服务站点，形成基层服务体系联动机制。

### （二）以农业合作组织为抓手，建立多层次的农业保险基层服务网络

地方政府大力发展当地农业合作组织，引导产业合作组织和龙头企业开展农业保险业务，如红塔集团、红塔区种植协会与养殖协会，建立一个多层次的农业保险基层服务网络。并通过农业保险制度建设促进农民组织化程度的提高，在农民自愿的基础上，鼓励各区县组织分散农户以村、乡镇为单位整体参保；鼓励由农业龙头企业带领基地农户集中参保；鼓励由农民专业合作组织和农产品行业协会组织社员（会员）集中参保。这种承保方式有利于提高投保率，降低展业成本；有利于投保人相互监督，减低逆选择和道德风险；也有利于密切公司与龙头企业联系，开展全方位的深入合作。

### （三）进一步夯实基层服务体系“软实力”，提升服务能力

“软实力”不仅是农业保险服务能力的重要体现，而且是基层服务体系“核心”所在。加强农业保险基层服务体系“软实力”建设，主要包括以下几个方面：一是进一步加强培育和树立服务三农的企业文化，建设一个充满社会责任感的现代保险企业。二是进一步加强基层服务体系基层站点人员的选拔和培训力度，特别是选拔有亲和力、有家族威望的本地人作为乡镇服务站点的负责人。服务站点工作人员个个都要“知三农”，对“三农”充满感情，服务到田间地头。这样就能和当地农民建立起牢靠的“信任”关系，恢复农民对保险行业的信任，有效减少理赔纠纷等。三是进一步乡（镇）政府加强农业保险的宣传工作。要充分利用电视、电台、报刊、网络、短信等，通过村委会召开学习农业保险的社员大会、编印、张贴、发放宣传资料多种形式，广泛宣传农业保险工作的重要意义和政策内容，做到家喻户晓，增强广大农民群众的保险意识、风险防范意识，引导农民积极主动参加农业保险。

### （四）进一步优化农业保险经营模式，理顺基层服务体系的体制机制

农业保险经营模式影响或决定着基层服务体系的体制机制。云南 94%国土面积为山区，地形地貌复杂，种养殖分散，出险地点较为分散，运营成本居高不下。当前“委托保险公司商业化经营，自负盈亏的模式”并不太符合云南的复杂的省情民情。经营农业保险的保险公司应抓牢“保险玉溪行动计划”机遇，按照“先行先试”的原则，建立保险公司与地方政府联办模式，经营风险由地方政府和保险经办机构共担、专户储存、单独核算、封闭运行、财政监督的农业保险经营模式，并进一步完善与此配套的基层服务体系，总结玉溪农险基层服务体系建设经验，然后全省推广。

参考文献

[1]钱振伟等.创新政策性农业保险模式及其巨灾风险分散机制研究：基于对云南实践的调查[M].北京：经济科学出版社，2011 年
[2]张艳等.云南政策性农业保险服务体系中的治理问题研究[J].云南财经大学学报（社科版），2011(4)
[3]奥尔森(陈郁等人译).集体行动的逻辑[M].上海：上海三联书店，2007 年

# 论农业保险基层服务体系建设中地方政府与市场的关系：基于对云南省玉溪市实践的调查[①]

钱振伟[1、2]

1.中国保险监督管理委员会博士后科研工作站，北京市西城区金融大街 15 号，100140

2. 云南财经大学金融学院保险系，云南 昆明市 650221

**摘要**：加强农业保险基层服务体系建设是农业保险合规经营和规范管理的必然选择，是发挥农业保险社会管理功能的重要载体，是确保党中央国务院强农惠农政策落实到位的重要保障。从调研来看，当前我国农业保险基层服务体系建设中地方政府，尤其是乡（镇）政府和保险公司关系问题，已经成为农业保险经营中的重要基础理论和实践问题。笔者在对云南省玉溪市农业保险基层服务体系调研的基础上，以"囚徒困境"博弈模型和奥尔森（Olson.M）的集体行动的逻辑理论为指导，分析玉溪市农业保险基层服务体系建设的基本现状，总结其运行特点和面临的困难，并提出了完善农业保险基层服务体系建设中政府与市场关系对策建议。

**关键词**：农业保险；基层服务体系；地方政府与市场

① 【基金项目】第五十批中国博士后（一等）科学基金《极端气候频现背景下的我国政策性农业保险制度创新研究：基于保障粮食安全视角》，项目编号：2011M500028。2012 年云南省省院省校合作课题《云南现代农业巨灾风险保障体系及实施难点研究：基于对云南 2010-2012 年抗旱实践的调查》。

【作者简介】钱振伟：男，1976——，福建人，经济学博士，中国保监会博士后，云南财经大学金融学院教授。

# Study on Construction of Typhoon Catastrophe Fund in China's Coastal Areas

SHEN Lei
School of Finance, ZheJiang University of Economic &Finance, Hangzhou, China, 310018

**Abstract:** In recent years, the super typhoons occurred more frequently and have become the constraints of economic development and social development in China's coastal areas. China does not have the conditions required by the typhoon catastrophe insurance fund because typhoon insurance market is not developed enough. So this paper puts forward ideas of Typhoon Catastrophe Fund which is led by government and insurance companies participate actively, the purpose of this fund is to enhance disaster relief functions of government and insurance compensation functions. This paper first discusses the necessity of construction of Typhoon Catastrophe Fund in china's coastal areas; on this basis, it puts forward the guiding principles of construction of Typhoon Catastrophe Fund and designs preliminarily its operation from four aspects of the operating mechanism, the core institutions, funding sources, and operating expenses; Finally, it analyses financing ratio and payment classification of Typhoon Catastrophe Fund by means of gray correlation methods.
**Keywords:** typhoon disaster; catastrophe risk fund; construction.

## Ⅰ.引言

1949 年至 1989 年，我国把中心附近最大风力达到 8 级（17.2m/s）或以上的热带气旋称为台风，将中心附近最大风力达到 12 级(32.7 m/s)或以上的热带气旋称为强台风。1989 年起我国采用国际热带气旋名称和等级标准，2006 年又将 “台风”以上强度的热带气旋进行了细分。因此，目前中国对发生在北太平洋西部和南海的热带气旋，依据其中心最大风力将中心附近最大风力小于 8 级的称为热带低压，8～9 级风力的称为热带风暴，10～11 级风力的称为强热带风暴，12～13 级风力的称为台风，14～15 级定义为强台风，16 级或以上的定义为超强台风。而本文所指的台风，考虑到历史资料的连续性及人民习惯，沿用 1989 年以前我国的规定，将近中心最大风力≥8 级的热带气旋统称台风，即将热带风暴、强热带风暴、台风、强台风、超强台风统称为台风。

中国海岸线漫长，是全世界遭受台风灾害最严重的国家之一，沿海自南向北都有可能受到台风袭击，平均每年有 7 个台风在沿海各省登陆，每次登陆的台风都造成大批人员伤亡和巨大经济损失，其中以广东、海南、浙江、福建最严重。如 2005 年沿海地区从 7 月～10 月月，接连遭遇了“海棠”、“麦莎”、“珊瑚”、“泰利”、“卡努”、“达维”和“龙王”等台风的袭击，给沿海各省造成的经济损失达到 500 多亿元，死亡 150 多人[①]。又如 2006 年台风“桑美”是 1949 年以来登陆中国大陆最强的一个台风，由于它具有中心气压特别低、风速特别大、降雨特别集中、发展迅速、移动快、影响时间短（集中）等特点，因而破坏力极大；据统计，台风桑美使浙江、福建、江西、湖北 4 省共有 665.65 万人受灾，因灾死亡 483 人，农作物受灾面积 29.0 万公顷，绝收面积 3.6 万公顷，倒塌房屋 13.63 万间，直接经济损失 196.58 亿元[②]。

目前应对台风的措施分为两类：一是台风袭击前的防御措施；二是台风袭击后的损失补偿机制。我国沿海各省一贯重视台风灾害防御体系建设，全面推进沿海防潮、渔船避风等工程建设，并逐步完善防台风预案、水文气象监测预报预警、防汛通信网等非工程措施。但就台风过后的损失补偿机制而言，虽然有财政资金进行灾后的救济，但政府救济的额度与台风造成的损失相比较，无异于杯水车薪。相关部门已意识到，应该充分发挥保险这种专业化的损失补偿机制为台风灾害提供保障，但由于种种原因目前保险发挥的作用相当有限。本文在分析建立台风巨灾基金必要性的基础上，提出构建以政府为主导的政府救济和保险补偿相结合的台风巨灾基金的设想，并对台风巨灾基金的运行进行了初步设计。

本文受浙江省教育厅科研计划一般项目资助（项目编号为 Y201010046）。

[①]资料来源：中国气象灾害年鉴 2006。
[②]资料来源：中国气象灾害年鉴 2007。

# Ⅱ.文献回顾

## A. 台风风险管理和损失补偿相关研究

一些学者单纯对我国台风灾害损失进行评估，而一些学者则在分析我国台风风险特征或对台风灾害损失进行评估的基础上，提出台风风险管理和损失补偿的相关策略。牛海燕、刘敏等(2011[1])根据 1990－2007 年的台风灾情资料，对沿海省市的台风灾害损失及其与致灾因子的关系进行分析评价，认为除个别区域外，沿海地区台风灾害损失都呈下降趋势，但各区域下降的幅度不等。陈和、蔡衡、吕智秀（2011[2]）认为妥善的台风灾害危机管理方案不仅包括预警与应急管理措施，还应包括灾后的赈灾补偿措施，而巨灾保险是完善赈灾补偿的有效途径。刁怀宏、谢婷婷（2011[3]）则分析了台风风险的可保性，并对有政府支持的台风保险供求行为进行博弈分析，表明农户购买台风保险的保险费用占其总产出的百分比在农户和保险公司的决策中至关重要。方伟华、钟兴春等(2011[4])利用浙江省农业政策性保险试点项目中的农村住房保险及理赔数据进行定量分析，以此建立了浙江省农村住房台风易损性方程并给出相关参数。薛建军、李佳英等（2012[5]）对登陆我国台风气候特征及灾害发生特点进行了分析，认为台风灾害导致的直接经济损失总量呈现缓慢增加趋势，人员死亡数明显下降；为了最大限度地降低和减轻台风灾害损失和社会影响，可依靠基于风险区划的防灾能力建设降低风险，依据准确的风险预评估避让风险，依赖保险特别是政策性巨灾保险的开展转移风险。曹伟华，黄崇福等（2012[6]）利用气象数据和企业财产保险理赔数据，对台风强度与企业财产脆弱性关系进行了识别，认为过程降雨量是刻画台风致灾强度的最优指标，该研究结果为区域台风风险管理提供了科学依据。

产生于上个世纪 90 年代的巨灾风险证券化推动了保险市场和资本市场的整合，鉴于在国外巨灾债券应对飓风巨灾风险损失补偿方面发挥的作用令人瞩目，国内一些学者因此受到启发，研究了我国发行台风巨灾债券的相关问题。施建祥、邬云玲（2006[7]）利用非寿险精算技术分析我国台风损失分布和次数分布，并以资本资产定价模型和债券定价原理计算台风灾害债券的收益率和价格。李永、刘鹃(2010[8])对我国 1990 年来损失在 1 亿元以上的台风损失以及次数分布进行拟合，并结合无套利 BDT 利率期限结构模型以及转移概率参数，建立了我国台风灾害债券短期利率离散形式的动态变化模型。侯峰、金大有（2010[9]）在考虑我国短期利率期限结构的基础上通过 Loubergè巨灾债券理论定价方法尝试对我国假想台风损失巨灾债券进行了具体定价。李永、范蓓、刘鹃（2012[10]）基于中国台风巨灾财产损失、受灾面积两事件，设计了多事件触发巨灾债券产品定价模型。

## B. 巨灾风险基金相关研究

一些国家和地区建立了巨灾风险基金制度，在巨灾风险基金的运行方面也积累了一定的经验，一些学者的研究围绕这方面而展开。王安（2008[11]）将巨灾保险基金的运作分为四种主要模式：政府作为巨灾保险提供者的美国国家洪水保险基金模式；商业化运作和商业化管理的挪威模式；多方合作的土耳其巨灾保险基金模式；政府提供巨灾风险再保险的佛罗里达飓风巨灾基金。冯占军（2008[12]）则在分析台湾地震保险制度的基础上，认为构建起多层次的地震风险分担机制，设立地震保险基金是关键。朱浩然（2011[13]）分析了土耳其巨灾保险基金的管理模式，认为其优点主要有:避免了在很多发展中国家中政府的权利集中，减少了腐败行为；使得各利益相关者的意见得到考虑，保持了良好的“公私合作”关系；充分吸收学术界和实务界的经验及技术。谢世清（2011[14]）考察了佛罗里达飓风巨灾基金的产生背景、组织结构、运作机制和运行状况等，认为和佛罗里达情况类似,我国东南沿海的广东省、浙江省、福建省容易遭受台风的袭击,可以考虑设立台风巨灾保险基金,而地震频发的西部各省可以设立地震巨灾保险基金。谢世清（2011[15]）还分析了加勒比巨灾风险保险基金(CCRIF)的产生背景和运作机制，认为 CCRIF 作为世界上第一个以参数指数为理赔机制、多国参与的区域性共保体,成功地吸引到了众多的会员和大量资金,并把巨灾风险转移到国际再保险和资本市场,它向加勒比各国政府提供了保费低廉的保险项目。

一些学者对于我国巨灾风险基金的建立等问题进行了研究。张雪芳（2006[16]）从彩票的公益性质、彩票市场的风险偏好、彩票与传统

保险的相似之处等方面进行分析，提出了以发行彩票方式筹资的巨灾风险基金模式。王晓炜（2007[17]）从巨灾基金的资金来源、支出、管理及信息披露等做出了会计监管方面的探索。卓志、王琪（2008[18]）提出通过政府、资本市场多渠道筹资和分担风险的巨灾风险基金构想。赵昕、冯锐（2009[19]）提出通过构建商业手段融资，但采取政府公共管理模式的巨灾风险基金，从中央和地方两个层面为巨灾风险提供分层保障。谢世清(2009[20])在论述中国建立巨灾保险基金必要性的基础上，认为建立我国巨灾保险基金的总体思路应当是，通过再保险的方式建立全国统一的巨灾保险基金，对巨灾保费实行单独立账、单独核算，由专业再保险公司代为管理，统一安排国际再保险、运用风险证券化等方式分散风险，实现成本收益的最优化。潘席龙、陈东（2009[21]）在分析目前财政救助性巨灾补偿体系弊端的基础上，提出在建立我国巨灾补偿基金的时候，至少应遵循补偿主体多和补偿资金来源多样化、补偿方式货币化、按受灾情况确定补偿额、成本与补偿对等、有利于风险预防和控制等几个方面的原则。

从现有文献来看，目前针对台风灾害损失补偿的研究并不深入，很多学者往往是在对台风灾害损失进行分析的基础上，泛泛提出建立台风保险制度的设想。一些学者关注于台风债券定价的研究，台风债券虽然是一种比较好的损失补偿方式，但其运行需要很多外部环境的配合，以目前我国现实来看，发行台风债券的时机并不成熟。台风巨灾基金制度是分散台风巨灾风险的有效手段，也是台风灾害损失补偿机制的关键环节，而国内这方面的研究尚未真正展开。基于此，本文试图对我国沿海地区台风巨灾基金的构建进行一个初步探讨。

## III.我国沿海地区构建台风巨灾基金的必要性

### A. 有助于解决台风巨灾风险弱可保性的问题

台湾学者袁宗蔚（ 2000 ）认为，可保风险的界限可以从技术上和经济上两个方面来看。可保风险在技术上的限制主要体现在：其一，有足够数量同类风险单位；其二，损失出于偶然而非故意之风险；其三，损失明确且能测定之风险；其四，损失非巨大灾害之性质的风险。可保风险在经济上的限制主要体现在：其一，发生较大损失金额之风险；其二，损失几率并不过高之风险；其三，保费负担合理可行之风险。台风风险并不能满足可保风险在技术上和经济上的所有限制。台风巨灾风险和其它巨灾风险一样，具有发生概率低，统计上不易做出有效的判断，因此存在参数不确定性，也就是说台风巨灾风险发生的概率很难进行正确的估算。当风险存在参数不确定性的时候，保险公司必须持有大量资金以保持出现无偿付能力的低可能性，相关保险的附加保费就会很高。对于投保人而言，意味着要支付极高的保险费，这可能使他难以承受。还有，台风巨灾风险的损失事件不是独立的，会影响比较广大的地区，使得几个省市同时受到不同程度的影响。可见，台风巨灾风险具有弱可保性，而建立沿海地区台风巨灾基金，不仅可以使台风巨灾风险在一个较广的区域内分散，更重要的是，可以实现台风巨灾风险的跨时分摊，从而在一定程度上解决台风巨灾风弱可保性的问题。

### B. 有助于增强商业保险在台风灾害损失补偿方面的作用

目前，商业保险在台风损失补偿方面发挥的作用比较小。以浙江省为例，2004 年，“云娜”台风造成直接经济损失 181.28 亿元，但全省保险业共支付赔款仅 7.54 亿元；2005 年，“海棠”等 5 次台风连续袭击浙江之后，造成直接经济损失 421.9 亿元，浙江保险业仅赔付 10.7 亿元； 2006 年，“桑美”等三个台风给浙江造成直接经济损失 134.3 亿元，但保险业赔付仅约 2.5 亿元；2007 年，在抗击“圣帕”等 3 次强台风中，浙江直接经济损失 157.2 元，但保险业支付赔款仅约 2 亿元①。可见，保险理赔数额在台风灾害损失中所占的比例很小，甚至有逐渐缩小的趋势。由于台风历史灾害数据的缺乏，保险公司无法对台风保险做出准确的定价，而强台风和极强台风发生概率小但损失巨大的特点，可能会对保险公司造成短期内的沉重的赔付压力甚至导致破产，再加上传统再保险市场的承保能力不足等多方面原因，导致保险公司在承保企业财产保险逐渐对台风高发

① 有关 2004-2007 年台风给浙江省造成直接经济损失的数据来自于 2004-2007 年《浙江省气候公报》，有关 2004-2007 年浙江省台风损失保险赔付的数据来自于《浙江保险业缩影》，证券日报，2012 年 5 月 24 日。

地区采取谨慎承保态度。而台风巨灾基金的建立有助于解决传统再保险市场承保能力不足的问题，减轻台风保险对保险公司造成的赔付压力，从而有助于扩大商业台风保险市场，增强商业保险在台风灾害损失补偿方面的作用。

### C. 有助于政策性保险在台风灾害损失补偿方面发挥更好的作用

近年来我国政策性农业保险的发展取得突破性进展，农业保费收入从 2006 年的 8.5 亿元增加到 2011 年的 162 亿元，增长了近 19 倍。而且，在对台风的灾后损失赔付中，农业保险发挥了较为重要的作用。例如在 2007 年在罗莎台风中，台风严重影响了浙江省乐清、鄞州、余杭和温岭四个地区的水稻生产，这四个地区的水稻简单赔付率分别为 657.12%、777.41%、706.45%、610.42%[①]，对于遭受台风损失的参保农户来讲，农业保险在一定程度上分担了灾后损失。除政策性农业保险外，政策性农房保险和渔船政策性互助保险在台风损失补偿方面也发挥了一定的作用。由于国家高度重视，政策性保险发展的制度环境日趋完善，但其发展面临仍一个突出问题，那就是缺少有效的巨灾风险分散机制。目前我国的政策性保险主要是由政府出钱给农民补贴保费，多家保险公司经营，全国并没有形成统一的体系，而单个保险公司又难以在全国较大范围分散风险。正是由于全国性的农业巨灾风险分散机制尚未建立，保险公司接受的巨灾风险得不到有效分散，这在一定程度上制约着保险公司政策性保险业务的承保能力，降低了保险公司对政策性保险的接受度，也难以提升巨灾损失补偿水平。在我国沿海地区，台风是政策性保险面临的主要巨灾风险，台风巨灾基金的建立自然可以在一定程度上解决沿海地区政策性保险缺少有效的巨灾风险分散机制的问题。

### D. 有助于平滑财政在台风救助方面的支出

全球气候变化和和财富的不断集中使台风所造成的经济损失不断增大，给我国沿海地区经济、人民的生产生活带来严重的影响。我国沿海省市政府历来十分重视防灾救灾工作的开展与实施，在保障灾民的基本生活、最大限度地降低灾害造成的损失、保持灾区的社会稳定等方面取得了显著的成绩。但是政府所能够提供的只是基本的民生保障，除了保障水平较低外，由于目前的政府拨发财政救济款都是在灾害发生之后，受到其他很多因素的限制，使政府财政补助带有临时性和不确定性的缺点，不能很好地满足灾后资金迅速到位的需求，甚至于许多计划中的救助资金最终可能会因为个人或机构的财务困难而无法完全兑现。政府救济会给中央财政和地方财政都带来比较大的压力，尤其是台风灾害发生的不可测，在个别年份灾害损失后果会特别严重，这无疑会影响到财政预算的计划性和连续性。而通过建立台风巨灾风险基金，政府每年拨付固定的数额到巨灾风险基金的帐户里，在巨灾基金资金积累到一定程度时，即便个别年份发生异常的台风灾害损失，巨灾基金仍能保证政府救济的顺利完成。这样，对政府财政来说，不至于因为台风损失的波动性造成财政支出的波动性，因此，台风巨灾风险基金的建立有助于平滑财政在台风救助方面的支出。

## Ⅳ.我国沿海地区构建台风巨灾基金的指导原则

笔者认为在构建我国沿海地区台风巨灾基金的时候，至少应该遵循以下几个方面的原则：

### A. 政府救助和保险补偿相结合的原则

很多国家和地区都建立了巨灾风险基金，这些巨灾风险基金都与保险直接联系，在政府和保险公司、再保险公司不同程度的参与下，层层分保，应对巨灾发生时大额的保险赔付，实现巨灾风险的分散转移。比如佛罗里达州的飓风巨灾基金(FHCF)是政府经营的巨灾再保险项目，旨在鼓励保险人留在佛州市场，于安德鲁飓风发生后在 1993 年 11 月成立，以应对有关飓风再保险的取得性问题。也就是说，很多国家和地区的巨灾风险基金就是巨灾保险基金。然而，根据我国目前实际情况，沿海地区台风巨灾风险基金并不适合采取巨灾保险基金的方式，原因在于我国台风保险覆盖面较小，在发挥台风灾害损失补偿方面起到的作用非常有限。当然，也有人提出可以通过强制性或半强制性的方式来推广台风巨灾保险，但这要花费相当高的成本，如果相关成本由政府支出的话，将给各级财政带来巨大的压力。从目前我国现实来看，政府救助和台风相关的保险虽然

[①] 数据来自于浙江保监局。

发挥的作用不同，但都是必不可少的台风损失补偿的方式，既然如此，我们可以通过建立台风巨灾保险基金来加大这两种方式所发挥的作用。也就是说，政府相关部门和保险公司都是台风巨灾保险基金的参与者，政府通过每年挑拨一定的资金来避免在不同年份台风救灾资金方面的波动性，而对保险公司来说，通过每年向巨灾基金缴纳一定的费用来规避台风巨灾风险。唯有这样，台风巨灾基金才能形成规模，当然，同时它也把政府救济和保险补偿相结合了。

### B. 风险跨区分摊和跨时分摊并重的原则

建立台风巨灾风险的目的就是为了更充分分散台风巨灾风险。对于巨灾风险基金来说，分散风险的基本方法主要有两种，即风险跨区分摊和风险跨时分摊。风险跨区分摊，是指巨灾风险基金通过在足够大的地区开展业务，使局部地区发生的风险尽可能在全部展业区域内得以分散。风险跨时分摊，是指巨灾风险基金通过在足够长的时期内开展业务，使得长期总收入与总支出保持平衡，以保证巨灾风险基金长期的财务稳定。巨灾风险基金在开展业务时，往往是将风险跨区分摊和跨时分摊两种方式结合运用，但其中跨时分摊风险方式更为重要。原因在于，同一时间台风巨灾风险造成的损失在区域上具有相关性，巨灾基金业务范围的扩大并不一定都能带来风险的更大分散，有时反而使风险更加集中，而不同年份台风风险造成的损失不具有相关性，如果巨灾基金开展业务时间足够长的话，就是较好地达到分散台风巨灾风险的目的。

### C. 社会责任和经济责任并重的原则

台风巨灾风险基金的作用就是要弥补台风巨灾风险可能造成的损失补偿空白，其对于社会的稳定、生产的发展、人民生活的安定具有非常重要的意义，因此承担的社会责任不言而喻。但巨灾风险基金在承担社会责任时，不可忽视其经济责任，也就是说，巨灾风险基金的运行虽然不能像商业化企业那样，以利润最大化为目标，但在一定时间内，其运行的成本和支出应基本平衡，才可以使其的发展具有可持续性。可见，台风巨灾风险基金社会责任和经济责任并重并不矛盾，承担经济责任的目的就是为了更好地承担社会责任。

### D. 鼓励融资方式和补偿方式创新的原则

在巨灾风险基金建立的初期，其资金主要来源于政府财政拨款和保险公司缴纳的费用，但在基金运行一段时候后，可积极探索补偿基金来源的多样化。比如，在时机成熟的时候，可在资本市场发行巨灾债券等，利用非传统风险转移工具扩大基金规模。同时，也应鼓励损失补偿方式的创新，比如借鉴加勒比巨灾风险基金以参数指数为触发机制的启赔方式。使用参数指数促发机制，巨灾基金赔偿机制的启动是事先约定的自然灾害事件本身的参数如台风风速和半径等，而不是基金参与人对灾害所造成实际损失的评估。参数指数机制的启赔方式可以减少道德风险，为基金在国际再保险市场和资本市场上分散风险提供有利条件,也能避免核定损失的繁琐程序,有效地减少一般损失补偿所需的冗长时间,满足对救灾资金的即时需求。

## Ⅴ.我国沿海地区台风巨灾基金运行初步设计

### A. 运行机制

从我国保险业的发展水平来看，国外那些以保险业为基础的巨灾保险基金模式，在我国都无法直接套用。但是，在台风灾害损失日益严重、对台风风险的转移和台风灾害损失补偿的要求日益迫切的背景下，我们不能等到沿海地区的台风保险市场充分发展后，才考虑建立台风巨灾补偿制度，而必须着眼于当前实际作出安排。这不表示我们否认了保险在分散台风风险方面所发挥的作用，恰恰相反，我们仍然认为保险是一种分散台风巨灾风险的重要手段，这不过在当下，保险发挥的作用的确有限。所以，本文所构建的整个台风巨灾风险基金系统中，不是把保险作为台风巨灾损失补偿的唯一手段而是把它作为重要手段之一。而且，我们相

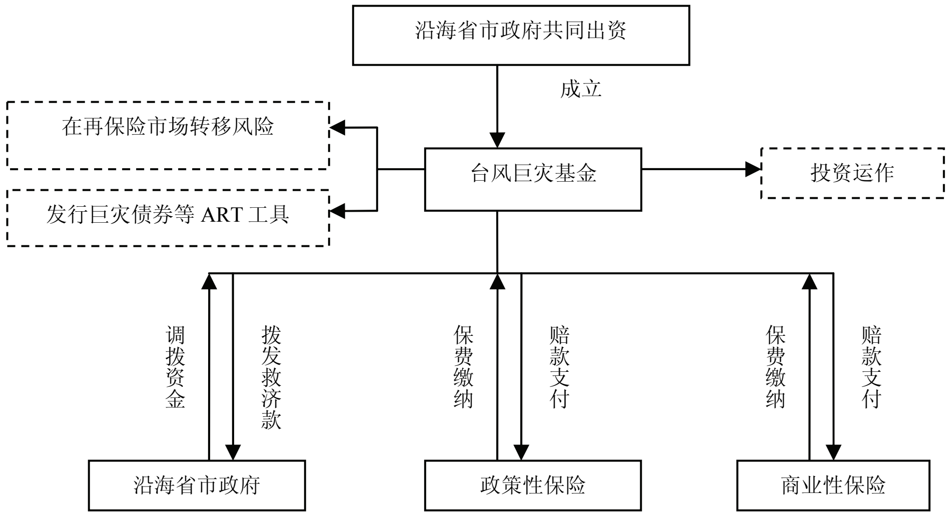



**图 1 沿海地区台风巨灾风险基金运行机制初步构建**

信，随着巨灾风险基金的发展，其对台风保险的支持作用就会日益显示出来，会有助于台风保险市场的日益扩大。可见，本文所构建的台风巨灾风险基金，是以政府为主导的，以各沿海省份政府协调一致后共同出资建立的、带有政府救助和保险补偿相结合性质的巨灾基金。其运行机制如图 1 所示。

## B. 核心机构

设立合适的核心机构是台风巨灾风险基金能否顺利运行的关键，拟建立的核心机构是“中国台风巨灾基金公司”，这是由沿海各省份联合控制和管理的独立法人机构，其主要职责是：制定巨灾风险基金的筹集方案并从各省政府、保险公司等筹集基金；制定台风巨灾风险的损失分摊计划并组织实施；选择并委托基金投资管理人、托管人，对基金的资产进行投资运作和托管，对投资运作和托管情况进行检查；在规定的范围内对基金资产进行直接投资运作；积极鼓励、促进和尝试台风巨灾融资方式和赔偿方式的创新。台风巨灾基金公司应建立健全公司治理结构、内部控制制度和风险管理制度，依法运营，独立核算。其董事会成员由各省市政府、保监会、保险公司推荐。在董事会下面还可设立一个咨询小组，其成员可由相关专家学者组成，对基金的运行状况、台风巨灾损失等情况进行调查研究，定期提交评估报告，为董事会提供决策依据。

## C. 资金来源

台风巨灾基金的启动金额，由沿海省市政府按一定比例共同出资。在正式营运时，其资金来源主要有以下一些渠道：

**1）政府财政拨款**

巨灾风险基金在成立后要根据不同省市台风灾害的历年损失状况、当地经济发展水平等制定缴费规则，每个省市根据该规则确定具体金额并进行调拨。当然，缴费规则的制定并不是一成不变的，在巨灾基金运行一段时间后，应根据实际情况作相应调整。有人会质疑台风巨灾基金的成立会增加政府的财政负担，当实际上并不会，因为对于易遭受台风灾害的一些沿海省市来说，每年都会拨付一定资金用于台风灾害预防和救灾方面，只不过在巨灾基金成立后，政府把这些资金的一部分划拨给了台风巨灾基金。

**2）政策性和商业性保险分保费收入**

如果发生巨大的台风灾害，将使经营政策性保险和商业性保险的保险人面临巨大的财务压力。因此，对于这些保险人来说，台风巨灾保险基金相当于一个再保险组织，保险人可以通过向基金分保来转移台风巨灾风险，同时，保险人缴纳的分保费自然成了基金的收入来源之一。

**3）社会捐赠**

主要来源于社会各界提供的用于救灾的捐款。

**4）发行巨灾债券等 ART（Alternative Risk Transfer，非传统风险转移）工具**

自 20 世纪 90 年代中期诞生以来，巨灾债券取得了长足发展。特别是近年来，巨灾债券的每年发行规模和速度连续取得了前所未有的突破，成为发行规模最大，交易最为成功的巨灾保险连接证券，对传统再保险形成了有力补充[22]。目前，飓风和地震是巨灾债券涉及最多的灾害种类，由此也可认为，用巨灾债券分散台风巨灾风险是一条可行的途径。在今后时机成熟时，台风巨灾风险基金可以作为发起人在国际资本市场发行巨灾债券进行融资，以实现台风巨灾风险在资本市场上的分散。

**5）发行巨灾彩票融资**

我国民政部门一直存在发行彩票来募集救灾资金的作法。如在 1998 年，中国南方遭遇特大洪水后，国务院决定由民政部通过发行 50 亿元抗洪赈灾专项彩票募集资金，该项目的顺利实施，使得遭受灾难的人们得到更多更及时的救助。又如从 2008 年 7 月 1 日至 2010 年 12 月 31 日的两年半时间内，民政部通过发行 300 亿元-400 亿元福利彩票网点即开票和中福在线即开票，募集汶川大地震灾区"福彩赈灾公益金"，帮助地震灾区恢复重建。如果我国沿海地区遭到特大台风灾害，导致巨灾基金相关支出猛增，甚至占到其可用资产价值的 90%以上时，可以出台相关规定允许它和民政部门一起通过发行彩票来筹集一定的资金。当然，这种方式一般不要轻易使用。

**6）投资收益**

台风巨灾风险基金的投资运营要坚持安全第一的原则，确保获得一定的收益，主要投资于银行存款、国债、央企债券等低风险的金融债券。当然，当条件成熟时，也可以做适当规模的产业投资、股票投资和海外投资。投资收益的逐年累积，有利于巨灾基金的可持续发展。

中国台风巨灾风险基金资金来源设计如图 2 所示。

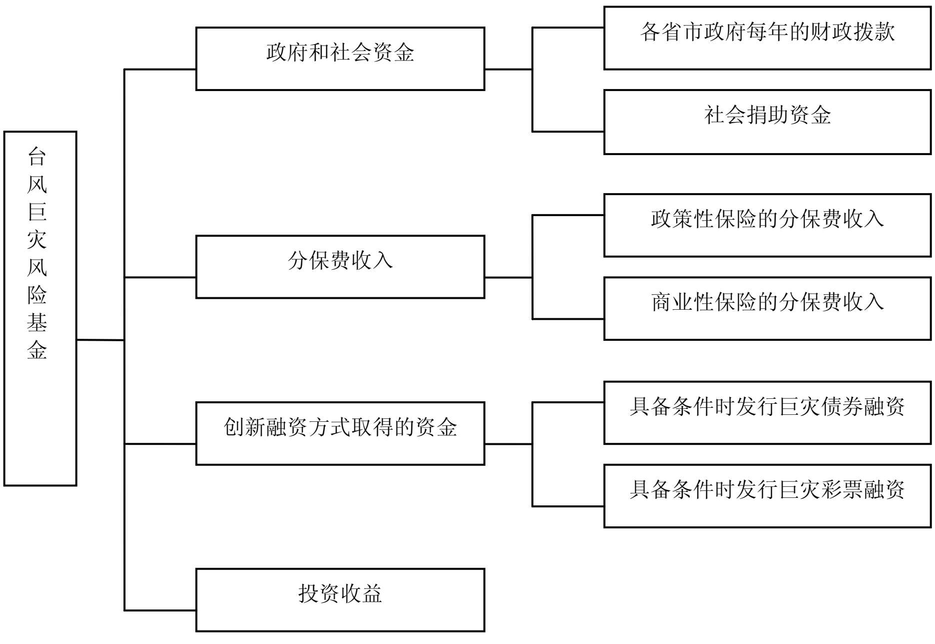



**图 2. 中国台风巨灾风险基金资金来源设计**

## D.营运支出

中国台风巨灾风险基金的运营开支主要有以下部分：

**1）各类运作费用和成本**

员工的薪水和福利、营运日常开支，再保险保费以及支付给再保险经纪人的佣金，各种筹资成本比如巨灾债券的发行费用等。

**2）台风灾害发生后支付给相关省份的救灾资金**

由于基金是基于台风巨灾而建立的，所以并非所有的台风灾害，基金都要拨出救灾资金。那么，究竟在什么样的情况下，基金要安排救灾资金呢？这时候可以考虑设定一个触发机制，该触发机制以台风相关的实际参数作为救灾资金拨付以及拨付金额多少的依据。当然，除了用灾害参数触发机制，也可以用模型损失触发机制。

**3）台风灾害发生后支付给保险人的赔偿款**

对保险公司赔偿条件的设置可以考虑使用两种或两种以上的触发机制相结合的方法，比如同时使用赔偿型触发机制和灾害参数触发机制，或者是同时使用赔偿型触发机制和模型损失触发机制，这样做的目的是尽可能防范保险人的道德风险，同时又不至于使保险人面临的基差风险太大。

# Ⅵ.我国沿海地区台风巨灾基金筹资比例和缴费分级分析

我国沿海各省市面临台风巨灾风险的程度不同，在确定各省市台风巨灾基金筹资比例和缴费等级时，应该要体现这种差异性。本文应用灰关联分析理论对于该问题进行简单分析。

## A.研究方法

灰色系统着重外延明确，内涵不明确的对象，研究重点是系统行为数据间的内在关系，是一种内涵外延化的方法。灰色关联分析法可以对事物的“小样本”、“少数据”、“不确定性”、“多变量输入”、“离散的数据”、及“数据的不完整”做有效的处理，根据因素之间发展态势的相似或相异程度，来衡量因素之间的关联程度。由于数据可得性的限制，本文应用灰关联分析理论对于沿海省市的筹资份额比例和缴费等级进行分析。模型原理如下：

**1）灰生成**

即数据的映射、转化、加工、升华与处理，其目的是为灰分析提供数据的可比领域。

**2）计算关联系数**

设 $X$ 为某一特定主题所确定的灰关联因子集，数列 $x_i=(x_i(1),x_i(2),x_i(3),......,x_i(k))\in X$，且 $x_i$ 已经过数据处理具有可比性。

其中：

$i=1,2,......,m\in N$，代表有 m 组数列。

$k=0,1,2,......,n\in N$，代表各数列包含 n 个因子。

令 $x_0$ 为参考数列，$x_1,\dots,x_m$ 为比较数列，将参考数列 $x_0$ 与其他比较数列 $x_i$ 之间的灰色关联度系数定义如下：

$$r_{0i}(k)=\frac{\Delta_{\min}+\xi\times\Delta_{\max}}{\Delta_{0i}(k)+\xi\times\Delta_{\max}} \tag{1}$$

其中：

$\Delta_{0i}(k)=\left|x_0(k)-x_i(k)\right|$，代表 $x_0(k)$ 与 $x_i(k)$ 差的绝对值；

$\Delta_{\min}=\min\limits_{\forall i}.\min\limits_{\forall k}.\Delta_{0i}(k)$，代表所有 $x_i$ 中最小的 $\Delta_{0i}(k)$；

$\Delta_{\max}=\max\limits_{\forall i}.\max\limits_{\forall k}.\Delta_{0i}(k)$，代表所有 $x_i$ 中最大的 $\Delta_{0i}(k)$；

$\xi$ 为分辨系数，在（0，1）内取值，$\xi$ 越小，关联系数间的差异越大，区分能力越强．本文中的 $\xi$ 取 0.1。

**3）计算关联度**

$$\Gamma_{0i}=\frac{1}{n}\sum_{k=1}^{n}r_{0i}(k) \tag{2}$$

灰色关联度表示两数列之相关程度，其中 $0<\Gamma_{0i}<1$，$\Gamma_{0i}$ 的值越接近 1 则表示相关程度愈高。如果将 m 个比较数列的对同一参考数列的灰关联度逐一求出，并依其大小顺序排序，得到所谓的灰关联序，这一灰关联序便可以用来评估各省市面临的台风灾害风险大小，以此作为沿海省市的筹资份额比例和缴费等级的依据。

## B.指标选择和数据来源

本文以我国沿海面临台风灾害的八个省市和自治区 2001~2010 年十年间发生的台风风暴潮灾害为研究对象。按照重要性、全面性及可比性的原则，及考虑实务上数据取得的限制，选取了以下指标：受灾人口（万人）、死亡（含失踪）人数、农作物受灾面积（千公顷）、海水养殖受灾面积（千公顷）、损毁房屋（万间）、损毁海岸工程（公里）、损坏沉没各类船只（艘）、直接经济损失（亿元）。本文选取的台风风暴潮灾害经济损失指标来源

于国家海洋局 2001-2010 年《中国海洋灾害公报》。

## C.计算结果及分析

通过计算得到的结果见表 1、表 2 及表 3。从表 1、表 2 可看出，各年度灰色关联度排名第一最多的为广东和福建，广东分别是 2003、2008、2009、2010 四个年度排名第一，福建则是 2001、2004、2005、2006 四个年度排名第一，而浙江则有二个年度灰色关联度排名第一，分别是 2002 和 2007 年度，说明这三个省份的台风灾害损失最严重。这从平均灰色关联度的情况也可以看出来，排前三位的依次是广东、福建和浙江。海南和广西在平均灰色关联度的排名中分列第四和第五位，说明这两个省遭受台风灾害的可能性还是比较大的，但严重性不及广东、福建和浙江三省。而江苏、上海、山东遭受严重台风灾害损失的可能性则比较小。

表 1 2001-2005 年各省市台风灾害损失灰色关联度及排名

| 省市名称 | 2001 | | 2002 | | 2003 | | 2004 | | 2005 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 灰色关联度 | 排名 | 灰色关联度 | 排名 | 灰色关联度 | 排名 | 灰色关联度 | 排名 | 灰色关联度 | 排名 |
| 山东 | 0.0909 | 3 | 0.0909 | 3 | 0.0909 | 4 | 0.0909 | 6 | 0.0951 | 6 |
| 江苏 | 0.0909 | 3 | 0.0909 | 3 | 0.0909 | 4 | 0.1332 | 3 | 0.0914 | 8 |
| 上海 | 0.0909 | 3 | 0.0909 | 3 | 0.0909 | 4 | 0.0910 | 4 | 0.1049 | 5 |
| 浙江 | 0.0909 | 3 | 0.7189 | 1 | 0.0909 | 4 | 0.5604 | 2 | 0.3236 | 3 |
| 福建 | 1.0000 | 1 | 0.4740 | 2 | 0.0909 | 4 | 0.5708 | 1 | 0.4920 | 1 |
| 广东 | 0.1953 | 2 | 0.0909 | 3 | 1.0000 | 1 | 0.0910 | 4 | 0.2130 | 4 |
| 广西 | 0.0909 | 3 | 0.0909 | 3 | 0.1158 | 2 | 0.0909 | 6 | 0.0932 | 7 |
| 海南 | 0.0909 | 3 | 0.0909 | 3 | 0.0979 | 3 | 0.0909 | 6 | 0.3996 | 2 |

表 2 2006-2010 年各省市台风灾害损失灰色关联度及排名

| 省市名称 | 2006 | | 2007 | | 2008 | | 2009 | | 2010 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 灰色关联度 | 排名 | 灰色关联度 | 排名 | 灰色关联度 | 排名 | 灰色关联度 | 排名 | 灰色关联度 | 排名 |
| 山东 | 0.0909 | 5 | 0.0909 | 7 | 0.0909 | 7 | 0.0909 | 7 | 0.0929 | 4 |
| 江苏 | 0.0909 | 5 | 0.1185 | 5 | 0.0911 | 6 | 0.1071 | 5 | 0.0909 | 6 |
| 上海 | 0.0909 | 5 | 0.0909 | 7 | 0.0909 | 7 | 0.0909 | 7 | 0.0909 | 6 |
| 浙江 | 0.3421 | 3 | 0.4480 | 1 | 0.0933 | 5 | 0.2407 | 2 | 0.0910 | 5 |
| 福建 | 0.5414 | 1 | 0.0950 | 6 | 0.1050 | 3 | 0.2355 | 3 | 0.3386 | 2 |
| 广东 | 0.4943 | 2 | 0.4438 | 2 | 0.8864 | 1 | 0.7786 | 1 | 0.7192 | 1 |
| 广西 | 0.0948 | 4 | 0.2099 | 4 | 0.2156 | 2 | 0.0974 | 6 | 0.2120 | 3 |
| 海南 | 0.0909 | 5 | 0.2195 | 3 | 0.0952 | 4 | 0.1814 | 4 | 0.0909 | 6 |

表 3 2001-2010 年各省市台风灾害损失平均灰色关联度及综合排名

| 省市名称 | 山东 | 江苏 | 上海 | 浙江 | 福建 | 广东 | 广西 | 海南 |
|---|---|---|---|---|---|---|---|---|
| 平均灰联度 | 0.0524 | 0.0571 | 0.0529 | 0.1719 | 0.2259 | 0.2815 | 0.0751 | 0.0831 |
| 综合排名 | 8 | 6 | 7 | 3 | 2 | 1 | 5 | 4 |

从计算结果来看，台风巨灾基金的构建对于广东、福建和浙江三省有重大的意义，对于海南和广西也是有必要的，但对于江苏、上海、山东三个省市而言，意义不是很大。因此，笔者认为，在建立台风巨灾基金公司时，广东、福建和浙江可作为主要发起人，海南和广西则作为参与者，而江苏、上海、山东可以不参与基金的建立。启动资金可由广东、福建和浙江三省承担大部分，海南和广西承担小部

分，比如广东、福建和浙江三省各承担 30%，海南和广西各承担 5%。

在筹建台风巨灾基金公司时，有些省市可以不参与，但在巨灾基金成立后，这些省市的政府和保险公司如果觉得有必要把台风风险向巨灾基金转移的话，巨灾基金还是应该接受，因为这样有助于扩大台风巨灾基金的规模，更好地实现风险跨区分摊和跨时分摊。而在确定各省市向台风巨灾风险基金的缴费等级时根据平均灰色关联度及综合排名作如下大致划分：广东、福建和浙江这三个省份可以划入为 A 类等级，也就是缴费的最高等级；海南和广西可以划入为 B 类等级，缴费费率低于 A 类等级；江苏、上海、山东则划入为 C 类等级，也就是缴费的最低等级。

## Ⅶ.结语

我国是世界上受台风灾害影响最严重的国家之一，平均每年有七个台风在我国沿海登陆，有年际变化大、登陆月份集中，影响范围广、极端风雨强等特征。面对严重的台风灾害损失，构建相对完善的台风巨灾损失补偿机制是十分必要的，正是基于这样的思考，本文提出了构建台风巨灾风险基金的设想。考虑到我国当前的台风损失补偿机制的实际，本文构建的巨灾基金并非国外普遍采用的巨灾保险基金的形式，而是政府主导的、政府救助和保险补偿相结合的混合形式。

本文只是对台风巨灾风险基金构建作初步探讨,相关问题仍有待深入研究。比如，在研究台风巨灾基金的运行时，仅从运行机制、核心机构、资金来源和营运支出这四个方面作了框架性的分析而没有深入探讨；又比如，由于数据可得性的限制，只采用了十年的台风风暴潮损失的数据对巨灾基金筹资比例和缴费等级进行简单分析，分析结果的参考意义相对有限；等等。这些问题有待在今后的研究中不断深入和完善。

## References

[1] Niu Haiyan，Liu Min，Lu Min, Quan Ruisong，Wang Jingjing and Zong Ning，Losses Assessment of Typhoon Disaster in China Coastal Areas，Journal of Coastal Areas, 2011.7.
牛海燕、刘敏、陆敏、权瑞松、王静静、宗宁，中国沿海地区台风灾害损失评估研究，灾害学，2011 年第 7 期。

[2] Chen He, Cai Heng, Liu Zhixiu, Typhoon Disaster Crisis Management: Based on Theory and Practice, Modern Management Scienci, 2011.11.
陈和、蔡衡、吕智秀，台风灾害危机管理：基于理论与实践的探求。现代管理科学，2011 年第 11 期。

[3] Diao Huaihong Xie Tingting，Insurability of Typhoon Risk and Its Demand and Supply Behaviors，Journal of Regional Financial Research, 2011.5.
刁怀宏，谢婷婷，台风风险的可保性及其市场供求行为分析，区域金融研究，2011 年第 5 期。

[4] FANG Weihua，ZHONG Xingchun，QIAO Yang，LIN Wei，XU Hong，LI Ying，Estimation of Rural Residential Building Vulnerability to Tropical Cyclone Hazards by Insurance Claim Data: Case Study in Zhejiang Province of China. Journal of Beijing Normal University (Natural Science), 2011.8.
方伟华, 钟兴春, 乔　阳, 林　伟, 徐　宏, 李　颖，基于浙江省台风灾害保险数据的农村住房易损性评价，北京师范大学学报(自然科学版)，2011 年第 8 期。

[5] Xue Jianjun，LiJiaying，Zhang Lisheng，Wang Xiurong，Xu Yinglong，Characteristics of Typhoon Disasters in China and Risk Prevention Strategies，Meteorology and Disaster Reduction Research, 2012.3.
薛建军、李佳英、张立生、王秀荣、许映龙，我国台风灾害特征及风险防范策略，气象与减灾研究，2012 年第 3 期。

[6] CAO Wei-hual，HUANG Chong-fu, ZHAO Han-ping, ZHAO Si-jian，Typhoon risk assessment of enterprise property: A case study on Taizhou city of Zhejiang province，Systems Engineering-Theory&Practice，2012.2.
曹伟华、黄崇福、赵晗萍、赵思健，企业财产台风风险评估:以浙江省台州市为例，系统工程理论与实践，2012 年第 2 期。

[7] Shi Jianxiang, Wu Yunling，China's Catastrophe Insurance Risk Securitization - The Design of The Typhoon Disaster Bonds, Finance Research, 2006.5.
施建祥、邬云玲，我国巨灾保险风险证券化研究—台风灾害债券的设计，金融研究，2006 年第 6 期。

[8] LI Yong, LIU Juan, Pricing Simulation of Typhoon CAT Bond Based on No-arbitrage Interest Rate Model, Forecasting, 2010.1.
李永、刘鹃，基于无套利利率模型的台风巨灾债券定价研究，预测，2010 年第 1 期。

[9] HOU Feng, JIN Da-you, Pricing Cat Bond Based on the B-K Binomial free Model, MATHEMATICS IN PRACTICE AND THEORY，2010.1.
侯峰、金大有，基于 B-K 二叉树利率模型的巨灾债券定价研究，数学的实践与认识，2010 年第 1 期。

[10]Li Yong，Fan Be，Liu Juan, Design and Pricing of Multi－event CAT Bonds:a Case of Typhoon Bonds in China, China Soft Science, 2012.3.
李永, 范蓓, 刘鹃, 多事件触发巨灾债券设计与定价研究：以中国台风债券为例, 中国软科学，2012 年第 3 期。

[11]Wang An, International Experience and China's Choice of Catastrophe Risk Fund, Western Finance, 2008.10.
王安，巨灾风险基金的国际经验与中国的选择，西部金融，2008 年第 10 期。

[12]Feng Zhanjun, Assessment of Development of Taiwan Earthquake Insurance System, Research, 2008.4.
冯占军，台湾地震保险制度发展评析，台湾研究，2008 年第 4 期。

[13] Zhu Haoran， Turkey Earthquake Insurance System and Its revelation， Chinese Insurance，2011.7.
朱浩然，土耳其地震保险制度及其启示，中国保险，2011 年第 7 期。

[14]Xie Shiqing，Operation and Lessons ofFloridaHurricane Catastrophe Fund， Journal of Central University of Finance & Economics, 2010.10.

谢世清，佛罗里达飓风巨灾基金的运作与启示，中央财经大学学报，2010 年第 10 期。
[15] Xie Shiqing， Operation and Lessons of Caribbean Catastrophe Risk Insurance Fund，Finance & Economics, 2010.1.
谢世清，加勒比巨灾风险保险基金的运作及其借鉴，财经科学，2010（1）：32-39
[16]Zhang Xuefang, Thinking of Catastrophe Risk Fund through the Issuance of Lottery, Finance Research, 2006.11.
张雪芳，对通过发行彩票建立巨灾风险基金的思考，财政研究，2006 年第 11 期。
[17]Wang Xiaowei， Catastrophe Fund Establishment of the Related Accounting， Modern Finance&Economics, 2006.11.
王晓炜，巨灾基金及相关会计的建立初探，现代财经，2007（5）：48-52
[18] Zhuo Zhi, Wang Qi, Construction and Pattern of Catastrophe Risk Fund In China, Insurance Reserch, 2008(Supplement).
卓志、王琪，中国巨灾风险基金的构建和模式探索，保险研究，2008（增刊）.
[19] Zhao Xin,Feng Rui, The Empirical Study of the Catastrophe Fund-raising Methods Based on the Factor Analysis. Fisheries Economic Research, 2009.1.
赵昕、冯锐，基于因子分析法的巨灾基金筹集方法实证研究，渔业经济研究，2009 年第 1 期。
[20] Xie Shiqing，The Thinking of the Establishment of China's Catastrophe Insurance Fund, Shanghai Finance, 2009.4.
谢世清，建立我国巨灾保险基金的思考，上海金融, 2009 年第 4 期
[21] Pan Xilong，Chen Dong, Study on Establishment of Catastrophe Compensation Fund, Southwest Finance, 2009.1.
潘席龙、陈东，设立我国巨灾补偿基金研究，西南金融，2009 年第 1 期。
[22] Xie Shiqing，Retrospect of Catastrophe bonds in Past Ten Years and Its Prospect, Guide of Securities Market, 2010.8.
谢世清，巨灾债券的十年发展回顾与展望，证券市场导报，2010 年第 8 期。

# 中国沿海地区台风巨灾基金构建研究

沈　蕾
金融学院，浙江财经学院，杭州，中国，310018

**摘　要**：近年来，强台风和超强台风发生频率呈上升态势，已经成为影响我国沿海地区经济发展和社会发展的制约因素。由于我国目前台风保险覆盖面不广，尚不具备构建台风巨灾保险基金所需的条件，鉴于此，本文提出构建以政府为主导的、保险公司积极参与，以提升政府救灾职能和保险补偿职能为目的的台风巨灾基金的思想。本文首先论述我国沿海地区构建台风巨灾基金的必要性；在此基础上提出台风巨灾基金构建的指导原则，并从运行机制、核心机构、资金来源和运营支出四个方面对台风巨灾基金的运行进行了初步设计；最后本文运用灰色关联法分析了台风巨灾基金筹资比例和缴费分级问题。

**关键词**： 台风灾害；巨灾风险基金；构建

# On Moral Hazard and It's Prevention in Agricultural Insurance of China

TUO Guozhu

Capital University of Economics and Business

**Abstract:** Since 2007, China's agricultural insurance has rapidly developed, and the collected premium has 20-fold increase, from 850 million RMB in 2006 to 17.4 billion RMB in 2011. But, the developing speed has slowed and fluctuated than that of expected in the past three years, especially livestock insurance, there are negative growth in 2009 and 2010, based on the heavy subsidies by governments. One of the important reason is the serious moral hazard cannot be hold back or within limits effectively. Some of these moral hazard problems both occur with the insured and insurer, and local governments. The main reason of the moral hazards is information asymmetry and the short of supervisory system, and local governments' cognitive gap with regard to agricultural insurance and so on. It is necessary to solve these problems throw many measurers, including legislative, supervisory public subsidies policies, micro operation and management of insurance company, famers learn the knowledge of insurance, so that promote its healthy and speed development of China's agricultural insurance with government financial support.

**Key Words**: Agricultural Insurance, Moral Hazard, Standardizing and Development

我国政策性农业保险在 2006 年到 2011 年里平均增长速度达到 83%，2011 年末保险费总收入达到创纪录的 174 亿元人民币。但在这五年中增长速度是波动的，特别是养殖业保险业务在此期间波动很大。我初略算了一下，2007 年中央财政开始补贴种植业和养殖业保险之后，最初两年，养殖业保险发展很猛，能繁母猪的承保量和保险费收入都创造了辉煌业绩。但是从 2009 年起养殖业保险大幅萎缩，保险费收入减少 30%以上，2010 年进一步负增长约 22%。养殖业保险中的主要险种能繁母猪保险和奶牛保险的签单量和保费收入都大幅度减少。直到 2011 年 12 月才扭转下降的颓势，到年末，主要承保家畜能繁母猪和奶牛有 6.2%和 10%的增长。养殖业保险与整个农业保险的持续增长显现出强烈的反差。

调查表明，造成农业保险在一段时间里增速减慢，特别是养殖业保险在 2009 和 2010 年萎缩的原因固然很多，但是某些地区和领域严重的道德风险，导致农业保险赔付率居高不下，经营养殖业亏损严重，是主要原因之一。重视研究政策性农业保险中的道德风险不仅是各家保险公司的重要课题，也是各级政府应当关注的重要课题。这个问题的较好解决是我国政策性农业保险制度健康和可持续发展的关键之一。

## 一、政策性农业保险中的道德风险

通俗地讲，道德风险是保险合同中一方和合同有关方因为不诚实守信、违反法律法规或者违背正常的经营规则，导致保险合同中的他方遭受风险损失的可能性。从理论上讲，道德风险是保险活动中信息不对称，其中一方藏匿信息和行为造成保险合同失衡，可能造成其他方的利益损失。很多研究成果都表明，投保方的道德风险造成的保险人冤枉赔款要占保险赔款的 20%甚至更高。而当前政策性农业保险特别是养殖业保险中的道德风险似乎更严重，已经成为农业保险持续发展的"拦路虎"。

在财产保险和人身保险中，保险双方都可能发生道德风险事故，但一般人特别是保险经营者都很重视投保人的道德风险。很少有人研究和注意保险人自身存在的道德风险问题。

在政策性农业保险中，道德风险事故同样可以发生在投保人和被保险人一方，也可以发生在保险人一方。特殊的是还可能发生在协助保险机构经营和管理农业保险业务的政府部门一方。三方的道德风险对政策性农业保险的经营都在产生非常严重的负面影响。当然，投保方的道德风险事故相对比较多，从面上来看也严重一些。这三方面的道德风险可以列举出很多种实例。

（一）投保方的道德风险

在种植业保险中，投保一方（投保人和被保险人）利用投保农户和保险标的比较分散的特点，和保险人对于保险标的风险精确识别和管理困难或风险管理中存在的漏洞，在种植业中，不按正常耕作制度或田间经营管理规范管理作物（例如，使用不适当的甚至假种、苗，该浇水不浇水，该排水不及时排水、该杀虫不杀虫，该防灾不防灾、该救灾不救灾等），导致或者扩大灾害损失等，或者偷梁换柱，有意混淆或更换保险标的，只投保部分地块，非投保地块遭受灾损后以已投保地块名义索赔，或夸大灾情和灾损；在养殖业中，将不同畜龄和健康状况的畜群作选择性投保，病畜带病投保，养殖鱼虾发生疫情之后才投保，甚至以无中生有制造畜禽死亡的假赔案的方式骗保。在保险监管部门所进行的能繁母猪保险专项检查中，还发现“少保多赔，多保假赔，一猪多赔”等问题。这类道德风险案件已经累见不鲜。这些情况也是典型的道德风险事故。

（二）保险人的道德风险

农业保险的保险人一方实际上也存在道德风险。由于农业保险的保险费接受各级政府财政补贴，有的保险业务人员便采取虚假承保或出具假保单的方式，不仅套取财政保费补贴款，而且使投保农户在发生风险损失时得不到保险补偿。有的地方在发生保险事故农作物受损之后，利用农民保险知识缺乏、又不直接持有保单的情况，不认真执行合同赔付责任，或者在定损理赔中压低灾损，少赔甚至不赔，欺骗被保险农民。

保险产品定价中也存在道德风险的问题。因为缺乏历史数据和理赔经验，加之主管政策性农业保险的政府部门没有参与，或者即使参与也因不大了解其中的技术和专业问题，没有多少发言权，更重要的是，迄今的政策性农业保险没有完善的法律制度，监管部门事实上并不严格审查条款和费率，致使有的地方由商业保险公司完全主导厘定的政策性农业保险费率不尽合理，有的地区对有的险种定价过高，也是保险人道德风险的一种表现。（当然，定价中利用信息和专业优势，不公正定价实际上是一种逆选择行为，因为是一种“事前隐匿信息”，造成保险合同的不平衡、不公正）。如果是在一个充分竞争的市场上，定价应该不是一个问题，通过很多保险人的竞争，最终会产生一个有利于投保人的均衡价格，也不会产生这里所说的道德风风险或者逆选择问题。而政策性农业保险的价格很难通过市场竞争来自动校正，就存在一个如何公平和合理定价的问题。

（三）地方政府的道德风险

目前，我国政府中央、省（直辖市、自治区）、市、县四级财政对农业保险的保险费进行补贴，这种补贴一般占到保费的 80%，有的地区甚至达到 90%。这个事实，加上我国农户分散、农业经营规模小、单位作物或饲养动物的保险金额不大，农户风险与保险观念淡薄，保险知识缺乏等原因，开展农业保险需要地方政府机构（主要是县、乡、村行政机构）在展业宣传和组织，灾后查勘定损和理赔等工作中予以协助。

在这种特殊情况下，基层政府部门可能在保险业务活动中，会有不适当的干预。有的地方政府曾经干涉保险机构的业务活动，要求保险机构签订不合规范的保单，否则别做；有的地方发生克扣、截留保险费的财政补贴款；有的甚至与保险公司合谋，搞“统保统赔”，农民不交保险费，有基层政府或者个人代垫代交投保农民应缴的保费，在年末通过假赔案或虚增赔款等方式，将基层政府或个人代交保费和政府财政补贴保费款套取回来；也有地方政府部门存在不规范地索取手续费、佣金问题；还有的地方政府，以补贴资金拨付为“武器”，迫使保险公司“无灾也赔”、“小灾多赔”，有的地方甚至出现地方政府和投保农户“联合起来吃保险”现象，没有参保也要求赔付；也有地方政府，在缺

乏经验依据的条件下，过分压低保险费率，致使保险经营困难，迫使保险经营机构收缩业务。这类道德风险事故，表面上是保险人的道德风险，事实上源于地方政府的不适当干预。

上述种种，源于地方政府的道德风险事故，造成保险经营机构正当保险费收入的减少和赔付率人为的提高，从而扩大了保险损失成本，或者不能给遭受灾损的投保农户足额赔付等问题，不仅损害了保险人的合法利益，更损害了被保险人的利益。也必然影响政策性农业保险制度的健康和可持续发展。

在这种保险环境下，在那些不能按合同得到足额赔偿的地方，农户投保积极性在一定程度上受到影响；一些保险经营成本很高的地方，保险人也只得收缩“战线”，减少承保；财政部门在没有找到有效纠正财政补贴“漏损”和不到位问题的措施的情况下，对于扩大补贴规模，增加保险标的种类、较快扩大农业保险的覆盖面，必然更加谨慎小心，也是顺理成章的。

## 二、政策性农业保险中产生道德风险的主要原因

### （一）投保方的信息隐匿和灾后不作为是其产生道德风险的重要条件

道德风险在理论上是因为保险经营活动中的信息不对称。

农业保险的投保人和保险标的本来就高度分散，保险过程中的任何一个环节都难以受到保险人的控制和监督，而且投保人（和被保险人）一方拥有对保险标的及其风险环境状况较多的信息，例如保险标的的自然、地理、经济环境和条件，当地的耕作制度、畜禽安全生产条件、饲养管理的规范程度、疫病发生状况等等，如果投保农户没有按照保险的最大诚信原则，在签订保险合同时如实告知，并在整个农作物和饲养动物生产过程中保证按照正常经营管理规范进行照料和管理，保险人就会在缺乏对保险标的风险状况了解情况下，厘定费率和制定承保条件，就必然会因此遭受不合理的损失。

而且，由于农业保险的标的，无论农作物还是饲养动物，都是活的生物，其组织、器官和整个机体在发生损害后，一般都具有自我恢复的能力。其灾害事故与其损失后果并不一定具有必然联系。在发生保险合同约定的灾害事故后，被保险人是否进行合理的及时的施救和加强田间管理（畜禽、水产的饲养管理），与农作物和家畜家禽、水产品风险损失的有无和大小关系极大。如果在灾后不作为，不该发生的损失也会发生，可能的较小损失也会成为巨额损失。这也是农业保险与其他财产保险的重大区别之一。

### （二）保险人的道德风险源于较大的且缺少监督的定价权

对于中国农业保险的保险人一方来说，它拥有制定格式保险合同的专业和技术的优势，合同条款中某些内容及其确切或者真实含意，并不是投保农户能够完全了解的。在现有条件下，保险人也因为拥有较大的甚至完全的定价权，可能不适当加大费率的安全系数，增加安全边际，使投保人支付的保费（包括财政支付的保费补贴）与其风险保障水平不一致。保险营销人员也会因为监管漏洞，通过非法手段与投保人密谋，签订假保单，骗取财政补贴或者多收保费，甚至将保费攫为己有。从而既损害投保农户的利益也损害国家的利益。

### （三）地方政府的道德风险与其对农业保险认识不到位关系较大

地方政府的道德风险问题，源于政府的财政补贴和基层政府对保险经营微观活动的深度参与。当然财政补贴和对微观活动的参与本身并不必然与道德风险相联系。问题是由于法律法规缺失，而政府在农业保险中又处于一种特殊地位，使得政府主要是地方政府，不大了解自己在农业保险制度和农业保险经济关系中的准确定位和权利边界，从而可能“越权”处理农业保险的微观业务问题，包括少数政府工作人员没有正确理解“财政补贴”的真正含义，以为自己可以对财政补贴有较大的“自有裁量权”，并理所当然地可以从中“分享”某些好处。当然，也不排除个别官员钻法律法规不健全的空子，借机谋取私人利益。

（四）监管不到位是农业保险道德风险

问题的重要原因之一

监管不到位也是频频发生上面多方道德风险问题的重要原因之一。与其他农业保险发达国家不同的是，我国政策性农业保险目前的制度，是由保监会、财政部、农业部等政府部门共同监管。财政部负责财政资金的补贴种类和范围的确定、补贴资金预算、补贴资金拨付、补贴资金的使用效果评价等规则制定和实施；保监会对由保监会审批的保险经营机构的经营活动、公司的偿付能力、公司的治理结构等进行监管；农业部门负责帮助保险经营机构进行展业宣传、并对灾损发生后的查勘、定损、理赔工作提供行政和技术支持等。如果制度严密，多头监管也会产生较好的监管效果，但目前的多头监管，却是各自制定监管规则。因为没有统一的规则，各个部门就可能“各自为政”、又因为缺少监管部门之间制度化沟通、协调的顺畅渠道，就难免会出现监管真空和监管漏洞。特别是地方政府，虽然参与农业保险的许多微观经营环节，却没有“人”监管它们，甚至在起草相关法规时，起草者也不知道要不要有相关监管规定，也不知道谁可以担当此类监管重任。

**三、多方位防范政策性农业保险中的道德风险**

有效遏制农业保险中的道德风险，要从多方面入手：

（一）加快农业保险立法的步伐，使农业保险活动有法可依。

鉴于政策性农业保险的特殊性，农业保险需要专门立法，建立相应的“游戏规则”，以便确立其有关各方的行为规范。有了“游戏规则”，投保人（被保险人）、保险人、各级政府在农业保险经济关系中的权利义务和行为规范有了依据，才能依法防范道德风险事故的发生，严厉惩治损害保险关系中他方利益的违法行为。例如，虚假承保问题、假赔案问题、选择性投保问题、灾后不作为问题等，都有赖于对这些问题的明确规范，包括对违规行为的惩罚规定。再如，不止一地出现的令保险公司头疼的“协议赔付[1]问题，基层政府克扣、截留保险费补贴等问题，都是农业保险损失补偿过程中发生损害被保险农户利益的原因之一，不从立法层面规范各级政府在农业保险活动中的权利和义务边界，合理调整保险政策。这类道德风险问题就难以解决。

继 2011 年春中国保监会发布了《关于加强农业保险承保管理工作的通知》，对于开办农业保险的条件、规划、条款费率的规范和报备、投保人的保险利益，对投保标的的识别等方面做出了具体明确规定。2012 年新春伊始，保监会又发布了《关于加强农业保险理赔管理工作的通知》，进一步要求各经营农业保险的公司要按照“主动、迅速、科学、合理”的原则，切实加强农业保险理赔管理工作，做到“定损到户”、“理赔到户”和“理赔结果公开”，确保赔案处理规范，赔款及时、足额支付给被保险人。这些规则尽管立法层次较低，但在一定程度上有助于道德风险的防范和治理。

（二）加强对财政补贴的效果的评价

公共财政支持农业保险在我国还是一种新的尝试，由于没有现成的经验可借鉴，资金的预算、拨付程序和监督以及使用效果，都需要进行评估和比较。评估也是一种检查和监督的过程，可以从中总结经验和教训，及时发现管理制度之中的漏洞和不完善之处。这对防范和制止各方道德风险有重要意义。高兴的是，财政部 2012 年已经安排在四川、内蒙、安徽、江苏四省、自治区进行农业保险保费财政补贴的效果评估工作。必定有益于提高财政补贴农业保险保费的资金使用效果，也可以探讨防范其中道德风险事故的有效途径。

（三）实行统一和全面的保险监管

保险监管是农业保险业务健康运行的保证，因此，近几年保监会和财政部发布了一系列文件规范保险公司在农业保险经营中的行为和财政补贴资金拨付程序和规则，保

[1] 这里所说的“协议赔付”是这样一种不合法、非正规的保险赔付的协商活动：有的地方农业保险在发生保险灾害损失后，不是依据保险合同约定进行合理和足额赔付，而是由保险公司与地方政府“讨价还价”。假如灾损不大，地方政府因为觉得“吃亏“，要求保险公司多赔，假如灾损太大，保险公司也会要求减少赔付。最后由地方政府和保险公司双方确定赔多少和如何赔。

证了政策性农业保险的顺利开展。但如上所述，由于是多家监管，难免有不衔接的地方，也还存在一些监管盲区。地方政府的一些行为实际上并不受保监部门和财政部门的监管。另外，有一些经营农业保险的机构（例如，中国渔业互保协会、陕西和湖北的农机安全互助协会，有些地区的谷物协会、果树协会、奶牛协会等），目前也还不受这些监管部门的监管。如果出现一些道德风险问题就无法很好解决。因此必须在统一的规则下实行对农业保险的全方位监管，以防范某些方面因为监管疏漏产生的的道德风险事故。

（四）完善保险经营的微观制度

对于很大一部分道德风险事故的发生，要靠保险经营机构完善保险经营管理制度来防范和杜绝，特别是要完善保险条款的设计，以及承保、核保、查堪、定损、理赔环节的管理。如果保险经营管理制度不健全，工作不细致规范，很容易为道德风险事故发生留下可乘之机。

另外，保险经营机构的经营管理制度建设，在地方政府的协助和支持下才能更加有效。乡村行政组织最了解本地农户从事农林牧渔业经营的规模和范围，生产经营和管理的规范程度，充分依靠基层行政组织，就可能较多掌握农户和保险标的的信息，容易识别和发现投保农户的道德风险，并加强对道德风险的管理。日本的农业保险，敢于按照农户的地块产量来承保，并实行区别于以家庭所有土地面积平均产量保险的费率，而不怕道德风险发生，除了农户普遍重视和讲求诚信之外，村一级组织对所有农户的土地和经营了如指掌是重要原因之一。

（五）在有条件的地方发展合作制保险

在有条件的地方发展相互与合作农业保险制度，也是减少道德风险事故发生的组织措施之一。国内外的经验表明，相互制或者合作制保险组织形式，因为参保农户之间利益的直接联系，有相互监督的条件和动机，道德风险就容易防范一些。在我国有条件的地方发展相互农业保险公司或农业保险合作社，至少在道德风险防范方面可以发挥机制方面的优势。上面所举日本的例子也可以说明这里的问题。当然从国外的经验来看，这种相互或者合作保险组织，如果规模过大，管理链条太长，"保东"或社员相互监督的作用也会相对减弱。

（六）让农民懂得更多保险知识并发挥其民主监督权力

对于不少地区的农民来说，他（她）们缺乏农业保险知识，而且大部分农民也实际上见不到保险合同[2]，对于自己在保险合同中的权力和义务知之甚少，甚至自己的利益受到侵害也浑然不知，这与其它欧美国家（如美国、加拿大、法国等）大不相同，这些国家的农业保险保单都是保险机构直接和农民签订的，投保农户清楚地了解自己的权利和义务，以及政府给农民补贴了多少保险费等。需要设法尽可能让我们的投保农民都一些保险知识，尽可能让他们了解保险合同权利和义务。

同时，也要在农业保险制度中规定投保农户的参与和监督权，例如把农民代表选进当地农业保险管理机构，对于投保、定损和理赔都应当有他们的代表参加，并在一定范围里张榜公布，广而告之。

**参考文献：**

[1] 江文胜 李冠佑 石有龙 龙文军. 发展畜牧业保险调研报告，载《中国农业保险组织制度研究》，p169，北京，中国农业出版社，2011 年 8 月第一版；

[2] 庹国柱. 道德风险 农业保险持续发展的"拦路虎"，金融时报，2011 年 1 月 19 日第 10 版;

[2] 因为至少在目前的情况下，保险公司处于经营成本的考虑，不可能在县和县以下有很多的业务机构人员，除少数规模较大的农户外，也不可能直接与每个投保农户签订保险合同。在业务比较好的地区和公司，最多也就能给投保险农户一个简单的"保险凭证"。

# 论政策性农业保险中的道德风险及其防范

庹国柱[1]

首都经济贸易大学

**摘要**：2007 年以来，中国农业保险发展迅猛，保险费收入由 2006 年的 8.5 亿元增加 2011 年的 174 亿元，增长了 19 倍。但近三年来的发展速度比预想的要慢一些，特别是养殖业保险 2009 或 2010 年连续两年负增长，与整个农业保险的发展很不协调。其重要原因之一是道德风险没有有效地得到遏制。这些道德风险事故既发生在投保人一方也发生在保险人一方，还发生在地方政府一方。其主要原因在于信息不对称和监管制度不健全，以及基层政府对政策性农业保险的认知差距等。必须要从立法、监管、财政补贴管理、保险微观管理以及农民自身增加保险知识和在农业保险中的积极参与等层面多方努力，才能有效解决这类问题，促进我国政策性农业保险的健康和快速发展。

**关键词**: 政策性农业保险 道德风险 防范 规范和发展

[1] 庹国柱，首都经济贸易大学农村保险研究所所长，保险系教授，博士研究生导师。

# Based on Entry and Hierarchical Grey Relational Analysis of Property Insurance Company Solvency Evaluation

WANG Haiyan, DANG Jiao

School of Economics and Management, Tongji University, Shanghai, China, 200092

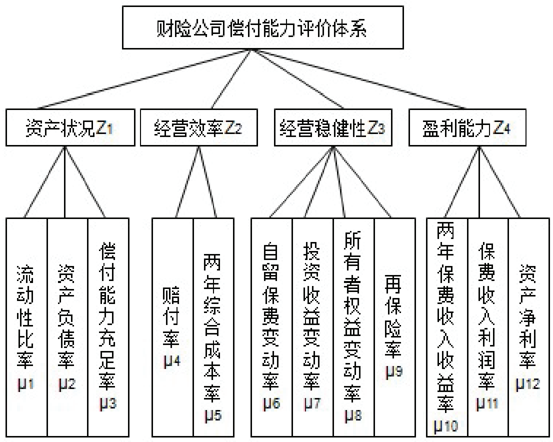
**Abstract:** Based on the established evaluation index system, aiming at solving the problem of incomplete statistical information in Chinese insurance industry, this paper introduces the gray relational analysis to evaluate the solvency of nine property insurance companies in China. This paper identifies the relative weights of grey relational coefficients for each index by analytic hierarchy process and entropy method. Then the paper sorts each insurance company’s solvency by grey relational analysis, providing a new thinking for the regulation of insurance institutions as well as the self-regulation of property insurance companies.
**Keywords:**solvency;grey relational analysis;analytic hierarchy process;entropy methods

## Ⅰ.引言

保险公司的偿付能力是指保险公司对其所承担的不确定风险责任，在发生风险损失时进行赔付和给付的金融支付能力。根据保监会于2008年10月31日发布的《保险公司偿付能力管理规定》，偿付能力又被定义为实际资产减去实际负债的差额。保户从保险公司处购买保单，是希望损失发生时保险公司给与赔偿或给付，这就要求保险公司有足够的偿付能力进行支付。因此，保险公司作为经营风险的特殊金融企业，充足的偿付能力是其维持正常经营和健康发展的必要条件。由于保险业具有社会性，保险公司偿付能力还关系到保户的切身利益和金融体系乃至整个社会的稳定性，是维护正常的社会秩序，保证国民经济健康稳定发展的重要环节。

目前有多种评价保险公司偿付能力的方法，如多元回归分析（Triechman 等，1973），logistic 回归分析（吕长江等，2006），比率模型，短期聚合风险模型，破产理论模型（陈鹏，2007）等，这类评价方法的共同特点是对样本数量和分布要求较高，而我国保险业起步较晚，随着相关政策的变化经历了多个阶段的调整和转变，从而造成保险公司统计数据缺失和口径不统一的现象，难以满足传统评价方法在数理统计上的要求。因此，近年来部分学者开始探索运用灰色关联分析法解决我国保险业在样本容量和数据完整性上的缺憾。灰色关联分析是灰色系统理论的基本方法之一，特点在于对样本容量要求不高，适用于无规律和部分样本数据缺失的情况，在社会科学和自然科学的各个领域都得到了广泛运用。

灰色关联分析在保险公司偿付能力分析中的运用主要分为两类，第一类是以灰色关联分析对影响非寿险公司偿付能力的内外部因素进行实证分析（闫春 赵清明等，2003）[1]，研究各种因素对偿付能力的影响程度。栗芳和俞自由（2001）以市场份额加权计算了各财险公司的灰色绝对关联度、相对关联度和综合关联




度，得出影响偿付能力的最大风险是再保险风险的结论[2]。除此之外，灰色关联分析还在评价保险公司偿付能力状况的方面得到运用，即通过灰色关联分析的计算，对保险公司偿付能力的优劣进行排序（闫春 刘伟等，2008）[3]。

无论是灰色关联分析在哪一方面的运用，确定各关联系数的相对权重都是非常重要的一步。在传统的灰色关联分析中通常采用算术平均值的方法（闫春 赵清明等，2003），虽然大大减轻了计算量，却不一定符合现实情况。闫

春和刘伟等（2008）将模糊数学与灰理论相结合，运用范数灰关联度法确定各因素的权重，虽然避免了算术平均法过于呆板和机械的缺点，但在计算权重的过程中又过于偏向复杂的数学处理，从而在一定程度上同样存在脱离实际情况的问题。因此，本文在确定指标权重时将主观赋权的层析分析法（AHP）与客观赋权的熵权法[4]相结合，对于指标数目较少，相对重要性易于区分的准则层指标采用层次分析法确定权重；数目较多且自身价值接近的基础层指标权重以熵权法计算，这样既考虑到了专家评分的主观意向，又客观的体现了各评价指标的重要性，从而得出较令人信服的评价结果。.

# Ⅱ. 构建财险公司偿付能力评价体系

本文的目的是对我国财险公司的偿付能力进行评价，其基础是建立起全面准确的偿付能力评价体系。以《保险公司偿付能力管理规定》和《保险业监管指标》为基础，同时借鉴美国保险监管系统（IRIS）的指标体系，本文构建起了有资产状况、经营效率、经营稳健性和盈利能力四个大类共计 12 个指标的财险公司偿付能力评价体系，如图 1 所示：

图 1.　财险公司偿付能力评价体系

## A. 资产状况类指标

资产状况类指标包括流动性比率、资产负债率、偿付能力充足率。某一时点保险公司资产负债表的的财务信息能够部分反映保险公司履行赔偿或给付能责任的能力。

$$流动性比率=\frac{流动资产}{流动负债}\times100\%$$

$$资产负债率=\frac{全部负债总额}{全部资产总额}\times100\%$$

$$偿付能力充足率=\frac{实际偿付能力额度}{最低偿付能力额度}\times100\%$$

## B.经营效率指标

经营效率指标包括赔付率和两年综合成本率。反映了保险公司利用资源、配置资源的状况及市场竞争能力。

$$赔付率=\frac{（赔款支出-摊回分保支出）}{保费收入-分保费收入}\times100\%$$

两年综合成本率=两年费用率+两年成本率

## C. 经营稳健性指标

经营稳健性指标包括自留保费变动率、投资收益变动率、所有者权益变动率和再保险率。指保险公司适应经济金融形势和市场环境变化，在消极事件发生后有偿付能力，并保持经营稳定性的能力，是保险公司偿付能力的一种体现。

$$自留保费变动率=\frac{本年自留保费-上年自留保费}{上年自留保费}\times100\%$$

$$投资收益变动率=\frac{本年投资收益-上年投资收益}{上年投资收益}\times100\%$$

$$所有者权益变动率=\frac{本年末所有者权益-上年末所有者权益}{上年末所有者权益}\times100\%$$

$$再保险率=\frac{分出保费}{总保费}$$

## D. 盈利能力指标

盈利能力指标包括两年保费收入收益率、保费收入利润率和资产净利率。反映保险公司赚取利润的能力，通常盈利能力越高，保险公司的偿付能力越好。

$$两年保费收入收益率=\frac{本年投资收益+上年投资收益}{本年已实现保费收入+上年已实现保费收入}\times100\%$$

$$保费收入利润率=\frac{承保利润}{保费收入}\times100\%$$

$$资产净利率=\frac{当年税后利润}{平均总资产}\times100\%$$

$$\xi_{ij}=\frac{\min_i\min_j|x_{0j}-x_{ij}|+\rho\max_i\max_j|x_{0j}-x_{ij}|}{|x_{0j}-x_{ij}|+\rho\max_i\max_j|x_{0j}-x_{ij}|}$$

## Ⅲ.基于层次分析法和熵权法的灰色关联度

灰色关联分析是对系统态势进行定量分析和比较的一种方法，其基本原理是比较参考数列和若干数列所构成的曲线在几何形状上的相似程度，用以衡量待评价数列与参考数列关联的紧密程度。曲线的几何形状越接近，灰色关联度就越大。

### A.确定参考数列和比较数列

设一共有 m 组比较数列，n 个评价指标。第 i 组比较数列 $X_i$ 可表示 $X_i=\{X_{ij}|i=1\cdots m, j=1\cdots n\}$。其中，i 表示第 i 家财险公司的序号，j 表示财险公司偿付能力评价体系中的第 j 个评价指标，$X_{ij}$ 即为第 i 家财险公司的第 j 个指标的评价值。

取数列 $X_0$ 为参考数列，$X_0=\{X_{0j}|j=1\cdots n\}$。

### B.指标值的无量纲化处理

不同列数据的量纲可能有所不同，从而影响分析结果的可信度。为使各数列在灰色关联分析中具有可比性，通常需要进行无量纲化处理，本文采用的是离差标准化的方法。

$$x_{ij}=\frac{X_{ij}-\min(X_j)}{\max(X_j)-\min(X_j)}$$
（i=1⋯m，j=1⋯n）

### C. 计算关联系数

其中，$\xi_{ij}$ 表示标准化后的比较数列 $X_i$ 与参考数列 $X_0$ 在第 j 个指标上的相对差值，即 $X_i$ 对 $X_0$ 在 j 指标的关联系数。$\rho\in(0,1)$，称为分辨系数，通常取 $\rho=0.5$。

### D．基于层次分析法和熵权法计算加权灰色关联度

关联系数反映了第 i 个数列对参考数列在第 j 个指标的关联程度。它的数值不止一个，因此反映的信息较为分散，为了便于做整体比较，需要将其集中为一个值。通常的做法是求各关联系数的平均值，即：

$$r_i=\frac{1}{n}\sum_{i=1}^{n}\xi_{ij}\quad(j=1\cdots n)。$$

但是考虑到财险公司偿付能力评价体系中，各指标影响偿付能力的重要程度不同，简单的将关联系数取算术平均值求出的关联度并不能准确的反映各财险公司实际的偿付能力，因此有必要重新设计各指标的权重。本文运用层次分析法和熵权法计算相对权重，将权重与关联系数相乘得出加权后的灰色关联度，最后将结果进行比较并评价各财险公司的偿付能力状况。

其中，加权灰色关联度为：$R_i=\sum_{i=1}^{n}\xi_{ij}\alpha_j$（α为各指标权重，j=1⋯n）

在计算各项指标权重时，准则层指标的权重以层次分析法确定，首先将各指标两两比较，构成判断矩阵，再进行一致性检验，当一致性比率 CR<0.1 时检验通过。然后计算各判断矩阵的最大特征值 $\lambda_{max}$ 和对应的特征向量 w 并进行层次单排序，即依次计算同一层指标对于上一层次某指标相对重要性的排序权值，确定准则层指标权重。

由于基础层指标数量较多，彼此之间相关性较强，重要程度也比较接近，继续使用层次分析法容易出现专家意见不统一，评分结果受主观因素影响较大的问题。为了克服以上缺陷，本文利用熵权法来消除各指标权重的主观影响，以各项指标反映的信息量来确定权重。某项指标变异程度越大，熵值越小，所携带的信息量越多，从而权重也越大；反之，权重则越小。

第一步：将 $R'_{m\times n}$ 标准化为 $R_{m\times n}$，消除指标之间的量纲。$R_{m\times n}=(r_{ij})_{m\times n}$ (i=1,2⋯m; j=1，2⋯n)

第二步：计算第 i 个待评价对象第 j 项指标的比重。$P_{ij}=r_{ij}/\sum_{i=1}^{m}r_{ij}$

第三步：计算第 j 项指标的熵。

$e_j=-k\sum_{i=1}^{m}P_{ij}\ln P_{ij}$ 其中，k=1/ln(m);并假定 $P_{ij}=0$ 时，$P_{ij}\ln P_{ij}=0$

第四步：计算第 j 项指标的熵权。

$$W_j=\frac{1-e_j}{\sum_{j=1}^{n}(1-e_j)}$$

## IV. 基于灰色关联分析的财险公司偿付能力实证

### A.确定参考数列和比较数列

本文选取了中国人民财产保险股份有限公司、中国太平洋财产保险股份有限公司、中国

平安财产保险股份有限公司、阳光财产保险股份有限公司、华泰财产保险股份有限公司、华安财产保险股份有限公司、中意财产保险股份有限公司、美亚财产保险有限公司和安联保险公司广州分公司作为样本，根据上文构建的偿付能力评价体系中的 12 个指标计算各公司的指标值，构成原始数据矩阵，如表 1 所示：

**表 1. 原始数据矩阵**

| 公司名称 | 指标 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 流动性比率$\mu_1$ | 资产负债率$\mu_2$ | 偿付能力充足率$\mu_3$ | 赔付率$\mu_4$ | 两年综合成本率$\mu_5$ | 自留保费变动率$\mu_6$ | 投资收益变动率$\mu_7$ | 所有者权益变动率$\mu_8$ | 再保险率$\mu_9$ | 两年保费收入收益率$\mu_{10}$ | 保费收入利润率$\mu_{11}$ | 资产净利率$\mu_{12}$ |
| 人保 | 0.3090 | 0.8769 | 0.1930 | 0.4601 | 0.7905 | 0.3226 | 0.3064 | 0.1411 | 0.1142 | 0.0433 | 0.3020 | 0.0284 |
| 太保 | 0.3153 | 0.7836 | 0.3660 | 0.3399 | 0.7018 | 0.5143 | 0.7641 | 0.1557 | 0.2041 | 0.0625 | 0.2740 | 0.0638 |
| 平安 | 0.4035 | 0.7839 | 0.1299 | 0.3213 | 0.6656 | 0.6471 | 0.3804 | 0.8634 | 1.3842 | 0.0487 | 0.3700 | 0.0597 |
| 阳光 | 0.2837 | 0.7586 | 0.3796 | 0.3550 | 0.7538 | 0.6405 | −0.3086 | 1.1711 | 0.0559 | 0.0829 | 0.4421 | 0.0285 |
| 华泰 | 0.5392 | 0.6679 | 1.6699 | 0.2756 | 0.7728 | 0.3226 | −0.3967 | 0.1426 | 0.2022 | 0.2243 | 0.3806 | 0.0400 |
| 华安 | 0.8843 | 0.9185 | 0.4230 | 0.3556 | 0.7623 | 0.4385 | −0.5070 | −0.1338 | 0.0096 | 0.5526 | 0.5993 | 0.0169 |
| 中意 | 0.6356 | 0.6072 | 1.6434 | 0.1644 | 0.5752 | 1.3088 | −0.1178 | −0.3066 | 0.2571 | 0.1002 | 0.4348 | −0.1907 |
| 美亚 | 0.8313 | 0.6291 | 1.0838 | 0.2765 | 0.9343 | 0.3764 | 0.1083 | −0.0231 | 0.3604 | 0.0318 | 0.2736 | −0.0084 |
| 安联 | 0.7418 | 0.8030 | 3.7934 | 0.1301 | 0.6006 | 0.3984 | −0.2084 | 0.0505 | 0.7764 | 0.1551 | −0.0956 | −0.0077 |

a. 数据来源：《中国保险年鉴 2011》
b．为便于处理，赔付率和两年综合成本率取原来数值的倒数。

**表 2. 关联系数值表**

| 公司名称 | 指标 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\xi_{i1}$ | $\xi_{i2}$ | $\xi_{i3}$ | $\xi_{i4}$ | $\xi_{i5}$ | $\xi_{i6}$ | $\xi_{i7}$ | $\xi_{i8}$ | $\xi_{i9}$ | $\xi_{i10}$ | $\xi_{i11}$ | $\xi_{i12}$ |
| 人保 | 0.3430 | 0.7893 | 0.3372 | 1.0000 | 0.6319 | 0.3333 | 0.5813 | 0.4177 | 0.3511 | 0.3383 | 0.5389 | 0.7824 |
| 太保 | 0.3455 | 0.5357 | 0.3483 | 0.7820 | 0.4851 | 0.3829 | 1.0000 | 0.4212 | 0.3681 | 0.3469 | 0.5165 | 1.0000 |
| 平安 | 0.3845 | 0.5363 | 0.3333 | 0.7459 | 0.4360 | 0.4270 | 0.6236 | 0.7060 | 1.0000 | 0.3407 | 0.6025 | 0.9688 |
| 阳光 | 0.3333 | 0.4934 | 0.3492 | 0.8107 | 0.5660 | 0.4246 | 0.3720 | 1.0000 | 0.3410 | 0.3566 | 0.6885 | 0.7831 |
| 华泰 | 0.4653 | 0.3832 | 0.4631 | 0.6545 | 0.5991 | 0.3333 | 0.3538 | 0.4180 | 0.3677 | 0.4423 | 0.6137 | 0.8423 |
| 华安 | 1.0000 | 1.0000 | 0.3521 | 0.8119 | 0.5805 | 0.3617 | 0.3333 | 0.3615 | 0.3333 | 1.0000 | 1.0000 | 0.7306 |
| 中意 | 0.5470 | 0.3333 | 0.4600 | 0.4136 | 0.3333 | 1.0000 | 0.4188 | 0.3333 | 0.3788 | 0.3653 | 0.6787 | 0.3333 |
| 美亚 | 0.8499 | 0.3497 | 0.4033 | 0.6565 | 1.0000 | 0.3459 | 0.4921 | 0.3822 | 0.4017 | 0.3333 | 0.5162 | 0.6382 |
| 安联 | 0.6781 | 0.5741 | 1.0000 | 0.3333 | 0.3597 | 0.3513 | 0.3952 | 0.3973 | 0.5307 | 0.3958 | 0.3333 | 0.6404 |

## B.原始数据标准化

采用离差标准化消除各指标的量纲，使其具有可比性。

**2）构造准则层判断矩阵，进行一致性检验和层次单排序**

准则层四个指标构成的判断矩阵采用向保险行业相关专家调研的方式得出，表 4 列出了该判断矩阵的值以及层次单排序的结果，一致性检验的结果附后。

**3）以熵权法计算基础层指标权重，得出加权灰色关联度**

根据表 2 中标准化后的数据，参照熵权法算法，各基础指标的相对权重如表 4，表 5，表 6 和表 7 所示：

## C.计算关联系数和加权灰色关联度

**1）确定参考数列，计算关联系数**

参考数列 X0 为{1,1,1,0,0,1,1, 1,1,1,1,1}，根据公式计算出关联系数。如表 2 所示：

**表 3 准则层判断矩阵及对目标层的权重**

| 综合评价 | Z1 | Z2 | Z3 | Z4 | 权重 |
|---|---|---|---|---|---|
| Z1 | 1 | 3 | 2 | 3 | 0.4330 |
| Z2 | 1/3 | 1 | 1/3 | 3 | 0.1645 |
| Z3 | 1/2 | 3 | 1 | 3 | 0.3085 |
| Z4 | 1/3 | 1/3 | 1/3 | 1 | 0.0940 |

注：$\lambda_{max}$=4.2153 CI=0.0702 RI=0.9 CR=0.078<0.1

**表 4 资产状况各指标权重**

| 资产状况 Z1 | 流动性比率$\mu_1$ | 资产负债率$\mu_2$ | 偿付能力充足率$\mu_3$ |
|---|---|---|---|
| 权重 | 0.3179 | 0.2142 | 0.4679 |

**表 5 经营效率各指标权重**

| 经营效率Z2 | 赔付率μ4 | 两年综合成本率μ5 |
|---|---|---|
| 权重 | 0.6752 | 0.3248 |

**表 6 经营稳健性各指标权重**

| 经营稳健性Z3 | 自留保费变动率μ6 | 投资收益变动率μ7 | 所有者权益变动率μ8 | 再保险率μ9 |
|---|---|---|---|---|
| 权重 | 0.3507 | 0.1759 | 0.1818 | 0.2916 |

**表 7 盈利能力各指标权重**

| 盈利能力Z1 | 两年保费收入收益率μ10 | 保费收入利润率μ2 | 资产净利率μ3 |
|---|---|---|---|
| 权重 | 0.7334 | 0.1409 | 0.1258 |

结合层次分析法得出的准则层权重，可以得出综合权重向量为：（0.1377，0.0928,0.2026,0.1110,0.0534,0.1082,0.0543,0.0561,0.0900,0.0689,0.0132,0.0118）。

## D. 财险公司偿付能力排序

将得出的指标权重带入公式$R_i=\sum_{j=1}^{n}\xi_{ij}\alpha_j$（α为各指标的权重，j=1…n），求得各财险公司的加权灰色关联度，如表 8 所示：

偿付能力充足率这一指标较为全面地反映了资产状况对整体偿付能力的影响。

**表 8 各财险公司的加权灰色关联度**

| 公司名称 | 人保 | 太保 | 平安 | 阳光 | 华泰 | 华安 | 中意 | 美亚 | 安联 |
|---|---|---|---|---|---|---|---|---|---|
| 加权灰色关联度 | 0.4959 | 0.4756 | 0.5289 | 0.4785 | 0.4585 | 0.6212 | 0.4850 | 0.5166 | 0.5742 |

可以看出，这九家财险公司按偿付能力的大小排序为：华安财产保险股份有限公司、安联保险公司广州分公司、平安财产保险股份有限公司、美亚财产保险有限公司、中国人民财产保险股份有限公司、中意财产保险股份有限公司、阳光财产保险股份有限公司、中国太平洋财产保险股份有限公司和华泰财产保险股份有限公司。

## V. 结论

本文构建了财险公司偿付能力的指标评价体系，并运用层析分析法，熵权法和灰色关联分析理论对我国八家财险公司的偿付能力进行了实证分析。针对我国保险业统计信息不完全的灰色系统特征，对传统的灰色关联分析法加以改进，在计算各指标相对权重时，利用层次分析法将专家评分意见转化为权重向量，并以熵权法挖掘各财险公司指标数据反映的真实信息水平，排除人为主观因素的影响。根据实证的结果，可以得出以下结论：

1.资产状况是影响财险公司偿付能力的最主要因素。根据层次分析法计算的相对权重，资产状况的权重达到了 0.4330，在四大指标中遥遥领先。可见，财险公司在改善和提高偿付能力状况的过程中，要着重优化资产结构，提升保险公司履行赔偿和给付责任的能力。此外，本文的资产状况指标由流动性比率、资产负债率和偿付能力充足率三个指标构成，同时考虑了保险公司短期和长期的偿债能力，也考虑了保监会监管中提出的

2.外资财险公司偿付能力相对较好，中型股份制财险公司表现参差不齐，国有大型财险公司偿付能力尚需优化。本文实证分析中的指标数据均采用财务比率，反映的是偿付能力的相对状况。虽然从偿付能力绝对值的角度来看，几家大型的国有财产保险公司，如人保财险和太保财险的偿付能力都名列前茅，但若是比较偿付能力的相对值，人保财险仅位居第五、太保倒数第二。虽然平安保险表现较好位列第二，但是和人保财险与太保财险不同，平安保险引入了高盛作为战略投资者，在公司架构和经营战略上更加的偏向于外资保险公司。在本文的灰关联分析排序中，表现最好的是华安财险，而最差的是华泰控股（即原来的华泰财险公司），这说明中等大小的股份制保险公司的偿付能力状况并不稳定。相比较而言，安联、美亚和中意这几家外资或中外合资财险公司的偿付能力排名虽然未能占据前三，但是整体上却优于国有和部分中资股份制财险公司，这表明近年来尽管中资保险公司的市场份额不断扩大，保费收入飞速增长，但与国外发达保险市场中的保险公司相比，还存在着管理经验欠缺，发展模式过于粗放等种种弊端，要想保持目前市场竞争力的绝对优势，中资财险公司还需要向外资财险公司学习经验，取长补短，提高偿付能力的相对状况。

3.整体上各财险公司的偿付能力尚需提高。从加权的灰色关联度来看，九家财险公司的灰关联度处于 0.45-0.62 之间，超过 0.6 的仅有安联一家财险公司，这说明没有偿付能力状况特别好的公司。造成这种现象的原因是主要是因为我国保险市场开放时间还比

较短，其发展尚处于初级阶段，保险公司都一味追求市场份额和保费收入的增长，而忽视了对偿付能力的监管和控制。虽然外资保险公司通常有着丰富的管理经验，但是在我国保险市场粗放发展的大背景下，也难免同中资保险公司一样过于陷入追求绝对业绩的境地。这种粗放式的经营模式往往增大了在发生超出正常年景赔偿和给付的特殊情况时，发展过于粗放的保险公司面临的因偿付能力不足而破产的风险。

4.提供了偿付能力评价的新思路。在通常的保险公司偿付能力监管体系中，监管机构更侧重于对各类会计财务指标进行合规监管，而本文则以改进的灰色关联分析法提供了一种新的思路供保险监管机构加以参考，也同样适用于财险公司对偿付能力的自我监管。

## References

[1] Yan Chun ,Zhao Mingqing and Zhang Yanmei, The grey relational analysis for solvency influencing factors of non-life insurance companies, Journal of Shandong University of Science and Technology(Natural Science) 2003.4
闫春、赵明清、张彦梅，非寿险保险公司偿付能力影响因素的灰色关联分析，山东科技大学学报（自然科学版），2003 年第 4 期
[2] Li Fang and Yu Ziyou, The empirical analysis of non-life insurance influencing factors ,The study of Finance and Economics,2001.7
栗芳，俞自由，“非寿险偿付能力影响因素的实证分析”，财经研究， 2001 年第 7 期
[3] Yan Chun, Liu Wei and Zhao Mingqing, The fuzzy comprehensive evaluation for solvency of property insurance company based on the grey relational analysis,Mathematics in Practice and Theory,2008.20
闫春、刘伟、赵明清，基于灰色关联分析的财产保险公司的偿付能力的模糊综合评判，数学的实践与认识， 2008 年第 20 期
[4] Peng Zhiqi and Dai Bin,The application research of grey relational analysis based on entroy method in supplier selection, Market Modernization,2008.1
彭志奇、戴斌，基于熵权的灰色关联分析方法在供应商选择中的应用研究，商场现代化，2008 年第 1 期
[5] ]Zhang Wei,Qiu Changrong, The empirical analysis of solvency of property insurance compnies, Journal of Jiangxi University of Finance and Economics, 2004.4
张伟、邱长荣，财产保险公司偿付能力实证分析，江西大学学报，中国， 2004 年第 4 期
[6] Yan Chun and Zhao Mingqing, The application of principal component analysis in solvency influencing factors of non-life insurance companies, Application of Statistics and Management, 2006.3
闫春，赵明清，主成分分析法在非寿险保险公司偿付能力影响因素中的应用，数学统计与管理，2006 年第 3 期
[7] Chen Hongtao, The early-warning index system research of the solvency of insurance company regualation,Research Forum, China, 2001.7
陈洪涛，保险公司偿付能力监管预警指标体系研究，研究论坛， 2001 年第 7 期

# 基于熵权法和层次灰色关联分析的财险公司偿付能力评价

王海艳，党姣

经济与管理学院，同济大学，上海，中国，200092

**摘　要**：本文在建立评价指标体系的基础上，针对我国保险业统计信息不完全的问题，引入了灰色关联分析的方法对我国九家财产保险公司的偿付能力进行了评价。文章以层次分析法和熵权法确定各指标灰色关联系数的相对权重，运用灰色关联分析对各财险公司的偿付能力排序，为保险机构监管和各财险公司的自我监管提供了一种新的思路。

**关键词**：偿付能力；灰色关联分析；层次分析法；熵权法

# An Research on the Participation of Fishermen in Marine-fishery Mutual Insurance

YE Xiaoling
School of Finance, Zhejiang University of Finance & Economics, Hangzhou, China, 310018

**Abstract:** The pilot work of the new round of agricultural insurance has been launching gradually under the government impetus since 2004。Meanwhile，there are still many special difficulties and problems. For example，most farmers have a low effective demand and insurance will, insurer is facing with a dilemma between supervision cost and high loss owing to asymmetric information, the conflicts between the public goal by government and the business profit by company, huge moral hazard problems in the field of agricultural insurance,etc. Fishery is an important component of agriculture in China, Fishery mutual insurance shows distinct characteristics. This paper, based on the topic about participation in marine-fishery mutual insurance, analyses several aspects including fishery production risk, means of risk management, income structure, Fisherman's attribute, culture and religious beliefs of the fishermen, and government interference, etc. Finally, conclusions and some other suggestions for future work about this paper were given.

**Keywords:** Fishman; marian fishery; mutual insurance; insurance will

## Ⅰ.引言

渔业是我国大农业的重要组成部分，渔业产值占农林牧渔业总产值的比重为 10%左右。从全球渔业产量看，从 1989 年到 2008 年我国水产品总产量已连续十九年位居世界首位，水产品出口额一直位于大宗农产品出口首位。2009 年我国水产品出口总额 106.9 亿美元，占农产品出口总额（395.9 亿美元）的 27%，在农产品出口贸易中具有比较优势。然而，渔业生产风险性极高，特别是捕捞渔业，是世界上公认的风险最大、灾害最重、死亡率最高的行业。据统计，美国从事渔业捕捞渔民的死亡率为 160/100000**，是美国其他行业平均死亡率的 25-30 倍；澳大利亚捕捞渔民死亡率为 143/100000，而其他行业平均死亡率为 8.1/100000，渔民死亡率是其他行业平均值的 18 倍。联合国粮农组织（FAO）估计，从事渔业捕捞和水产养殖的渔民中，约有 42%左右的人在有甲板和无甲板的渔船上作业，其中 90%以上工作在船长小于 24M 的渔船上。由此推断，那些没有统计数据的发展中国家，其渔民伤亡数字比上述提到的美国、澳大利亚等国家更高。根据中国渔业互保协会 1995-2004 年的统计数据，我国参与互保的海洋捕捞渔民死亡率为 210/100000，这个数字高于美国等发达国家。渔业生产高风险性不仅发生在渔业捕捞，在水产养殖中也表现突出。我国绝大多数水产养殖是在露天自然条件下进行，台风等自然灾害一旦发生，往往造成堤坝毁损、鱼塘垮塌、网箱损坏，养殖物死亡和流失。一次台风袭击，往往使经营者多年投入和辛苦劳作毁于一旦。如 2004 -2007 年，东南沿海 8 次台风共造成浙江省 440932 公顷水产养殖面积受灾、40 万吨水产养殖物流失，直接经济损失 64 亿元；再如，2006 年台风“桑美”使福建省福鼎市水产养殖遭受毁灭性打击，7 万多口养殖网箱全部摧毁，经济损失超过 6 亿。渔业生产的高风险迫切需要通过保险方式来分散风险和填补损失。然而，由于渔业保险的高风险、高赔付特征导致渔业保险供给不足。一方面商业保险公司出于风险控制和盈利考虑不愿提供相应风险保障，另一方面较高的保险费率和苛刻的承保条件也使渔民无法接受。因此，在渔业领域商业保险供给失灵的境况下，互助保险是一种有益的填补。

互助保险是有别于商业保险的一种生产者风险共济的非营利保险。我国渔业互助保险组

** 表示每十万人死亡 160 人，下同。

织-----中国渔业互保协会成立于 1994 年，至今已走过了 18 个年头，经过 18 年的发展，互助保险逐渐成为渔民风险保障的主要方式之一。互助保险的出现弥补了渔业保险市场供给的不足，在实践中显现了极强的生命力。

尽管缺少渔民的参保动因的专题研究，但国内外关于种植业农民参保意愿的相关文献还是不少。从保险需求理论分析，投保人的风险态度是影响其参保积极性的原因之一。国外研究与经验表明，农民对农业保险的需求相对较低。U.S.General Accounting Office(1999)报告显示，农户和农场主常利用多种风险管理方式来分散农业风险，如农作物种植和牲畜养殖多样化；改良农田灌溉方式；储蓄或对外借款；签订产销合约；利用农产品期货或弃权市场，以及政府补贴或政府灾害救济等等。这些风险管理工具都存在与农业保险相竞争。上述分散农业风险的管理方式的运用不利于农业保险参保率的提高。较低的参保率反过来又会导致保险人农业保险保费收入不能弥补赔付支出，从而导致农业保险市场的失败（Knight and Coble 1997）。Goodwin and Smith（1995）研究估算了农作物保险的需求水平，其需求弹性较低，一般在（-0.2）-（-0.92）之间。一些学者对农户购买农业保险的影响因素做了相关研究，Just ;Calvin and Quiggin（1999）认为，农户是否参与农作物保险计划主要取决于预期利益的大小，而规避风险只是促使他们投保的一个次要原因。对于农业保险供给问题，国外研究表明，商业性保险公司经营农业保险，尤其是农作物多重保险无一例外以失败告终。

近年来国内也出现了不少关于农业保险需求方面的研究。张跃华（2007）从效用层面解释了农业保险能够有效分散风险，但农民对农业保险需求非常低下的悖论，认为农民收入非常低，因而其对货币的边际效用非常高，当农民财富较低时，利用保险规避风险的意识也较低。一些学者从自然灾害严重程度、农业收入占家庭收入比重、农民支付能力、农民受教育程度以及政府保费补贴等对农业保险的需求进行了研究（张跃华等 2005；钟甫宁、宁满秀 2005；孙香玉、钟甫宁 2008；常亮、贾金荣 2009；孔哲 2010；黄英君等 2010）。还有一些学者则从政府补贴是否对农民参保决策和生产行为产生影响进行了实证分析（施红 2008, 2010;胡炳志、彭进 2009;孙香玉、钟甫宁 2009;龙文军 2003；黄英君 2009），认为政府保费补贴对农民参保具有正向激励作用。上述研究文献为本论文提供了研究的理论基础和基本思路。

## Ⅱ.海洋渔业互助保险的功能和作用

### A.渔业互助保险可以弥补渔民社会保障的部分缺失

我国一直以来城乡二元经济结构使社会保障形成了相互独立的城市社会保障制度与农村社会保障制度。农村社会保障是全国社会保障的重要组成部分，它的必要性在于保障农民基本的生活权益，维护农村稳定的需要。农村社会保障制度在面对渔民特有的风险时，存在较大缺失，表现在：

**1）渔民工伤风险**

我国《工伤保险条例》第二条规定“中华人民共和国境内的各类企业、有雇工的个体工商户应当依照本条例规定参加工伤保险，为本单位全部职工或者雇工（以下称职工）缴纳工伤保险费”。第二条第三款同时规定“有雇工的个体工商户参加工伤保险的具体步骤和实施办法，由省、自治区、直辖市人民政府规定”。条例对于渔民这种特殊群体是否归为“雇工”参加工伤保险没有明确规定。通常情况下均将渔民归类于农民，不属于工伤保险保障范畴。

即使退一步看，假设法律没有限制渔民参与工伤保险，但事实上，渔民工伤保险可操作性较差。根据工伤保险条例，参保人员发生事故后，必须提交合法劳动合同确认其劳动关系的存在才可享受工伤保险待遇。渔业生产季节性非常强，大多数渔民雇工都是临时性的、流动频繁，其作业的渔船和雇主也是频繁变动的，这些特征决定了渔民雇工难以从船东那里取得证明材料，尤其是面临高额赔偿风险时。可见，渔民往往在主体认定这第一个环节上就陷入困境，因而无法继续工伤索赔。所以说渔民“工伤”缺乏工伤保险制度保障。

**2）渔民失业风险**

我国农村实行以土地保障的自然就业制度，某一经济集体的农民子女，只要长到一定年龄，具有一定的劳动能力，就可以直接成为该集体的成员，参加该集体的农业生产劳动，实现就业，作为正式的劳动者，参与对生产成

果的分配，因此，现行农村社会保障制度并不包含失业风险保险。

渔民与农民存在很大差异，渔民没有土地，海洋渔业资源具有共有性。近年由于我国与周边国家 200 海里专属经济区的划定，加之渔业资源衰退，可供渔民作业的海域越来越小。政府为了限制过度捕捞实行渔船报废制度，渔民转产转业形势严峻。对于那些仍在海上作业的渔民，则面临着渔获物减少、柴油价格上涨、生产成本增加等困境，许多依靠传统捕捞的渔民已经无法维持基本生活。而从事水产养殖的渔民同样面临“失业”风险，近年来海域滩涂资源被大量征用，渔民失去了赖以作业的水域，由于没有渔业水域滩涂占用补偿机制，渔民“失海”意味着失去以往的谋生手段。渔民以渔业为生，其生活除了渔业基本上没有其他的来源，没有土地这种重要的不动产作为其基本的生产资料和财产，更不能从土地上获得生活保障。一旦渔民失去赖以生存的生产水域，便意味其丧失了获得生存保障的最后底线。因此与农民耕作土地减少的隐形失业相比，渔民的失业问题更为急迫。

我国并没有单独的渔民社会保障，它是依据农民风险保障的需求建立起来的，归类于农村社会保障体系。与农民社会保障一样，渔民社会保障也主要以养老、医疗保险为主，费用标准和保障水平按照所在地区农村生活水准确定，没有考虑渔民的属性和渔民所面临的特殊风险-----工伤风险、失海失业风险。由于城乡分割的二元社会保障制度 “篱笆”，渔民参与城镇职工工伤和失业保险并不现实，建立一个适合渔民风险特点的保障体系因此也显得尤为迫切。渔业互助保险是最典型的弱势行业风险管理与保障，渔业互保协会开展的雇主责任保险具有与工伤保险相似的风险保障功能，在很大程度上可以替代工伤保险，并且适应了渔民雇工临时性、流动频繁的特点，工伤认定和损失理赔上更符合渔民需要。在现行二元社会保障制度框架下，渔业互助保险可以填补现有渔民社会保障的“空缺”，是渔民社会保障体系最理想的补充。进一步分析，利用渔业互助保险既可以实现降低渔民渔业生产成本，又可以减轻“高危险作业、高强度劳动、谋生手段单一、生存危机四伏”的渔民群体面对自然界的不确定性，从而提高渔民与社会福利水平，实现渔村社会稳定之目的。而这正是政府所要达到的目标。有鉴于此，政府支持渔业互助保险是必要的、也是可行的。

### B.渔业互助保险适合“生计型渔民”风险补偿需求

自改革开放以来，我国形成了以传统家庭个体经营、股份合作制经营和企业化经营等多种形式并存的渔业生产经营体制。随着渔业产业化的不断推进，渔区出现了渔业生产资料向少数人集中的现象和趋势，造就了一批先富者，类似于投资者所有的渔业企业发展迅速，渔民贫富差距明显并有进一步扩大的趋势。渔区社会阶层分化为以“生计渔业”为目的的大多数传统渔民和以“商业渔业”为目的的现代化渔业企业。生计渔业通常指渔业经营目的是为了获得水产品维持自身或家庭成员生活需要，或有交换目的但主要是维持生计的渔业活动；而商业渔业则是以获取经济利润为目的，通过市场化的生产和交换，实现资本增值和积累。

我国生计型渔民大量存在，2006 年统计数据显示生计型渔民 766.66 万，占专业渔业劳动力总数的 60.86%，捕捞渔船大多为 60 马力以下木质结构，作业范围限于沿岸和近海水域，渔船抗风险性较差，一旦遇到台风大多受损沉没。据浙江海洋与渔业局台风灾害统计，因台风造成渔船沉没者 90%以上为小型渔船。渔业互助保险是解决生计型渔民风险损失的有效工具之一，理应成为渔村发展政策的组成部分。然而在不完全市场条件下，私营保险公司只青睐大型商业渔船和生产高附加值水产品的水产养殖公司，而将小规模生计型渔民和个体养殖户排除在外。即便是非营利性机构----渔业互保协会也因自身较弱的风险承担能力而不得不抬高入会门槛。比如，渔业互保协会目前承保的渔船大部分为 60 马力以上，水产养殖保险仅在个别地区试点，试点对象为有一定养殖规模的单位会员*。由此可见，对于那些抗风险能力非常脆弱、最需要风险保障的小型渔船、个体

* 2008 年 6 月，中国渔业互保协会与大连獐子岛渔业集团股份有限公司海水增养殖产品保险协议（总保险金额 1 亿元人民币，同时向英国 RSA 保险集团、韦莱保险经纪有限公司进行再保险。大连獐子岛渔业集团股份有限为 A 股市场上市公司，注册资本 4.5 亿人民币。2009 年 1 月，中国渔业互保协会与福建龙泽海产养殖有限公司签署总保额 2.7 亿元水产养殖保险协议，并同时向英国 RSA 保险集团、韦莱保险经纪有限公司再保险。 福建龙泽海产养殖有限公司是新加坡上市公司--欧圣集团的子公司。

养殖户，政府有必要给予财政支持，以彰显政府保障弱势群体权益、维护社会公平的责任。

# Ⅲ.影响海洋渔民对渔业保险需求的主要因素

## A.海洋渔业生产风险大损失后果严重

理论上，风险损失程度与保险需求之间存在相关关系。当个体（消费者）是风险厌恶时，面临的风险越大、风险损失程度越高，个体希望通过保险来规避未来不确定性损失的愿望就越强烈。从近几年的渔业生产损失原因调查结果看，对渔业生产造成重大影响的气象灾害主要是台风以及由台风引起的风暴潮、灾害性海浪等海洋气象灾害，其中最具破坏力、危害面积最大、损害程度最深是台风灾害。台风灾害对我国沿海地区渔业生产造成的损失后果主要表现在三个方面：

第一，渔民人身伤亡。渔业捕捞生产受海况影响较大，渔民人身伤亡主要表现在捕捞业生产过程。尽管近年来由于气象科技进步，对恶劣气象的监测信息越来越准确，管理部门也加强安全管理，提前向渔民发出台风等灾害预警并禁止渔民出海捕鱼等安全措施。但是，由于生态环境恶化，近年来极端性气象灾害加剧。人身伤亡仍然不可避免。近年我国沿海渔区台风活动频繁，每年登陆沿海的台风平均 7-9 个，台风强度增大、破坏性大。例如 2004 年台风“云娜”造成浙江 164 人死亡，24 人失踪。2005 年“卡努”台风在浙江台州登陆，浙江、上海、江苏、山东等地受其影响，渔民死亡 18 人；同年台风“龙王“造成福建渔民死亡 67 人；台风”维达”影响海南、广东、广西等省，致 25 人死亡。2006 年超强台风“桑美”袭击福建、浙江两省，造成渔民大量财产和人身伤亡，仅福建省福鼎市渔民死亡 240 人，失踪人 57 人，福建天然避风港沙埕港几成“死港”[1]；2006 年台风“碧利斯”袭击广东、福建、湖南等省，造成 154 人死亡，死亡渔民大多是家庭中的顶梁柱，许多渔民家庭因此失去了生活来源。

第二，渔船等直接财产损失。对从事捕捞的渔民来说，渔船是基本生产资料，也是遭受台风等灾害损失最直接的标的财产。2004 年 8 个影响我国沿海省份的台风共造浙江、广东、福建等省渔船损毁 4082 艘， 2005 年 9 个台风造成上述地区渔船损毁 6432 艘；以浙江省为例， 2004-2007 年期间，8 个台风共造成浙江省渔船沉没 3591 艘、受损 10.4 万艘，损失金额 3.5 亿元，其中 2004 年“云娜”台风造成全省渔船损毁 2582 艘，仅浙江台州一地损毁渔船 2149 艘，其中 284 艘沉没，经济损失 3825 万元（表 1）。

第三，养殖水产品流失。目前国内水产品养殖产量占整个水产品产量的比重为 63.7%，超过捕捞水产品产量。绝大多数水产养殖在露天自然条件下进行。当发生台风等自然灾害，往往造成堤坝毁损、鱼塘垮塌、网箱损坏，养殖物死亡或流失。一次台风袭击，往往使经营者前几年内的投入和辛苦毁于一旦。2004 年-2007 年，8 个主要台风共造成浙江省 440932 公顷养殖面积受灾、40 万吨养殖物流失、直接经济损失 64 亿元，其中 2005 年台风“麦莎”造成浙江省水产养殖产量损失 8 万余吨，直接经济损失 13 亿，占全省当年渔业总损失的 82.22%，部分地区水产养殖几乎全军覆没（王莉、骆乐 2006）。2006 年“桑美”给福建省福鼎市水产养殖带来毁灭性打击，7 万多口养殖网箱全部摧毁，经济损失超过 6 亿。

## B.海洋渔民缺乏多样化的风险处置手段

渔民风险处置手段相对种植业农民来讲显得较为单一。种植业农民应对风险的手段主要包括采取多样化种植、自我储蓄积累、增加非农收入、风险分担（保险、实物帮助、货币收入转移等。在中国，由于种植农业经营小规模化的特点，农户更易采用种植空间和种植作物的多样化、外出打工收入等方式来减轻风险冲击、平滑家庭收入。也正因为土地细碎、经营分散，种植农业收入在家庭收入中占比不大，农户参与保险的意愿不强。与土地种植不同，渔业生产大部分在海上进行，海上作业使作业渔民面临极高的财产和人身风险；海水养殖对气候和水质要求非常高、且不同养殖品种需要不同的养殖技术，渔民很难通过多样化养殖水产品来降低风险。所以，相比种植业，渔业风险缓解手段比较单一，通常情况下，渔民一般会通过自我储备积累来缓解风险冲击。自我储备包括食物储备、金银饰品、现金和存款等，这些可视为渔民的流动性资产，当遇到大的风

[1]人民网 http://society.people.com.cn

险冲击的时候，渔民可以动用这些流动资产，临时满足基本生活需要的开支。但是当渔民没有流动性资产储备，且没有外界帮助的情况下，可能会面临更大的困难，其基本生活不能得到满足，此时渔民将不得不变卖固定性资产，一般是生产性固定资产。从长期看，如果渔民变卖生产性资产来进行消费，后期生产将会受到较大影响，进而导致未来收入进一步减少。况且对于捕捞渔民来讲，渔船、渔具不仅是渔民家庭最主要的固定资产，而且还是获取收入来源的最重要生产工具，渔船灭失损毁会导致多数渔民实际上没有任何可以变卖的固定资产，甚至一些渔民为购渔船已经负债累累。所以对于大多数家底不富裕的渔民，自我储备积累应对风险的能力是十分有限的。

**表 1：　近年以来台风对浙江渔民造成的直接损失**

| 台风名称 | 发生时间 | 渔船损失 | | | 水产养殖损失 | | | 二项合计金额（万元） |
|---|---|---|---|---|---|---|---|---|
| | | 沉没*（艘） | 受损（艘） | 金额（万元） | 面积（公顷） | 产量（吨） | 金额（万元） | |
| 韦帕 | 2007 | 949 | 1673 | 2614 | 38310 | 69843 | 74878 | 77492 |
| 罗莎 | 2007 | 212 | 446 | 1415 | 39611 | 34713 | 63004 | 64419 |
| 桑美 | 2006 | 1003 | 1153 | 6988 | 15806 | 30139 | 39703 | 46691 |
| 海棠 | 2005 | 390 | 278 | 1046 | 24568 | 34853 | 49670 | 50716 |
| 麦莎 | 2005 | 332 | 1458 | 5085 | 232788 | 78602 | 131386 | 136471 |
| 泰利 | 2005 | 36 | 105 | 30.6 | 5201 | 1871 | 3306 | 3337 |
| 卡努 | 2005 | 276 | 2667 | 9875 | 45003 | 65945 | 153298 | 163173 |
| 云娜 | 2004 | 393 | 2582 | 8352 | 39645 | 84852 | 120852 | 129204 |
| 合 | 计 | 3591 | 10362 | 35405.6 | 440932 | 400818 | 636097 | 671503 |

注*：沉没渔船 90%为小船。资料来源：浙江省海洋与渔业局。

与渔民相比，种植农户常通过外出打工、自营工商业等非农收入为补充进行风险缓解，平滑收入，但是对于渔民来讲外出打工的成本相对较高。比如，对于从事捕捞作业的渔民来讲，捕捞渔船的资本投入大、渔船的资产专用性强，一旦放弃捕捞，渔船无法再用于别的行业，依靠打工收入往往难以弥补“弃船上岸”产生的渔船沉淀成本。现实中，从事渔业生产比种粮具有一定的比较效益，所以在渔区，通过外出打工应对风险的做法较少被用到。在渔民没有更多的风险处置工具可供选择的背景下，保险作为风险处置的有效工具被渔民所认同。

## C.海洋渔业收入在渔民收入构成中比重较高

收入与保险需求存在相关关系，收入水平的高低直接决定了渔民是否会将保险的需求意愿转化为有支付能力的购买行为。根据我国历史数据，渔民收入总体上高于农民， 1998 年-2002 年，我国渔民人均纯收入在 4500 元左右，同期农民人均纯收入仅为渔民的一半。从渔民收入结构看，1998 年-2002 年，渔民收入构成中来自捕捞和养殖渔业的收入平均超过 70%，而以种植业为主的农业收入只占农民收入来源的 50%左右，前者明显高于后者。从生产风险看，渔业风险高于种植业风险，前者风险不仅导致财产损失，而且导致渔民人身伤亡，后者更多的表现为种植物财产损失。因此，与农民相比，渔民购买渔业保险的意愿及支付能力理论上应高于农民，不过相对于渔民面临的巨大渔业生产风险，渔民收入的有限性又使其希望通过保险分散风险的保费支付力不足。从 90 年代中期以来，尤其从 2000 年以后，渔民收入增长缓慢，收入增幅呈逐年下降趋势，而同期农民收入增长相对稳定，渔民与农民的收入差距

在缓慢缩小。近年来由于渔业资源衰退、生产成本上升、作业渔场缩减，渔民依靠传统捕捞收入下降。在江苏南通、浙江温州、广东湛江等沿海传统渔业市县，渔民人均收入已低于当地农民。2004 年南通市渔民、农民人均收入分别是 4929 元、4225 元；同期温州渔民、农民人均收入则分别是 5993 元、6202 元。渔民整体收入预期的下降直接引起保险支付意愿下降，所以，在收入约束条件下，以何种价格购买保险获得足够的安全保障是渔民保险决策的关键。

## D.渔民群体的特殊属性

渔民虽被视为在大农业框架下农民的组成部分，但是渔民在生产和生活方式上与农民存在较大差别，渔民的特殊属性表现为以下几个方面。

**1）渔民与农民比较**

（1）渔民缺乏必要的生产资料保障。土地是保障农民生活的基本生产资料，只要有土地农民就能维持基本生活，《农村土地承包法》赋予农民长期有保障的土地使用权及土地流转、收益、补偿等权利。渔民的基本生产资料是水域和滩涂，利用水域、滩涂进行渔业生产是渔民得以生存的根本保障（韩立民等 2007）。我国《渔业法》虽然规定了渔业捕捞和水域养殖实行许可证制度，但没有规定许可证的使用年限，这给地方政府收回渔业水域许可权留下了空间(韩立民、林超 2007)。尽管 2007 年颁布的《物权法》第 123 条规定，依法取得的“使用水域、滩涂从事养殖、捕捞权利受法律保护”，这是我国首次从基本法的高度和民法的角度对渔业权性质进行的法律定位。但是《物权法》仅对渔民养殖、捕捞权利做了原则性规定，相关制度还未建立，因此，渔民权益受损现象远不能在短期能消除。

（2）渔民花费的生产要素成本很高。农民进行作物种植需要种子、化肥等农资投入，渔民从事捕捞和养殖需要渔船、渔具、鱼苗、鱼药等支出。捕捞渔船、渔具成本高昂，购买或打造一条用于生产的渔船需要耗费毕生的积蓄，甚至债台高筑。渔船等生产工具的灭失风险远远大于农机具，而且渔船具有一定的使用年限，折旧费用很高，还要受国家政策的影响，需要及时更新。渔船与农业生产工具相比投入大、生产专用性强、沉淀成本高，一旦退出渔业行业损失远高于农业。这些生产费用负担都是农民所无法比拟的。

（3）渔民所承受的作业风险远高于农民。农业生产的主要主要风险是自然灾害和病虫害对农作物的损害，而农民人身伤害则较少发生。相比较而言，渔业生产是一个高风险、极不稳定的行业，自然灾害和海上事故不仅仅造成渔船等财产损失，同时还造成渔民（家庭主要劳动力）人身伤亡，这种“船毁人亡“的灾难是一个渔民家庭所无法承受的。一个家庭一旦失去顶梁柱往往意味着失去了家庭生活的来源，受灾家庭很难依靠自己的力量来恢复生产和维持意外事故前的生活水平，只能依靠政府的救济和补助维持生活（韩立民等，2007）。

**2）渔民与城镇居民比较**

在某些方面，渔民与城镇居民又存在相似的地方，比如二者存在类似的雇佣关系。渔民与城镇居民，尤其是个体工商户存在类似的雇佣关系。渔民的生产关系形式不外乎三种：一是渔民自筹资金购买渔船、渔具，自己下海捕鱼，自己既是船东又是船员；二是渔民自筹资金购买渔船、渔具，自己也下海作业，自己是船东，同时承担船老大；三是渔民出资购买渔船、渔具，雇佣其他渔民在渔船上打工，自己做船东不下海。渔民之间的关系与城镇个体工商户类似。

综上所述，渔民是介于农民和城镇居民之间的特殊群体。渔业属于第一产业，故渔民长期以来被归入农民的行列，却在生产和生活属性方面与农民存在较大差异。同时，渔业产品的单一性，无法满足渔民生活的多方面需要，者使得渔民和城镇居民一样具有较高的市场化程度。但渔民既做不到农民的自给自足，又不能像城镇居民那样由于从事非农产业从而摆脱受制于自然的不确定性，拥有相对稳定的收入来源。由此可以看出，相比农民和城镇居民，渔民在保障自身生存上处于劣势，对风险保障需求更为迫切。

## E.海洋渔民文化中的风险意识

海洋蕴含着丰富的食物资源，人们从远古时期就开始依赖简陋的工具在近岸和浅海领域进行捕捞，向海洋索取渔、盐等基本生活资料；通过海上运输进行渔产品交换，换取索取的其他生活资料。变幻莫测的大海使渔民的生活充满风险，为了生存，渔民没有其他选择，他们

只能直面危险的海浪和大风，勇往直前。所以，渔民要比陆地上的农民更具冒险精神。从事海上捕捞与陆地种植不同突出表现在两个方面：一是海上捕捞风险远大于种植业风险，恶劣的海上气候使渔民面临的不仅仅是捕不到渔的风险，更时时面临渔船灭失、生命葬身大海的威胁，客观上使得渔民的风险意识强于种植业农民，在缺少科学风险规避方式下，形成了信奉宗教2祈求平安的海洋风险文化；二是渔民具有比农民更强的合作思想。传统小农耕作，一个人即可完成，但是海上捕鱼却需要划船、撒网、捕鱼等多个人一起协作才能完成；而且渔船在茫茫大海上作业，不可避免地要遭受台风、暴雨、海啸等自然灾害的侵袭，为了能抵御灾害、顺利捕到鱼获物，船上作业的人只有团结起来，借助群体的力量来共同抵抗天灾。互助思想、合作文化成为海洋文化最明显的特性，它是保险思想的最基本体现，正是这种以风险意识、合作精神为特质的海洋文化互助保险形成的动力之一。

## F.政府支持是渔民参与互助保险的外部动力

**1）政府在渔业灾害救助中的角色定位**

（1）从政府公共职能看，任何政府都肩负着管理全社会公共事务的职能。政府对在自然灾害中生命遇到危险、生活遇到困难的公民给予及时、必要的救助不仅是政府保障公民基本人权的基本职责，也是政府行使全社会公共风险管理，维护整个社会的公共安全的基本职能。因此，从社会公共利益考虑，政府必然要参与渔业救灾，并在其中发挥重要的领导和组织作用。

（2）从经济角度看，政府在救灾中扮演着提供公共产品和服务的角色

公共产品和公共服务的非营利性，决定了只能由全社会的公共机关——政府提供，在灾害救助过程中，政府利用其行政权力能够在较短的时间内调动巨大的资源，与其他社会组织相比具有较高的组织实施效率。政府的收入主要来自于税收，而税收的增加是随着社会财富即税基的扩大而增加的。那么，社会减少了损失，对于政府而言，也能减少损失。因此，政府在救灾上的投入既是职责也是其意愿。（表2）

表 2：农业部渔政指挥中心渔业海难救助统计

| 年份 | 海难救助事件(起) | 政府投入经费（万元） | 救助渔船（艘） | 救助渔民（人） | 挽回经济损失（万元） |
|---|---|---|---|---|---|
| 2005 | 669 | 1693 | 749 | 4080 | 22345 |
| 2006 | 651 | 2103 | 686 | 3932 | 17821 |
| 2007 | 946 | 3128 | 943 | 4545 | 28000 |

数据来源：《中国渔业年鉴 2005-200?年》。

**2）组织渔民互助保险抵御风险符合政府的利益**

渔业生产安全管理是政府一项重要职责，关系渔民生命财产安全和渔区社会稳定。随着渔业经济的发展，国内渔业安全生产形势发生了较大变化，出现了一些新的情况和特点:一是渔业经济体制改革的不断深入，渔船所有制结构和渔区生产经营方式发生重大变化，过去的集体化大生产已变为千家万户的个体生产；二是新海洋制度的实施，使我国海洋渔业生产格局发生了重大变化，许多渔船被迫从传统的作业渔场退出，渔场范围大大缩小，导致渔场作业渔船空前密集；三是随着我国改革开放的不断深入，海洋运输业飞速发展，过往的国内外大轮日趋繁忙，大大增加了通航密度，航道增多，挤占了传统的渔业生产区域，致使渔船与渔船、渔船与商船之间的海上碰撞和作业纠纷事故不断，安全形势更加严峻；四是沿海经济发展对廉价劳动力的需求，推动了内陆非渔业劳力向沿海的快速流动，渔业从业人员的构成更加复杂，且人员整体素质也受到较大的影响。上述变化客观上加重了政府主管部门对渔业安全生产管理的难度，加之国家对渔业安生生产的公共基础设施投入不足，渔业安全生产监督管理体系不完备，渔业生产风险加剧，渔民伤亡事件发生率增加。根据统计，2000年-2006年，全国渔业船舶水上交通事故平均每年发生618起，沉(毁)渔船305艘，死亡(失踪)535人，如果再加上渔业生产性事故，则死亡(失踪)逾千人。以每年1500万吨捕捞产量来推算，平均

[2] 如中国南部沿海及东南亚地区普遍信仰马祖，即是渔民出海之前祈求平安的一种象征。

每捕1.5万吨鱼，就要死亡1人。[3] 从政府主管部门立场分析，渔业生产安全管理既有政治上的压力（一些地方官员因此丢了乌纱帽），还有出险后的灾害救济、抚恤等经济上的压力，尤其是后者直接关系到渔区社会稳定[4]。渔业安全生产不仅是主管部门的重要工作，也是考核部门领导政绩的主要指标[5]。在商业保险市场失灵、政府财政救助有限的情况下，动员渔民组织起来，采取互助保险形式进行风险分散和损失分担，增强渔民抗灾能力、减轻政府救灾压力符合政府部门的公共利益，自然受到政府部门的支持。

从政府与渔民关系看，互助合作保险组织创建初期缺少熊彼特式的企业家，导致诱致性制度变迁模式制度供给不足，此时政府介入恰好扮演了制度供给者的角色，并从客观上缓解了制度供给不足的问题。政府行政部门热衷于渔民互助保险组织的发展主要出于追求政策目的----降低渔民灾害损失，打造平安渔业。由于政府的公信力与强制力存在，且利用自身特有的一般企业家所无法比拟的社会动员能力、社会稀缺资源配置能力以及技术服务组织资源优势等可以迅速推动互助保险全面开展。从渔民立场分析，渔民也愿意通过参加互助保险组织来寻求政府的庇护和支持（渔政、港监、救灾等）。由于自身的素质、资源限制以及与政府之间博弈能力的巨大差距，渔民的互助在某种程度上依赖于行政权力和政府信用，为了获得各种便利以及考虑到其他一些更为复杂的因素，渔民在这种互助中甘愿放弃“私人决策权” 。本文对浙江沿海渔民保险需求问卷数据显示，在调查“为何选择渔业互保协会投保”的理由时，有 25.9%的渔民认为互保协会具有政府背景；22.3%的渔民认为互保协会提供的保费较低；21.4%的渔民认同协会宣传服务工作做得比较好；理赔及时 16.1%；因为“人情关系”或“其他原因”的比例分别为 2.7%和 11.6%。从渔民选择互保协会投保的理由可以发现，1/4的渔民并不清楚协会是渔民自己的互助组织，更不知道自己的会员身份，而基层协会开展互保业务的人员基本上是渔业主管部门工作人员兼任，基层协会办事处主任一般均由当地渔业主管部门负责人担任，渔民将互保协会视为政府的一个主管部门，某种程度上互助保险带有强制性保险的色彩。

**3)政府保费补贴对渔民参保具有正向激励作用**

补贴是政府干预经济的方式之一。保费补贴可以降低渔民保险保障支出，对于提高渔民保险需求具有正向激励效果。以下以浙江渔业互助保险实践予以证实。

浙江省渔业互保协会成立于2004年，其前身为成立于1994年的中国渔业互保协会浙江省办事处。2005年浙江省渔业互保协会根据《浙江省政策性渔业保险补贴试行方案》采取政策引导、财政补贴、协会运作、渔民资源的方式率先在温州、台州地区的6个县市开展补贴试点。省财政贴补对象和范围包括：参加渔业互保协会的渔民人身意外伤害和渔船全损两个险种的渔民；补贴标准：渔船全损险按保费的20%补贴；渔民人身意外伤害险每份投保5万元以上，费率为0.5%，省财政补贴50元/份或按应缴互保费20%补贴。温岭、洞头等当地财政补贴30%，这样省、市县各级政府补贴比例合计可以达到或超过保费的50%。2005年省财政当年安排保险专项资金500万元给省海洋与渔业局，作为温台地区政策性渔业互助保险试点的补助资金。之后，随着补贴资金的增加，试点地区不断扩大。2008年农业部下发《关于下达2008年渔业互助保险中央财政保费补贴试点项目资金的通知》（农财发（2008）78号），农业部在全国选择部分重点渔区进行渔业互助合作保险补贴试点，这些地区包括辽宁省大连市，山东省青岛市、日照市，福建省福州市，广东省东莞市、江门市新会区，浙江省岱山县，以及江苏、海南全省。受农业部补贴政策影响，浙江省地方财政补贴规模进一步扩大。从2005年到2011年，浙江省财政累计下拨专项补贴资金1.89亿元，省级以下市县、乡镇财政配套补贴共6785万元万元，渔业互助合作保险保费补贴试点范围几乎包括全省渔区。 全省渔区参与互保渔民从保费补贴前2004年的6.1万人上升到2011年的12.67万人，参保人数翻了一番；参保渔船从2004年5400艘扩大到2011年的1.4万艘，参保渔船增加了1.59倍。以此同时互保费规模从2004年的3084万元扩大到2011年的3.53亿元，7年间增长了10倍；赔款支出则从2004年的1147万元上升到2011年的1.34亿元，期间增长

[3] 《中国渔业年鉴》2000-2006.

[4] 在沿海一些渔区，因灾死亡渔民常因救济、抚恤等发生群体事件，成为渔区不稳定因素。

[5] 根据国家安全生产管理规定，发生重大安全事故，主管领导要承担责任，面临降职、调离岗位等行政处分。

了11倍。由此可以看出，补贴政策对渔民参保积极性起到了较大的推动作用。（图1、2、3）

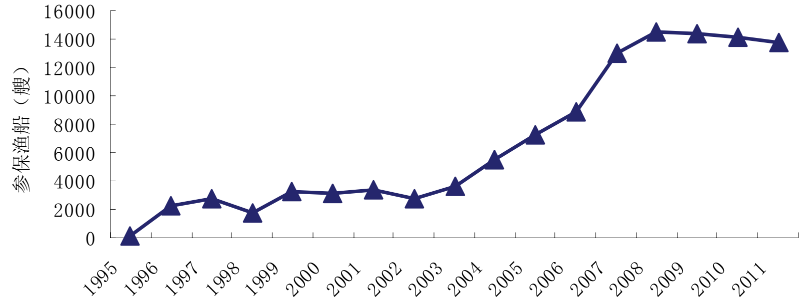



图 1：浙江渔业互助保险历年参保渔船数量情况

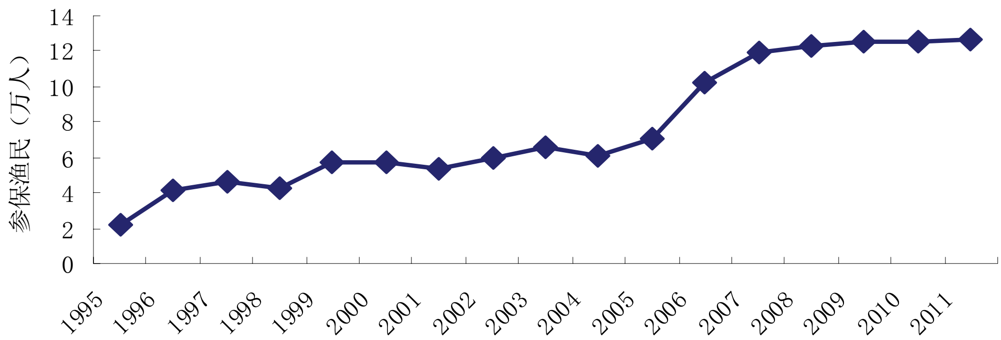



图2：浙江渔业互助保险历年参保渔民人数情况

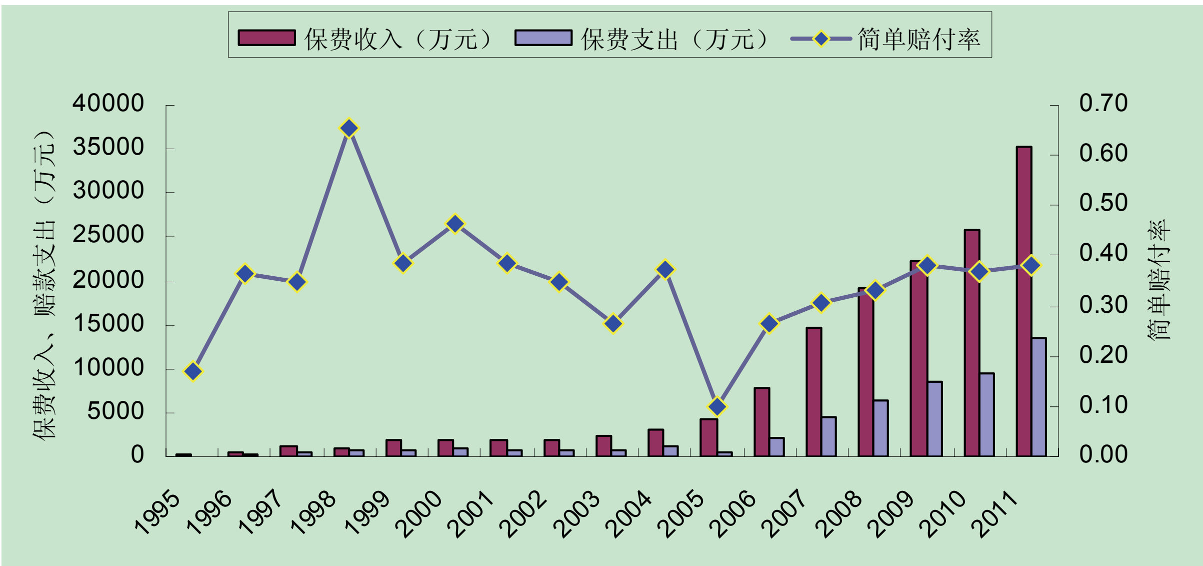



图 3：浙江渔业互助保险历年互保费收入、赔款支出及赔付率数据

# Ⅳ结论

本文的主要结论包括：渔业生产高风险性是渔民保险需求的基本前提；渔民收入来源单一，缺少多样化的风险处置手段、缺少适应渔民特殊群体的风险保障使渔民更倾向选择保险的方式转移风险；政府公信力和基层行政部门的权威对渔民参保决策有影响；政府保费补贴对于渔民参保具有正向激励作用，保费补贴是

影响渔民参与互助保险的又一重要因素。渔业互助保险是在商业保险无法提供渔业风险保障的历史和现实背景之下，渔民互助共济对抗风险的必然选择。从渔业保险的未来发展趋势看，随着渔船质量的改善和国家支农支渔政策力度的提高，商业化渔保市场环境较之过去有了较大改善，这为商业保险公司重新进入渔业保险市场提供了新的机会和发展空间，也为渔民提供了更多的选择。

## References

[1] Goodwin B K, V H Smith . 1995.The Economic of Crop Insurance and Disater Aid .Washington, D.C. The AEI Press .

[2] Knight Thomas O, Keith H Coble. 1997. Survey of Multiple Peril Crop Insurance Literature Since 1980. Review of Agricultural Economics,19: 128~156

[3] Just RE, L Calvin and J Quiggin.1999. Adverse Selection in Crop Insurance. American Journal of Agricultural Economics, 81(11): 834~849

[4] Han Liming,Ren Guangyan and Qin hong, The Basic Connotation of Three-Fishing-Issues and its Speciality . Issues in Agricultural Economy,2007,3

韩立民，任广艳，秦宏．三渔问题的基本内涵及其特殊性 [J] ．农业经济问题，2007 年第 3 期

[5] Si hong,Empirical Study on Influence of Financial Subsidy on Farmers'Agricultural Insurance Decision:Evidence from Zhejiang Province in China, Technology Economics,2008,9

施 红．财政补贴对我国农户农业保险参保决策影响的实证研究—以浙江省为例[J]．技术经济，2008 年第 9 期

[6] Zhang Yuehua,Gu Haiying and Si Qinhua,A Theoretical and Positive Study on the Demand of Crop Insurance The Journal of Quantitative & Technical Economics,2007,4

张跃华，顾海英，史清华．农业保险需求不足效用层面的一个解释及实证研究[J]．数量经济与技术经济研究，2007 年第 4 期

[7] Zhong funing ,Ning Manxiu and Xin li,A Study on the Relationship between Crop Insurance and Agrochemical Uses——An Empirical Analysis of the Manas Watershed, Xinjiang, China，China Economic Quarterly,2007,1

钟甫宁; 宁满秀; 邢鹂等.农业保险与农用化学品施用关系研究——对新疆玛纳斯河流域农户的经验分析[J].经济学(季刊), 2007 年 1 期

# 渔民参与海洋渔业互助保险的动因分析

叶晓凌

金融学院，浙江财经学院，杭州，中国，310018

**摘　要：**自 2004 年开始，新一轮农业保险试点规模在政府的强力推动下稳步开展，国内掀起了农业保险试点高潮。在农业保险规模扩大，保费增加的同时一些深层的问题仍然困扰着农业保险深入开展，如：农民对农业保险有效需求较低，参保意愿不高；严重信息不对称使保险公司面临高监督成本和高赔付损失的两难选择；政府公益目标与商业保险公司盈利目标之间的矛盾冲突，农业保险道德风险等等。作为大农业保险的组成部分，我国渔业互助保险的发展历程却表现出了与众不同的鲜明特色。本文以从事海洋渔业生产渔民参与互助保险的动因为研究主题，从渔业生产风险；渔民风险处置手段；渔民收入构成；渔民群体属性；渔民文化及政府干预等方面展开分析并给出相应结论。

**关键词：** 渔民；海洋渔业；互助保险；参保动因

# The Choice of Optimal Reinsurance of Flood Insurance

ZHANG Lin[1], **SHEN** Zhigang[2]
[1] Finance & Statistics College, Changsha Hunan, China
[2] Hunan Branch of CLPIC, Changsha, Hunan, China
Email: lindazhang0203@126.com

**Abstract:** The purpose of this paper is to do an empirical analysis about the optimal reinsurance portfolio of flood insurance, with the internal loss-sharing and the practical feasibility of the portfolio, in order to provide technical supports for the smooth development of China's flood insurance. The paper uses the Mean-variance principle in optimal reinsurance to research the mixed optimal reinsurance of proportional and non-proportional reinsurance, and then derives the expression of the mixed reinsurance portfolio's optimal retention level. In the empirical study, the authors use stochastic simulation to get the loss distribution which accords with realistic disaster characteristics, rather than the Poisson distribution. The actual distribution is used to derive the optimal reinsurance portfolio, and the trend about the share part of the portfolio is analyzed.

**Key words:** Flood insurance; Reinsurance; Mean-variance principle; Mixed optimal reinsurance

当前全球的洪水灾害非常严重，在 2011 年发生了 65 例洪水巨灾，死亡 5093 人，被保险损失达到 162.62 亿美元。尤其是 2011 年的泰国洪水成为保险业的特殊案例，它有几个指标都是异常的：被保险损失占全国财产保险保费的 1846％，被保险损失占非寿险保费的 203.5％，占 GDP 的 3.4％，总损失占 GDP 的 8.6％。这些指标惊人的高，也说明给泰国造成的损失是巨大的。泰国洪水之后，Swiss Re 开展了“高洪水风险与高经济增长”的研究，发现在新兴市场潜在的洪水风险比泰国还要高，而在风险的排序中中国在其中排在第一位[1]。这应该得到中国政府和保险业高度警觉。可见洪水保险的建立已是非常急迫的，为了使洪水保险可持续发展，关于洪水保险风险分散方式的研究是必不可少的，再保险是这中间第一位需要考虑的风险分散手段。由于极端气候变化的不断出现，洪水灾害越来越受到发达国家和发展中国家的重视，很多国家都建立了洪水保险和包含洪水保障的巨灾保险计划,其中最为突出的是美国的洪水保险计划,但是该计划由于没有再保险，也经营的非常吃力，故为洪水保险安排合理和最优的再保险可以帮助洪水保险持续稳健的经营。本文运用均值方差原理研究洪水保险的最优再保险形式和自留额的确定。

## Ⅰ.文献综述

再保险在巨灾风险管理中的作用是巨大的，它可以帮助原保险公司管理他们的风险，吸纳他们的部分损失，稳定原保险公司的经营成果，使其保持增长和创新的能力[2]。

如何安排再保险方式并设置最佳自留额一直是全球学者关注和研究的热点问题。Gajek，Zagrodny[3]（2004）推导出了当保险人试图最小化破产概率时停止损失再保险合同中的最优再保险形式。Yisheng Bu[4]（2005）测试了巨灾风险的最优再保险选择，认为最优再保险可以通过对数据模拟和损失分布的分析得到。Leslaw Gajck[5]（2004)，以最小化期望损失为优化准则，研究了在几种特殊损失函数模型下的最优再保险问题，并得出了相应的最优再保险形式。Kahszka，Marker[6]（2004）运用前人的研究成果，综合考虑了不同最优再保险准则，并得到了各种准则下再保险最优自留参数的表达形式。Kaishev，Dimitrova[7]（2006）研究一个超赔再保险的最优再保险模型，这个模型充分考虑了原保险人与再保险人的利益。在这个模型中，假设损失的出现服从 Poisson 过程，原保险人与再保险人通过合理的分摊损失与分配保费，使得最优再保险的指标最大化（最小化）。Ignatov 等[8]（2004）,假设损失是离散的联合分布，并研究了无承保限制的简单超赔再保险。运用联合风险测量方式，计算出了原保险人与再保险人在一个有限时间轴上的联合生存概率，并推导出这种概率的详细表达式。Cai 和 Tan [9]（2007），Cai 等[10]（2008）和 Tan 等[11]（2011）都假设了期望保费原则用最小化保险人总风险暴露的 VaR 和 CVaR 两种方法推出了两类最优再保险模型。

上述的研究都是在某个保费原则和风险度量方法下得出一种最优再保险形式，而实际操作中不会只选择一种再保险方式来分散风险，因此有必要研究混合再保险。

Kaluszka[12]（2001）运用了均值-方差保费原则研究最优溢额与成数混合再保险，并推导出了混合再保险的最优表达式。Centeno[13]（2002）在研究最优再保险时，提出了修正系数的问题。Centeno（1985[14], 1986[15], 2002[16]），Kaluszka[12]（2001） 和 Schmitter[17]（2001）研究了包含比例再保险与超赔再保险的最优再保险。Robert Verlaak, Jan Beirlant（2003）[18]研究

了基于均值-方差保费原则的最优混合再保险，并认为再保险的安排顺序非常重要。

在中国混合再保险方面研究的论文比较少，且基本上都是停留在理论研究阶段，还没有学者对最优混合再保险做过实证分析。宋立新和杜宇静等（2007）[19]采用超额再保险与成数分保混合的策略，其中成数分保再保险费按照原始条款计算，超额损失再保险按 Escher 保费原则来计算。通过调整系数来研究再保险效应，将调整系数看作自留额水平的函数，证明了在 M 充分大时保险人的调整系数关于自留额水平 M 单调增加，在一定程度上有利于保险公司确定更合理的自留额水平 M。尹青松 ，张峰 (2010) [20]研究了 Centeno 在 Sparre Anderson 模型中调节系数性质,得到了原保险人的调节系数是关于其自留额的单峰函数的结论。并给出在带扩散扰动项的复合 Poisson 过程的索赔时，调节系数与再保险自留额的函数，并得出了保险公司的再保险的最优自留额。

本研究与文献中论文的不同是运用最优再保险的均值-方差原则研究比例再保险和非比例再保险的混合最优再保险，并推导出混合再保险组合的最优自留水平的表达式。在实证研究中运用随机模拟获得符合实际灾害特征的损失分布而不是使用 Poisson 分布,并运用实际的分布推导最优混合再保险组合和分析再保险组合中各分担部分的走势。对洪水保险的最优再保险组合、再保险组合内部损失分担、再保险组合的现实可行性进行实证分析，以期能为我国洪水保险的顺利开展提供技术支持。

## Ⅱ. 最优再保险准则及模型的构建

评价再保险方式最优的标准有很多(均值－方差法、破产概率法)，迄今为止还没有形成大家普遍认可的标准。

其中应用最广泛的要属”均值-方差”方法。它的原理是：在既定方差条件下，最大化期望利润，或在既定期望利润条件下，最小化方差。也就是说，对于原保险人，在既定自留风险条件下，市场上提供的最便宜再保险组合为最优再保险，或在再保险价格相同的情况下，原保险人承担的自留风险最小的再保险组合为最优再保险。

本文引入”均值-方差”来构建混合最优再保险模型，在该模型中通过设定原保险人自留风险，然后计算各再保险组合成本的方式来寻找最优再保险。本文的模型相对于其它的最优再保险模型，存在以下几方面的改进：

1.假设原保险人属于风险厌恶型，其再保险成本由两部分构成：再保险保费和自留风险乘以一个固定系数。

2.假设再保险附加费与分摊给再保险人的期望损失成正比例关系，则再保险保费为（1+$\lambda$）乘以期望损失，其中$\lambda$为附加因子，附加因子依据再保险种类以及再保险在组合中的顺序进行选择。$\lambda$附加因子所属的区间在相关网站上可以查阅，本文中将取其平均数。

在国际再保险市场上，人们为了更好地发挥非比例再保险的作用，通常按如下顺序安排超赔再保险：首先是险位超赔再保险，其次是事故超赔再保险，最后才是停止损失再保险。而成数再保险可以安排在任意顺序，因为保费和赔款都按固定比例在原保险人与再保险人之间进行分摊，因此，它可以出现在任意再保险方式前后。

溢额再保险通常安排在混合再保险组合较前的位置，在实际应用中，通常只允许安排在成数再保险之后。假如溢额再保险在险位超赔再保险之后，一旦出险，大部分损失将由险位超赔再保险承担，溢额再保险几乎不发挥左右，但在再保险市场上，溢额再保险的$\lambda$附加因子较高，这样就造成了花高价钱，却买了个几乎用不着的保障，因此，人们总是尽量避免这种情况的出现。

溢额再保险在事故超赔再保险和停止损失再保险之后，是不符合逻辑的。因为事故超赔和停止损失再保险是基于一次灾害事故或一年的累计灾害来考虑的，溢额再保险是基于某一风险单位的保额进行来考虑的，两者的理赔口径不一致。

$PI$：原保险人的保费收入，其中$PI$与$E(S)$不存在线性关系，但通常会有$PI > E(S)$

$\Gamma(S)$：指原保险人在应用各种再保险后，仍保留的风险

$\alpha Std[\Gamma(S)]$：原保险人的风险厌恶成本，其中$\alpha$为一个固定值

$\sum_{i=1}^{n} T_i(S)$：再保险人承担的风险

$\lambda_i \sum_{i=1}^{n} T_i(S)$：再保险附加费用，通常来说，附加因子$\lambda_i$是由两部分构成，一部分是直接支付给再保险人的费用，另一部分是管理和维护再保险合约的费用。

由$S = \Gamma(S) + \sum_{i=1}^{n} T_i(S)$可以推出：

$$E(S) = E(\Gamma(S)) + E(\sum_{i=1}^{n} T_i(S)) \tag{1}$$

$$Std(S) \le Std(\Gamma(S)) + Std(\sum_{i=1}^{n} T_i(S)) \tag{2}$$

原保险人的利润可以定义为：保费收入减去保留的损失，减去再保险成本，减去原保险人的风险厌恶成本，表示为：

$$G = PI - \Gamma(S) - \sum_{i=1}^{n}(1+\lambda_i)T_i(S) - \alpha Std(\Gamma(S)) \quad (3)$$

期望利润表示为：

$$E(G) = PI - E(\Gamma(S)) - \sum_{i=1}^{n}(1+\lambda_i)E(T_i(S)) - \alpha Std(\Gamma(S))$$
$$= PI - E(S) - \sum_{i=1}^{n}\lambda_i T_i(S) - \alpha Std(\Gamma(S)) \quad (4)$$

基于“均值-方差”原理：在保留风险标准差为既定的情况下，使得期望利润最大化。本文拟采用拉格朗日原理求利润最优化问题。

用标记 $w_j$ 来表示未规定的再保险变量，$u^*$ 代表拉格朗日因子。

$$0 = \frac{\partial E(G)}{\partial w_j} = \frac{\partial[PI - E(\Gamma(S)) - \sum_{i=1}^{n}(1+\lambda_i)E(T_i(S))]}{\partial w_j}$$
$$+(u^* - \alpha)\frac{\partial Std(\Gamma(S))}{\partial w_j} \quad (5)$$
$$Std(\Gamma(S)) = C$$

假设 $u = u^* - \alpha$，则拉格朗日最优问题可以转化为：

$$G = PI - E(S) - \sum_{i=1}^{n}\lambda_i T_i(S)$$

以及 $Std(\Gamma(S)) = C$ (6)

假如 $\Psi = E(G) + \mu Var(\Gamma(S))$ 则拉格朗日等式为：

$$\frac{\partial \Psi}{\partial w_j} = \frac{-\sum_{i=1}^{n}\lambda_i E(T_i(S))}{\partial w_j} + \mu\frac{\partial Var(\Gamma(S))}{\partial w_j} \quad (7)$$

其中 $Std(\Gamma(S)) = C$

## Ⅲ. 实证分析

本文以我国洪水灾害损失为例，对在我国建立洪水保险如何安排再保险计划进行实证分析。由于已有的洪水灾害损失数据有限，文中采用蒙特卡罗方法进行随机模拟，该方法通常可以归结为三个主要步骤：1、对样本进行输入，并选择一种合适的先验分布模型。2、计算机根据上述输入，利用给定的某种规则，快速实施充分大量的随机抽样。3、对随机抽样的数据进行数学计算与分析。

### A.选择适合我国洪水损失灾害的先验分布 模型

依据中国可持续发展信息网及《中国减灾》杂志所记录的我国洪水灾害事件，运用 SAS，EASYFIT 软件对我国洪水灾害的频率和损失程度进行分析。

对中国可持续发展信息网及《中国减灾》杂志所记录的 1990-2009 年的数据进行整理，并分别对期间发生的洪水灾害次数和损失程度进行统计分析，依据 Kolmogorov Smirnov、Anderson Darling、Chi-Squared 对模型进行拟合优度检验，最终选定我国洪水灾害的损失模型，如表 1 所示。

表 1 我国洪水灾害的统计描述

| | Mea | Std | CV | Skewness |
|---|---|---|---|---|
| 频率（N） | 61.55 | 43.971 | 0.71439 | 1.0799 |
| 平均损失程度（X） | 33.799 | 71.771 | 1.334 | 3.1278 |
| 年度损失（S） | 2351.3 | 1566.9 | 0.84636 | 1.3605 |
| 频率（N）服从 Neg. Binomial 分布 （ $p$ =0.03183，$r$ =2） | | | | |
| 平均损失程度（X）服从 Lognormal 分布（$\sigma$=1.1299 $\mu$ =3.3577） | | | | |
| 年度损失（S）服从 Lognormal 分布（$\sigma$=0.85554 $\mu$ =7.1825） | | | | |

### B.基于我国洪水损失灾害模型实施充分大量的随机抽样

笔者先在 EXLCE 构建了 1000 个位于(0,1)之间的随机数，通过我国洪水灾害模型，快速实现了损失频率和损失程度 1000 个随机抽样。例如随机数 0.070420254，对应的平均损失程度（X）服从 Lognormal 分布（$\sigma$=1.1299 $\mu$=3.3577）随机抽样为 7.976519，对应年度损失（S）服从 Lognormal 分布（$\sigma$ =0.85554 $\mu$ =7.1825）随机抽样为 373.3713。

由于无法收集我国洪水灾害受损标的的保额信息，因此，本文分析的再保险组合中不含溢额再保险，笔者仅对成数先于事故超赔再保险组合、事故超赔先于成数再保险组合、成数再保险先于停止损失再保险、停止损失再保险先于成数再保险组合四种再保险组合进行了分析与对比，得出的最优再保险组合也只是以上四种组合中的最优。

### C.对随机抽样的数据进行数学计算与分析

针对四种再保险组合，在原保险人选取不同自留 Std x 比例下，通过等式两边无限渐近的方式，可以计算再保险组合中各再保险的最优自留参数，四种再保险组合在原保险人自留 Std x 比例为 0.1、0.4、0.7 时的参数如表 2 和表 3

所示。

表 2 成数与事故再保险组合部分数据

| | 成数先于事故 | | | 事故先于成数 | | |
|---|---|---|---|---|---|---|
| 自留 y 风险 std x | 0.1 | 0.4 | 0.7 | 0.1 | 0.4 | 0.7 |
| $\alpha$ | 0.11 | 0.42 | 0.64 | 0.12 | 0.42 | 0.63 |
| $R$ | 44.32 | 44.32 | 44.32 | 103.21 | 71.32 | 46.55 |
| 再保险期望分出 | | | | | | |
| 成数 | 849.61 | 546.96 | 244.30 | 720.97 | 453.80 | 406.42 |
| 事故 | 7.28 | 101.49 | 177.60 | 129.35 | 169.44 | 105.65 |
| 共计 | 856.88 | 648.45 | 421.90 | 850.31 | 623.24 | 512.07 |
| 成数占比 | 99.15 | 84.35 | 57.90 | 84.79 | 72.81 | 79.00 |
| 事故占比 | 0.85 | 15.65 | 42.10 | 15.21 | 28.19 | 21.00 |
| 再保险成本 | | | | | | |
| 成数 | 1019.53 | 656.36 | 293.16 | 865.16 | 544.57 | 428.69 |
| 事故 | 8.88 | 123.81 | 216.68 | 157.80 | 206.71 | 111.47 |
| 共计 | 1028.41 | 780.17 | 509.84 | 1022.96 | 751.28 | 540.16 |
| 成数占比 | 99.14 | 84.13 | 57.50 | 84.57 | 72.49 | 79.36 |
| 事故占比 | 0.86 | 15.87 | 42.50 | 15.43 | 28.51 | 20.64 |

表 3 成数与停止损失再保险组合部分数据

| | 成数先于停止 | | | 停止先于成数 | | |
|---|---|---|---|---|---|---|
| 自留风险 std x | 0.1 | 0.4 | 0.7 | 0.1 | 0.4 | 0.7 |
| $\alpha$ | 0.13 | 0.54 | 0.94 | 0.10 | 0.41 | 0.84 |
| $P$ | 1255.39 | 1255.39 | 1255.39 | 6357.33 | 3106.56 | 1905.63 |
| 成数 | 849.61 | 546.96 | 244.30 | 720.97 | 453.80 | 406.42 |
| 停止 | 52.26 | 216.80 | 370.23 | 300.00 | 316.50 | 345.04 |
| 共计 | 873.36 | 636.13 | 403.37 | 883.91 | 684.32 | 423.73 |
| 成数占比 | 94.02 | 65.92 | 6.23 | 66.06 | 53.75 | 19.31 |
| 停止占比 | 5.98 | 34.08 | 93.77 | 33.94 | 46.25 | 80.69 |
| 再保险成本 | | | | | | |
| 成数 | 895.01 | 457.07 | 27.41 | 636.46 | 400.92 | 85.78 |
| 停止 | 67.93 | 281.84 | 491.70 | 390.00 | 411.45 | 448.55 |
| 共计 | 962.94 | 738.91 | 519.10 | 1026.46 | 812.37 | 534.32 |
| 成数占比 | 92.95 | 61.86 | 5.28 | 62.01 | 49.35 | 16.05 |
| 停止占比 | 17.05 | 38.14 | 94.72 | 37.99 | 50.65 | 83.95 |

通过最优参数，就得到了再保组合内部的保费与赔款分担信息，从而可以计算出在原保险人选取的自留风险水平下的再保险组合成本。以下四种组合的再保险成本计算的前提条件是原保险人选取相同自留风险水平，则原保险人的风险厌恶成本是相同的，因此，在以下的再保险组合成本剔除了该部分因素的影响。

1. 成数先于事故超赔再保险组合的成本

成数再保险成本+事故超赔再保险成本

$$=(1+\lambda_q)(E(N)[E(X')(1-\alpha)]) \\ +(1+\lambda_x)E(N)[E(E(\alpha X'\wedge R))] \tag{8}$$

2. 事故超赔先于成数再保险组合成本

事故超赔再保险成本+成数再保险成本

$$=(1+\lambda_x)E(N)[E(X')-E(X'\wedge R)] \\ +(1+\lambda_q)E(N)[E(X'\wedge R)(1-\alpha)] \tag{9}$$

3. 成数再保险先于停止损失再保险组合成本

成数再保险成本+停止损失再保险成本

$$=(1+\lambda_q)(1-\alpha)E(S)'+(1+\lambda_p)E(\alpha S'\wedge R) \tag{10}$$

4. 停止损失再保险先于成数再保险组合成

本 (11)

停止损失再保险成本+成数再保险成本

$$=(1+\lambda_p)(E(S')-E(S'\wedge R))$$
$$+(1+\lambda_q)E(S'\wedge R)(1-\alpha)$$

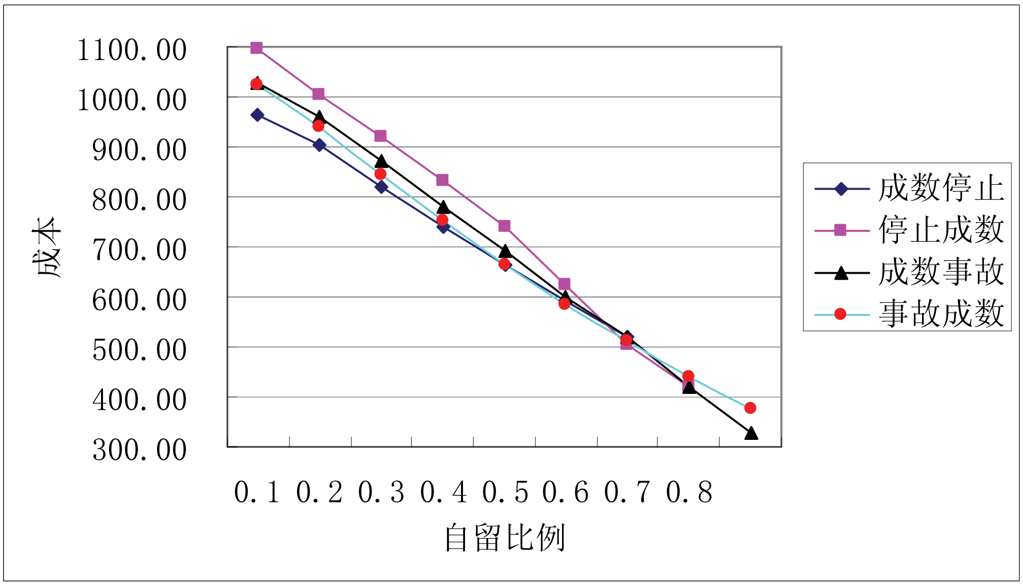



图 1 再保险组合成本图

基于“均值-方差”原理，在原保险人选取自留风险既定的条件下，期望利润最大的再保险组合就是最优再保险组合。也就是说，在原保险人承担相同风险条件下，成本最小的组合为最优再保险。图 1 为原保险人自留风险 std x 与四种再保险组合成本的折线图，由上图可以得出四种再保险组合的购买成本随原保险人自留风险 std x 的增加而减少，呈右下方倾斜状态。在原保险人选取的自留风险 std x 较小时，成数再保险先于停止损失的成本线位于四条线的最下方，因此该再保险组合为此阶段的最优再保险组合。而随原保险人选取的自留风险 std x 增加到大约 0.6 时，成数再保险先于事故超赔再保险组合的成本线位于四条线的最下方，则该再保险组合为此阶段的最优再保险组合。

因此，如果我国洪水保险采取类似于英国和法国的模式，洪水保险业务由一些承保能力相对比较小的财产保险公司承保，原保险公司选取的自留风险比较低，则应该选择成数再保险先于停止损失再保险组合进行分保。如果我国洪水保险采用类似于美国的模式，洪水保险业务是由政府主导的保险基金承保，其承保能力相对比较强，原保险人选取的自留风险比较高，则应该选择成数再保险先于事故超赔再保险组合进行分保。

## IV. 结论

纵观全文，影响我国洪水最优再保险选择的因素有：

第一，我国洪水灾害模型的选择。在本文中，洪水损失频率选择的是负二项分布，单次洪水损失程度和年损失程度选择的 Lognormal 分布，然而在年损失程度的数据拟合中，fatigue life 分布的检验效果虽优于 Lognormal，但 fatigue life 为不常见分布且表达式复杂，从模型简化和大众接受的角度出发，最终选择放弃，如果选择该分布作为我国洪水灾害模型，将可能对我国洪水再保险的最优选择带来一定的影响。

第二，再保险顺序的安排。在原保险人选取自留风险既定的条件下，成数再保险先于停止损失再保险组合的成本一直低于停止损失再保险先于成数再保险，因此，对于我国洪水再保险而言，成数先于停止损失再保险组合要优于停止损失先于成数再保险组合。

第三，再保险的附加因子。在计算再保险组合成本时，均考虑了再保险的附加因子。在本文中，所有的附加因子均为附加因子区间的均值，与现实中的附加因子存在一定的偏差。如果再保险附加因子越小，则再保险组合的成本就越小，就越有可能成为最优再保险。

第四，风险在再保险组合内部的分摊。当原保险人选取自留风险较小或较大时，期望损失的大部分会分摊到再保险组合内的某一再保险，这样会导致风险分摊不均匀。在现实中，风险分摊不均匀的再保险组合在再保险市场上是没有竞争力的。

## 参考文献

[1]Swiss Re. Natural catastrophes and man-made disaster in 2011: historic losses surface from record earthquake and floods[R]. Sigma, 2012, (2):16.
[2]Yung-Ming Shiu. Reinsurance and Capital Structure: Evidence from the United Kingdom Non-Life Insurance [J]. The Journal of Risk and Insurance, 2011, Vol. 78, No. 2, 475-494
[3]Gajek, Zagrodny. Reinsurance arrangements maximizing insurer's survival probability[J]. The Journal of Risk and Insurance, 2004, 71(3): 421-435.
[4]Yisheng Bu. On optimal reinsurance arrangement[C]. Casualty Actuarial Society Forum, Spring 2005.
[5]Leslaw Gajck. Optimal reinsurance under general risk measures[J]. Insurance:Mathematics and Ecomomics, 2004, 34: 227-240.
[6]Kaluszka, M.. Mean-variance optimal reinsurance arrangements[J]. Scandinavian Actuarial Journal ,2004, (1) : 28-41.
[7]Kaishev, Dimitrova. Excess of loss reinsurance under joint survival optimality[J]. Insurance: Mathematics and Ecomomics, 2006, 39: 376-389.
[8]Ignatov, Kaishev. A finite time ruin probability formula for continuous claim severities[J]. Journal of Applied Probability, 2004, 41: 570-578.
[9]Cai, J., Tan, K.S.. Optimal retention for a stop-loss reinsurance under the VaR and CTE risk measures[J]. Astin Bulletin ,2007, 37(1): 93-112.
[10]Cai, J., Tan, K.S.,Weng, C., Zhang, Y.. Optimal reinsurance under VaR and CTE risk measures[J]. Insurance:Mathematics and Ecomomics, 2008, 43(1): 185-196.
[11]Tan, K.S., Weng, C., Zhang, Y.. Optimality of general reinsurance contracts under CTE risk measure[J]. Insurance:Mathematics and Ecomomics, 2011, 49(2): 175-187.
[12]Kaluszka. Optimal reinsurance under mean-variance premium principles[J]. Insurance: Mathematics and Ecomomics, 2001, 28: 61-67.
[13]Centeno, M.L.. Measuring the effects of reinsurance by the adjustment coefficient in the Sparre Anderson model[J]. Insurance: Mathematics and Ecomomics, 2002, 30: 37-49.
[14]Centeno, M.L.. On combining quota-share and excess of loss[J]. ASTIN Bulletin, 1985,15: 49-63.
[15]Centeno, M.L.. Some mathematical aspects of combining proportional and non-proportional reinsurance [J]. Insurance and Risk Theory, D. Reidel Publishing Company, 1986: 247-266.
[16]Centeno, M.L.. Excess of loss reinsurance and Gerber's inequality in the Sparre Anderson model [J]. Insurance: Mathematics and Ecomomics, 2002, 31(3): 415-427.
[17]Schmitter, H.. Setting optimal reinsurance retentions[R].Swiss Re publications, Zurich, 2001.
[18]Robert Verlaak, Jan Beirlant. Optimal reinsurance programs:An optimal Combination of several Reinsurance Protections on an heterogeneous Insurance Portfolio [J]. Insurance: Mathematics and Ecomomics, 2003, 33(2): 381-403.
[19]李洪静,宋立新,杜宇静,George Fegan. 关于再保险效应的注记[J]. 数理统计与管理，2007, 26(4): 641-648.
[20]尹青松,张峰. 成数超额混合再保险中最优自留额的确定[J]. 兵团教育学院学报, 2010, 20(2): 39-41.

# 洪水保险的最优再保险选择

**张 琳[1]，沈志刚[2]**
[1]湖南大学金融与统计学院，湖南长沙，中国，410079
[2]中国人寿财产保险公司湖南分公司，湖南长沙，中国，
Email: lindazhang0203@126.com

**摘 要** 本文运用最优再保险的均值-方差原则研究比例再保险和非比例再保险的混合最优再保险，并推导出混合再保险组合的最优自留水平的表达式。在实证研究中运用随机模拟获得符合实际灾害特征的损失分布而不是使用 Poisson 分布，并运用实际的分布推导最优混合再保险组合和分析再保险组合中各分担部分的走势。对洪水保险的最优再保险组合、再保险组合内部损失分担、再保险组合的现实可行性进行实证分析，以期能为我国洪水保险的顺利开展提供技术支持。

**关键词** 洪水保险；再保险；均值方差原则；混合最优再保险

# Concerning Agricultural Insurance Catastrophe Risk Assessment and its Reserve Estimates: Based on1949-2008 Yunnan Agriculture Data Loss

Zhang Yan', Li Yunxian

Kunming Yunnan University of Finance and Economics, Financial Institute 650221;

**Abstract:** With global warming, extreme weather have become increasingly frequent, facing China's agricultural insurance catastrophe risk increasing the probability also. Agricultural catastrophe risk has become the sustainable development of agricultural insurance is a key nodes. The 2011 China’s Premier Wen Jiabao on government working report clearly put "establish catastrophe risk scattered mechanism". The establishment agriculture insurance catastrophe risk reserve fund system of agricultural catastrophe risk is an important part of scattered mechanism. In this paper the 1949-2008 Yunnan rice, wheat, corn and rapeseed historical data loss as an example, on data PP inspection, JB inspection, KS inspection based on the method of choice crop yield AIC random fluctuation, the optimal model of the four crop yield wave model fitting, estimates of Yunnan crop production risk and catastrophe venture reserve arrangement. Explore agricultural insurance catastrophe risk reserve general measuring method.

**Keywords:** **A**gricultural Insurance, Catastrophe Risk, Reserve

## 一、引言

目前我国已经成为仅次于美国的全球第二大农业保险市场。随着全球气候变暖，极端天气日益频繁，我国农业巨灾风险的概率也日益增大。2010 年春季西南五省遭遇历史罕见特大旱灾，农业直接经济损失达到 700 多亿元，其中云南直接农业损失近 200 亿元[2]。农业巨灾风险已经成为农业保险可持续发展的一个关键节点或阿基里斯之踵（Achillies Heel）[①]。2010 年-2012 年云南连续三年旱灾更是对建立云南政策性农业巨灾风险分散机制提出更高期待，而农业巨灾风险准备金则是建立农业巨灾风险分散机制的核心。本文以云南 1949——2008 年农业损失数据为基础，测度云南农业保险巨灾风险准备金安排，探索农业保险巨灾风险准备金测算方法。

## 二、农作物单产波动模型

农作物生产风险又称单产风险，是种植业的最主要风险，也是农户最为关注的风险[4]。对农作物生产风险进行分析和评估可以为广大农民、农业企业和政府管理者提供决策依据，而且是农业风险区分、农业保险设计及费率厘定的基础。因此，对农作物生产风险的分析是一个比较重要的问题。然而，由于导致农业生产风险的因素复杂且繁多，以及在评估农业风险的过程中，历史数据缺乏等原因，导致对农业生产风险的分

[①]阿基里斯（Achillies）是古希腊神话中的勇士。他出生后，其母提着他的脚将他浸入冥河之中。由此使他全身刀枪不入，只有未被浸入水中的脚跟除外。阿基里斯之踵（Achillies Heel）比喻为某事物中的致命弱点。

析及评估极其困难。孙良媛[5]（2004）对农作物生产风险进行过定义，即农作物生产风险是在一定时期和一定客观环境下，由于不确定性的存在和人的有限理性，致使经济行为主体的预期收益与实际收益可能发生偏离的程度。在此基础上，张峭等[6]（2007）将农作物生产风险定义为一定时期及一定客观环境下，农作物实际单产低于预期单产的程度。综合上述定义，本文认为农作物生产风险是一定时期及一定客观条件下，农作物实际单产偏离预期单产的程度及不确定性。根据张峭等[6]的讨论，对农作物生产风险的分析可分为以下几个步骤：第一，收集数据，并检验所得时间系列数据是否稳定；第二，剔除时间系列中的确定趋势，得到农作物的随机单产波动系列；第三，采用 JB 检验和 KS 检验选择各单产波动系列的分布，并进一步根据拟合优度检验得出单产波动系列的最优分布。本文借鉴他们的方法对云南省四种农作物（稻谷、玉米、小麦和油菜籽）的单产波动模型进行拟合，并估计四种农作物的生产风险。然而，在对单产波动系列的分布进行拟合的过程中，本文除了采用 JB 检验和 KS 检验之外，还将引入模型选择的概念，采用 AIC 方法[6]选择单产随机波动的最优模型。

**1、数据收集**

根据农作物生产风险的定义，要估计农作物的生产风险，必须得到农作物单产波动的程度及相应概率。因此，分析农作物生产风险的第一步便是拟合农作物单产波动模型。本文以云南省四种农作物为例来说明具体方法，表 1 给出了从 1949 年到 2008 年云南省稻谷、玉米、油菜和小麦四种农作物的单产数据，数据来源于《云南统计年鉴》，其中 NA 表示缺失数据。

**表 1 农作物单产数据**

| 年份 | 稻谷 | 小麦 | 玉米 | 油菜籽 |
|---|---|---|---|---|
| 1949 | 2.671711 | 0.775304 | NA | 0.435961 |
| 1952 | 2.847996 | 0.942308 | 1.213007 | 0.403846 |
| 1957 | 3.117816 | 0.910769 | 1.326135 | 0.256136 |
| 1962 | 2.782808 | 0.833846 | 1.34743 | 0.29454 |
| 1965 | 2.91348 | 0.953593 | 1.528826 | 0.439267 |
| 1970 | 3.763283 | 0.803728 | 1.789446 | 0.383405 |
| 1975 | 3.813155 | 1.065724 | 2.174711 | 0.479698 |
| 1978 | 3.961501 | 1.290541 | 2.276367 | 0.350993 |
| 1980 | 3.770428 | 1.333616 | 2.025653 | 0.530457 |
| 1985 | 4.496741 | 1.397291 | 2.703804 | 0.816629 |
| 1987 | NA | NA | NA | NA |
| 1988 | 4.542319 | 1.712629 | 2.809601 | 0.943833 |
| 1989 | 4.638294 | 1.522727 | NA | 0.897196 |
| 1990 | 4.965302 | 1.873509 | 2.833939 | 1.188424 |
| 1991 | 5.112463 | 1.974443 | NA | 1.39339 |
| 1992 | 5.069386 | 2.162203 | 3.015409 | 1.558115 |

| | | | | |
|---|---|---|---|---|
| 1993 | 5.104473 | 2.041867 | 3.201467 | 1.248619 |
| 1994 | 5.427979 | 1.975637 | NA | 1.2 |
| 1995 | 5.481084 | 2.216 | 3.459818 | 1.490094 |
| 1996 | 5.699148 | 2.189608 | 3.672334 | 1.381726 |
| 1997 | 5.795548 | 2.380229 | 3.734729 | 1.409692 |
| 1998 | NA | NA | NA | NA |
| 1999 | 5.9174 | 2.11712 | 3.996413 | 1.453796 |
| 2000 | 6.012887 | 2.230484 | 4.09529 | 1.517172 |
| 2001 | 5.415572 | 2.151988 | 4.193795 | 1.608203 |
| 2002 | 5.015512 | 2.219556 | 4.088231 | 1.674214 |
| 2003 | 6.09598 | 2.191576 | 3.748629 | 1.710745 |
| 2004 | 5.886577 | 2.239586 | 3.830875 | 1.773687 |
| 2005 | NA | NA | NA | NA |
| 2006 | 5.906781 | 2.089341 | 3.804302 | 1.790462 |
| 2007 | 5.955363 | 2.136832 | 3.888932 | 1.803596 |
| 2008 | 6.103112 | 1.954118 | 3.994192 | 1.694119 |

数据来源于云南省农业厅

## 2、稳定性检验

前面得到的四种农作物的数据均为时间系列数据，在分析时间系列数据前，必须对时间系列进行稳定性检验。时间系列的稳定性检验比较常用的方法有 ADF 检验和 PP 检验。Enders W[7]指出，跟 ADF 检验相比，PP 检验具有对残差假设较少、拒绝存在单位根原假设可信度更强的优点，因此本文采用 PP 检验对云南省 4 种作物的历史单产数据进行稳定性检验。由于存在缺失数据，在对这些系列进行稳定性检验之前，本文先对这些缺失数据进行了简单处理，即采用移动平均法对缺失数据进行估计，之后通过 R 软件对这四个系列做 PP 检验。表 2 给出相关结果，其中 P 值表示 PP 检验的 P 值，当 P 值接近 0（或者小于给定的显著水平，如 0.1 时），则认为该系列是平稳的；否则认为该系列是非平稳的。由于 4 中农作物单产数据 PP 检验的 P 值均大于 0.1，因此这 4 组数据均是非平稳数据。

**表 2　PP 检验结果**

| 农作物 | 稻谷 | 小麦 | 玉米 | 油菜籽 |
|---|---|---|---|---|
| P 值 | 0.719 | 0.8731 | 0.5944 | 0.269 |

## 3、时间系列趋势值和随机波动的计算

经过前面的检验结果，稻谷、小麦、玉米和油菜籽四种农作物的单产数据均为非平稳时间系列。因此在分析数据之前，必须将时间系列进行平稳转换，求出时间系列的趋势值，然后对趋势进行剔除。首先，假设 $X_{1t}$，$X_{2t}$，$X_{3t}$，$X_{4t}$ 分别表示稻谷、小麦、玉米和油菜籽在第 t 年(t=1，…，32，分别对应 1949 年到 2006 年)的单产数据。对于 i=1，…，4，t=1，…，32，假设

$$X_{it} = \mu_{it} + Y_{it}, \qquad \cdots\cdots\cdots\cdots \quad (1)$$

其中，$\mu_{it}$是$X_{it}$随时间变化的均值，

刻画了非平稳系列中的确定性组成部分，也即时间系列中的趋势值；$Y_{it}$是一个平稳系列，描述$X_{it}$中的随机组成部分，称为“随机波动”系列。式(1)可以变换为：

$$Y_{it} = X_{it} - \mu_{it}. \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad (2)$$

通过式(2)，可以剔除时间系列中的趋势值$\mu_{it}$，得到随机波动$Y_{it}$，也称为单产波动。

下面先讨论趋势值$\mu_{it}$，即$X_{it}$中确定性组成部分的拟合。趋势拟合方法有很多：移动平均法、滑动平均法、以及趋势线法等。由于趋势线法具有很大的主观性，而本文收集的数据时间间隔较大，用滑动平均法会导致对趋势估计的不准确。因此，本文采用 3 点移动平均法对所得时间系列的趋势进行拟合，即

$$\mu_{it} = {}^{1}\!/_{3} \sum_{k=t-1}^{t+1} x_{ik}, \quad i = 1, \cdots 4, \quad t = 2, \cdots, 31 \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad (3)$$

根据式(3)便可得到各系列的趋势值，由于移动法会对样本容量造成一定损失，本文采取的 3 点移动法将会损失 2 个样本点，即 t=1，32。最后根据式(2)得到的随机波动系列$Y_{it}$样本容量均为 30。$Y_{it}$反映了实际单产偏离预期单产的程度，$Y_{it} > 0$说明实际单产高于预期单产；反之，这说明实际单产低于预期单产。然而，由于$Y_{it}$具有量纲，不具可比性。根据张峭等[5]的讨论，可以将其转换为相对随机波动(RSV)系列，转换公式为：

$$RSV_{it} = {}^{Y_{it}}\!/_{\mu_{it}}. \quad \cdots\cdots\cdots \quad (4)$$

RSV 系列既可以表示作物的生产风险大小，同时又具有不受时间和空间影响、可比性好的优点，能较好的描述各种短期变动因子对农作物单产的影响。因此，本文采用相对随机波动来刻画作物生产风险。表 3 给出了根据式（3）得到的 RSV 系列的一些简单统计量。四种农作物波动的均值均接近于 0；小麦为负偏分布，其余三种农作物均为正偏分布；油菜籽的峰度接近于 0，稻谷峰度最大，说明油菜籽的分布最接近于正态分布，稻谷的分布偏离正态分布较大，具体见表 3。根据四个系列的最大值和最小值，所有 RSV 系列的数据取值范围均在期间[-1，1]上；变异系数绝对值最大的是稻谷，说明稻谷单产波动系列值与其均值的离散程度最大；JB 检验结果说明油菜籽以较高可信度接受正态分布假设，其余三种均需做进一步检验。

表 3 RSV 系列的统计量

| | 稻谷 | 小麦 | 玉米 | 油菜籽 |
|---|---|---|---|---|
| 均值 | 0.000379 | 0.00152 | -0.00165 | -0.00252 |
| 偏度 | 0.382 | -0.394 | 0.0663 | 0.0446 |
| 峰度 | 1.408 | 0.46 | 0.882 | 0.009 |
| 标准差 | 0.035 | 0.057 | 0.055 | 0.122 |
| 最大值 | 0.0929 | 0.1228 | 0.1482 | 0.2806 |
| 最小值 | -0.076 | -0.146 | -0.133 | -0.27 |
| 变异系数 | 93.198 | 37.58 | -33.105 | -48.209 |

| | | | | |
|---|---|---|---|---|
| JB 统计量 | 4.496 | 1.4776 | 1.6915 | 0.0714 |
| P 值 | 10.56% | 47.78% | 42.92% | 96.5% |

**4、单产随机波动系列的模型选择**

对于农作物单产分布，国外学多学者做过很多研究证实[8][9]。根据他们的研究结果，主要的分布模型有：Beta 分布，Gamma 分布，Weibull 分布，Logistic 分布，极值分布，双曲线反正旋分布，Johnson family 分布（SU，SB 和 lognormal），非参数分布（Kernel density）等。然而，前面所得到的 RSV 系列取值范围均在期间[-1，1]上，而上述很多分布均不满足这个定义域，为了扩大分布选择范围，本文不直接拟合各 RSV 系列，而是将各 RSV 系列进行如下变换：

$$ER_{it} = e^{RSV_{it}}, i = 1,\dots,4; t = 1,\dots,30 \quad \cdots\cdots (5)$$

根据上式变换后得到的$ER_{it}$取值均大于 0，接下来将对变换后的 4 个系列的分布进行拟合及选择。本文采用 KS 检验和 AIC 准则对各个系列的分布进行选择，表 4 给出了具体结果。其中 AIC 和 KS 分别对应于各个系列在各种分布假设下的 AIC 值和 KS 检验的 P 值，AIC 值越小说明模型越接近真实模型，而 KS 检验的 P 值越大说明分布拟合越好。根据该表给出的结果，AIC 值和 KS 检验给出的结果是一致的，即四个系列的分布均为 Logistic 分布。为了进一步说明拟合效果，以玉米为例，图 1 给出了$ER_3$在 Logistic 分布假设下的 QQ 图。图 1 样本的数据基本上可以看成是来自 Logistic 分布总体。另外，为了比较观测数据在不同分布假设下的密度函数与相应数据的柱形图的比较，图 2 还给出了$ER_3$的柱形图，非参核密度(kernel)估计方法得到的密度函数、正态分布假设下的密度函数及 Logistic 分布假设下的密度函数。从该图可知，核密度的拟合效果较好，但不够光滑，Logistic 的拟合较之正态分布更接近核密度估计函数。同时，Logistic 拟合的密度函数比核密度函数的拟合更光滑。因此，该图可以得到相同的结论。

**表 4　各 ER 系列分布拟合的 AIC 值及 KS 检验 P 值**

| | $ER_1$ | | $ER_2$ | | $ER_3$ | | $ER_4$ | |
|---|---|---|---|---|---|---|---|---|
| | AIC | KS | AIC | KS | AIC | KS | AIC | KS |
| Gamma | -112.28 | 0.46% | -83.62 | 40.1% | -86.21 | 80.5% | -36.2 | 15.4% |
| Logistic | -116.95 | 1.24% | -85.29 | 67.8% | -87.98 | 95.8% | -38.3 | 32.2% |
| Normal | -111.95 | 0.39% | -83.94 | 46.8% | -85.97 | 77.6% | -37.59 | 16.0% |
| Weibull | -102.238 | 0.1% | -81.25 | 45.3% | -78.44 | 31.9% | -32.99 | 6.34% |

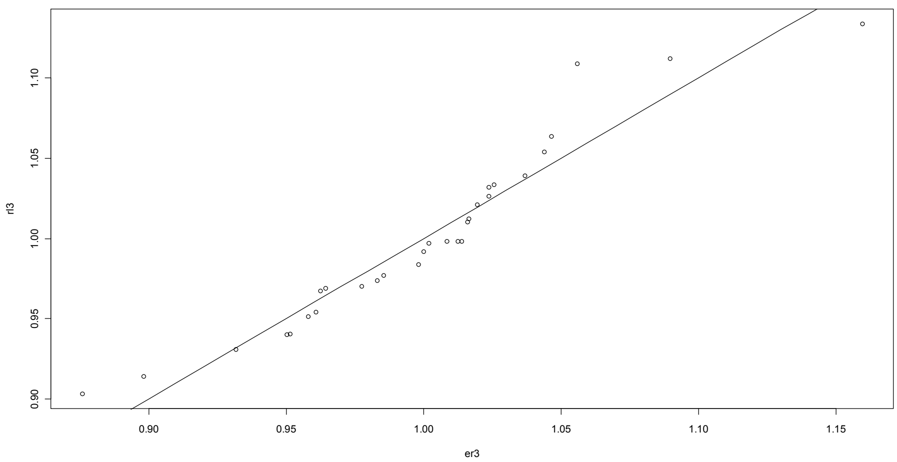



图 1 $ER_3$在 Logistic 分布假设下的 QQ 图

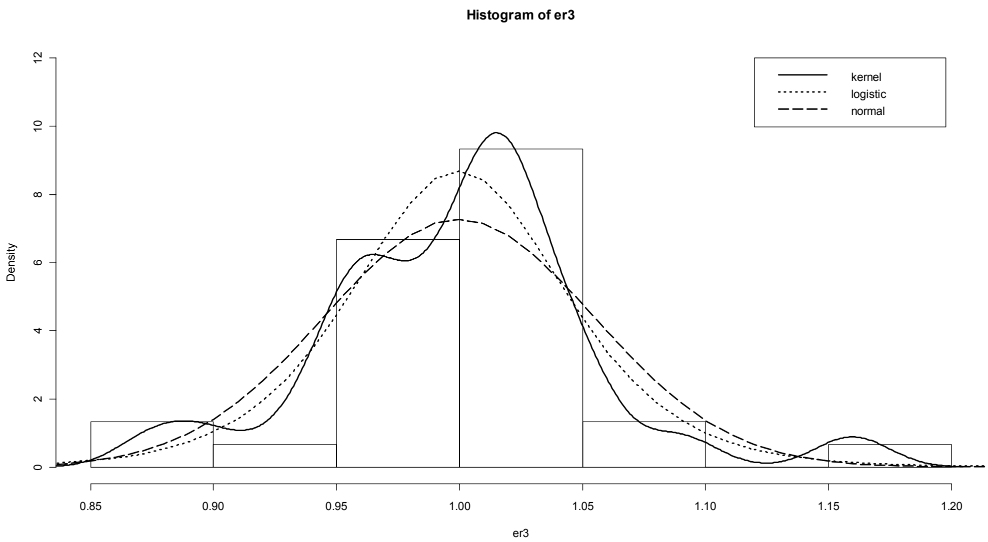



图 2 玉米的 ER 系列柱形图及分布拟合图

## 三、参数估计与风险评估

根据前面给出的结论，假设

$ER_{it} \sim Logistic[m_i, \sigma_i]$，$i = 1, 2, 3, 4$

其中，$m_i$，$\sigma_i$为未知参数，参数的估计方法主要有矩估计法、最大似然法等，其中最大似然法是最常用的方法之一。本文通过 R 软件，采用最大似然法对这些参数进行估计，其结果为：

$m_1 = 0.9993$，

$m_2 = 1.004$，$m_3 = 0.9995$，$m_4 = 9989$，$\sigma_1 = 0.017$，$\sigma_2 = 0.03$，$\sigma_3 = 0.0288$，$\sigma_4 = 0.66$

作物风险分析的目的之一就是对作物在不同损失强度下损失发生的概率有一个明确的、定量的概念；明确损失概率和损失严重程度是风险估算所要解决的问题。前面构造出了本文考虑的 4 中农作物的单产波动模型，根据这些波动模型，可以计算出这几种农作物的生产风险程度。根据刘荣花等提出的灾损标准，生产风险可分为以下 4 个级别：损失 5%-15%为轻灾；损失 15%-25%为中灾、损失 25%-35%为重灾；损失 35%以上为巨灾。用概率表示即：

① 轻灾：$\Pr\left(-0.15 < RSV \leq -0.05\right)$；

② 中灾：$\Pr\left(-0.25 < RSV \leq -0.15\right)$；

③ 重灾：$\Pr\left(-0.35 < RSV \leq -0.25\right)$；

④ 巨灾：$\Pr\left(RSV \leq -0.35\right)$。

上一小节得出的各 ER 系列的分布，根据式(5)可得

$$\Pr(a < RSV \leq b) = \Pr\left(e^{a} < ER \leq e^{b}\right) \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots \quad (6)$$

综合各类风险的定义及式(6)可求出各农作物风险发生各种灾害的概率，表 5 给出了计算结果，其中风险均值=10%*Pr(轻灾)+ 20%*Pr(中灾)+ 30%*Pr(重灾)+ 50%*Pr(巨灾)。其中油菜籽的风险均值最大，玉米次之，稻谷的风险最小，具体见表 5。

表 5　生产风险估计结果

| | 稻谷 | 小麦 | 玉米 | 油菜籽 |
|---|---|---|---|---|
| 轻灾 | 5.23% | 13.72% | 14.93% | 21.7% |
| 中灾 | 0.024% | 0.77% | 0.75% | 7.55% |
| 重灾 | 0.000% | 0.05% | 0.04% | 2.31% |
| 巨灾 | 0.000% | 0.005% | 0.004% | 1.16% |
| 风险均值 | 0.53% | 1.54% | 1.77% | 4.95% |

## 三、巨灾准备金的测算

为计算大灾准备金，引入以下记号：A=农业产值，B=农作物播种面积，C=平均产值，D=保费收入，E=成灾面积，L=损失金额，M=投保比例，N=保险公司封顶赔付金额，Ca=大灾准备金。则根据庹国柱（2010）等的讨论，大灾准备金的测算公式为：

大灾准备金（Ca）=损失金额(L)-保险公司封顶赔付金额(N)………（7）

其中，

损失金额(L)=成灾面积(E)×投保比例(M)×平均产值(C) ……………(8)

保险公司封顶赔付(N)=保费收入(D)×200% ……………………………（9）

其中，保费收入(D)=农作物播种面积×亩平均产值（C）×M×平均费率。本项目中，为计算巨灾准备金，首先给出如下假设：（一）全省投保农作物面积用 M 表示，假设为 10%且为均匀分布；（二）种植业平均费率为 7%；（三）当年全省简单赔付率超过 200%，便启动大灾准备金；（四）如果应赔付的实际损失小于保险公司封顶赔付金额（即 2 倍保费收入），则大灾准备金的金额设定为 0。

表 6　　1991-2009 云南省农作物播种面积及平均产值

| 年份 | 农作物播种面积（万亩） | 农业产值（亿元） | 平均产值（元/亩） | 农作物成灾面积（万亩） |
|---|---|---|---|---|
| | B | A | C=A/B | E |
| 1991 | 6514.08 | 130.67 | 200.6 | 1333.41 |
| 1992 | 6447.72 | 146.7 | 227.52 | 1778.76 |
| 1993 | 6348.672 | 179.39 | 282.56 | 1780.7 |
| 1994 | 6603.924 | 228.99 | 346.75 | 1973.14 |
| 1995 | 6556.884 | 299.48 | 456.74 | 1667.6 |
| 1996 | 7930.317 | 369.36 | 465.76 | 687.9913 |
| 1997 | 7589.198 | 397.09 | 523.23 | 1093.576 |
| 1998 | 6494.841 | 381.26 | 587.02 | 1307.56 |
| 1999 | 6843.732 | 394.96 | 577.112 | 1502.18 |
| 2000 | 7185.012 | 416.36 | 579.4841 | 587.013 |
| 2001 | 7810.26 | 431.31 | 552.2351 | 843.43 |
| 2002 | 7489.044 | 445.35 | 594.6687 | 1790.416 |
| 2003 | 7323.12 | 433.91 | 592.5207 | 2325.44 |
| 2004 | 7485.252 | 516.92 | 690.5846 | 57.7 |
| 2005 | 7657.08 | 559.32 | 730.4612 | 200.9 |
| 2006 | 7236.216 | 630.19 | 870.8833 | 647.8 |
| 2007 | 7190.1 | 707.15 | 983.5051 | 891.8 |
| 2008 | 7348.04 | 790.87 | 1076.3 | 2196.1 |
| 2009 | 7198.21 | 850.65 | 1181.752 | 1522.1 |

基础数据来源于云南省农业厅

根据具体见表 6 以及式（7）-（10），可以计算 1999-2009 年的大灾准备金，具体见表 7。

表 7　　1999-2009 年历年大灾准备金金额

| 年份 | 保费收入（万元） | 封顶赔款金额（万元） | 损失金额（万元） | 金额缺口（万元） | 平均缺口（万元） |
|---|---|---|---|---|---|
| | D=A×M×5% | N=2D | L=E×M×C | Ca=L-N | |
| 1991 | 9146.9 | 18293.8 | 26747.7 | 8453.904 | |
| 1992 | 9146.9 | 20538 | 40470.75 | 19932.75 | |
| 1993 | 10269 | 25114.6 | 50316 | 25201.4 | |

| | | | | | |
|---|---|---|---|---|---|
| 1994 | 12557.3 | 32058.6 | 68418.31 | 36359.71 | 22486.94 |
| 1995 | 16029.3 | 41927.2 | 76166.19 | 34238.99 | |
| 1996 | 20963.6 | 51710.4 | 32043.67 | 0 | |
| 1997 | 25855.2 | 55592.6 | 57219.22 | 1626.623 | |
| 1998 | 27796.3 | 53376.4 | 76756.36 | 23379.96 | |
| 1999 | 26688.2 | 55294.4 | 86692.61 | 31398.21 | 18128.76 |
| 2000 | 27647.2 | 58290.4 | 34016.47 | 0 | |
| 2001 | 29145.2 | 60383.4 | 46577.17 | 0 | |
| 2002 | 30191.7 | 62349 | 106470.4 | 44121.43 | |
| 2003 | 31174.5 | 60747.4 | 137786.9 | 77039.5 | |
| 2004 | 30373.7 | 72368.8 | 3984.673 | 0 | 24232.19 |
| 2005 | 36184.4 | 78304.8 | 14674.97 | 0 | |
| 2006 | 39152.4 | 88226.6 | 56415.82 | 0 | |
| 2007 | 44113.3 | 99001 | 87708.98 | 0 | |
| 2008 | 49500.5 | 110721.8 | 236366.2 | 125644.4 | |
| 2009 | 55360.9 | 119091 | 179874.5 | 60783.47 | 37285.58 |

为求巨灾准备金，将 1991-2009 年分为四个周期，即 1991-1994 为第一周期，1995-1999 为第二周期，2000-2004 为第三周期，2005-2009 为第四周期。根据表 7，第一周期每年的准备金为 22486.94 万元；第二周期每年的准备金为 18128.76 万元；第三周期每年的准备金为 24232.19 万元；第四周期每年的准备金为 37285.58 万元。由于前两周期离现在的时间较长，经济发展状况有很大不同，本项目将根据第三、四周期的每年的准备金平均值来估算以后的准备金，即在保险平均费率为 7%，投保面积为 10%的情况下，大灾准备金为 30758.89。

## 四、结论及建议

将 1991-2009 年分为四个周期。这四个周期巨灾风险准备金如下：
1991-1994 为第一周期：每年的准备金为 22486.94 万元；1995-1999 为第二周期：每年的准备金为 18128.76 万元；2000-2004 为第三周期：每年的准备金为 24232.19 万元；2005-2009 为第四周期：每年的准备金为 37285.58 万元。由于前两周期离现在的时间较长，经济发展状况有很大不同，本项目将根据第三、四周期的每年的准备金平均值来估算以后的准备金，即在保险平均费率为 7%，投保面积为 10%的情况下，大灾准备金为 30758.89 万元。今后一段时期云南农业保险巨灾风险准备金，可参考这个数值。然而，在测算大灾准备金的过程中，由于缺少相关信息，本文对投保比例以及平均费率进行了假设，即投保比例为 10%且为均匀分布，保险平均费率为 7%。但实际投保比例不足 10%，各种农作物的费率也不尽相同，应注意以下几点：

（1）本节给出的准备金只是在一定假设下的结论，实际情况中投保比例小于 10%，由于准备金的额度随着投保比例的增加而增加，因此实际需要的准备金要低于本节得到的准备金额度。

另一方面，随着政策性种植业保险覆盖率逐年递增，应该逐年增加巨灾风险准备金。

（2）在实际情况中，各种农作物的费率不尽相同，各种农作物面临的风险也不相同，而各种农作物的种植面积与受灾面积不一定为均匀分布，因此本节给出的准备金只是一种初略估算，要测算更为精确的准备金需要各种农作物保险费率、种植面积与成灾面积的具体数据。近年自然灾害频发，损失金额与保险封顶赔付之间的差额较大，如果要使保险在防灾防损中发挥其作用，就需要提留较多的准备金。

（3）由于政策性农业保险巨灾风险准备金属于准公共品，具有很强的外部性，存在市场失灵，政府应积极干预，参与其资源配置，财政部门应给予一定补助。政策性农业保险巨灾风险准备金实行全国统筹。种植业保险按当年保费收入的 15%比例计提巨灾风险准备金，同时中央财政补贴 10%，共计 25%。鉴于西部地区和山区面积过半的省份的农业保险经营费用过高，保险公司巨灾风险准备金计提比例应略下调，计提比例为 10%比较合适。

另外，政策性农业保险保费结余也要全额转入巨灾风险准备金，不作为利润分配，逐年滚存。各保险公司把政策性农业保险巨灾风险准备金存入财政部专门账户，专户管理，专款专用，审计署每年审计一次。当保险公司的政策性农业原保险和再保险不足以赔付保险责任范围内的农业损失时，可向财政部申请使用农业巨灾风险准备金。财政部严格审核后，做到应赔尽赔。

**【参考文献】**

[1]O. Vergara, G. Zuba, T. Doggett, and J. Seaquist, 2008. Modeling the potential impact of catastrophic weather on crop insurance industry portfolio losses. Amer. J. Agr. Econ. V90, number 5: 1256-1262.

[2]钱振伟等. 政策性农保险模式创新及巨灾风险分散机制研究：基于对云南实践的调查[M].北京：经济科学出版社，2011 年 12 月。

[3]庹国柱、赵乐、朱俊正等.政策性农业保险巨灾风险管理研究——以北京为例[M].北京：中国财政经济出版社，2010。

[4]Joy Harwood. Managing risk in farming: concepts, research, and analysis. Agricultural Economic Report. No. 774, ERS USDA.

[5]孙良媛.经营环境，组织制度与农业风险[M].北京：中国经济出版社, 2004：16-18.

[6]张峭、王克. 农作物生产风险分析的方法和模型[J].经济分析.2007 年第 8 期，第 7-10 页。

[7]H. Akaike, Information Theory and an Extension of the maximum Likelihood Principle. In Second International Symposium on Information Theory, 1973.

[8]Walter. Enders, Applied econometric time series, Wiley; 2nd edition, 2003.

[9]R.E. Just and Q. Weninger, Are crop yields normally distributed? Amer. J. Agr. Econ. V81(2):287-304.

[10]R.E. Just and R.D. Pope, Agricultural Risk Analysis: Adequacy of Models, Data, and Issues. Amer. J. Agr. Econ., 2003, vol. 85, issue 5, pages 1249-1256

[11]John Duncan and Robert J. Myers, Crop Insurance under Catastrophic Risk, American Journal of Agricultural Economics, Vol.82, No. 4 (Nov., 2000), PP. 842-855.

[12]陈玲.我国农业再保险制度建立问题的相关研究[J].特区经济，2007（6），第 171-173 页。

# 政策性农业保险巨灾风险评估及其准备金测算：基于云南 1949—2008 年的农业损失数据[②]

张艳　李云仙
金融学院　云南财经大学，昆明，650221

**摘要：**随着全球气候变暖，极端天气日益频繁，我国农业保险面临巨灾风险的概率也日益增大。云南 2010-2012 年连续三年干旱表明，农业巨灾风险已成为农业保险可持续发展的一个关键节点。建立农业保险巨灾风险准备金制度是农业巨灾风险分散机制的重要组成部分。本文以 1949—2008 年的云南稻谷、小麦、玉米、油菜籽历史损失数据为例，在对数据进行 PP 检验、JB 检验、KS 检验基础上，采用 AIC 方法选择农作物的单产随机波动最优模型，对这四种农作物的单产波动模型进行拟合，探索农业保险巨灾风险准备金的一般测算方法，估测云南农作物生产风险和巨灾风险准备金，为建立云南农业巨灾风险分散机制提供技术准备。

**关键词：**农业保险、巨灾风险、准备金

[②]【基金课题】第五十批中国博士后科学基金（一等资助）《极端气候频现背景下的我国政策性农业保险制度创新研究：基于保障粮食安全视角》，编号：2011M500028。2012 年云南省省院省校合作课题《云南现代农业巨灾风险保障体系及实施难点研究：基于对云南 2010-2012 年抗旱实践的调查》。
【作者简介】张艳：女，1981——，云南陆良县人，云南财经大学金融学院讲师，主要研究方向：保险理论与实践；李云仙:女，1981——，云南陆良县人，云南财经大学金融学院讲师、博士，主要研究方向：保险精算；

# Research on Risk Security Mechanism of the Public Liability Insurance of Fires

ZHAO Shangmei GU Guoxue
School of Economics and Management，Beihang University，Beijing

Abstract: The insurance rate of Public liability insurance of fire in china is very low , only a few provinces and cities started trying out compulsory insurance. In case a fire occurs in a public place, the responsible party loss the capacity of compensation, it may cause the abruptness and unexpectedness of group events, and affect the steadiness of the society, in the end, the government often has to bear compensation responsibility and the operator of public place escape the civil compensation liability. That is unfair to taxpayers. Therefore, Researching on the pattern and mechanism of public liability insurance of fires is of great significance. In this article Firstly, analysis of the property public goods of public liability insurance of fires revealed that it belongs to the quasi public goods, which lays the theoretic foundation for the select of the mode of public liability insurance of fires ; second , we analysis on the necessity for compulsory insurance from social welfare angle;Then, we propose the mode of compulsory liability insurance and rate liberalization according to the property of quasi public goods ; Finally, based on the property of quasi public goods and Cooperative economics, the mechanism of three-layer defense which is made up of the Central Government，local Government and some commercial insurance companies, is presented.

Keywords:public liability insurance of fires，Quasi public goods，the mode of compulsory liability insurance and rate liberalization，three-layer defense

## Ⅰ、引 言

火灾是严重危害人民群众生命和财产安全的多发性灾害。据统计，在我国仅 2008、2009、2010 三年全国共发生火灾就达 40.2 万起，死亡 4246 人，受伤 1730 人，其中影剧院、歌舞厅、商场、宾馆、饭店等公共场所火灾造成死亡人数接近 15%。[1]

我国虽然在法律上对公共场所经营者的赔偿责任认定较为清晰，但在其经济赔偿的执行中会遇到很多问题。主要原因是责任方自身在火灾中往往也蒙受严重的损失，不具备火灾之后的赔偿能力，最终通常是由政府承担了灾后赔偿责任。而灾后的政府赔偿的主要来源是财政税收，而税收是由所有纳税人负担的，这种征收方式又会带来严重的不公平。另外，政府的财政拨付毕竟有限，如果不能妥善解决这些问题，遇到重大突发公共场所火灾可能会引发群体性事件，甚至影响社会稳定。因此，研究公共场所火灾公众责任险的实施模式和运行机制意义重大。

在保险业较发达国家和地区，公众责任险已成为具备社会管理功能的险种。美国、英国、瑞士、俄罗斯、日本、韩国、我国台湾地区等均以不同方式规定，公共场所实施包括火灾责任的公众责任强制保险制度。美国责任险占整个非寿险业务的 50%左右，英、法、德、日等此比例也维持在 35%至 45%左右，我国台湾地区，公众责任险的投保占比约为全部责任险保费的三分之一。[2]中国早在 1995 年，公安部就下发了《公共娱乐场所消防安全管理规定》，其中提出：“重要企业、易燃易爆化学危险品场所和大型商场、宾馆、饭店、影剧院、歌舞厅等公共场所必须参加火灾保险和公众责任险。”但之后由于种种原因这项制度并没有有效施行。目前仅有深圳市、重庆市等部分省市公共场所实行强制火灾公众责任保险。保监会 2006 年曾对全国十几个大城市的商场保险情况进行了调查，发现有 90%以上的经营者未投

* 本文系教育部人文社会科学研究资助项目“我国火灾公众责任保险风险保障资源协调优化模型及运行机制研究”（项目编号：09YJA630006）和国家自然科学基金项目“突发公共事件保险保障模式及运行机制研究”（项目编号：70973007）

保火灾公众责任险。[3]目前我国的公众责任险在财产险中的占比只有 4%左右。[4]

关于我国公共场所火灾公众责任风险保障模式的研究开始引起了国内学者的关注。大部分学者提出了公共场所火灾应实行强制投保模式，[5][6] 但却没有给出理论或模型来支持。也有学者提出“相对强制保险模式”，即公共场所经营者可以选择火灾公众责任保险，也可以选择由金融机构等第三人为潜在的侵权责任人，提供财务上的保证或者企业通过建立专有损害基金的方式来承担潜在责任。[7]这种模式中的担保方式仅关注了有雄厚财力的公共场所经营者，却忽视了众多得不到担保的经营者的火灾风险分摊问题。

现有文献大多还只是定性地讨论强制投保模式的必要性和意义等，并没有给出选择风险保障模式的理论依据，更没有对强制保险模式中费率管制还是自由的选择及保障模式的运行机制进行深入讨论。本文将借鉴已有研究成果和国际经验，结合我国现实状况，科学选择公共场所火灾公众责任风险保障模式及运行机制，并从理论上给出解释。

## Ⅱ、公共场所火灾公众责任险的准公共物品属性分析

从公共经济学角度看，社会产品可分为公共物品和私人物品。公共物品是“每个人对于这种产品的消费，都不会导致其他人对该产品消费的减少”。[8]公共物品的典型特征一般包括：效用上的不可分割性；生产经营上的规模性；消费上的无排他性；取得方式上的非竞争性；较强的外部性等。公共物品又可分为纯公共物品和准公共物品。同时具有这些基本特征的称为纯公共物品，而在具备效用不可分割性的基础上，只具备非排他性或非竞争性一个基本特征的公共物品为准公共物品。准公共物品又可分为两种：一种是具有竞争性而非排斥性的物品，另一种是具有排斥性而非竞争性的物品。火灾公众责任险是具有排斥性而非竞争性的准公共物品。

第一，公共场所火灾公众责任险具有效用的不可分割性。火灾公众责任险不仅具有避免公共场所经营者破产的效应，更重要的是保障在公共场所消费的公民的利益，管理社会风险。因为公共场所一旦发生火灾，一般损失大而且还涉及人员伤亡，影响家庭稳定和社会和谐。因而，火灾公众责任险具有避免经营者破产、保障消费者利益和维护社会稳定的三重效应的统一性。

第二，公共场所火灾公众责任险具有非竞争性。公共场所火灾公众责任的风险是客观的不确定的，每个经营者均有面临火灾责任风险的可能，每个经营者均有购买火灾责任保险的必要，公共场所经营者火灾公众责任险投保面越广，风险保障越充分。因此，公共场所火灾公众责任险具有互助性，不具有竞争性。

第三，公共场所火灾公众责任险具有规模性。火灾公众责任险的大数定理性质决定了只有达到一定保险规模，保险人才能承担风险成本。

第四，公共场所火灾公众责任险具有较强的外部性。公共场所火灾公众责任险的投保人是公共场所的经营者，受益人是公共场所的消费者，它有利于保障消费者的安全和利益，有利于维护社会稳定。

公共场所火灾公众责任险的准公共物品属性，导致完全依靠自由投保分散风险的市场失灵，无法达到帕累托最优，所以需要政府参与调节供需，实现社会福利最大化。

## Ⅲ、公共场所火灾公众责任强制保险模式选择的福利分析

根据历史统计数据，公共场所火灾发生概率小，但一旦发生，责任方往往面临破产威胁。而火灾公众责任保险的投保人和被保险人是责任方，受益人是消费者，因此责任方缺乏投保的积极性，导致公共场所火灾公众责任保险的需求不足；对保险人来说，保险标的需要达到一定的规模才能够承保，否则将面临巨大的经营风险，因此，火灾公众责任保险应当有一个最小供给规模。在自由投保模式下由于需求不足，达不到最小供给规模，交易难以达成，导致公共场所火灾公众责任保险市场失灵。从全社会的角度看，公共场所火灾公众责任保险能够使受害人得到及时足额赔付，保证赔偿责任公平负担，协助政府处理重大火灾责任事故，维持社会稳定，具有较强的正外部性。因此，公共场所火灾公众责任险的准公共物品属性需要政府介入这一市场，强制保险，以保证社会福利最大化。

下面从福利经济学的角度给出理论分析。

基本假设：

1．只考虑公共场所火灾公众责任险的投

保人（需求者）和保险人（供给者）的福利。因为消费者是公共场所火灾公众责任险的受益人，假设政府为了社会稳定，既使在自由投保模式下消费者也能得到与强制投保模式下相同的赔付。在此，社会福利仅指投保人的消费者剩余和保险人的生产者剩余之和；

2．为了便于说明，假设公共场所的经营者为同质经营者（如公共娱乐场所），对火灾公众责任险的需求曲线假设为 $D$ ；

3．假设国家立法强制所有公共场所的经营者都投保,没有逃避和漏保的经营者；

4．假设公共场所火灾公众责任险未达到最小供给规模时，商业保险公司不提供火灾公众责任险。又由于保险产品（风险）具有“分摊”的性质，当投保的数量增多时，费率相应的减少，即费率是投保数量的减函数。设保险公司的最小供给规模为曲线 $S_0$ （如图 1 所示）。

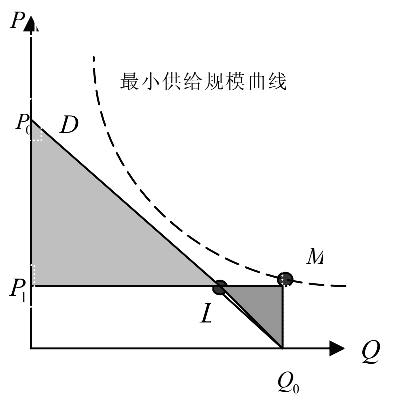



**图 1 公共场所火灾公众责任强制险的社会福利分析**

在自由投保模式下，公共场所的经营者投保火灾公众责任险的需求达不到保险人的最小供给规模如图 1，表现为供给曲线 $S_0$ 与需求曲线 $D$ 没有交点，所以公共场所火灾公众责任险的需求者和供给者难以达成交易，此时社会福利为 0。国家强制保险后，公共场所的总数量为 $Q_0$ 家的经营者都投保，

此时完全反映风险成本的均衡费率为 $P_1$，保险人的生产者剩余为 0，而投保人（经营者）的消费剩余为三角形△ $P_0P_1L$ 面积减去△ $MLQ_0$ 面积，此时，投保人（经营者）的消费剩余最大。投保人（经营者）的消费剩余来自于风险的分散而避免赔付和破产。社会总福利为火灾公众责任险需求者（投保人）的消费剩余和供给者（保险人）的生产剩余之和，此时处于最大值。

结论：强制投保公共场所火灾公众责任险，有利于社会福利的提高，且实际费率等于均衡费率（风险成本）时，社会福利最大。

中国保监会与公安部在 2006 年将上海、深圳、天津、吉林、重庆、山东六地列为火灾公众责任保险试点地区。在试点地区，河北、山西、黑龙江、河南、贵州、青海、宁夏等省市对推行火灾公众责任险采取了“鼓励、引导”的非强制保险模式，效果并不理想。以山西太原为例，2010 年上半年，全市参加火灾公众责任险的消防安全重点单位只有 140 余家，尚不到全市 1600 多家重点单位的 1/10。[3]深圳市自 2009 年 5 月 1 日至 10 月 31 日，在全市范围内对 200 平方米以上的公共娱乐场所展开火灾公众责任强制保险的试点工作，截至 2010 年 1 月 15 日，参保率达到 99.5％。[9]可见，公共场所火灾公众责任险，实行“自由”投保模式，投保率偏低，无法达到分散风险的目的；必须推行强制保险，才能达到经营者、消费者、保险人及政府的社会福利最大。

## Ⅳ、强制投保模式下费率管理机制的选择

公共场所火灾公众责任强制保险模式下，由于市场数量已定，费率自由还是费率管制更能接近均衡费率水平，将根据不同的市场结构（完全竞争，完全垄断，寡头垄断）和监管水平，作不同的选择。

1、在完全竞争市场上，实行自由费率，能及时准确地反映风险成本，实际费率会围绕均衡费率（风险成本） $P_1$ 波动，基本稳定在风险成本 $P_1$，此时投保人的消费剩余最大，也没有损害保险人的利益，所以社会总福利最大（如图 1 所示）。

2、在完全垄断市场上，垄断企业会通过制定高于风险成本的费率来获得垄断利润，损害投保人的利益，需要政府对费率进行管制，尽可能的使实际费率接近均衡费率，维护市场公平。

3、在寡头垄断市场上，少数几个寡头保险企业极易形成价格卡特尔。卡特尔要么为了获取超额利润维持垄断高价（远高于风险成本），要么为了保费指标降价（远低于风险成本）以排挤非卡特尔保险企业。前者会损害投保人的利益，后者保险企业会发生偿

付能力危机，威胁公共场所火灾公众责任险的健康发展。因此，政府对费率的适度管制是必要的。

我国的保险市场目前处于寡头垄断阶段，2011 年底，三家大型产（人保、平安、太保）、寿（国寿、平安、太保）险公司分别占产寿险 68.93% 、54.56%的市场份额。我国公共场所火灾公众责任险市场上具备形成卡特尔所需要的条件。

第一，卡特尔必须具有提高或降低行业价格的能力。这种能力的大小，与卡特尔面临的需求价格弹性有关，弹性越小，卡特尔操纵价格的能力越强。由于公共场所火灾公众责任险实行强制保险，因此，需求价格几乎无弹性。

第二，卡特尔成员被政府惩罚的预期较低。只有当成员预期不会被政府抓住并遭到严厉惩罚时，卡特尔才会形成，因为巨额预期罚金将使得卡特尔的预期价值下降。由于我国的反垄断法和保险市场监管尚不成熟，政府对价格卡特尔的发现和惩罚机制不能保证一以贯之的严厉，寡头公司对因卡特尔而被政府惩罚的预期较低。

第三，设定和执行卡特尔协定的组织成本必须较低。使组织成本保持在低水平的因素有：涉及的厂商数目较少、行业高度集中、所有的厂商生产几乎完全相同的产品、行业协会的存在。中国的产险市场分别由 3 家保险公司垄断了近 70%的市场份额，而且控制着保险行业协会，销售着同一款公共场所火灾公众责任强制保险产品。

因此，为了防止公共场所火灾公众责任强制保险市场上形成价格卡特尔，侵害投保人的利益，损害公共场所火灾公众责任强制保险的健康发展，政府必须对公共场所火灾公众责任强制保险的费率适当管制。另外，在一个不成熟的保险市场上，对于一个缺乏历史统计数据的新险种费率进行管制，还能够避免保险公司在缺乏定价数据和经验的情况下竞相降价，费率的统一也便利了投保人投保，降低了选择成本。当然我们也应看到，费率管制也存在弊端，政府很难代替保险人对市场信息变化做出及时准确的反应。尤其在该险种推出初期，会使实际费率要么过于高于均衡费率，要么过于低于均衡费率（如交强险）。不过，随着历史数据的积累，政府管制费率偏离均衡费率的幅度会逐渐收窄。

在国外发达国家（如美国和日本)，保险业都比较发达，都将公共场所火灾公众责任险归为责任险中，对于责任险费率实施模式，在保险业发展前期，对强制责任险费率都有严格的管制或指导性管制，伴随着保险业的发展和监管体系的完善，费率逐渐放开费率或实行浮动的费率。如在美国，从 1944 年以后到 1960 年代以前，保险费率受到普遍的管制，主要的方式是事前审查和批准。到了 1980 年代以后，不同的州实行的模式也不尽相同，到底实行何种模式，这种争论差别一直持续到现在。由于美国的保险市场近似一个完全竞争市场，有 7000 多家保险公司，保险市场主体和监管比较成熟（2010 年世界 500 强企业中，美国保险业就有 19 家），因此，现在美国保险业市场费率管制程度较低，主要方式是事前审查和批准。在日本，日本保险市场一直处于寡头垄断之中，监管体系相对于美国还不够完善，在日本最初推出赔偿责任险时，所有产品条款费率必须得到主管机构批准，为了限制竞争实行统一费率制。1998 年后，随着放宽管制呼声的高涨，日本政府开始放松管制，保险公司可以在政府制定标准费率的基础上自由浮动。[10]

因此，在公共场所火灾公众责任强制保险初期，需要政府对费率进行适当管制，实行有管理的浮动费率制，给出一个火灾公众责任险的标准费率，允许保险人的费率在标准费率的一定范围内波动(例如波动范围 1%)。随着我国保险市场寡头垄断局面的减弱和保险监管的成熟，形成价格卡特尔的因素消失，同时，随着公共场所火灾公众责任险历史数据和经验的积累，政府可逐步放松费率管制，实行有管理的市场化费率机制。

## Ⅴ、“保险公司和地方及中央政府三级联防” 运行机制

公共场所火灾公众责任强制保险模式在运行过程中，政府和市场的合作机制也会影响作为一个准公共物品的公共场所火灾公众责任险的公平与效率。目前国际成熟的保险市场上基本可归纳为两种运行机制。一种是“政府主导，公司代办”。如法国，被保险人购买公共场所火灾公众责任险的保费由各保险公司代收，并缴入巨灾准备金。巨灾准备金的 70%，投资于新西兰政府公债、债券、银行票券，另

30%则投资于全球资本市场。[2]这种模式要求政府具有丰富的火灾专业经验，且兼有独立高效廉洁透明并受严格监督的公共部门。第二种是“政府配合，市场运作”。如美国、韩国、英国、瑞士、俄罗斯，政府提供政策和税收优惠等支持，由保险公司经营。美国工厂联合保险公司（FM global）主要承保“严格受控风险（HPR）”的大型工商企业资产保险业务，为美国三大工业保险公司和投保企业从事咨询服务。满足“严格受控风险（HPR）”要求的客户，可以获得低保费，高赔付的保险。[2]尽管这种模式带来了高效率，但需要完善的高福利制度作保障，因为如果没有社会医疗等福利保障，超出保险公司相应保险额的损失势必还会落在公共场所经营者或受害的消费者身上。我国目前尚不具备上述两种运行机制所要求的条件。

我国应采取何种运营机制，目前少有研究。有学者在假定我国通过立法强制实行了火灾公众责任保险的前提下，提出实行火灾公众责任保险的“专营化”和“市场化”的双规运营机制。[11]由政府成立的 “专营”机构效率低下，将不得不在政府的补贴下和商业保险公司竞争，这种不公平的竞争最终可能会导致商业保险公司逐步退出火灾公众责任险市场，最后可能会由“行政”性质的专营机构垄断，将面临严重寻租，成本偏高，效率低下等问题。

本文提出了“商业保险公司和地方及中央政府三级联防” 运行机制。

1．公共场所火灾公众责任风险保障资金的筹集机制。首先，公共场所经营者向具有资格的商业保险公司购买火灾公众责任险，缴纳的保险费形成第一级风险保障资金；其次，鉴于我国各地区经济发展不平衡及不同的地理文化特征，成立以各个省、直辖市、自治区为单位的各自的地方火灾风险保障基金，由地方政府财政和社会捐款等注入，形成第二级风险保障资金；最后成立中央政府国家重大突发火灾风险保障基金，形成第三级风险保障资金。地方和中央政府火灾风险保障基金可以通过资本运作获得利润，实现火灾风险保障基金的保值增值。

2. 公共场所火灾公众责任险事故的赔付机制。当火灾损失在商业保险金额内的火灾责任事故，由商业保险公司赔偿，形成第一级风险保障；当火灾损失超出了商业保险金额，超出部分由地方政府火灾风险保障基金赔偿，形成第二级风险保障；当发生商业保险金额和地方政府火灾风险保障基金仍无能力全部赔偿的特大火灾时，向国家重大突发事件火灾风险保障基金申请援助，形成第三级风险保障，发挥中央政府最后保障人的作用。这样可以抵御不同程度的火灾风险（如图 2）。

在第一级保障中充分发挥市场机制的功能，引入商业保险公司，在政府强制投保的前提下，投保人自由选择保险人，风险事故的赔付以投保人的保险金额为限，体现了公共场所火灾公众责任险私人物品属性，来解决政府运作火灾公众责任险成本高，效率低的问题，充分发挥商业保险管理社会风险的功能。在第二级和第三级保障中，充分发挥地方和中央政府的保障功能，体现了公共场所火灾公众责任险所具有的公共物品属性。商业保险公司和地方及中央政府三级联防的有机结合，充分体现公共场所火灾公众责任险所具有的准公共物品属性，达到了三方合作的共赢。

商业保险公司和地方及中央政府三级联防的运行机制，既能充分发挥市场效率，又能发挥地方和中央两级政府安全网的功能，增强社会抵御巨灾风险的能力，充分保障了经营者持续经营，受灾者得到及时补偿，起到了社会“减震器”和“防护网”的作用。

3.“三级联防”运营机制的监管。首先监管机构每年根据条件的变化及时调整火灾公众责任险的基本费率水平，并给出浮动范围；其次要对商业保险范围和赔偿机制进行监督；再次要对地方和中央政府的火灾风险保障基金的赔偿拨付机制进行严格监管，防止滥用政府的火灾风险保障基金；最后对火灾风险保障基金的投资运作进行严格监管，保证基金的安全和增值。

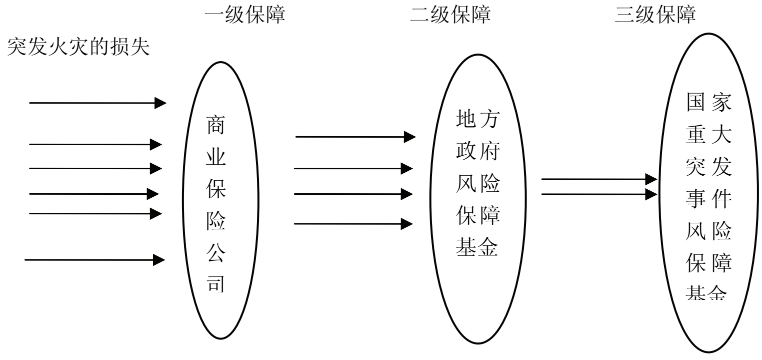



**图 2 公共场所火灾的三级联防保障模式示意图**

**[参考文献]**
**[References］**
[1]Fire Department of Ministry of Public Security. China Fire-fighting e-book, 2004-2009. Beijing: China Personnel Press.
公安部消防局.中国消防年鉴 2004-2011.北京:中国人事出版社.
[2]Lin Xiao. Trying out the public liability insurance of fires with reference to the foreign experiences.
http://info.fire.hc360.com/2011/06/221601467927-2.shtml
林晓. 推行火灾公众责任险可借鉴的国外经验［EB/OL］.
http://info.fire.hc360.com/2011/06/221601467927-2.shtml
[3]Huang Qinchang、Liu Xiaopeng. Imposing the public liability insurance of fires
http://www.ce.cn/xwzx/gnsz/gdxw/200810/28/t20081028_17201751.shtml
黄庆畅、刘晓鹏. 强制火灾公众责任险［EB/OL］.
http://www.ce.cn/xwzx/gnsz/gdxw/200810/28/t20081028_17201751.shtml
[4]Wang Xiaoping .The casualties happened frequently show that the public liability insurance of fires is seriously scarce.
http://finance.people.com.cn/insurance/h/2011/0817/c227929-1022612053.html.
王小平. 安全事故频发凸显公众责任保险“缺位”［EB/OL］.
http://finance.people.com.cn/insurance/h/2011/0817/c227929-1022612053.html.
[5]Hu Chuanpin、Yangyun. Brief Talking on the significance and measures of Trying out the public liability insurance of fires, Fire Science and Technology, 2007. 26 (2): pp205-208.
胡传平、杨昀. 浅谈我国推行火灾公众责任保险的意义和措施[J]. 消防管理研究，2007 26(2)：205-208
[6]Zhao Zuohua、Ru hui , Discussion on imposing the public liability insurance of fires, China Insurance ,2004（6）：pp44-45
张作华、余辉，探索强制火灾公众责任保险[J]. 中国保险，2004（6）：44-45
[7] Guo Lijun , On perfection of the public liability insurance of fires, Insurance Studies, 2008 (4)：pp25-27.
郭丽军，论完善火灾公众责任保险制度[J]. 保险研究，2008（4）：25-27
[8] Samuelson.Paul A, The Pure Theory of Public Expenditure，Review of Economies and Statisties, 1954(36):387-389.
[9] Zhao Hongfei. My city is trying out the public liability insurance of fires.
http://finance.qq.com/a/20100116/000674.htm
赵鸿飞. 我市试行火灾公众责任险［EB/OL］.
http://finance.qq.com/a/20100116/000674.htm
[10] Liang Wenwu、Xu Chunwu，American government taking the supervision for insurance industry， Insurance Studies, 1996（1）：63—64
梁文武、徐春武，美国政府对保险业的监管[J]. 保险研究，1996（1）：63—64
[11] Wang Weiguo、Lei Youxin ,Trying out the mode of the public liability insurance of fires：compulsion and monopoly, China Economist , 2007（12）：pp64—65.
王卫国、雷佑新，推行火灾公众责任保险的目标模式:“强制”加“专营 ”[J]. 经济师，2007，（12）：64—65.

# 公共场所火灾公众责任风险保障机制研究*

赵尚梅， 顾国学
经济管理学院，北京航空航天大学，北京，中国，100191

**摘　要**：中国公共场所火灾公众责任保险投保率低，公共场所一旦发生重特大火灾，而责任方又丧失灾后赔偿能力，通常由政府承担了灾后赔偿责任，这既使公共经营场所业主逃脱了民事赔偿责任，又对纳税人有失公平。因此，研究公共场所火灾公众责任险的实施模式和运行机制意义重大。本文首先提出并论证了公共场所火灾公众责任险的准公共物品属性，为公共场所火灾公众责任险模式的选择奠定了理论基础；其次从社会总福利的角度分析了强制投保的必要性；再次根据我国保险业仍处在寡头垄断的现实，提出“强制投保、费率浮动管制”的保险模式并给出了论证；最后基于准公共物品属性和合作经济学，提出了“中央和地方政府及商业保险公司三级联防”的运行机制。

**关键词**：火灾公众责任保险；准公共物品；强制投保；三级联防

[Authors] Zhao Shangmei is Professor at School of Economics and Management，Beihang University, a director of doctor students; Gu Guoxue is studying for a doctorate from School of Economics and Management，Beihang University．Beijing 100191

* 本文系教育部人文社会科学研究资助项目“我国火灾公众责任保险风险保障资源协调优化模型及运行机制研究”（项目编号：09YJA630006）和国家自然科学基金项目“突发公共事件保险保障模式及运行机制研究”（项目编号：70973007）

# Empirical Analysis of the Term Life Insurance's Business Tax Base：Based on the Comparison to the Bank's Business Tax

**NING Wei**[1], **XU Meng**[2]

1. Financial School, Central Financial Economic University; Insurance Department, Beijing Technology and Business University, Beijing, China, 100048
2. Insurance Department, Beijing Technology and Business University, Beijing, China, 100048

**Abstract:** Commercial life insurance has its own peculiarity in financial industry, but its business tax is levied according to the unified standard with other financial businesses. Unified standard inevitably causes different tax burden and the excess part of the commercial life insurance's business tax may be paid by the insurance consumer through a higher premium rate. For consumers, on the same capital investment, different burden of taxation must influence their selection on different financial products. This paper selects the term life insurance (the most simple and common insurance product) as the breakthrough point, comparing with the banking industry, to see the balance in their business tax amount. In the paper, the author will calculate the term life insurance's actual business tax base by the bank's calculation method, and using China Life Table (2000-2003) to do empirical research.

**key words:** Commercial life insurance; term life insurance; business tax

## Ⅰ. The current business tax system in China (suitable for the term life insurance)

The current regulation on business tax *PROVISIONAL REGULATIONS OF THE PEOPLE'S REPUBLIC OF CHINA ON BUSINESS TAX* has been in use since 1994 in China after it came into force. Business tax taxpayers include units and individuals who provide taxable services, transfer intangible property or sell immovable properties. There are nine tax items, including transportation industry, construction industry, financial and insurance industry, postal and telecommunications industry, service industry, entertainment industry etc, and they have different tax rates respectively.

According to the different types of taxpayers, insurance's business tax system can be classified by the insurance company business tax system, the insurance intermediary business tax system and the insurance marketing business tax system. This paper mainly involves the first category, the insurance company business tax system. The insurance company is the main business taxpayer in insurance industry. As insurance company charges policyholders for insurance services, in accordance with the financial and insurance's business tax taxable items, calculation of its business tax and turnover shall be based on the charges of insurance services' full price and other costs. The rate of business tax is 5%, one should pay the taxes to the competent local tax authority within 10 days since the expiration of the tax period (a month). The insurance's business tax system has its own peculiarity in two respects. First, different categories of insurance use different methods to calculate turnover. For example, the turnover of the insurance business which has been reinsured is determined by the whole premium incomes and initial insurer pays the taxes for reinsurer on their behalf1; the deposit insurance's turnover is determined by savings interests2; the business which policy

1 According to the Ministry of finance and the State administration of taxation's provisions [1997] and *IMPLEMENTING REGULATIONS on BUSINESS TAX PROVISIONAL REGULATIONS,* for insurance business that reinsures with other parties, the turnover of the initial insurance business shall be the total insurance premiums after deduction of the premiums paid to the reinsurers. In order to simplify procedures, in the actual collection process, the turnover of the insurance business is determined by the whole premium incomes the insurance company charged from the policyholder. Initial insurer pays the taxes for reinsurer on their behalf and reinsurer no longer to pay the business tax for the reinsurance premium income.

2 State Administration of Taxation: *Notice of Regulation on Financial & Insurance Industry's Business Tax Report*. The 16th clause (ii): if insurance company obtains the economic benefit by savings (the premium's interest income), that the capital should be returned to the policyholder, then the turnover of this saving business will be the product of saving's average balance and the months rates the People's Bank of

includes the clause of No-Claim Discount would calculate its turnover by the actual fees that charge from policyholder. Second, there is tax relief for specific insurance business, such as export credit insurance 3, agricultural insurance4, etc. In the meantime, subrogation receivables5, reinsurance premium income6, personal participating insurance7, the restitution type insurance which insurance period is longer than a year (including annual contract) and other duty-free businesses are also exempted from business taxation8. Other life insurance, before they have allowance to relief the business taxation, should pay its tax first. After it is approved, the amount of tax deduction that paid before can be used to counteract the taxable insurance's future taxation. If there is still a surplus, insurance company can obtain tax refund from the tax authorities.

## Ⅱ. Unsuitable tax base makes heavier tax burden on Life Insurance Company

Generally, foreign-funded life insurance companies are under the nominal tax burden9 of 5%, while Chinese-funded companies' are about 5.5%. The business tax of general business of bank is levied from the whole interest income, while the foreign exchange on-relending business is levied from interest margin. The security company sees the balance of the purchase price and the selling price as the business tax base. The insurance's business tax bases are composed of premium income and additional premium. Normally, premiums pricing are based on the expectation rule. However, the vast majority of premiums would be used for indemnity or reimbursement, which are the cost of risk and they are equivalent to the bank's interest expense or the prices the securities companies buy securities. So comparing with banks and security companies, the insurance's tax base has been expanded.

## Ⅲ. The comparison between term life insurance and banking on business tax base

Assume $P$: the pure premium of term life insurance, $P'$: the gross premium, $\alpha$: the fixed additional premium, $\beta$: the floating additional premium, $t$: the business tax rate, $T$: the business tax.

Then, $P' = P +（\alpha + \beta P'）$. There is a $\gamma$, that,

$$\gamma P' = \alpha + \beta P' \rightarrow P' = P + \gamma P' \rightarrow P' = \frac{P}{1-\gamma}$$

Based on the current tax law, the insurance tax base equals the gross premium, $\frac{P}{1-\gamma}$.

China announced. The saving's average balance equals the average of initial balance and ending balance in a tax period (a month).
Saving interest= ( initial balance+ ending balance) ÷2×annual interest rate÷12

[3] Ministry of Finance & State Administration of Taxation: *Notice of Certain Policies about Business Tax* (Jan.15th.2003). Subrogation receivables and SINOSURE's export credit insurance are not included in the range of tax collecting.

[4] See in the 6th clause in *PROVISIONAL REGULATIONS OF THE PEOPLE'S REPUBLIC OF CHINA ON BUSINESS TAX.*

[5] See in the 1st and 2nd terms in the *Notice of Certain Policies about Business Tax ([2003]16)* by Ministry of Finance & State Administration of Taxation.

[6] Ministry of Finance & State Administration of Taxation: *Notice of Issues in Financial Tax Policy Adjustment ([1997]45)*. In order to simplify procedures, in the actual collection process, the turnover of the insurance business is determined by the whole premium incomes the insurance company charged from the policyholder. Initial insurer pays the taxes for reinsurer on their behalf and reinsurer no longer to pay the business tax for the reinsurance premium income.

[7] Ministry of Finance & State Administration of Taxation: *Notice of Tax Exemption on Personal Participating Insurance. Personal participating insurance* is a long term insurance that insurer provides a high degree of protection on death, disability and so on. When policy expires, the insurer pays investment bonus for policyholder.

[8] The restitution type insurance is the general life insurance, annuity insurance and health insurance (insurance period is longer than a year) that when policy expires, the insurer should pay capital and interest back to policyholder. Ministry of Finance & State Administration of Taxation: *Notice of Tax Exemption on Life Insurance Business ([2001]118), Notice of Tax Exemption on Restitution Type Insurance, List of Life Insurances On Tax Exemption (the 16th batch) ([2006]115)* and other 13 notices successively published.

[9] In China, items of insurance tax include business tax, urban maintenance and construction tax, stamp duty, enterprise income tax, individual income tax, land value-added tax, urban land use tax, building taxes, vehicle and vessel use tax and education surcharges with nature of tax, etc. Among them, business tax, urban maintenance and construction tax, stamp duty and education surcharges are turnover tax.

### A. The method of calculation on bank's business tax base

Because the bank's business tax base is the balance of interest income and interest expense. That is,

$$P\ (i_2 - i_1),$$

Where $i_2$ : ROI of bank, $i_1$ : the predetermined deposit rate, $P\ i_2$ : the interest income, $P\ i_1$ : the interest expense.

We choose the pure premium of term life insurance $P$, instead of the gross premium $P'$ as the bank's tax base, that because the gross premium $P'$ covers the insurance company's operating expenses, but the pure premium $P$ is approximately equal to the deposit income. Through collecting deposit and investment, bank gains the interest income $P\ i_2$. Although it subtracts the interest expense $P\ i_1$, operating expenses and profits are also included in the tax base. So if using $P'$ to be the tax base, the operating cost would be double counting.

### B. Bank's business tax base (interest income minus interest expense)

If interest income minus interest expense can account for the bank's business tax base, then when we use this method to calculate insurance's business tax base, we should take life insurance's specificity into consideration. Since the premium is constant, the expenditure is uncertain. For a n-years life insurance, theoretically, it is more accurate that take the n-years income as the tax base. Then,

$$P'\ (1+i_2)^n - P\ (1+i)^n,$$

Where $P'\ (1+i_2)^n$ : accumulated income of a n-years investment of $P'$, $i$ : insurance pricing interest rates. If we do not take the cumulative mortality rate into consideration, then $P\ (1+i)^n$ : accumulated value for $P$, $P$ : actuarial present value of premium expenditure10.

$$P'\ (1+i_2)^n\ - P\ (1+i)^n \rightarrow \frac{P}{1-\gamma}(1+i_2)^n - P(1+i)^n$$

That is, the balance of the insurance's income and expense.

### C. Comparative analysis

1) The old method VS the new method

For consistency, we place the two values to the same point, the end of the nth. year.

$$F = \frac{P}{1-\gamma}\ (1+i_2)^n - \left[\frac{P}{1-\gamma}(1+i_2)^n - P(1+i)^n\right]$$

Then, $F = P\ (1+i)^n > 0$

We can prove that numerical result under the old method is larger than the new method in calculation of the term life insurance.

2) The insurance's business tax base calculated in the new method VS the bank's business tax base

From the above, $i_2$ : ROI on capital market, $i_1$ : the predetermined deposit rate, $i$ : insurance pricing interest rates, $i_2 > i_1 > i$.

$$G = \frac{(1+i_2)^n}{1-\gamma} - (1+i)^n - (i_2 - i_1)^n$$

Then, $G > (1+i_2)^n - (1+i_1)^n - (i_2 - i_1)^n$

$$\Rightarrow \frac{\partial G}{\partial i_2} = n(1+i_2)^{n-1} - n(i_2 - i_1)^{n-1}$$

……

[10] The principle for determination of pure premium is the balance between income and expenditure. So the net expenditure may equal to the pure premium $P$.

$$\frac{\partial G}{\partial^{n-1} i} = n!(1+i_2) - n!(i_2 - i_1) = n!(1 + i_2 - i_2 + i_1) > 0$$

It can be proved that $G$ is monotonic increasing function.

When $i_2 = i_1$, then $G$ =0,

$i_2 > i_1$, then $G$ >0.

When n=1, then

$P^{'}(1+i_2)^n - P(1+i_1)^n = P^{'}(1+i_2) - P(1+i_1) = P^{'} - P + (P^{'} i_2 - P i_1)$

Because $P^{'} > P$, then $P^{'} - P + (P^{'} i_2 - P i_1) > P(i_2 - i_1)$

We can conclude that, though using the new method to calculate the business tax base, the commercial life insurance's tax base is still larger than the banking one's.

## D.The empirical analysis

The author randomly selects 30-year old males who are under the 30 years death insurance and 1 RMB as the unit insured amount to do the empirical analysis (data can be seen in appendix).

Order: $i_2$ =4.5%, $i_1$ =3.5%, $i$ =2.5%, $\gamma$ =20%

Then, $P$ = (15033.17-12565.64) /46941.74=0.05256611, $P^{'}$ =0.065707

The old method: $P^{'}(1+i_2)^n$ =0.065707*1.025^30=0.2460949

The new method: $P[\frac{(1+i_2)^n}{1-\gamma} - (1+i)^n]$==0.065707*[1.045^30-1.025^30]= 0.1358344

The bank's business tax base: $P$($i_2 - i_1$)=0.0525659*(0.045-0.035)= 0.000526

If the business tax rate is 5%, then,

the insurance's business tax calculate by the old method: 0.065707*5%=0.003285367

the insurance's business tax calculate by the new method: 0.065707*(1.045-1.025)*5%=0.0000657073

the bank's business tax: 0.052566*(1.045-1.035)*5%=0.0000262829

Through the empirical analysis, the current business tax base is 49 times larger than the real tax base, so that the business tax has been paid 49 times more. Meanwhile, comparing with the same amount of funds invested in bank businesses, the insurance's business tax base is 125 times as much as that in bank business. Because the term life insurance's premium rate is low, about 5.26% in lump-sum payment, although its business tax increase many times, adding additional premium, the absolute amount of its gross premium remains little. Just because of this, the problem of insurance's business tax is still lying on the table, but the overpayment of taxes can be borne by applicant, through raising the premium rate (For example, choosing a larger $\gamma$), which will not influence proceeds of commercial insurance company. So the insurance companies also do not have motivation to reform, which ultimately harm the benefit of applicant. This phenomenon is not conducive to the tax law's principle of fairness and it goes against the spirit of taxation.

If using the method of computing the bank's tax base, the balance between insurance and bank businesses can be reduced to about 2.5 times. Combining the factor of absolute value, the gap can be further narrowed. Nowadays, with the development of the insurance industry, reform of the business tax system will guide consumers to establish a correct concept to the insurance consumption, and furthermore, it can promote the life insurance industry develop to a higher level and achieve the goal of justice and fairness in tax system.

[11] $P = \frac{M_{60} - M_{30}}{D_{30}}$

# Gender Differences in the Effect of Applicants' Risk attitude Differences

## ——Based on the Research Results of the Status of Commercial Health Insurance in Beijing

CHAI Xinhui, JI Caihong
School of Economics, Beijing Technology and Business University, Beijing, China 100048

**Abstract:** Kahneman and Tversky amended the theory of expect utility to get the prospect theory. The prospect theory emphasize that people are not completely rational when they are making decisions. Their risk attitudes are different when faced the same risk but in different situations. So the desire of people plays a leading role when people make decisions. The insuring process of an applicant is much alike to the process the prospect theory has represented. So the prospect theory is used to count the risk attitude of applicants in this thesis. Based on prospect theory and the results of the status of commercial health insurance in Beijing, transfer the incalculable risk attitude to calculable expect value of different applicants' in the same financial and other situation when facing loss. And then analyze and compare how the gender differences affect the applicants' risk attitude of the commercial health insurance in order to get a conclusion. The search result reflects that: among those who have social insurance male tend to be risk averse but female tend to be risk lover; among those who have no social insurance male tend to be risk lover and female tend to be risk averse. At last the conclusion will be used to give some further developing advices to commercial health insurance.

**Key words:** prospect theory; risk attitude; gender difference.

## Ⅰ.引言

随着经济的不断发展和人们生活水平的提高，保险越来越成为人们生活中支出流量的重要组成部分，特别是随着医疗体制改革的不断深入，和医疗成本的日渐提高，商业健康保险渐渐成为社会大众应对健康风险的重要武器。人们的投保决策受到很多因素的影响，投保人除了要考虑自己的预期收益与预期保险效应外；由于风险的不确定性，其风险态度对于投保决策起了很大的作用。

本文主要运用实证分析的研究方法，力图通过对比研究不同性别人群的在相同经济状况下对于商业健康保险投保情况，即在相同风险情景下的不同风险决策比较，对其风险态度差异进行比较分析。即发现不同性别的投保者在投保商业健康保险时其风险态度的差异。其中在对投保人的预期效用进行评估的时候主要依据是前景理论中的决策权重理论，数据基础为北京商业健康保险的发展现状及趋势的研究结果。

目前针对投保人性别导致的风险态度差异进行分析的研究还比较少，并且主要集中于心理学研究等方面，在经济学方面的研究主要集中于投资人进行风险决策时风险态度的差异分析。本文将结合这些研究结果，通过运用前景理论，对性别导致的健康风险态度差异进行研究。

本文主要分为四个部分，第一部分主要对前景理论进行介绍；第二部分是将前景理论运用到研究过程中的运用方式，包括模型的假设，修正和实际计算几个方面；第三部分是对第二部分的计算结果进行量化的比较后进行分析比对，并对其结果显示的健康风险态度差异的原因进行分析阐述；第四部分是根据第三部分的分析结果对专业健康险公司和兼营健康险的其他保险公司的一些建议。

## Ⅱ. 健康风险性别差异研究的基本理论分析

诺贝尔经济学奖获得者 Kenneth J. Arrow 把人们对风险的态度分为三种，分别是“冒险型”（好冒险的），“避险型”（回避风险），和“中性型”（漠视风险）。

这是影响投保人风险决策的重要因素。不同的风险态度决定了人们对于购买保险的不同态度，这都直接影响着保险的需求。

同样是诺贝尔经济学奖的获得者 Kahneman 和 Tversky 通过对预期效用理论的修正，提出了著名的前景理论（prospect theory）。其风险选项可被表达为：

$$V = \sum W(pi)vi(x)$$

其中 Pi 表示人们主观认为事件发生的概率，vi(x)表示事件对于决策者来说的价值，它的参照点为决策者目前的状况，对于不同的人是不一样的，也就是说人们不止关心最终收益的绝对水平，还关心其对于参考点的变化情况。而 M 表示的是主观概率函数，也就是影响决策人进行风险决策的判断标准。

前景理论的主要内容可以分为 3 个部分：

## A.价值函数理论

价值函数的指数形式为：

$$V(x) = \begin{cases} x^{\alpha}, x \geq 0 \\ -\omega(-x)^{\beta}, x < 0 \end{cases}$$

其中α和β分别表示收益和损失区域价值幂函数的凹凸程度。ω系数表示损失区域比收益区域更陡的特征，ω大于 1）表示损失厌恶。

价值函数的形状如图 1 所示，价值函数综合反映了前景理论的 3 个基本观点：

1）人们的是收益还是损失是相对于参考点而言的。参考点在价值函数中起着关键作用， 它指的是决策者在评价事物时， 总会与某种参考物相比较， 当对比的参考物不同时，即使相同的事物也可能会得到不同的结果。因此， 参考点是一种主观的评价标准。参考点不同，会影响个人对是获益情境还是损失情境的判断， 进而影响决策者对风险的态度。对于参考点的确定，主要取决于决策者当前财富水平或者极力期望达到的财富水平。

2） 面对收益， 投资者是风险规避的，由图可知，价值函数在收益区域是凹的， 体现为风险规避， 即在确定性收益与非确定性收益中偏好前者；而面对损失， 投资者是风险偏好的；表现在图中在损失区域是凸的， 体现为风险偏好， 即在确定性损失与非确定性损失中偏好后者。

3）对于收益和损失都是敏感性递减的，且人们对损失比对获得更敏感。即财富减少产生的痛苦与等量财富增加给人带来的快乐不相等，前者要大于后者。前期的决策的实际结果会影响后期的风险态度和决策。前期盈利可以使人的风险偏好增强，还可以降低后期的损失；前期的损失会加剧以后亏损的痛苦，风险厌恶程度也相应提高。在图中表现为损失部分的斜率变化要小于收益部分。

## B.决策权重函数理论

前景理论中的决策权重函数取代了期望效用理论中的概率。决策权重是决策者根据事件结果出现的概率做出的某种主观判断，可以认为是决策者的心理概率。决策权重函数有两个特征：

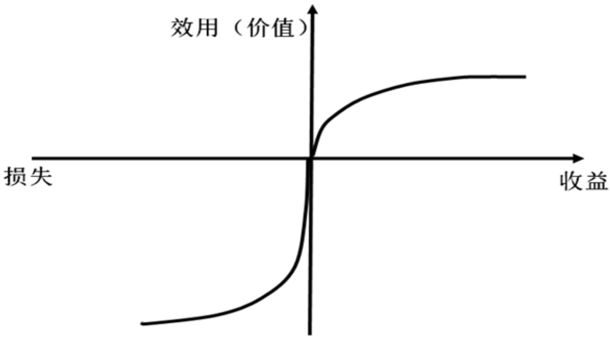



**图 1.决策权重价值函数图**

1） 决策权重不是一种客观概率， 它并不符合贝叶斯法则。它是一种主观概率， 主观概率仅存于人的头脑中， 它是人基于自己的经验和希望对事件的客观概率的判断。主观概率为 1， 意味着人相信某个事件会出现； 主观概率为 0， 意味着人相信某个事件不会出现； 而各个中间值则反映决策者不同的信心水平。

2） 决策权重与客观概率 p 相联系。决策权重 W(pi)是客观概率 p 的一个非线性函数。当出现的概率 p 很小的时候W(pi)>p，这表示投资者对于概率很小的事件会过度重视；但是当出现的概率一般或者很大时，W(pi)<p，这表明建设项目投资风险决策者在决策时，容易对小概率事件高估而对大概率事件低估。对小概率事件的高估放大了对偶然性获利的希望，增大了对严重损失这一小概率事件的厌恶程度。结果，决策者通常在对待不可能的盈利时表现出风险偏好，

在对待不可能的损失时表现出风险厌恶。

### C.形式效应理论

前景理论认为，在决策过程中，人并不是完全理性，只是有限理性。在决策过程中，决策者会因为情境或问题表达的不同而对同一种方案表现出不同的风险态度， 从而做出不同的选择，这就是形式效应理论。Kahneman 和 Tversky 的实验表明： 当一种方案被正面表述时， 决策者会将其结果看成是获利情境， 从而表现出风险规避性；当这种方案被负面表述时，决策者会将其结果看成损失情境， 从而产生风险偏好性。

## Ⅲ.基于前景理论风险态度数量化计算：

每个投保人都有自己的目标和消费准则，会对各个人的经济状况和所处环境所处判断和估计，并且要对未来的情形进行判断和估计，然后做出决策，以实现所追求目标的最优化。基于前景理论在相同参考点下，对不同性别的投保人投保商业健康保险的时间价值做出测算，可以反映出不同性别投保人的的风险态度差异。

### A.基本计算模型

在前景理论中，“前景”的价值是由“价值函数”和“决策权重”共同决定的，即：

$$V=\sum W(pi)vi(x)$$

我们已经知道价值函数为：

$$V(x)=\begin{cases} x^{\alpha}, x\geq 0 \\ -\omega(-x)^{\beta}, x<0 \end{cases}$$

根据 Kahneman 和 Tversky 的测定$\alpha=\beta=0.88$，$\omega=2.25$时最符合决策者的损失规避心理。

而决策权重函数则为$W(pi)$，根据 Kahneman 的测算，决策权重计算如下：

在收益情景下：$W^{+}(p)=\frac{p^{r}}{[p^{r}+(1-p)^{r}]^{\frac{1}{r}}}$

在损失情景下：$W^{-}(p)=\frac{p^{s}}{[p^{s}+(1-p)^{s}]^{\frac{1}{s}}}$

其中 p 为客观概率，r=0.61；s=0.69.

根据上述公式和数据，通过计算不同人对于购买商业健康保险的期望价值，可以间接反映出人们的风险态度。

### B.数据基础

#### 1）商业健康保险

健康保险在我国是近些年新提出的概念。过去习惯的被称为医疗保险，只是近些年随着国家医药卫生体制的改革和社会保险事业的发展，以及人民生活水平的提高和普遍对身体健康的重视，健康保险的概念才逐步形成。

商业健康保险是以被保险人的身体为保险标的，保证被保险人在疾病或意外事故所致伤害时的直接费用或间接损失获得补偿的保险，包括疾病保险、医疗保险、收入保障保险和长期看护保险。疾病保险指以疾病的发生为给付条件的保险；医疗保险指以约定医疗的发生为给付条件的保险；收入保障保险指以因意外伤害、疾病导致收入中断或减少为给付保险金条件的保险；长期看护保险指以因意外伤害、疾病失去自理能力导致需要看护为给付保险金条件的保险。

#### 2）北京市商业健康保险调查研究结果

北京市商业健康保险发展现状调查（后文中简称“调查”）是通过随机问卷做出的，针对 18 岁以上不同年龄层，不同职业，不同收入水平的人群的商业健康保险购买状况的调查，经过汇总，结果如下：

共收回有效问卷 500 份，其中男性被调查者 233 人，女性被调查者 267 人。男性中，有 21.1%即有社保又购买了商业健康保险，有 36.0%有社保没有购买商业健康保险，6.9%没有社保但购买了商业健康保险，36.0%即无社保也没有购买商业健康保险。女性中，有 30.0%即有社保又购买了商业健康保险，有 39.3%有社保没有购买商业健康保险，2.7%没有社保但购买了商业健康保险，28.0%即无社保也没有购买商业健康保险。

根据研究结果我们可以发现，在相同年龄，相同医疗支出水平和收入水平下，男性和女性对于商业健康保险的投保情况有着很大的分别。可见其面对风险的风险态度有着性别差异。下面将运用基本计算模型进行模拟，其中，商业健康保险中不同性别的投保比

例情况将作为决策权重中的客观概率 p，来测算出不同性别的人群对于损失的敏感程度和价值函数，从而对性别差异对于商业健康保险的购买者的风险态度差异进行测算和验证。而在下面的计算中，为了计算方便结果明了，将男性设为 M，女性设为 W。其中，具体投保情况的不同人群可设为以下数据：

表 1. 不同性别投保状况的数据假设

| 男性有社保有商保 | 男性有社保无商保 | 男性无社保有商保 | 男性无社保无商保 |
| --- | --- | --- | --- |
| $M_{11}$ | $M_{10}$ | $M_{01}$ | $M_{00}$ |
| 女性有社保有商保 | 女性有社保无商保 | 女性无社保有商保 | 女性无社保无商保 |
| $W_{11}$ | $W_{10}$ | $W_{01}$ | $W_{00}$ |

## C. 相关假设

由于商业健康保险属于第三类保险，具有财产保险的性质，属于补偿性保险，被保险人在发生保险责任范围内的保险事故时，只能通过商业健康保险获得经济补偿，而不可能通过保险获益，所以在以下关于决策权重的计算中，只对将保险结果视为损失情景的情况进行计算。为了进一步简化计算，我们需要假设人们所要遭受的损失是相同的，设为 m。此时，价值函数可以表述为：

$$V(x) = -\omega(-x)^{\beta} = -2.25m^{0.88}$$

即价值函数无差异性。

并且我们需要假设人们对风险的承受能力是相同的，即其前景期望损失达到一定限度时人们才选择购买保险，其选择购买保险的这个限度是相同的。

另外，前景理论中，人们的损失是相对于参考点而言的。当对比的参考物不同时， 即使相同的事物也可能会得到不同的结果。因此我们假定不同的投保人极力期望达到的财富水平是相同的，也就是对于每一个投保者来说价值的参考点是一定的。

在这三种假设下，根据

$$V = \sum W(pi)vi(x)$$

由于人们对于购买保险这个事件的期望损失越小，人们越有可能去购买保险。而又假设情况下可以知道对于同一时间的客观价值是相同的，因此决定人们对于购买保险这个事件的期望损失的就是决策权重的大小；即在假设条件下，期望损失是以决策权重为自变量的递增线性函数。因此决策权重越大，对于购买保险这个事件的期望损失越大，我们只需要比较其决策权重便可得到其风险态度的比较结果。

前景理论认为，人们在面对损失时往往呈现风险偏好的态度，即在面临确定性损失和不确定性损失的时候，更倾向于后者。比如，在投资经营活动中， 表现为当投资经营失败，尤其是濒临破产边缘时， 决策者面临风险时往往倾向于冒险。所以，当其测算出的决策权重较大时，被测算者表现为风险偏好更强，不购买保险的可能性也也就越大。

## D.测算过程

测算时选择 Kahneman 和 Tversky 的测定的最符合决策者的损失规避心理的数据 $\alpha = \beta = 0.88$，$\omega = 2.25$ 进行计算。

1)既有社会医疗保险又购买了商业健康保险的不同性别决策权重测算。

$M_{11}$的决策权重：

已知$M_{11}$有投保比例为 21. 1%，则 p=21. 1%

$$W^{-}(p) = \frac{p^{\delta}}{[p^{\delta}+(1-p)^{\delta}]^{\frac{1}{\delta}}}$$

$$= \frac{21.1\%^{0.69}}{[21.1\%^{0.69}+(1-21.1\%)^{0.69}]^{\frac{1}{0.69}}}$$

$$= \frac{0.3418}{(0.3418+0.8491)^{1.4492}}$$

= 0. 3418/1. 2881=0. 2653

$W_{11}$的决策权重：

已知女双有投保比例为 30. 0%，则 p=30. 0%

$$W^{-}(p) = \frac{p^{\delta}}{[p^{\delta}+(1-p)^{\delta}]^{\frac{1}{\delta}}}$$

$$=\frac{30.0\%^{0.69}}{[30.0\%^{0.69}+(1-30.0\%)^{0.69}]^{\frac{1}{0.69}}}$$

$$=\frac{0.4357}{(0.4357+0.7818)^{1.4492}}$$

$=$ 0. 4357/1. 3300=0. 3276

2）有社保但没有购买商业健康保险的不同性别决策权重测算。

$M_{10}$的决策权重：

已知$M_{10}$投保比例为 36. 0%，则 p=36. 0%

$$W^{-}(p)=\frac{p^{\delta}}{[p^{\delta}+(1-p)^{\delta}]^{\frac{1}{\delta}}}$$

$$=\frac{36.0\%^{0.69}}{[36.0\%^{0.69}+(1-36.0\%)^{0.69}]^{\frac{1}{0.69}}}$$

$$=\frac{0.4941}{(0.4941+0.7450)^{1.4492}}=0.4941/1.3644=0.3621$$

$W_{10}$的决策权重：

已知女有无投保比例为 39. 3%，则 p=39. 3%

$$W^{-}(p)=\frac{p^{\delta}}{[p^{\delta}+(1-p)^{\delta}]^{\frac{1}{\delta}}}$$

$$=\frac{39.3\%^{0.69}}{[39.3\%^{0.69}+(1-39.3\%)^{0.69}]^{\frac{1}{0.69}}}$$

$$=\frac{0.5250}{(0.5250+0.7086)^{1.4492}}=0.5250/1.3556=0.3873$$

3）无社保但购买了商业健康保险的不同性别决策权重测算。

$M_{01}$的决策权重：

已知$M_{01}$投保比例为 6. 9%，则 p=6. 9%

$$W^{-}(p)=\frac{p^{\delta}}{[p^{\delta}+(1-p)^{\delta}]^{\frac{1}{\delta}}}=\frac{6.9\%^{0.69}}{[6.9\%^{0.69}+(1-6.9\%)^{0.69}]^{\frac{1}{0.69}}}$$

$$=\frac{0.1581}{(0.1581+0.9519)^{1.4492}}=0.1581/1.1633=0.1359$$

$W_{01}$的决策权重：

已知$W_{01}$投保比例为 2. 7%，则 p=2. 7%

$$W^{-}(p)=\frac{p^{\delta}}{[p^{\delta}+(1-p)^{\delta}]^{\frac{1}{\delta}}}=\frac{2.7\%^{0.69}}{[2.7\%^{0.69}+(1-2.7\%)^{0.69}]^{\frac{1}{0.69}}}$$

$$=\frac{0.0827}{(0.0827+0.9813)^{1.4492}}=0.0827/1.0941=0.0756$$

4）既无社保有没有购买商业健康保险的不同性别决策权重测算。

$M_{00}$的决策权重：

已知$M_{00}$投保比例为 36. 0%，则 p=36. 0%

$$W^{-}(p)=\frac{p^{\delta}}{[p^{\delta}+(1-p)^{\delta}]^{\frac{1}{\delta}}}=\frac{36.0\%^{0.69}}{[36.0\%^{0.69}+(1-36.0\%)^{0.69}]^{\frac{1}{0.69}}}$$

$$=\frac{0.4941}{(0.4941+0.7450)^{1.4492}}=0.4941/1.3644=0.3621$$

$W_{00}$的决策权重：

已知$W_{00}$投保比例为 28. 0%，则 p=28. 0%

$$W^{-}(p)=\frac{p^{\delta}}{[p^{\delta}+(1-p)^{\delta}]^{\frac{1}{\delta}}}$$

$$=\frac{28.0\%^{0.69}}{[28.0\%^{0.69}+(1-28.0\%)^{0.69}]^{\frac{1}{0.69}}}$$

$$=\frac{0.4155}{(0.4155+0.7972)^{1.4492}}=0.4155/1.3353=0.3111$$

对以上 1——4 数据进行汇总可得：

表 2. 决策权重计算结果

| | 有社保有商保 | 有社保无商保 | 无社保有商保 | 无社保无商保 |
|---|---|---|---|---|
| 男 | 0.2653 | 0.3621 | 0.1359 | 0.3621 |
| 女 | 0.3276 | 0.3873 | 0.0756 | 0.3111 |

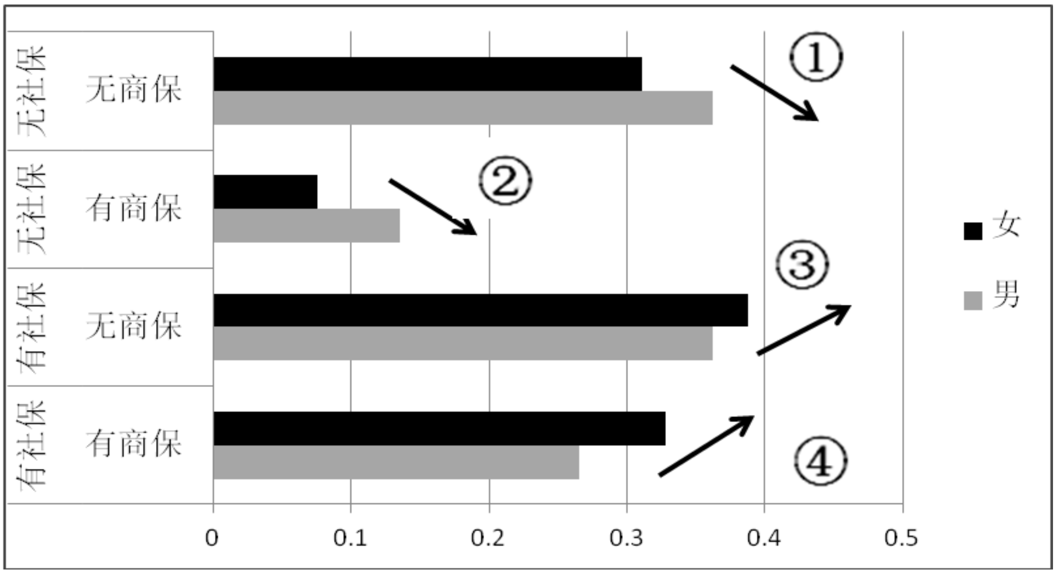



图 2.决策权重结果柱状图

# Ⅳ.性别差异对于风险态度的影响

## A.以有无社保作为先决条件对购买者的决策权重进行性别差异比较

**1）在有社保作为基本保障时，女性的决策权重大于男性的决策权重。**

从图二可以看出，在男女均有社保和商保以及男女有社保无商保的条件下，女性的决策权重均大于同条件下男性的决策权重。即在有社会医疗保险作为基本保障的情况下，比起女性来有更多的男性选择购买商业健康保险，而女性更愿意选择自我承担超出社保保障范围内的那部分可能的损失。而在调查结果中也反映出，在有社会保险且没有购买商业健康保险的那部分人群中，在将来预期会购买商业健康保险的男性人数多于女性人数。并且在对商业健康保险险种的选择上，女性大部分只选择疾病保险和医疗保险，而除了医疗保险和疾病保险外，有一定数量的男性也会投保失能收入保险和长期护理保险。可见在有社会保障的前提下，女性对未知风险偏好性更强，而男性对未知风险的规避倾向更强。

用 Kenneth J. Arrow 的理论来说，在有社保作为基本保障时，男性往往为“避险型”，而女性往往为“冒险型”。

究其原因，在笔者看来可能有以下几点：

（1）、从根本上来说，中国还是一个重男权的社会。在大部分的社会家庭中，男性的收入往往为家庭中经济收入的主要来源，并且在日常生活的重要决策特别是抚养后代的过程中，男性往往起着主导的作用。因此，在经济基础和基本生活有保障的条件下，男性相比女性来说更注重自己健康状况；因而除了基本的社会保障之外，更多的男性会投保商业健康保险来更大程度的转移自己因为可能的疾病或者医疗费用支出产生的风险。

（2）在有社会医疗保险的群体中，大部分为城镇企事业单位工作人员或者国家公务员，其经济水平较为良好，拥有商业健康保险的购买能力。而据中国国情来看，在国家机关或者企事业单位中，管理层或者领导层的男性比例要远远大于女性的比例，可见男性不仅仅是家庭主导，而且还是社会主导。而事实也表

明，在同等条件下，男性获得升迁的机会要大于女性。因而职业男性，特别是期望职业生涯有更大上升空间的男性更加注重自己的身体健康状况，对商业健康保险的个人需求也就相应的更大。

（3）一般说来，人们都会认同这样一个观点，即女性比男性更谨慎，因而我们可以推断在面对风险的时候，女性会选择更能降低风险的选择。然而心理学研究发现，男女对得益和损失的敏感程度是具有有差异性的，暂时不考虑外界因素和环境的影响，单就自我判断而言，在损失条件下，女性更愿意孤注一掷冒较多损失的风险去避免确定的损失。一般说来，男性对得益更敏感而女性对损失更敏感。

中国的保险也正处于初级发展阶段，很多人的保险意识还不强甚至没有保险意识，很一部分人将购买保险却未能出险的保费支出视为损失的范畴。因此，结合上述的研究结果，可以认为女性更愿意孤注一掷地冒因生病或者医疗遭受损失的风险去避免付出不会出险的保费，因此在已有强制医保的情况下，女性对商业健康保险的投保率较男性低。

**2）在无社保作为基础保障时，女性的决策权重小于男性的决策权重。**

从图二可以看出，在男女无社保也无商保和男女无社保有商保条件下，女性的决策权重均小于同条件下男性的决策权重。恰恰与 1 的结果相反，在没有社会医疗保障基础的时候，比起男性来有更多的女性选择购买商业健康保险，而男性更愿意选择自我承担超可能的损失。而在调查结果中也反映出，在没有社保且没有购买商业健康保险的那部分人群中，在将来预期会购买商业健康保险的女性人数多于男性人数。

调查中显示，没有医疗保障基础的人群大部分为个体商户，自由职业者或者农业工作者，首先其收入水平有限，在没有社会保障并且没有购买商业健康保险的人群中大部分人是由于此原因，不愿购买或没有能力购买，这是男女购买者的的通性；而其性别差异主要表现在这部分人中更多的女性购买了商业健康保险。

用 Kenneth J. Arrow 的理论来说，在有社保作为基本保障时，女性往往为“避险型”，而男性往往为“冒险型”。

究其原因，笔者认为主要有以下几个方面：

（1）再回到中国是男性主导社会的这个原因，在无社保的这部分人群中，调查结果显示出，购买了商业健康保险的那部分人群较多的是个体工商户或者家庭妇女。而女性购买者的比例又相对男性较高，其主要原因是其中家庭妇女的比例较高。在当今社会家庭妇女或是因找不到工作而被动失业或者或是因家庭条件优越而选择主动失业，而主动失业的那部分人由于家庭条件优越具有足够的购买力，在本身没有工作没有基本的社会保障的条件下，为了得到一定的医疗疾病保障，自然会选择商业健康保险。

而在家庭收入相对较低的家庭中，特别是普通个体工商户或者农业工作者的家庭中，男性更倾向于去承担未知的风险或者采取风险事前规避，来面对医疗或者疾病的损失风险，而不是通过保险来降低风险。而在这样的经济条件下，女性作未完全弱势群体更加需要保险来为其健康提供保障。因此，女性对于商业健康保险的需求反而会比较高。

（2）再用冒险倾向的性别差异来解释，相对 1-（3）中的损失情景下的男女差异，在收益情景下，男性比女性更愿意为较多的得益而冒不确定的风险。因此在这种情况下，女性会为了潜在的保障得益而选择去购买商业健康保险，而男性却对此得益进行了低估，而冒着更大的风险。因此，在没有社保保障的前提下，男性对于商业健康保险的投保率较女性更低。

## B.性别差异导致的风险态度差异对于商业健康保险发展的启示

### 1）我国商业健康保险目前发展面临的问题

首先从保费收入占比来看，2009 年商业健康保险保费总保费收入的 5. 15%，而在成熟市场上这一比例一般在 30%左右，我国健康保险的发展深度还远远不够。其此我国健康保险市场的专业化程度还太低，健康保险的经营理念大多仍停留在寿险的层面上；管理制度严重不完善，包括精算技术、核保技术、核赔技术和风险管控技术严重匮乏；经营管理人才不足，高素质、专业化的人才队伍尚未形成。再次，健康险的发展环境仍不成熟。我国对商业健康保险缺少税收优惠，目前国内只对经营健康保险业务的保险公司实行了税收优惠，对购买健康险的消费者还没有优惠，这会影响消费者购买保险的倾向。另外法律法规严重缺少，目前关于健康保险的法律法规还比较少，还有一个最明显的问题就是社会基本保险和健康保险的业务范围不明确。

### 2）针对性别差异完善健康保险公司发展的建议

研究性别因素对于商业健康保险的购买者的影响从理论上来说是为了了解不同性别的人群在购买保险

的风险决策时会有怎样的差异以及其原因是什么，而对于现实中的商业健康保险的发展来说，在保险公司的实际运营过程中，特别是产品设计和展业过程中，是有一定的实际意义的。因此，基于健康风险态度性别差异的结论，对于专业健康险公司或者其他经营健康险业务的保险公司的发展，有以下建议。

第一，有效地将性别导致的健康风险态度差异运用到产品的开发过程中，对于有效地开拓产品，提高商业健康保险的有效供给有一定的意义。

有效供给不足和需求供给不对称是我国当今商业健康保险发展所面临的重要问题，虽然我国商业健康保险的发展已有一定的基础，但专业化的商业健康保险公司还比较少，专门的商业健康保险业务基础还比较薄弱，在实际中商业健康保险大多作为投资型保险的附加项目而被消费者所接受。而商业健康保险的有效供给不足主要表现在保险公司提供的商业健康保险的产品和购买者需要的产品在价格，保障程度等方面有着一定的出入，在《北京市商业健康保险的现状及发展趋势》的调研结果中显示，有很大一部分人群因为找不到合适自己的商业健康保险产品而放弃购买商业健康保险，这种不对称将使保险公司损失一大批的潜在客户。

所以，商业健康保险产品的开发过程中，充分考虑到性别因素导致的风险态度差异，能够在一定程度上缓解需求供给不对称的困境。比如，在疾病保险产品的研发过程中，可以将不同性别的一些发生率较高的重大疾病分别研发出不同的险种，再根据具体疾病的实际支出计算相应的保险费率，相对传统的疾病保险来看，这样能更有针对性和倾向性的为不同性别的投保人提供合适的健康保险产品。

因此，有效地将性别差异影响因素运用到保险产品的研发过程中去，考虑到不同性别人群风险态度差异,更有针对性地研发出不同性别人群的健康险产品，对于为投保人提供适合自己的保险产品有一定的意义，从而进一步地提高商业健康保险的有效供给，进而促进商业健康保险的发展以致整个保险业的发展。

第二，将性别导致的健康风险态度差异运用到商业健康保险的展业过程中，对于提高展业效率和质量有一定的帮助。

我国目前的社会医疗保险制度还不甚完善，覆盖范围还不够广泛，特别是随着医疗成本的日益增加，其保障水平也远远不能满足人们的医疗保险需求。虽然社会医疗保险是全民性的保险，但在实际生活中，并且在《北京市商业健康保险的现状及发展趋势》的调研结果中也显示，还有很大一部分人群没有享受到社会医疗保险。因此在我国人们对商业健康保险的需求是很大的，特别是没有享受到社会医疗保险那群人的潜在需求，如何发现并满足这些需求就是商业健康保险展业需要做的事情。

全面了解性别风险态度差异，展业人员在展业过程中能够更有效地发现并把握不同性别潜在投保者的需求，投其所好，因人制宜，为不同性别的投保人提供有效的商业健康保险产品。在展业过程中，在了解到展业目标人群的大体收入和医疗支出水平之后，可以根据性别差异，首先选择那部分购买倾向更高的人群进行展业。譬如两个均没有社会医疗保险的男女，在大致相同的家庭收入和医疗支出水品之下，在上文的阐述中医讲了解到，在这种情况下女性比男性更有购买健康保险的倾向，所以，可以更有针对性地向女性进行展业，从而提高展业成功率。这样可以大大地提高展业的效率，降低展业成本，进而提高商业健康保险展业的水平和效果。

第三，有效地将性别导致的健康风险态度差异运用到商业健康保险的经营中，对于商业健康保险的经营也有一定的益处。

在商业健康保险的承保，核保，精算，理赔等项目中，考虑性别差异，进行差异化管理。能够一定程度上提高商业健康保险的经营效果和效率。

## 致谢

在论文完成之际，我要特别感谢我的老师吉彩虹，王绪瑾的热情关怀和悉心指导。在我撰写论文的过程中，他们无论是在论文的选题、构思和资料的收集方面，还是在论文的研究方法以及成文定稿方面，都对我倾注了悉心细致的教诲和无私的帮助，特别是他们广博的学识、深厚的学术素养、严谨的治学精神和一丝不苟的工作作风使我终生受益，在此表示真诚地感谢和深深的谢意。

## References

[1]Gu Mengdi,Zhang Jingyi,Zhang Yanfeng,Effects of Risk Attitudes in Medical Insurance Decision, Journal of Systems & Management,2010,2:137-139

顾梦迪，张婧屹，张延峰. 风险态度对医疗保险决策的影响. 系统管理学报，2010，2：137-139

[2]Zhang Yan,Wei Jiuchang, Risk Attitude, R isk Perception and

Trust:an Analysis Framework of Government Information SupplyingMechanism in Crisis Situation Based on Prospect Theory, Journal of University of Science and Technology of China,2011,107:53-59
张岩，魏玖长.风险态度、风险认知和政府信赖——基于前景理论的突发状态下政府信息供给机制分析框架.华中科技大学学报，2011，107：53-59
[3]He Guibing,Liang Shehong,Liu Jian,Effects of Gender Stereotypes and Task Frames on RiskPreference Predictions.Chinese Journal of Applied Phychology,2002,4:19-23
何贵兵，梁社红，刘剑.风险偏好预测中的性别差异和框架效应.应用心理学，2002， 4：19-23
[4] Lijie, Gaodingguo. Achievement Motivation and Gender Predict Risk Attitude. Chinese Journal of Applied Psychology.2005,11,3:214-221
李洁，高定国.成就动机和性别对风险倾向的预测作用.应用心理学，2005，11，3：214-221
[5]Liu cun. Enterprise staff's supervision and incentive strategy research based on prospect theory. Productivity research.2011,2:160-162
刘存.基于前景理论的企业员工监督与激励策略研究.生产力研究，2011，2：160-162
[6] Guo bei.Investment decision analysis based on prospect theory. Financial view. 2010,9:46
郭蓓.基于前景理论的投资决策分析.现代商业.2010，9：46
[7]Liu Yujie, Zhang Shiying, Wang Zhenqiang. The application of prospect theory in insurance. Journal of Northwest A&F University. 2006,2:10-12
刘玉杰，张世英，王振强.前景理论在保险学中的应用.西北农林科大学报.2006, 2：10-12
[8]Liu Ming, Liu Xinwang. To Review on Reserch of Loss Aversion under Prospect Theory. Value Engineering. 2008,10:143-146
刘明，刘新旺.前景理论下的损失规避研究综述.价值工程.2008，10：143-146

# 性别差异对于投保人风险态度差异的影响

## ——基于北京市商业健康保险发展现状调研结果

柴鑫慧, 吉彩红
北京工商大学 经济学院

**摘 要:**前景理论是由诺贝尔经济学奖获得者 Kahneman 和 Tversky 通过对预期效用理论的修正而得出的。相对于预期效用理论，它更强调决策人在面对风险时并不是完全理性的，他们往往会由于情境或状况的不同而对同一风险显示出不同的风险态度；决策者对于事件的主观判断性更强，并且人们判断收益或者损失是相对于参考点的相对收益或者相对损失而言的。投保人投保的过程与前景理论描述的特点极为相似，投保人在不同的身体或者财产状况下对于同一风险的风险态度是不同的，投保人具有很强的自主性选择性。因此，本文主要运用前景理论，以北京市商业健康保险现状调查结果作为数据基础，将北京市商业健康保险的调查结果中，不同性别的投保者在同等投保状态下的风险态度转化为，其面对损失时对损失事件的期望价值进行的测算，将风险态度数据化。并在此基础上分析比较性别差异造成的商业健康保险的购买者的风险态度的差异，以及其所显示出的规律性结果，从而得出结论。结果显示，在以是否有社会医疗保险为先决条件时，男女对于购买商业健康保险的风险态度的差异表现为：在有社保时男性是避险型女性为冒险型；而在无社保时男性为冒险型女性为避险型。并运用得出的结论对商业健康保险的未来发展做出发展建议。
**关键词:**前景理论；风险态度；性别差异；

# Analysis on the Demands and Supplies of Rural Micro-Life Insurance in China

CHEN Zhichu

Schools of economics,Tianjin University of Finance and Economics,Tianjin,China,300000

**Abstract:** Rural micro life insurance is an affordable insurance for rural low -income groups. The development of the insurance offer government a financial method which, by using the market mechanism, can strengthen the economic security of the low-income groups. The supply of rural micro-insurance helps, to enhance self-protection ability of the low-income groups, to build and improve a harmonious social security mechanism, to improve the rural financial system. This is the purpose of our study.

The essay can be divided into four parts. Part Ⅰ,we introduce the domestic and international research literature and the development of Chinese rural micro insurance. We evaluate the research result from the demand factors and empirical survey analysis、mode of operation、external environment construction. We also give a description to the try outs and development status of rural micro life insurance.

Part Ⅱ, Analysis on the demands of micro life insurance. We analysis the demand factors of micro life insurance by using the social questionnaire and quantitative method. We got 453 questionnaire from the farmers of shandong, hebei and tianjin county. Data processing results show that there is disparity between the potential demand and the real demand.Then we use the Logistic regression to examine whether the factor like the level of income, age, educational level, whether or not have commercial insurance and the level of the willingness to pay premium, have a significant association with the rusult.Our result suggests that the first four factors have a significant association of 90% with the rusult ,howerer,the last is not significant to the demand.

PartⅢ, Analysis on the supplies of micro life insurance. We introduce the present situation of the incurance supply and point out that the supply of the micro life insurance is a breakthrough which adjusts the limitation of the traditional "insurable" by using the homogeneous risk, stratification of consideration, low rate method ,which has the combination function of commercial insurance and social insurance. We analysis the advantages and disadvantages of the three operation mode,point out the problems in operation. Then we puts forward that "Government support, business operations,diversified,broad coverage" is a better way to supply micro life insurance. We also analysis the economic and empirical feasibility.

Part Ⅳ,Suggestions to the development of the demands and supplies of micro life insurance. First develop the demand of rural insurance, second strengthen government policy support, third clear the function of commercial insurance company in the supply of the micro life insurance,fourth promote the managements level of the commercial insurance company in micro life insurance, last promote the prodution design and the sales channel.

**Key words**：rural micro-life insurance; demands of rural micro -life insurance ; supplies of rural micro- life insurance; mode of rural micro- life insurance

为了改善农村低收入群体保险保障缺乏的现状，国际保险协会协同世界著名保险公司设计开发出了一款适合农村低收入群体的新型保险产品——农村小额人身保险。农村小额人身保险是为低收入农民提供的一种消费得起的保险保障产品。发展农村小额人身保险供给，为政府运用市场机制增强对低收入人群的经济保障，提供了一种金融方式。供给农村小额人身保险，有利于增强低收入农民自我保障能力，有利于构建与完善和谐社会保障机制，有利于完善农村金融体系。本文对我国农村小额人身保险的需求现状及供给模式进行分析，并提出相关的政策建议。

## 一、 国内外文献综述及我国小额保险的发展

### （一）国内外文献综述

国外很过学者对小额保险进行理论与实践研究。Mosleh U Ahmed（2005）对孟加拉国农村小额健康保险发展进行了分析总结，并提出向低收入人群提供健康保险的政策建议。Monique Cohen and Jenneffer Sebstad(2005)指出了小额保险应该保障的对象，即小额保险的目标人群划分，并指出保险供给方产品设计应符合低收入人群的需求。Craig Churchill（2007）主编《Protecting the Poor ：A Microinsurance Compendium》中，系统介绍开展小额保险的目的、意义，小额保险产品范围、经营模式、政府政策支持作用等内容。Michael J.Mccord《The partner-agent model ：Challenges and opportunities》阐述了合作代理模式的利弊，并把合作代理模式和小额保险的特点结合起来，对代理人的选择，保费收取和分配，保险理赔程序等进行了详细的阐述。Lena Giesbert、Susan Steiner（2008）指出了小额保险销售量不高的原因主要有：一是其他金融服务工具对小额保险具有替换性，如小额贷款和存款，二是很多低收入人群没有接触过任何金融服务，导致了对小额保险的没有任何认识。国际劳工组织（ILO）、国际小额保险中心（MIC）、国际保险监督官协会（IAIS）和国际扶贫咨询联合组（CGAP）等机构也在小额保险理论研究上做出了突出贡献，促进了小额保险在全球的开展。在MIC2007会议上，Dominice Li-ber and Crag Churchill的《product design and insurance risk management》对小额保险各险种产品设计以及风险特征进行了系统分析。Lena Giesbert Susan Steiner Mirko Bendig（2011）通过对加纳参加农村小额人身保险数据调查显示，农村小额人身保险对整个农村金融发展具有一定影响，并且在承保时投保人会出现逆向选择的现象。

我国学者对小额保险理论与实践的研究，可以归纳以下几方面：

（1）农村小额人身保险影响需求因素研究

有效需求不足制约我国农村小额人身保险的发展。很多学者对影响农村小额人身保险的需求因素进行了深入的研究。孙健、申曙光（2009）运用广东、广西两省10县区的调查数据，通过模型分别对农村小额健康保险、意外伤害保险、农业保险、家庭保险的需求影响因素进行了研究，得出农村居民教育水平、保险认识和收入水平对小额保险影响需求较大。高峰、王珺（2008）指出影响我国农村小额人身保险需求的主要因素是较高的保险成本和农村收入水平。曹晓兰（2009）从经济学方法解析了小额保险的供需矛盾，指出产品的供给不能满足低收入人群的需求，从而制约了有效需求。刘妍、卢亚娟（2011）基于江苏省13个市379个农村的调查数据，通过建立实证模型分析影响农村小额人身保险需求的主要因素，结果表明：年龄、教育程度、保险认知水平、近三年的风险情况对购买意愿具有显著影响。研究结论证实收入水平、受教育水平等因素对发展我国农村小额人身保险起到重要作用。

（2）农村小额人身保险供给研究

在我国，小额保险的供给研究较多的停留在运行模式层面，孙健（2007）运用金字塔理论，将小额保险目标客户分成两类，贫困农户和贫困社区，并指出合作代理模式较完全商业模式具有更多优势。刘万（2008）介绍了不同组织对农村小额人身保险的分类（国际小额保险中心（MIC）、Warren Brown等人、Jim Roth 等人、其他学者分类），并按照不同层次标准对国际小额保险模式进行

了新的划分。徐淑芳（2008）对互助或合作保险模式、合作—代理模式和独立经营模式三种模式进行了比较分析，认为对穷人而言，自我保险和非正式保险措施是成本较高的次优方案，发展小额保险能有效增强贫困人口和低收入人群抵御风险冲击的能力。朱俊生（2009）提出推动小额保险发展的关键在于提高供给效率，并指出通过供给模式的创新，降低交易成本，提高供给效率。庹国柱(2009)提出适合我国农村小额人身保险的五种经验模式：商业运作模式、政府支持下的半商业运作、多主体合作模式、存款信用与合作社模式、网络模式，并对农村小额人身保险产品设计、营销渠道建设、风险控制等方面提出相关政策建议。陈之楚（2009）阐述了小额保险供给对传统保险理论的突破，提出小额保险供给模式应采用半商业化运作模式，即“政府扶持，商业运作，多元化、广覆盖”的模式。

（3）农村小额人身保险发展外部环境建设研究

梁涛、方力（2008）介绍了国际小额保险、政府及监管部门在小额保险发展中的角色。肖明迁（2008）提出未来培育健康有序的小额保险市场，需要制定严格的小额保险市场的准入标准，包括：偿付能力要求，设立独立的管理部门，独立的小额保险产品，服务能力要求。刘冀广（2008）从监管角度提出了推动小额保险发展的政策建议，他认为小额保险相关制度建设有待进一步完善，监管方面缺乏足够的经验，因此小额保险监管还面临严峻的挑战。

### （二）我国农村小额人身保险的发展

2006 年，国际保险监督官协会(IAIS)与 CCAP 决定成立联合工作组，共同推进小额保险的相关工作。我国保监会积极推动国内农村保险业务的发展。2007 年 4 月，中国保险监督管理委员会申请并正式加入 IAIS-CGAP 小额保险联合工作组。同年 5 月，中国保监会人身保险监督部启动了小额保险课题研究，并于 2008 年初选取了中西部 8 个省区的 432 个行政村进行调查。调查结果表明：中西部农村 81%的家庭人均年收入不到 4000 元，69%不足 3000 元。45%的家庭最担心家庭成员遭受意外事故。 55.2%的农民因为价格高没有购买保险，12.4%是因为没有合适的产品。

保监会在 2008 年 6 月 17 日颁布了《农村小额人身保险试点方案》，首批选择山西、黑龙江、江西、河南、湖北、广西、四川、甘肃、青海九省（区）的县以下地区开展试点。

2010 年底，中国人寿农村小额保险试点已覆盖 24 个省市，为超过 2500 万人次提供了 3446 亿元的保险保障。2011 年，小额保险新增承保人数 1996 万人，保费收入规模达 10.6 亿元，在全国农村小额人身保险的市场的份额占到 95%以上。在 2012 年初，保监会批复开展农村小额人身保险业务的保险公司共有 9 家，分别是中国人寿、太平洋寿险、太平洋产险、泰康人寿、新华人寿、平安养老、大地保险、人保寿险及中邮人寿。并批复增加内蒙古、江苏、浙江、湖南、青海、宁夏和新疆等 7 省（区）为太平洋寿险的农村小额人身保险试点区域。上述措施在解决农民“买得起、买得到、愿意买”保险方面取得积极成效。

## 二、我国农村小额人身保险的需求实证分析

我国农村小额人身保险发展存在潜在需求大，有效需求不足状况。本部分根据课题组对山东、河北部分农村地区问卷调查统计数据，分析我国农村小额人身保险的潜在需求与有效需求。通过 logistic 实证分析影响我国农村小额人身保险的需求因素，并根据模型结果分析我国小额人身保险需求因素的特殊性。

问卷内容主要包括三大部分：第一部分为农户基本情况：年龄、教育程度、家庭收入、家庭结构等，这些因素都可能对农村小额人身保险需求产生影响；第二部分为农户的风险情况和保险认知情况：农户最需要的风险保障需求、对保险和农村小额人身保险的认知情况；第三部分主要为如何促进农村小额人身保险持续发展以及改进保险公司服务态度的政策方法。

### （一）我国农村小额人身保险潜在需求分析

潜在需求是指消费者虽然有明确意识的欲望，但由于种种原因还没有明确的显现出来的需求。本节将从以下几个方面对小额人身保险的潜在需求进行分析：

（1）农户主要收入来源

调查所得的 453 份样本中，依靠农业收入作为主要来源的有 214 人，占被调查人数的 47.24%；依靠非农业收入的有 239 人，占被调查人数的 52.76%，其中大多为外出务工人员，主要从事建筑业、采矿业等高危险性行业。对于外出务工人员，面对最多的是意外伤害风险，453 份问卷中 71 个农户对意外伤害保险具有潜在需求，占比 16.61%。

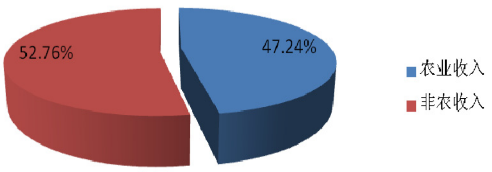



图 1 农村人口收入来源情况

（2）收入状况

我国农村人口的月平均收入水平普遍偏低，月收入不足 1500 元的人数占到了调查总数的 50.33%，88.52%的人月收入低于 2500 元。收入水平偏低，导致农村人群抗风险能力差，无能力购买传统商业保险的形式来转移和分散风险，所以对于价格较为低廉的农村小额人身保险具有巨大的潜在需求。

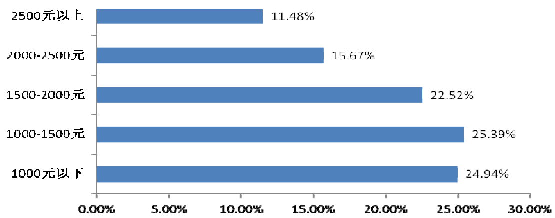



图 2 农村地区月人均收入情况

（3）家庭结构

调查问卷显示，45.25%的被调查者是小家庭，另有 11.7%的老人独居。农村人口家庭结构的变化以及空巢老人现象加重，使我国农村地区人口的养老问题日益严重。调查问卷中，农村人口中最需的保障中，选择养老保障的人数为 141 人，占比 31.13%，所以对农村小额养老保险潜在需求巨大。

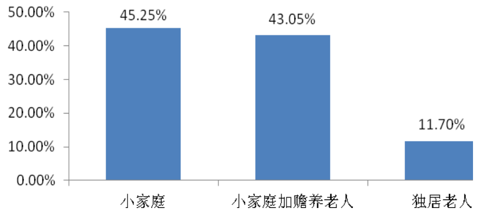



图 3 农村地区家庭结构情况

（4）风险分散方式

农村地区风险分散方式以自留为主。调查中当被问及如果自身或家人发生意外伤害或重大疾病时如何进行风险化解时，35.98%的人选择自己承担，34.88%选择找亲戚朋友帮忙，24.28%选择“新农合”，只有 19.65%的被调查者会选择保险方式分散风险。

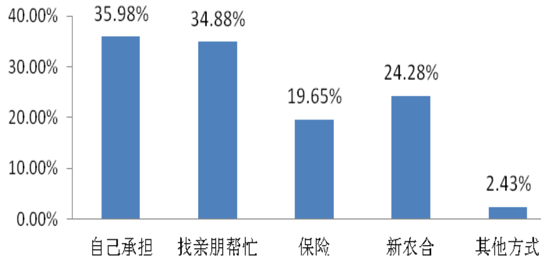



图 4 农村地区分散风险方式选择情况

近些年，重大疾病和意外伤害出现的概率逐年上升，加之我国医疗费用的增加，对于农村低收入人群来说，如果单纯依靠风险自留的方式，负担沉重。而通过向亲戚朋友借款方式则不能从长远解决农村人口面临的问题。但此次调查问卷中显示，324 人没有购买过农村小额人身保险，占比 71.52%，则可以看出如果加大农村小额人身保险宣传，可使很大比例的低收入农民的潜在需求转为现实需求。

（5）保费支付意愿

虽然农村人群收入偏低，但对于每年支付几十元的保险费，农户仍具有一定的支付意愿。调查显示，一万元意外伤害风险保障愿意支付保费为多少时，65.34%的人愿意年缴费 30-50 元，15.89%的人愿意年缴费 50-70 元，12.14%的人愿意缴费 70-100 元。可见，如果农村小额人身保险产品价位合理，低收入人群具有很大需求意愿。

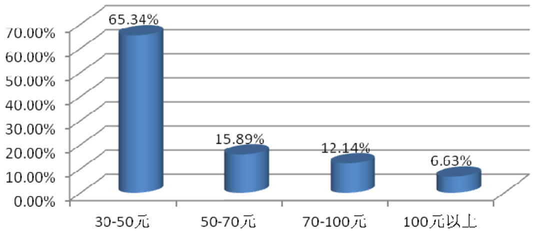



图 5 为获得万元保额愿意支付的保费

通过上述五个方面分析可知，外出务工人员增多、家庭规模小型化、疾病发生概率增高，促使了农村低收入人群面临更多风险，对于风险保障的需求欲望也逐渐增强。因此农村小额人身保险存在广阔的潜在需求市场。

### （二）我国农村小额人身保险有效需求分析

小额人身保险有效需求是指根据自身的支付能力，将潜在需求转化为现实需求，已购买了我国现有小额人身保险产品。本部分以问卷调查结果为基础，分析我国农村小额人身保险有效需求现状。

调查统计显示，听说过农村小额人身保险的比例占 54.30%，而实际购买的比例只有 28.48%，当被问及没有购买小额保险的原因，除了 52.78%是因为没有听说过此保险、18.21%是对农村小额人身保险产品不了解，有 3.7%的人认为产品定价过高，4.01%是因为没有合适的产品，还有 0.62%的人认为保险服务差、不可靠（见表 1）。

表 1 未购买农村小额人身保险原因

| 原因 | 占被调查者比例 |
|---|---|
| 没有听说过 | 52.78% |
| 对于产品不了解 | 18.21% |
| 产品定价高 | 3.70% |
| 没有合适产品 | 4.01% |
| 保险公司服务差 | 0.62% |
| 已参加“新农合’ | 18.21% |
| 已购买其他商业保险 | 2.47% |

数据来源：调查问卷数据统计

### （三）农村小额人身保险建模实证分析

（1）模型选取与设定

我国农村居民面对小额人身保险只有购买与不购买两种选择，为判别对农村小额人身保险购买与否具有显著的影响的因素，本文采用 Logistic 回归分析。

假设 $y_t$ 取值为 0 和 1 的因变量，$i=1,2,3,\ldots n$；$x_k$ 是与 $y_t$ 相关的自变量，事件发生的概率为：

$$p=\left(y=1/x_i\right)=p_i$$

$$p_i=\frac{1}{1+e^{-\left(\alpha+\sum_{i=1}^{m}\beta_i\alpha_i\right)}}$$

则：$1-p_i=\dfrac{1}{1+e^{\left(\alpha+\sum_{i=1}^{m}\beta_i\alpha_i\right)}}$

其中 $p_i$ 表示农村居民购买小额人身保险的概率，$\left(1-p_i\right)$为未购买概率，$p_i/\left(1-p_i\right)$为机会概率，简记为 Odds。对 Odds 做对数变换，就能得到 Logit 回归模型的线性模式：

$$\ln\left(\frac{p_i}{1-p_i}\right)=z_i=\alpha+\sum_{i=1}^{m}\beta_i x_i$$

（2）变量选取与赋值

因变量主要选取是农村居民购买小额人身保险意愿 Y。自变量 X 选取：课题组借鉴了学术界对保险需求的研究成果以及本次调查问卷数据，选取了以下 5 个自变量进行回归分析，分别为：被调查者的年龄（AGE）、教育程度（EDU）、月均收入水平（INC）、家庭收入的主要来源（SOU）、是否参加过其他商业保险（INS）。

表 2 实证分析变量描述表

| 变量 | 名称 | 定义 |
|---|---|---|
| 因变量 | 是否购买小额人身保险（Y） | 未购买，赋值 0<br>购买，赋值 1 |
| 自变量 | 人均月收入（INC） | 1000 元以下，赋值 1<br>1000—1500 元，赋值 2<br>1501—2000 元，赋值 3<br>2001—2500 元，赋值 4<br>2500 元以上，赋值 5 |

| | | |
|---|---|---|
| | 年龄（AGE） | 20—29 岁，赋值 1<br>30—39 岁，赋值 2<br>40—49 岁，赋值 3<br>50—59 岁，赋值 4 |
| | 是否购买过商业保险（ISU） | 未购买，赋值 0<br>购买，赋值 1 |
| | 受教育程度（EDU） | 初中及初中以下，赋值 1<br>高中，赋值 2<br>高中以上，赋值 3 |
| | 家庭收入的主要来源（SOU） | 农业收入，赋值 0<br>非农业收入，赋值 1 |

本文采用 spss17.0 统计软件进行 logistic 回归分析。是否购买农村小额人身保险作为被解释变量（0/1 二值变量），其余各变量作为解释变量，其中是否购买过商业保险和家庭收入主要来源为品质变量，年龄和收入为定距变量，教育程度为定序变量。具体回归过程见下文各表。

（3）模型回归过程

**表 3 分类变量编码**

| | | 频率 | 参数编码 |
|---|---|---|---|
| | | | （1） |
| 是否购买过商业保险 | 没有购买 | 25 | 1.00 |
| | 购买 | 221 | .00 |
| 家庭收入主要来源 | 农业收入为主 | 117 | 1.00 |
| | 非农业收入为主 | 129 | .00 |

表3显示：对是否购买商业保险产生一个虚拟变量insurance(1)，表示是否购买了商业保险，取值为0表示购买；对家庭收入主要来源产生一个虚拟变量source(1)，表示是否收入来源以农业收入，取值为0表示收入以非农业为主。

**表 4 模型汇总图**

| 步骤 | 对数似然值[①] | Cox & Snell R Square | Nagelkerke R Square |
|---|---|---|---|
| 1 | 328.829[a] | .046 | .062 |
| 2 | 324.732[a] | .062 | .083 |

[①]注： a. 因为参数估计的更改范围小于 .001，所以估计在迭代次数 3 处终止
b. 因为参数估计的更改范围小于 .001，所以估计在迭代次数 4 处终止

| | | | |
|---|---|---|---|
| 3 | 320.260[b] | .079 | .105 |
| 4 | 315.345[b] | .097 | .129 |

表4显示了模型拟合优度方面的指标，-2倍的对数似然值越小则模型的拟合优度越高。本表内该值较大，所以模型拟合优度并不理想。Cox & Snell R Square和Nagelkerke R Square的值也较小，因此拟合程度较低。

表 5 Hosmer-Lemeshow 检验

| 步骤 | 卡方 | df | sig. |
|---|---|---|---|
| 1 | 2.455 | 3 | .484 |
| 2 | 1.651 | 4 | .800 |
| 3 | 6.714 | 7 | .459 |
| 4 | 11.591 | 7 | .115 |

表5显示，Hosmer-Lemeshow统计观测值为11.591，概率为0.115，明显大于显著性水平α=0.05，因此不能拒绝零假设，说明模型拟合优度较低。

表6 Model if Term Remove

| 变量 | | 模型对数似然性 | -2 对数似然中的更改 | df | 更改的显著性 |
|---|---|---|---|---|---|
| 步骤1 | income | -170.221 | 11.614 | 1 | .001 |
| 步骤2 | income | -167.858 | 10.984 | 1 | .001 |
| | insurance | -164.415 | 4.097 | 1 | .043 |
| 步骤3 | income | -163.993 | 7.726 | 1 | .005 |
| | age | -162.366 | 4.472 | 1 | .034 |
| | insurance | -162.467 | 4.674 | 1 | .031 |
| 步骤4 | income | -163.585 | 11.825 | 1 | .001 |
| | age | -160.449 | 5.553 | 1 | .018 |
| | source | -160.130 | 4.915 | 1 | .027 |
| | insurance | -160.397 | 5.449 | 1 | .020 |

表6显示，第一步，月均收入变量（income）进入方程，本步对数似然函数值为-170.221，与第零步相比的对数似然比卡方为11.614，概率P值为0.001，显著性水平为0.05，则P值小于显著性水平，因此模型该解释变量与LogitP的线性关系显著，模型合理。同理，直到步骤4，income、age、source、insurance四个解释变量均与LogitP线性关系显著，故模型合理。

表7 方程中的变量

| | | B | S.E. | Wals | Sig. | Exp (B) | EXP(B) 的 95% C.I. | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | 下限 | 上限 |
| 步骤 1 | income | 0.318 | 0.095 | 11.085 | 0.001 | 1.374 | 1.14 | 1.657 |
| | 常量 | -0.735 | 0.28 | 6.902 | 0.009 | 0.48 | | |
| 步骤 2 | income | 0.312 | 0.096 | 10.52 | 0.001 | 1.366 | 1.131 | 1.649 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Insurance（1） | -0.901 | 0.459 | 3.849 | 0.05 | 0.406 | 0.165 | 0.999 |
| | 常量 | -0.63 | 0.285 | 4.891 | 0.027 | 0.532 | | |
| 步骤 3 | income | 0.27 | 0.098 | 7.51 | 0.006 | 1.309 | 1.08 | 1.588 |
| | age | -0.25 | 0.119 | 4.411 | 0.036 | 0.778 | 0.616 | 0.983 |
| | insurance（1） | -0.977 | 0.467 | 4.374 | 0.036 | 0.376 | 0.151 | 0.94 |
| | 常量 | 0.084 | 0.442 | 0.036 | 0.849 | 1.088 | | |
| 步骤 4 | income | 0.369 | 0.11 | 11.212 | 0.001 | 1.446 | 1.165 | 1.794 |
| | age | -0.284 | 0.122 | 5.443 | 0.02 | 0.753 | 0.593 | 0.956 |
| | source（1） | 0.668 | 0.307 | 4.743 | 0.029 | 1.951 | 1.069 | 3.56 |
| | Insurance（1） | -1.066 | 0.473 | 5.076 | 0.024 | 0.344 | 0.136 | 0.871 |
| | 常量 | -0.403 | 0.5 | 0.65 | 0.42 | 0.668 | | |

通过表4到表7的分析可得，该模型虽然拟合效果较差，也就是说仅仅通过以上四个变量分析对是否购买农村小额人身保险有没有影响是不够全面的，还应考虑其他因素。但是该模型仍可以用于分析购买与这四个解释变量之间的线性关系。通过表7可得Logistic回归方程：

LogitP=-0.403+0.369income-0.284age+0.668source（1）-1.066insurace（1）

（4） 回归结果分析

通过logistic回归方程可得，收入水平和以农业收入为主要来源的农民与农村人群购买农村小额人身保险呈正比例关系，而年龄、没有购买过商业保险的变量与购买农村小额人身保险呈反方向变动。但logistic回归不同于线性回归模型，相比自变量的回归系数而言Exp（β）则更有价值，他反映了自变量变动一个单位而引起的Odds的变化率，即解释变量的变化农村居民小额人身保险购买意愿的边际概率影响。

人均月收入对农村小额人身保险需求意愿影响的发生比为Exp（β）= 1.446>1，说明随着收入水平的提高购买农村小额人身保险意愿的越强烈；年龄的Exp（β）=0 .753<1，说明随着年龄的增长，农村人群购买小额人身保险的意愿降低；以农业收入为主的农村人群的Exp（β）= 1.951，是以非农业收入人群购买农村小额人身保险的1.951倍，则说明以农业收入为主的农村人群对于农村小额人身保险需求意愿较为强烈；没有购买过商业保险的人口的Exp（β）=0.344。只相当于购买过商业保险0.344倍，从侧面说明了，因为没有购买过商业保险，所以农村低收入人群保险意识较差，故购买农村小额人身保险的意愿较小，故保险意识对于购买农村小额人身保险影响也较为显著。

通过调查问卷与模型结果分得出，影响我国农村小额人身保险的需求因素具有特殊性，除人均收入和家庭收入来源的影响外，政府的支持力度很大程度上影响了农村小额人身保险需求，如果地方政府加大财政支持力度，则无论该地区人均收入水平高低，年龄与收入来源结构怎样，都可让当地农村人口购买得起小额人身保险。这就是为什么在实证分析中拟合优度不高的主要原因。所以加大政府财政支持力度，可在农村小额人身保险开展初期起到较好的效果，能够迅速的提高小额保险的覆盖率。但是若想保持农村小额人身保险持续健康发展，提高农民收入水平和农村低收入人群的保险认识意识是发展小额保险的重要方面。

## 三、我国农村小额人身保险供给分析

### （一）农村小额人身保险对传统保险供给理论的突破

传统保险产品供给理论体现在三个层面。

经济层面表现为传统商业保险的经营性质和保险产品的经济有偿性。保险是一种风险保障产品。由于风险的客观存在产生了对

保险产品的需求与供给。保险需求方面对自身的风险，愿意通过支付一定保费转嫁和分散风险，从而获得风险保障。而保险供给方，在大数法则的基础上，通过专业的技术手段设计出针对相应风险的保障产品，对投保人因风险所造成的损失进行补偿或给付，同时还获得一定的经营利润。

法律层面保险是一种民事合同行为。投保人与保险人在法律地位平等的基础上，经过自愿的要约与承诺，达成一致并签订保险合同。通过合同明确双方保险保障关系，只有在双方均履行合同时才能实现合同效力。表明保险是一种规范的法律行为。

社会功能层面保险作为一种风险损失转移机制，很大程度上保险是社会风险管理方式，通过保险机制将社会众多单位面临的风险进行分散和转移。将个体应对的风险分摊到整个群体，把风险损失降到最低，从而提高了个体应对风险的能力。即 “一人为众，众人为一”的社会风险互助关系，增强了社会应对风险的能力。

通过上述分析可得，传统保险产品供给理论是基于经济、法律和社会功能三个层面。同时也显示了传统保险产品供给理论存在的局限性。表现为： （1）风险保障的局限性。投保人具有风险厌恶性，他们愿意支付一定的保费，转移和分散风险。但在实际生活中当保费过高时，超出投保人的支付能力；或保险消费者受财富限制而无法购买保险时，他们就无法通过保险获得保障，从而保障程度受到一定限制。（2）可保风险条件的规定。由于保险市场是信息不对称市场，且保险公司自身经济实力限制，故保险公司不能提供市场所需要的所有保险产品。运用“不可保风险”界定的定义限制保险产品的供给，不能满足可保风险条件的风险，是得不到保险保障的。（3）不完全的保险市场限制了商业保险的作用。由于保险市场存在明显的信息不对称，保险市场运行中的道德危险和逆向选择等问题阻碍了保险市场发展，也限制了商业保险作用的发挥。现实保险市场是不完全的保险市场。传统商业保险产品供给受到一定的局限。经济学家阿罗认为，当市场失灵时,其他机构缓解由此产生的问题，有时可以通过公共产品，有时可以通过使用非竞争分配机制。如果将其运用在保险上，当商业保险市场供给不能充分发挥作用时，其他保险制度(如社会保险、政策保险、互助保险或自保等)和其他保险组织形式则会在不同范围、不同程度地出现。

### （二）小额保险供给理论的创新

分析可知，传统商业保险遵循同质风险，同等价格的交易原则。对低收入者而言是难以实现的，主要体现在低收入者的支付能力不足和受“可保性”条件制约。就低收入人群而言，风险保障需求是客观存在的，其风险不具有特殊性。并且对于低收入者来说疾病风险、养老风险是迫切需要的。之所以造成低收入者有效需求不足，主要是受支付能力的约束。即在同质风险、同等价格的交易条件下，低收入者无法承担同等的保费，风险被动自留。陈之楚和刘晓敬（2007）[①]、杨舸[②]和卓志[③]等研究均证实收入变量与寿险需求正相关。而且对于保险人来说，低收入人群的真实信息难以获得，增加了风险测算的难度和道德风险的产生。因此，传统商业保险供给受到 “可保性”制约，进而限制了传统商业保险人向低收入人群提供保险保障的积极性。

要想将低收入人群纳入可保范围必须调整传统保险供给理论，陈之楚（2009）指出小额保险供给可“采用同质风险，分层对价方式；采用低费率的方法”，突破了传统保险“可保性”的限制，将商业保险与社会保险的功能融合。主要体现在：一、简化保险责任。根据低收入人群面临的主要风险，设计与其相符的保险产品。二、采用同质风险，分层对价方法。区别同质风险，相同价格传统做法，采用低保费，低保障方法。通过各种方式降低供给成本，并相应的降低保额，从而解决支付能力对于保险需求的约束。这类措施都体现了产品供给方面的创新，小额保险也正是从这两个方面，调整了商业保险

[①]陈之楚, 刘晓敬. 中国寿险需求决定因素分析[J]. 保险研究, 2004, (6).
[②]杨舸,田澎,叶建华.我国寿险需求影响因素的实证分析[J].保险究,2005,(3).
[③]卓志.中国人寿保险需求的实证分析[J].保险研究,2001,(5).

的“可保性”，使保险产品能够贴近低收入者的保险需求。小额保险的供给创新更加明确了小额保险的本质含义，体现了小额保险供给制度服务于低收入群体的政策价值取向。

**（三）我国农村小额人身保险供给模式**

发展农村小额人身保险的关键是供给模式的创新，良好的供给模式可以较好的解决信息不对称与交易成本等问题。我国农村小额人身保险运行模式还处于探索阶段，呈现出更强的地域特征。中国人寿在推行农村小额人身保险，凭借其丰富的县域销售网点与强大资金实力，取得农村小额人身保险销售的良好成绩，并逐步形成适合我国国情的销售模式。我国实施农村小额人身保险经营模式如下：

（1）全村统保模式

该模式是当前我国农村小额人身保险销售规模最大的模式。保险公司选择保险意识强、经济基础较好、保险知识宣传广泛的地区，通过当地政府支持，由村干部牵头，保险公司积极配合的情况下，向村民广泛深入宣传农村小额人身保险产品，让村民了解小额人身保险产品。认可小额保险产品认可后，以团体保单形式将符合条件的村民纳入保障范围内，实现“一张保单保全村，一张保单保全组，一张保单保全家 ”的模式[①]。

全村统保模式的优点在于节省了保险公司经营成本，降低道德风险，并可在短时间内扩大保障承保范围。该模式已在全国多个省份进行了成功复制。其保费缴纳方式分为三种：一是村民自行承担保费；二是村委会或村内企业支付保费；三是村政府、村民和保险公司按比例承担保费。比如山西“晋中模式”，通过政府缴纳 20%，保险公司让利 20%，村民自己承担 60%。

其弊端，该模式开展的前提是必须得到当地村基层领导的认可，这就需要保险公司与当地政府建立良好的关系。

（2）联合互动模式

联合互动售模式主要基于农村现有的风险保障体系，比如“新农合”与“新农保”，借助它们现有的服务网点资源，把农村人身小额保险作为“新农合”和“新农保”的配套或补充产品。课题组调查问卷显示：85%的村民已经参加“新农合”，这样更有利于农村低收入人群对于小额人身保险的认可和接受。太平洋人寿黄梅支公司推出“新农合+大病医疗+小额人身保险”模式，即“黄梅模式”，得到广大农村居民的认可[②]。

该模式的优点在于通过现有“新农合“的服务网点，节省了保险公司建立新销售网点的成本，且可将农村小额人身保险缴费机制与“新农合”合并，提高了保险公司的承保效率。不足之处在于“新农合”业务较多，需要较高的业务管理能力，耗费大量人力、物力。

（3）信贷保险 1+1 模式

该模式是小额保险销售的传统模式。该模式具体做法是指保险机构支付一定佣金或手续费与农村金融机构合作，借助金融机构的销售网点、良好的信誉和丰富的客户资源，将农村小额人身保险销售给需要贷款的消费者。一方面对借款农户进行了风险保障，另一方面降低了金融机构贷款损失风险。

该模式较好的将保险与农村金融机构相结合，一方面健全了农村金融体系，另一方面扩大了农村风险保障范围。但保险公司要向金融机构支付较高比例佣金，一定程度上压缩了保险公司的利润空间，打击了推广农村小额人身保险的积极性。

（4）小型团单模式

该种模式主要在小额人身保险推广条件不成熟地区，由保险公司委托当地有一定专业技术人员，如医生、村干部、技工等协助保险公司对农村小额人身保险进行推广宣传；或由保险公司派驻保险服务员进入当地，进行推广。这种模式的优点在于能够使保险公司更加便捷的接触到农村低收入人群，但是由于形式较为不固定，风险难以控制。

**（四）农村小额人身保险供给可行性财务分析**

（1）政府补贴可行性匡算

由于小额意外保险以及小额医疗保险是农村低收入人群急需的保障险种，因此以国

[①] 吴海波， 农村小额保险销售模式比较研究[J]，上海保险，2010 年第 8 期：34-35 页

[②] 粟榆、李琼、李池威. 我国农村小额人身保险运行回顾与评价[J],保险研究 2010 年第 12 期：21 页

寿农村小额意外伤害保险（附加医疗费用保险）为例进行小额人身保险的财务平衡实证。

①保险保障水平与保险费

该保险期限为 1 年，凡是年满 28 岁以上、65 周岁以下，身体健康的农村居民均可作为被保险人，可续保至被保险人年满 70 周岁。保险责任为身故、残疾以及Ⅲ度烧伤。年保险费率见表

**表 8 年保险费率表 单位：元**

| 风险类别 | A 级 | B 级 |
|---|---|---|
| 年缴保险费（每 1000 元保额） | 2 | 8 |

注：风险类别 A 级为保险公司《职业分类表》的职业类别三及三以下，B 级为四及四以上

农业收入居民的风险类别均为 A 级，从上表可知年保险费率为 2‰，国寿为了方便计算保费，又以险种组合的方式推出了三种规范化产品：

**表 9 国寿农村小额人身保险产品组合 单位：元**

| 保险产品 | 保险金额 | 保险费 |
|---|---|---|
| 国寿农村小额意外伤害保险 | 10000 | 20 |
| 国寿农村小额意外伤害保险附加意外伤害医疗费用 | 主险 10000 | 35 |
| | 附加险 2000 | |
| 国寿农村小额意外伤害保险附加意外伤害医疗费用 | 主险 20000 | 50 |
| | 附加险 2000 | |

②政府财政补贴可行性

农村小额人身保险需要政府一定力度的财务支持，这也是小额保险顺利发展的一个国际经验。那么政府是否有能力进行补贴就是接下来需要研究的问题。

政府财政补贴额度假设：以上述三种产品组合为例，假设农村居民购买小额人身保险时，固定个人承担15元保险费，其余由政府政策性补贴。随着政府补贴额度不同，投保人能够享有的保障金额不同，两者之间的变动情况如下表10所示：

**表 10：保险金额、个人负担保险费和政府补贴 单位：元**

| 保险金额合计（含主险和附加险） | 个人负担 | 政府补贴 |
|---|---|---|
| 10000 | 15 | 5 |
| 12000 | 15 | 20 |
| 22000 | 15 | 35 |

政府财政补贴承受能力：以天津为例，假设在最初的几年内，政府只对该种农村小额人身保险进行补贴，商业保险公司也只经营此一个险种。根据2011年天津农村人均年可支配收入11801元，人均年消费性支出5606元①，农村最低生活保障230元等指标，我市农村低收入水平定为600-1000元/月。依据问卷调查的数据估算，我市农村低收入居民为65.99万人，其中不享受新农村合作医疗保险的居民占其中的14.79%②，为9.76万人③。我们假设上述群体为政策补贴对象，考察在各种保险金额下，政府补贴的总金额(见表11)。

①2011 年天津统计年鉴

②农村小额人身保险需求问卷调查

③问卷调查结果显示样本中收入水平低于 1000 元的农村居民占调查总数的，假设该比例为天津农村居民中低收入人群的比例，2011 年天津统计年鉴中，农村居民总数为 264.59 万，与上述比例相乘得到

表 11 农村小额人身保险政府补贴额

| 保额合计（主险和附加险）（元） | 政府补贴（元/人） | 政府补贴总额（万元） | |
|---|---|---|---|
| | | 65.99 万人 | 9.76 万人 |
| 10000 | 5 | 329.95 | 48.8 |
| 12000 | 20 | 1319.8 | 195.2 |
| 22000 | 35 | 2309.65 | 341.6 |

由此得出，在 2011 年的数据支持下，根据假设的补贴程度及群体数量规模的不同，政府补贴金额规模在 48.8 万元至 2309.65 万元之间。

以天津为例：天津市财政用于社会保障方面的支出， 2010 年为 137.7 亿元，2011 年达到 177.5 亿元，增长率为 28.9%[①]。同期市财政收入，2010 年为 1068.8 亿元，2011 年为 1454.87 亿元，增率为 36.1%[②]。表明财政收入增长率快于财政用于社会保障支出的增长率，说明财政有一定的承担能力。农村小额人身保险的政府补贴总额，根据补贴程度及群体数量规模的不同，大致在 48.8 万元至 2309.65 万元之间，相对财政收入增长规模和财政用于社会保障支出规模占比在可接受范围内，政府有能力对小额保险供给制度提供财政支持。

（2）保险公司经营财务匡算

鉴于保险公司经营中存在着未来财务的不确定性，我们只对一些较为关键的可控因素对政府补贴下的农村小额人身保险经营财务状况进行预测和说明。

①假设说明

A.保费收入

假设政府为使农村低收入人群能够获得意外和医疗保障，为每人提供保额为 12000 元（含主险和附加险）的小额人身保险。这样政府需为每人补贴 20 元，个人缴纳 15 元，保费合计 35 元。

农村小额人身保险的补贴对象为我市农村低收入水平（600-1000 元/月）的居民，人数为 65.99 万人，以此为基数计算保费收入，并假设其全部参保，且平均年龄为 40 岁。根据我市近年经济增长速度，以及随着农村小额人身保险范围逐步扩大，以后每年参保人数增长 10%。

表 11 小额医疗保险保险费收入及财政补贴预算

| 年份 | 第 1 年 | 第 2 年 | 第 3 年 |
|---|---|---|---|
| 投保人数（万人） | 65.99 | 72.59 | 79.85 |
| 每人保费（元） | 35 | 35 | 35 |
| 保费收入（万元） | 2309.65 | 2540.65 | 2794.75 |
| 财政补贴（万元） | 1319.8 | 1451.8 | 1597 |

B.投资收入

根据长期经济发展趋势，假设投资收益率为 5%，且保费收入、赔款以及各项费用支出都是在全年均匀分布。则投资收入=[上年末资产+（本年保费收入-费用-赔款-保险保障基金）/2]×投资收益率

C.赔款支出：分为两部分，意外伤害支出和医疗费用支出。

意外伤害保险金支出：根据我国人身意外伤害保险平均费率 3.6‰，和全年人身意外伤害保险费 33782.72 万元，得到全年人身意外伤害保额为 938.4 亿，而全年人身意外伤害赔款支出为 6807.34 万元[③]，可以推算出 10000 元保额的赔款金额约为 7.25 元。

医疗费用保险金支出：医疗费用保险赔款支出根据再保险公司提供的医疗赔付表[④]得出 2000 元保额对应的预期赔款支出为 24.46 元。

①2011 年天津市国民经济和社会发展统计公报
②2011 年天津统计年鉴、2011 年天津市国民经济和社会发展统计公报
③2011 天津统计年鉴
④中国人寿再保险公司网站

总赔付金额预算（见表 12）

**表 12 小额医疗保险总赔付金额预算**

| 年份 | 计算过程 | 第 1 年 | 第 2 年 | 第 3 年 |
|---|---|---|---|---|
| 投保人数 | （1） | 65.99 | 72.59 | 79.85 |
| 意外伤害赔付+医疗费用赔付金额 | （2） | 31.71 | 31.71 | 31.71 |
| 保单年度赔付金额 | （3）=（1）×（2） | 2092.5 | 2301.8 | 2532. |
| 会计年度赔付金额 | （4）=$[(3)_t+(3)_{t-1}]/2$ | 1046.2 | 2197.2 | 2416.9 |

注：t 表示当期，t-1 表示上一期

保单年度赔付金额是指以保险单签订的时间期限为一个核算期限的赔款金额。例如保单是 2011 年 3 月 5 日—2012 年 3 月 4 日的一年期，赔款期限与其相同。会计年度赔付金额是指以我国财务会计核算的年度为一个财务核算年度，是从 1 月 1 日—12 月 31 日的一个自然年度，其间的赔款金额。

D.保险公司费用支出

保险公司费用支出包括两部分，佣金及手续费支出、营业费用支出，假设全部在承保时支出。

佣金及手续费支出：虽然农村小额人身保险是政府补贴性保险，但保险公司通过渠道（如工会、代理机构）办理此项业务也需要支付一定的手续费，使用低于市场平均水平的费率，假设手续费为保费 1%。

营业费用支出：我们考虑营业费用中固定部分向小额保险的分摊以及保单维持费用两部分，固定费用难以准确估计，故粗略将其两部分合并，假设营业费用总支出占保费的 4%。

E.保险保障基金

根据中国保监会规定，该险种需交纳的保险保障基金为毛保费的0.15%。

F.准备金

该保险为1年期，准备金由未到期责任准备金和未决赔款准备金两部分组成。

未到期责任准备金：由于假设保费收入在全年均匀分布，因而未到期责任准备金为当年保费收入的 1/2；

未决赔款准备金（见表5-9）：未决赔款准备金为当年实际赔款支出的4%。

**表 13 农村小额人身保险未决赔款准备金　　（单位：万元）**

| | 计算方法 | 1 | 2 | 3 |
|---|---|---|---|---|
| 未到期责任准备金 | （1）=当年保费/2 | 115 4.83 | 127 0.33 | 139 7.38 |
| 未决赔款准备金 | （2）=当年赔款×4% | 41. 85 | 87. 89 | 96. 68 |
| 准备金合计 | （3）=（1）+（2） | 1196.6 8 | 1358.2 2 | 149 4.06 |
| 准备金提转差 | （4）=$(3)_t-(3)_{t-1}$ | 1196.6 8 | 161.54 | 135 .84 |

注：t 表示当期，t-1 表示上一期

G.毛保险费收入

资产负债表中本年毛保险费收入为当年保费收入减去各项费用支出、赔款支出后的余额。由于我们无法估计毛保险费收入在现金、银行存款等项目之间的分配方式，故只用“毛保险费收入”这一科目代表各项新增的金融资产。同时，用“上年末资产”这一科目代表期初的金融资产总额。

②财务分析

A.损益表及资产负债表

根据上面的假设分析，预估公司在三年内的经营状况，得到损益表及资产负债表如下：

**表 13 农村小额人身保险损益表　　（单位：万元）**

| 年份 | | 第 1 年 | 第 2 年 | 第 3 年 |
|---|---|---|---|---|
| 收入 | 保费收入 | 2309.65 | 2540.65 | 2794.75 |
| | 投资收入 | 28.61 | 63.97 | 78.33 |
| | 收入合计 | 2338.26 | 2604.62 | 2873.08 |
| 支出 | 赔款支出 | 1046.27 | 2197.19 | 2416.94 |
| | 佣金及手续费 | 23.1 | 25.41 | 27.95 |
| | 营业费用 | 92.39 | 101.63 | 111.79 |
| | 保险保障基金 | 3.46 | 3.81 | 4.19 |
| | 准备金提转差 | 1196.68 | 161.54 | 135.84 |
| | 支出合计 | 2361.9 | 2489.39 | 2696.71 |
| 营业利润 | | －23.64 | 115.23 | 176.368 |

**表 14 农村小额人身保险资产负债表　　（单位：万元）**

| 年 份 | 第 1 年 | 第 2 年 | 第 3 年 |
|---|---|---|---|
| 资产 | | | |
| 上年末资产 | - | 1173.04 | 1449.62 |
| 本年毛收入 | 1144.43 | 212.61 | 233.88 |
| 投资收入 | 28.61 | 63.97 | 78.33 |
| 固定资产 | - | - | - |
| 资本化费用 | - | - | - |
| 资产合计 | 1173.04 | 1449.62 | 1761.83 |
| 负债 | | | |
| 未到期责任准备金 | 1154.83 | 1270.33 | 1397.38 |
| 短期负债 IBER | 41.85 | 87.89 | 96.68 |
| 负债合计 | 1196.68 | 1358.22 | 1494.06 |
| 所有者权益 | -23.64 | 91.4 | 267.77 |

B. 分析说明

国寿农村小额人身保险为一年期险种，当年的利润数据即可大致反映公司的经营情况。保险公司经营农村小额人身保险的第一年利润为负值，是因为该年需要提取首次农村小额人身保险的责任准备金，以至于责任准备金数额过大引起的。从第二年开始这种情况就会好转。因此我们可以看到，在费用管控合理，不出现超额、集中赔付的情况下，保险公司经营该险种达到两年以上是可以实现一定的利润。因此，保险公司推行农村小额人身保险是具有经济可行性的。

## 四、调节农村小额人身保险需求与供给的政策建议

如何将潜在需求转化为有效需求，增加农村小额人身保险的供给，据以上分析，调节农村小额人身保险需求与供给的建议如下

### （一）完善多元化的农村小额人身保险经营模式

我国农村小额人身保险运行模式具有较强的地域性，鉴于我国各地农村经济基础等各方面差异性较大，课题组认为应通过自发

性实践及引导性实践相结合，形成多元化的农村小额人身保险机构体系和运行模式。

（1）确立政府支持下的半商业化主导模式

半商业化经营模式是指政府给予政策支持，并提供一定的财政支持，基层村委会宣传并组织动员农村低收入人群投保小额人身保险。保险公司负责经营：包括产品开发、承保、核保、理赔等保险事项。

该模式体现了政府的公信力，通过基层组织的宣传，使农村低收入人群更容易认可、接受农村小额人身保险产品，提高农村居民投保积极性，降低了保险公司的销售难度。我国山西地区的“晋中模式”类似于半商业化模式。该地区政府积极号召，督导宣传，运用财政进行保费补贴，并与“新农合”相结合形成 1+1 模式，即每一个农民有一份新型农村合作医疗基础上，增加一份国寿农村小额意外伤害保险。太谷县和新农合组织合作联动，小额保险作为新农合补充，每人交费 10 元，小额意外险保额 4000 元，附加意外住院医疗保额 1000 元，与新农合同步进行赔付。这中模式推广快、成本低、覆盖广、易操作，保费全部由农村居民承担。

（2）加快保险公司为主体的商业化模式的成熟

商业化运作模式即由商业保险公司作为风险承担方，独立完成产品的定价、销售、收取保费、核保理赔、服务等，完全按照商业化原则运作。

完全商业化经营模式优势在于：商业保险公司在精算、信息系统、风险控制、经验数据搜集等方面专业性较强，在产品设计、费率厘定等方面具备较强的技术实力，；并且公司在经营过程中自主性强，渠道带来的风险较小。因此，在此模式下有利于保险公司根据农村低收入人群的需求情况，设计出适合农村低收入人群的产品，为农村小额人身保险的可持续发展提供基础。

目前，在我国开展农村小额人身保险试点的公司主要有中国人寿、新华人寿、泰康人寿等几家公司，这些公司凭借其自身的实践经验以及在资金、服务网点、较强的专业技术能力等各方面的优势已经具备采用完全商业化经营模式的条件。

（3）推动多主体合作模式的发展

多主体合作模式指将与农村低收入人群有着密切联系的机构、各种组织或民间团体参与到农村小额人身保险市场。如：村委会、妇联组织、医疗站等基层组织，由这些机构进行宣传与销售。该种模式的运行实现了多方面的共赢的局面，保险公司增加了产品的销售渠道，基础组织将他们销售的产品与该组织的组织目标结合起来，在产品和服务各个方面满足成员的要求，农村低收入者则通过购买小额人身保险提高了自身的保障水平。中国人寿山西分公司采取的“全村统保模式”属于多主体合作的模式。该模式极大的提高了农村小额人身保险的覆盖范围，有利的促进农村小额人身保险持续有效发展。

上述三种模式实施，推动了我国农村小额人身保险持续发展。课题组认为我国农村小额人身保险持续发展应建立多元化的经营模式。在发展初期需要政策与财政的支持，提高商业保险公司的积极性。后期财政支持慢慢减少，逐步形成以商业保险公司为主体的经营模式。

**（二）加强政府政策支持**

国际经验表明，农村小额人身保险需要政府大力支持，政府是重要推动力。我国农村小额人身保险发展同样需要政府支持。

（1）完善农村小额人身保险发展的法律、法规

政府在支持我国小额人身保险发展时，应积极构建适合小额保险发展的的法律法规环境。

我国 2010 年中央一号文件首次提出要大力发展农村小额人身保险，农村小额人身保险已经列为我国长期发展战略之中。但是目前为止我国仍未出台支持农村小额人身保险发展的条例或法规。由于没有相关法规的政策支持，使小额保险的性质、经营主体资格的确定、经营主体参与农村小额人身保险的权利与义务以及农村小额人身保险的范围都不能得到有效的实施与保障，一定程度上减缓了农村小额人身保险的发展。伴随我国农村小额人身保险的逐步深化，试点不断增加、覆盖范围逐步扩大的同时应尽快颁布小

额保险的相关条例，从制度上对小额保险发展予以支持。

（2）增加国家财政支持

政府的财政支持体现在两个方面：①提供保费补贴。我国政府对保险公司经营小额保险提供一定补贴。试点初期政府承担了包括山西省 10 个市政府、76 个县级政府、312 个乡政府的小额保险宣传成本。同时政府还对试点地区的部分产品进行成本分摊，以农村小额人身意外伤害保险为例，保险金额 1 万元，保费人均 20 元。通过政府与保险公司协商，保险公司减免 4 元，政府再补贴 4 元，投保人最终成本降到了 12 元，缓解了投保人保费支付压力。由于政府补贴能力有限，所以不能对所有农村小额人身保险产品进行补贴，可针对农村低收入人群迫切的风险保障的相关产品进行补贴。比如农村小额健康险和农村小额寿险产品，这样有利于满足低收入人群急需的风险保障，同时有利于促进农村小额人身保险发展。②实施税收优惠政策农村小额人身保险虽然以大数法则运算为基础，但是由于农村低收入人群的道德风险和逆向选择较为严重，不利于风险测算，导致保险公司经营成本较高，一定程度上影响了经营主体的积极性。税收优惠可以分摊经营主体的成本负担，降低保险业务费用水平。我国正处在农村小额人身保险开展初期，通过实行税收优惠政策，提高保险公司经营积极性。比如，优惠开展农村小额人身保险营业税和所得税。

**（三）加强农村小额人身保险宣传和客户服务**

（1）强化宣传，提高低收入者风险意识

课题组调查显示，没有购买农村小额人身保险的人中，有 70.99%是由于没有听说过或不了解，大多数农民对小额人身保险的认识不足，制约了农村小额人身保险的发展。为此，加强宣传教育工作，提高农村居民的保险意识，有利于小额保险发展。可通过广播、电视、讲座、报纸、宣传等形式，让农村居民了解保险；用真实的案例教育、影响广大农民，让他们了解通过保险方式转移风险的优势，提高投保的意识；积极与农信社、妇联、村委会等机构合作开展宣传，结合各地文化下乡等活动，扩大宣传。

（2）提升农村小额人身保险服务能力

虽然农村小额人身保险产品保费和保额较低，但由于农村低收入人群的特殊性，更应该提高保险公司对低收入者的服务质量。这样不但有利于克服低收入人群对保险公司的偏见，而且对低收入人群起到更加全面的保障。服务能力的提升主要从承保和理赔两个方面体现：简化承保程序：农村小额人身保险承保时，可以免去体检要求，这么做不但为保险公司节省大量的经营成本，并为低收入的投保者提供了方便。简化理赔程序，加快理赔速度，提高理赔质量。农村小额人身保险的保险金额较低、风险单一，加之投保人的知识、精力有限，需要简化理赔程序，从而降低为理赔付出的成本。为低收入者提供小额保险理赔服务，关键要做——“快”和“准”。“快”是指迅速受理客户理赔申请，对于能在营销服务部门解决的索赔，要尽量在当时解决。“准”是指公司理赔人员需要对引起保险事故的原因做出准确的判断和认定，并正确计算给付金额。快速给付保险金，限制在 10 个工作日内解决理赔事项。

③重视客户回访，注重与顾客沟通，提供全方位服务。保单销售不是一次性交易。续保率是保险经营重要指标。小额保险购买者，在一个保险期间内未发生保险事故，未得到赔偿，他们就可能放弃续保。因此保险公司要做好客户回访工作，及时与投保人沟通，结合新产品推介等活动，倾听客户意见，更新客户信息，通过客户回访，增强忠诚度。保险公司定期到社区或工地提供现场服务，了解投保人需求，倾听顾客意见和建议，及时改进工作，同时吸引更多的客户。此外，保险公司定期为投保人提供诸如健康咨询、身体检查等附加服务，一方面树立起保险公司服务大众的良好形象，另一方面也帮助投保人控制潜在风险，降低风险发生概率。

**（四）完善农村小额人身保险产品设计**

设计农村小额人身保险产品应遵循以下原则：

（1）保险条款通俗化。回归分析显示，受教育程度高低会影响农村小额人身保险的需求，而受教育程度高低一定程度体现在是

否能够理解保险条款内容。在此次问卷调查中，初中以下学历的人数占到总调查人数的51.22%。保险条款的复杂性和专业性，农村居民不容易理解，进而降低小额保险产品的有效需求。保险条款难以读懂也会引发保险纠纷，影响了农民的参保需求，影响农村小额人身保险的潜在需求向有效需求的转化。因此，保险公司在开发农村小额人身保险产品时，应积极推进人身保险条款通俗化，为客户提供的通俗易懂条款、产品说明。

（2）降低保险产品价格。前文中的Logistic回归分析显示，收入水平会影响农村人口对小额保险产品的需求，价格低廉的保险产品可以有效减弱收入水平因素对农村小额人身保险需求的影响效力，使得大量原先由于产品定价过高而无法实现的潜在需求转化为有效需求。保险公司应该处理好经营效益和社会效益的关系，尽量降低保险费率，薄利多销，提供低廉保费、适度保障的保险产品。

（3）应用宽限期条款。由于农作物生产的季节性，农民收入呈现周期性，支付能力出现暂时的无力。需要宽限条款应用为了保证他们能够继续享受保障，保险公司应用的宽限期条款，在低收入者无力支付保费时保留保单，保障被保险人权益，并在其补交保费后能够继续享受保险保障。

（4）设计组合式、免核保的简单产品。可以将产品开发成各种“零部件”的形式，由展业人员根据客户需要灵活组装，这样的产品易于更适宜农村低收入者。

## 参考文献

[1]梁涛.农村小额人身保险[M].北京:中国财政经济出版社，2008

[2]杜强、贾丽艳.SPSS 统计分析从入门到精通[M].北京：人民邮电出版社，2009

[3]贺克玲.我国农村小额人身保险发展研究[D].河北：河北经贸大学硕士论文，2010年：17-25、28-35

[4]张兴.中国小额保险发展研究—基于“三农”风险管理视角[D].天津：南开大学博士论文，2009 年 66-84

[5]杨林林.我国小额保险发展策略及路径研究[D].福建：厦门大学硕士论文，2009年：24-30

[6]张静.我国开展小额保险研究[D].黑龙江：黑龙江财经大学硕士论文，2009 年：6-9

[7]陈雪.关于在我国城市低收入人群中推广小额人身保险的研究[D].北京:对外经贸大学硕士论文，2009 年：23-30

[8]卢燕.农村小额保险的需求分析,河北农业科学，2012 年第 15 期：97-98

[9]刘琼,刘爽等.农村小额人身保险的制度经济学分析[J].保险研究,2011 年第10期：39-44

[10]丁爱华.农村小额人身保险的可持续发展[J].中国金融，2011 年第 1 期：85-86

[11]王晓燕.借鉴印度经验发展我国农村小额人身保险[J].上海保险，2011 年第 1 期：36-38

[12]庹国柱，王德宝.我国农村小额人身保险制度可持续性发展研究[J]，上海保险，2010 年第 1 期：5-9

[13]刘琼，刘丽.小额人身保险菲律宾之经验解析[J].保险研究，2010 年第 8 期：116-121

[14]吴海波.农村小额保险销售模式比较研究[J].上海保险，2010 年第 8 期：34-36

[15]刘妍，卢亚娟.我国农村小额保险经营模式的现实选择[J].金融纵横,2010 年第 5 期：45-47

[16]粟榆、李琼、李池威.我国农村小额人身保险运行回顾与评价[J].保险研究 2010 年第 12 期：18-23

[17]尹成远，任鹏充，陈伟华.农村小额保险与小额信贷结合发展及其模式探讨[J].现代财经 2010 年第 3 期：22-26

[18]马黎.小额保险挖掘“金字塔底端的财富”[J],中国金融家,2010 年第 6 期:34-36

[19]张洪涛.农村小额人身保险可持续发展面临的问题和建议[J].金融纵横，2010 年第 7 期：67-69

[20]杜朝运，毕柳.农村小额人身保险供求分析与协同发展[J]，福建金融管理干部学院学报 2010 年第 2 期：3-8

[21]朱俊生，庹国柱.推动小额保险发展的关键在于提高供给效率[J].中国金融，2009年第5期：44-46
[22]肖明迁、陈孝劲.我国小额保险发展模式的探讨[J].海南金融，2009年第3期：51-54
[23]王文军、张梦茵.农村小额保险情况调查[J].中国保险报，2009第4期：34-35
[24]陈　华.农户购买小额保险意愿影响因素研究—来自广东两个县的证据[J].保险研究,2009第5期：51-56
[25]曹晓兰.我国小额保险的经济学分析[J].保险研究，2009第6期：33-36
[26]刘扬，张桂香.农村人身保险需求影响因素研究[J]，税务研究，2009年第7期：93-94
[27]肖弦弈.乌克兰小额保险市场需求和发展思路[J].保险研究,2008年第1期:53-57
[28]林熙，林义.印度农村小额保险发展经验及启示[J].保险研究，2008年第02期：90-91
[29]刘万.国际小额保险模式问题研究[J].保险研究，2008年第12期：85-88
[30]徐淑芳.国外小额保险经营模式比较及其对我国的启示[J].南方经济,2008年第6期：65-71
[31]高峰，王珺.小额保险需求分析[J].保险研究，2008年第10期，42-46
[32]刘冀广.我国保险监管在推动小额保险发展中的实践与政策建议[J].上海保险，2008(03)
[33]刘珺.中国农村人身保险市场发展潜力研究[J].农村经济，2007年第6期：74-77
[34]张跃华，顾海华，史清华.《农业保险需求问题的一个理论研究和实证分析》[J].数量经济技术经济研究，2007年第4期：65-75
[35]孙　健，申曙光.我国农村居民保险需求意愿的实证[J].统计与决策,2009年第5期：82-84
[36]庹国柱、王德宝.关于我国农村小额人身保险的几个重要问题[J].中国保险报2009年第11期：9-13
[36]陈之楚,小额保险供给制度理论诠释与功能定位，北大塞瑟论坛论文，2009年并入选《中国重要会议论文全文数据库》CPCD.
[36]陈之楚,小额保险供给制度对传统保险的突破及其功能定位，现代财经，2009.12
[36]陈之楚，小额保险供给制度创新研究，Z0804，天津市政府项目，2008。12.被天津市政府《决策咨询建议》刊载，获天津市政府2009年优秀建议奖
[37]IAIS ,Issues in regulation and supervision of micro-insurance, IAIS-CGAP Joint Working Group on micro-insurance inconsultation with IAIS members and observers and CGAP working group on Microinsurance,2007
[38]Brown, Warren, Craig Churchill. Providing Insurance to Low Income. Pare 1-A Primer on Insurance Principles and Products.Bathesda,MD:Microinsurance Best Practices project,DAI,2000
[39]Michal J.McCord.Microinsurance in Uganda:A case study of an example of the partner-agent model of microinsurance provision.AIG\FINCAUGANDA,2000a
[40] ]Michal J.McCord.Microinsurance:A Case Study of An Example of The Mutual Model of Microinsurance Provision.2000b
[41] Warren Brown , CraigF.Churehill.Insuance Provision in Low 一 income Conununlties Part11:Initial Lesson sfrom Microinsurance Experiments for thepoor.2000

# 我国农村小额人身保险需求与供给分析[①]

陈之楚
天津财经大学经济学院金融系保险教研室
邮箱 tjchenzhichu@126.com, 电话：13752418846

**摘　要：**农村小额人身保险是为低收入农民提供的一种消费得起的保险保障。发展农村小额保险供给，为政府运用市场机制增强对低收入人群的经济保障，提供一种金融方式。供给农村小额保险，有利于增强低收入农民自我保障能力，有利于构建与完善和谐社会保障机制，有利于完善农村金融体系。这是本文研究的目的。

论文分为四个部分：第一部分：梳理国内外研究文献及我国农村小额人身保险的发展。从农村小额保险的分类、运营模式、经营状况、供给效率、实证调查分析和发展监管等角度归纳评价研究成果。阐述我国农村小额人身保险的发展规模、提供产品及试行状况。

第二部分：我国农村小额人身保险的需求分析。运用社会调查问卷和量化方法，分析我国农村小额人身保险需求影响因素。社会调查有效问卷 453 份，来自山东、河北和天津郊县的常住农民。数据处理结果，显示我国农村小额人身保险的潜在需求和有效需求之间存在差距。在此基础上，运用 Logistic 回归方法检验了收入水平、年龄、受教育程度、是否购买商业保险和每年愿意支付保费水平等五个因素的影响显著性检验。结果：前四个因素显著性水平为 90%以上，而每年愿意支付保费水平因素影响不显著。

第三部分：我国农村小额人身保险的供给分析。分析传统保险产品供给理论及其局限性。阐明小额保险供给对传统保险的突破。即调整传统保险的“可保性”的限制，采用同质风险，分层对价，低费率的方法，融合商业保险与社会保险的功能。分析我国三种运行的模式利与弊，和运行中存在的问题。论文提出：“政府支持、商业运作、多元化、广覆盖”小额农村人身保险供给模式。并对农村小额人身保险供给经济可行性进行实证分析。

第四部分：调节我国农村小额人身保险需求与供给的建议。培养农村小额人身保险需求市场，加强政府政策扶持，明确商业保险公司在小额保险供给中功能和作用，提升商业保险公司对小额保险经营管理水平，完善小额保险产品设计和销售渠道。

**关键词：**农村小额人身保险；小额保险需求；小额保险供给；小额保险运行

[①] 本文是渤海财产保险股份有限公司科研基金资助项目（2011 年 11BH04）“我国农村小额人身保险制度研究”的阶段成果。

附件：

农民朋友好：

农村小额人身保险是专门针对广大低收入农民的消费能力、特定设计的一种人身风险保险产品，它保费较低，保险金额较小，投保和理赔手续都比较简便。为了深入了解我国农村小额人身保险发展现状和需求，天津财经大学金融系“我国农村小额人身保险制度研究”课题组组织此次问卷实地调研，从而获得一线资料，以对完善农村小额人身保险制度进行研究，非常感谢您的支持与配合。

1. 您的年龄（　　）　①20-29　②30-39　③40-49　④50-59

2. 您的文化程度（　　）①初中　②高中　③中专及技校　④大专　⑤ 本科及以上

3. 您的月收入大致为（　　）①1000 以下 ②1000-1500 ③1500-2000 ④2000-2500 ⑤2500 以上

4. 您的家庭主要收入来源是什么（　　）① 农业收入　②非农收入

5. 您的家庭人口结构是 （　　）①小家庭 ②小家庭加赡养老人 ③老人家庭

6. 假如家人发生意外伤害或重大疾病需要支出费用，您筹集钱的方式是（　）

①自己承担　②找亲戚、朋友帮忙　③有保险　④新农合　⑤其他方式　（具体说明）

7. 您对保险功能的认识（　　）①获得风险保障，减少后顾之忧　②缴纳少量保费，获得较高的赔付　③作为一种理财产品，可以带来预期收益　④保险保障功能较低 ⑤ 不了解

8. 您已经购买了保险有（　　）①简易人寿保险　②意外伤害险　③重大疾病　④医疗保险 ⑤养老保险

9. 您年缴纳保费是（　　）①100 以下　②100-200　③200-300　④300-400　⑤500 以上

10. 您最需要的人身保障有（　　）①意外伤害的保障 ②重大疾病的保障 ③医疗、住院保障 ④养老保障

11. 您是否参加了农村新型医疗合作保险（　　）　① 是　② 否

12. 您参加农村新型医疗合作保险的年缴保费是（　　）①100 以下　②100-200　③200-300 ④300-400

13. 您是否听说过农村小额人身保险（　　）　①是　②否

14. 您知道农村小额人身保险的途径（　　）　①乡镇政府宣传　②亲戚、朋友介绍　③银行、邮政储蓄场所　④保险公司宣传　⑤电视、广播、报纸等

15. 您是否已经购买过农村小额人身保险（　　）　①是　②否

16. 您没有购买的原因是什么（　　）　①没有听说过　②对于小额人身保险产品不了解 ③产品定价高　④没有合适产品　⑤保险公司服务差　⑥已参加农村合作医疗　⑦已经有其他商业保险

17. 您购买了小额人身保险有（　　）　①意外伤害险　②医疗健康险　③定期寿险

18. 您购买小额人身保险的途径有（　　）　①保险公司推销员上门推销　②通过银行、邮政储蓄、农村信用社　③由村政府组织村民购买　④自己去保险公司购买

19. 对于小额人身保险每一万元保障（即如果发生保险事故，保险公司最高赔偿金额为 1 万元时），您觉得保险公司应该收取多少保费（　　）　①30-50 元　②50-70　③70-100　④100 以上

20. 您认为保险公司服务态度需要改进（可多选）（ ）

①推销保险时，讲解不详细 ②理赔不及时 ③服务态度不好

21. 您更愿意接受的小额人身保险供给的方式（ ） ①保险公司推销员上门推销 ②通过银行、邮政储蓄、农村信用社 ③由村政府组织村民购买 ④自己去保险公司购买

22. 对于购买农村小额人身保险，你希望采取的保费缴纳方式（ ）

①一次性缴纳全部保费 ②在一定期限内分期缴费

23. 对于购买农村小额人身保险，您希望获得补贴的形式是（ ）

①政府分担一部分保费 ②保险公司降低保险费

24. 您对小额人身保险发展的其他建议？

# China's Compensation Hospitalization Insurance Premium Rate---Analysis on the Actuarial Assumption of Claim Cost

QIU Chunjuan [1], CHEN Tao [2]

1. School of Finance and Statistics, East China Normal University, Shanghai, 200241

2. School of Insurance, Southwestern University of Finance and Economics, Chengdu, 611130

**Abstract:** There is insufficient effective supply problem in Chinese health insurance market. its main reason is that we suspect whether the medical insurance premium is reasonable and consumers are lack of understanding of the actuarial assumptions behind the health insurance price. In this paper, we made a detailed comparative analysis for claim cost assumption which is one of the key assumptions behind the compensation hospitalization insurance by the four population groups (the general hospital population, specific hospital population, social health insurance population and commercial health insurance population). Finally, we use the generalized linear model to do empirical research. It shows that commercial hospitalization insurance premium structure is generally too simple and there is some room for price cuts. We suggest that the commercial health insurance should further optimize the rate structure and properly lower premium to meet more people's meet for health insurance. As a result, commercial health insurance is better able to play a complementary role in China's medical insurance system.

**Key Words:** Hospitalization Insurance; Claim Cost; Premium Rate

一、引言

2012 最新医改方案指出要充分发挥基本医疗保险、医疗救助、商业健康保险、多种形式的补充医疗保险等等协同互补作用。由于我国目前基本社会医疗保险保障水平偏低，商业健康保险日益成为大家关注和讨论的热点，但是很多人在质疑商业健康保险的作用。一般消费者会感觉健康保险产品乃至保险产品的价格太高，以至于普通老百姓承受不起。也有一些学者指出目前我国商业健康保险市场发展滞后并且存在着较大的供需矛盾（比如莫红琴等，2006；胡泊，2011）。

从供给主体上看，2009 年，全国共计 89 家保险公司经营医疗保险业务[1]。其中财产保险公司 36 家，人寿保险公司 49 家，专业健康保险公司 4 家。从产品数量上看，截至 2009 年 9 月底，在保监会备案销售的健康保险产品共计 1546 款，其中，疾病保险产品 552 款，医疗保险 963 款，护理保险 15 款，失能收入损失保险 16 款[2]。可见，医疗保险产品是健康保险产品中数量最多的一个险种。然而同年我国健康保险的保费收入才 530.8 亿元，比 2008 年下降了 3%。健康保险的保费收入占人身保险保费收入的比例才 6.5%[3]，占总保费收入 5%左右，可见在健康保险中医疗保险的比例更低。而一般发达国家的健康保险保费收入占全国总保费收入的 30%左右（李玉泉，2011）。进一步，2010 年全国健康保险赔付支出仅占全国医疗卫生支出的 1.3%，发达国家平均在 10%左右（李玉泉，2011）。

但是另一方面，我们也看到，很多调查

1 数据来源：《中国健康保险发展报告》，报告中原文是共计 89 家保险公司经营健康保险业务，但实际上经营健康保险业务的保险公司一般都是会经营医疗保险。

2 数据来源：《中国健康保险发展报告》

3 数据来源：梁涛主编（2010），《2009 中国人身保险市场监管与发展报告》，中国财政经济出版社。

结果都显示人们对商业医疗保险的需求真实存在且旺盛。2007 年英国保柏公司(BUPA)针对中国保险市场的调研显示,64%的消费者愿意购买能够覆盖到社保所不能保障的疾病的商业健康保险，却仅有 23%的消费者已经购买[4]。2009 年我们在四川省的一个关于健康与医疗消费的调查报告显示，大概 60％的家庭觉得商业医疗保险对家庭很有需要。但是在剩下的 40％的表示不需要购买商业医疗保险的家庭，分析其原因后发现，56.2％是是出于经济原因。

导致商业医疗保险供需矛盾的可能原因有很多，比如我国商业健康保险发展的历史不够长导致医疗保险损失数据的不够完善；商业保险公司的粗放式经营以及医疗费用的急剧攀升和控制力度的不够等等。但是其关键问题还是在于医疗保险的价格问题。事实上，个人医疗保险的保费是比较敏感的，Buchmueller et al.(1997)研究发现，个人面对 10 美元的保费增加，就会有 5 倍的可能性转向别的保险计划。而保险的费率厘定和定价是基于假设基础之上的，消费者直接面对的是医疗保险的价格或者保费，对保费后面的假设一无所知，因此会让人产生医疗保险价格过高的怀疑，这一点跟曾经社会各界热议的交强险“暴利”问题（周县华，2010）很类似。美国全国保险监督官协会（NAIC）在《财产和意外保险费率厘定示范法》的立法宗旨第 5 节界定了费率过高和费率不足的判断标准，并且要求保险人的定价假设合理，其定价假设包括损失分布假设、费用假设和利润假设（阎建军等，2009）。我国《财产保险公司保险条款和保险费率管理办法》（2010 年）也指出保险费率应按照风险损失原则科学合理厘定，不危及保险公司偿付能力或者妨碍市场公平竞争。所以说费率的约束限制往往被看作一个监管的工具来增加市场上个人保险的覆盖(Wynand et al.,2000)。

2005 年世界卫生大会 58.33 号决议称，人人都应该能够平等地获得卫生医疗服务，同时不会因为支付卫生服务费用而遭受经济困难（WHO,2010）。因此商业医疗保险除了正常以盈利为主要目的外，更应该发挥在整个医疗保障体系中的社会责任。也就是说：（1）我们有责任向消费者透明商业医疗保险价格背后的成本假设。（2）在合理的假设基础上，商业医疗保险是否存在降价的空间，让我们不再觉得保险是个奢侈品，人人都能享有充分的医疗保险。这正是本文的逻辑起点。

商业医疗保险从精算的角度分为费用补偿型医疗保险和定额给付型医疗保险。两者的本质在于定价和精算假设的区别上。本文以短期费用补偿型住院医疗保险为主要研究对象，暂不涉及定额给付型医疗保险的探讨。本文后面的结构安排如下：第二部分简介目前我国短期费用补偿型商业医疗保险的定价模型与精算假设；第三部分分析各类人群的理赔成本；第四部分是详细陈述数据和模型。第五部分是对医疗保险损失也就是医疗保险的理赔费用的实证结果与分析。第六部分给出结论与建议。

## 二、短期费用补偿型住院商业医疗保险定价模型与精算假设

实务中，短期费用补偿型医疗保险的费率厘定公式为：

$$P = \frac{q \times k}{1 - e}(1 + t)$$

其中，q 为伤病发生率（在住院医疗保险中表现为住院率），k 为在给定保障内容与条款下，伤病发生条件下平均理赔成本，e 为附加费用率，t 为安全附加。

据此，国内市场上一般的一年期住院医疗费用保险的保费在几百元至几千元不等。比如人保健康《守护专家住院费用(推广版)个人医疗保险》第 2 档的年交保险费 707 元（30 岁的男性）。某些高端产品甚至有可能达到 1 万元以上。我们看到在给一年期费用补偿型住院医疗保险产品定价时关键需要住院率、理赔成本、安全附加以及费用率的假设。

### 1. 费用率与安全附加的假设

短期医疗保险的相关精算规定按《意外伤害保险精算规定》执行，其中关于附加费用率 e 的规定如下：个人业务不得超过毛保费的 35%，团体业务不得超过毛保费的 25%。安全附加 t 的选择则依赖于精算师的经验，一般在比较基础的产品中由于假设了保守的伤病发生率和平均理赔费用后，精算师不太会加

[4] 资料来源：网页 http://insurance.jrj.com.cn/2007/12/000000182236.shtml

入安全附加因子，而在某些高端的医疗保险产品中精算师们才会假设一个安全附加因子，比如 10%不等。

2． 住院率的假设

对住院率的假设精算师可以参考的来源有：保险公司内部经验数据、再保险公司的咨询建议、官方公布的资料以及一些特定研究目的的调查报告。它往往通过如下形式表示出来，比如表 1。

表1　我国不同性别和年龄人群的住院率%

| 年龄 | 城市 | | | 农村 | | | 合计 | 引入保险因子后的住院率 |
|---|---|---|---|---|---|---|---|---|
| | 男 | 女 | 合计 | 男 | 女 | 合计 | | |
| 0-4 | 3.0 | 3.7 | 3.3 | 11.0 | 6.8 | 9.1 | 8.1 | 8.91 |
| 5-14 | 1.2 | 1.2 | 1.2 | 2.7 | 1.9 | 2.3 | 2.1 | 2.31 |
| 15-24 | 1.1 | 2.8 | 2.0 | 2.3 | 8.5 | 5.3 | 4.1 | 4.51 |
| 25-34 | 1.8 | 8.9 | 5.6 | 3.1 | 11.6 | 7.4 | 6.9 | 7.59 |
| 35-44 | 2.9 | 3.6 | 3.3 | 4.2 | 6.1 | 5.2 | 4.7 | 5.17 |
| 45-54 | 5.0 | 5.4 | 5.2 | 5.8 | 7.3 | 6.6 | 6.2 | 6.82 |
| 55-64 | 9.2 | 10.1 | 9.7 | 9.3 | 9.0 | 9.2 | 9.3 | 10.23 |
| 65- | 21.6 | 17.4 | 19.4 | 13.9 | 12.0 | 12.9 | 15.3 | 16.83 |

注：摘自全国卫生服务总调查分析报告（2008）

由于保险计划会增加住院的概率，所以表 1 最后一列是在原始数据上附加了 10%的保险因子。一般来讲随着年龄段的增长，住院率上升，25-34 岁年龄段的住院率偏高的原因在于未剔除生育住院的情形。如果在医疗保险产品中包含生育给付，必须给与这个年龄段的住院率特别考虑。

商业住院医疗保险中的住院率假设类似于表 1，我们比较某商业保险公司 A 对于某个住院费用补偿型医疗保险住院率的假设以及某再保险公司 A 对于某医疗产品的住院率假设进行比较。如图 1。

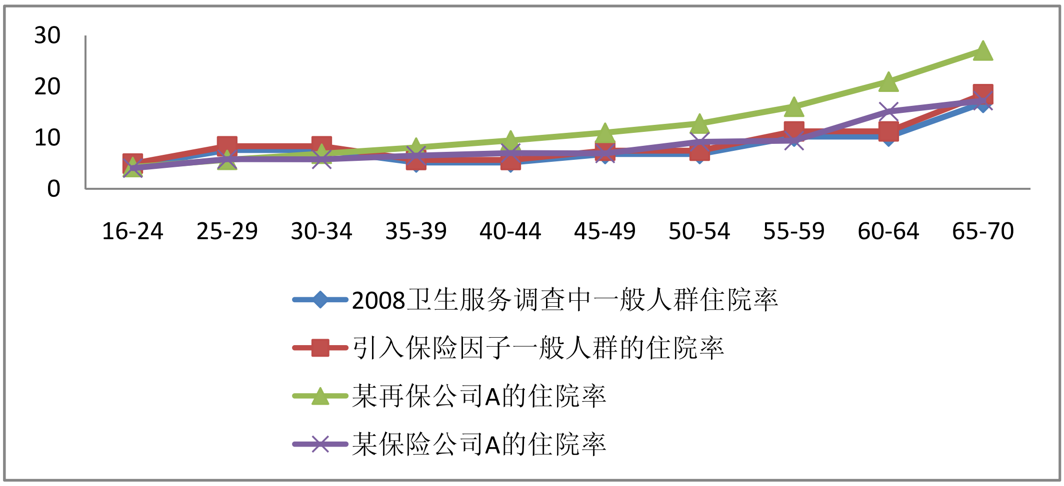



图 1：各人群住院率比较（注：公司的数据属于内部资料，笔者整理所得）

我们发现，除了再保险公司 A 的住院率假设在高年龄段少许偏高以外，其余人群的住院率假设差异并不十分大。

3． 理赔成本的假设

基于上述的分析，本文更关注各类人群理赔成本的假设。这是决定费率高低的最关键因

素。不同的公司，不同的保险产品的保障内容与保险金额后面是不同的平均理赔成本的假设。我们比较同是 20 万保险金额的住院医疗保险产品下，某公司 A、某公司 B 以及再保公司 A 的理赔成本假设。

表 2 20 万保险金额下住院费用补偿医疗保险的理赔成本的假设

| 年龄组\保额 | 某公司 B | 某再保公司 A | 某公司 A |
|---|---|---|---|
| 16-24 岁 | 6637 | 11404 | 17292 |
| 25-29 岁 | 7170 | 9925 | 22050.68 |
| 30-34 岁 | 7771 | 9479 | 20718.2 |
| 35-39 岁 | 8220 | 9158 | 21374.49 |
| 40-44 岁 | 8643 | 8861 | 20877.19 |
| 45-49 岁 | 8916 | 8614 | 20314.14 |
| 50-54 岁 | 9260 | 10503 | 21097.22 |
| 55-59 岁 | 9476 | 10780 | 19623.19 |
| 60-64 岁 | 9696 | 11448 | 17266.67 |
| 65-70 岁 | 9982 | 14445 | —[5] |

资料来源：内部资料，笔者整理所得（均针对无社保人群，补偿比例为 70%）

[5] 由于 A 保险公司此产品不保 65 岁以上的人群，所以缺少 65 岁以上的理赔成本的假设

实务中，我们发现同是 20 万元保险金额的理赔成本假设却天壤之别。由于 A 公司的此类产品属于高端住院补偿型医疗保险产品，除了在其网络医院（网络医院包括一些专科医院以及私立医院等）内补偿 90%，网络医院外补偿 70%的住院医疗费用外，还补偿住院前后 7 天的门急诊费用，因此 A 公司的理赔成本假设远远高于B公司和再保A的假设。公司 B 的理赔成本假设随年龄的增长稳步增长，再保公司 A 却呈现两头高中间低的情形。

三、各类人群真实的理赔成本分析

显然，对于理赔成本假设的参考不应仅限在公司内部的信息，或者由于资料限制，我们没有内部数据，此时，其他大量的信息数据来源也有很大的参考价值。本文试从如下几类人群全面分析医疗保险的理赔成本：（1）综合医院人群；（2）特定医院人群；（3）社会医疗保险人群；（4）商业医疗保险人群。

1 综合医院人群

表 3　2007-2010 全国公立医院出院病人例均住院医疗费用

| 医院级别\年份 | 2007 年 | 2008 年 | 2009 年 | 2010 年 |
|---|---|---|---|---|
| 公立医院 | 4834.5 | 5363.3 | 5856.2 | 6415.9 |
| 三级 | 8087.0 | 8969.1 | 9753.0 | 10442.4 |
| 二级 | 3294.8 | 3647.2 | 3973.8 | 4338.6 |
| 一级 | 2331.4 | 2550.4 | 2609.6 | 2844.3 |

资料来源：《2011 中国卫生统计摘要》

表 3 显示：2010 年平均的住院医疗成本在 6000 多，即使是三级医院，也是在 1 万元左右。保险的理赔是建立在住院医疗费用基础上的，我们如果假设 70%的给付比例，那么住院医疗保险的理赔成本在 4000-5000 之间，甚至远比此要更低，因为还要考虑其中一些不补偿的医疗费用和给付限额的约束。单纯地看三级医院的住院费用，也可以大致估算出三级医院就诊的保险人群的理赔成本大概在 6000 左右。

2．特定医院人群（某三级医院）

表 4 某三级医院在不同的保险限额下理赔成本

| 年龄组\保额 | 1 万 | 5 万 | 10 万 | 20 万 |
|---|---|---|---|---|
| 0-5 岁 | 4230.02 | 5964.73 | 6019.39 | 6019.39 |
| 6-10 岁 | 4414.52 | 5807.85 | 5917.70 | 5917.70 |
| 11-15 岁 | 4898.53 | 6842.12 | 6913.34 | 6913.34 |
| 16-24 岁 | 4879.99 | 6943.53 | 7060.68 | *7075.84* |
| 25-29 岁 | 5237.97 | 8002.25 | 8334.89 | *8400.52* |
| 30-34 岁 | 5446.32 | 8830.79 | 9430.88 | *9864.88* |
| 35-39 岁 | 5610.39 | 9192.11 | 9791.70 | *9911.72* |
| 40-44 岁 | 6039.81 | 9782.45 | 10423.58 | *10640.28* |
| 45-49 岁 | 6031.48 | 9612.09 | 10133.38 | *10243.98* |
| 50-54 岁 | 6073.19 | 9676.05 | 10138.63 | *10323.82* |
| 55-59 岁 | 6120.68 | 9727.45 | 10136.61 | *10273.14* |
| 60-64 岁 | 6335.13 | 10493.73 | 11043.96 | *11224.35* |
| 65-69 岁 | 6426.68 | 10352.28 | 10938.45 | *11137.27* |
| 70-74 岁 | 6492.25 | 10426.19 | 10947.13 | *11128.98* |

资料来源：笔者自己整理所得

此处的理赔成本以某三级医院非公费医疗、无社保患者的住院病人的医疗费用个体数据为基础，假设 70%的补偿比例，分别设定 1 万、5 万、10 万和 20 万的保险限额下的平均发生额度，但实际上此类医疗保险计划的真实的各年龄段的保险理赔成本要远小于此（我们假设 10%的自费药品不计入医疗保险补偿的范围中，根据数据中自费药的额度做出的合理假设）。对比表 2 中 20 万元保险金额、70%补偿比例的保险公司 A、保险公司 B 和再保公司 A 的同类险种的理赔成本，见图 2。

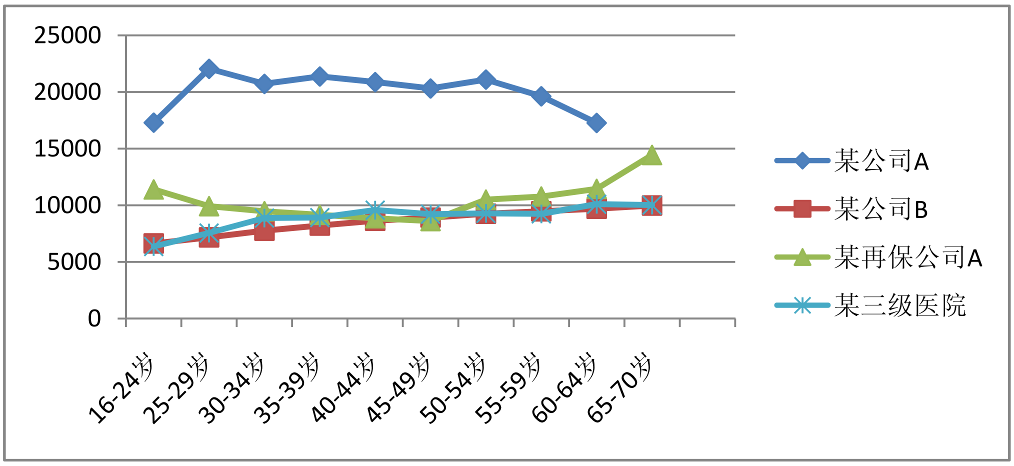



图 2：类似保障程度下，理赔成本的比较

图 2 中可以看出，即便是医疗服务成本最高的医院，其理赔成本也小于商业保险所假定的理赔成本，本例中，医院的理赔成本与某公司 B 的理赔成本的假设比较接近。而且医院人群的理赔成本是随年龄增长而逐渐增长的趋势，与公司 A 和再保公司 A 的假设存在较大的差异。

此外，我们在表 4 中发现，10 万元的保险金额的假定下的理赔成本和 20 万元保险金额假定下的理赔成本的差异并不是非常大，但是一些保险公司由于对高额医疗费用的保守控制，通常过分夸大了不同的保险金额下（特别是高额的保险金额）理赔成本的差异。

3 社保人群的医疗保险损失

本文中的社保是 2008 年上海市某区封顶为 5 万元的一个新农合计划，给付比例为一级医院 70%，二级医院 65%，三级医院 60%；

表 5 某社保计划的平均理赔成本

| 年龄组\保额 | 总的 | 二级和三级医院 | 三级医院(70%)[6] |
|---|---|---|---|
| 0-5 岁 | - | - | |
| 6-10 岁 | - | - | |
| 11-15 岁 | - | - | |
| 16-24 岁 | 2369.37 | 2393.76 | 4383.04(5113.55) |
| 25-29 岁 | 1913.28 | 1944.61 | 2173.69(2535.97) |
| 30-34 岁 | 2805.20 | 2897.86 | 3670.55(4282.31) |
| 35-39 岁 | 3310.95 | 3380.73 | 4339.97(5063.30) |
| 40-44 岁 | 4316.61 | 4460.73 | 4198.37(4898.10) |
| 45-49 岁 | 3903.18 | 4095.57 | 4855.08(5664.26) |
| 50-54 岁 | 4928.08 | 5177.46 | 5812.68(6781.46) |
| 55-59 岁 | 4871.23 | 5110.16 | 6134.57(7157.00) |

6 （）里表示的如果是 70%的补偿比例的理赔成本。

| | | | |
|---|---|---|---|
| 60-64 岁 | 4854.76 | 5001.45 | 6661.65(7771.93) |
| 65-69 岁 | 5198.24 | 5510.70 | 8149.19(9507.39) |
| 70-74 岁 | 5060.36 | 5722.48 | 6543.18(7633.71) |

总体而言，在社保理赔中，即使控制了高级别的比例给付，但是最终的理赔成本依然和医院级别呈现正向变动的关系。在年龄方面，理赔成本随着年龄的增长而逐渐增大（除了16-24 岁年龄组）。

此外，我们同表 4 中 5 万元的限额下的某三级医院的理赔成本[7]做比较。同医院级别下，本例中社保的理赔成本要低于某特定医院的理赔成本。其原因可能是：（1）人群的差异，新农合的参保人群都是农村人口，其经济基础限制了总的医疗费用的支出。（2）社保人群中由于样本量偏少，可能存在较大的偏差。

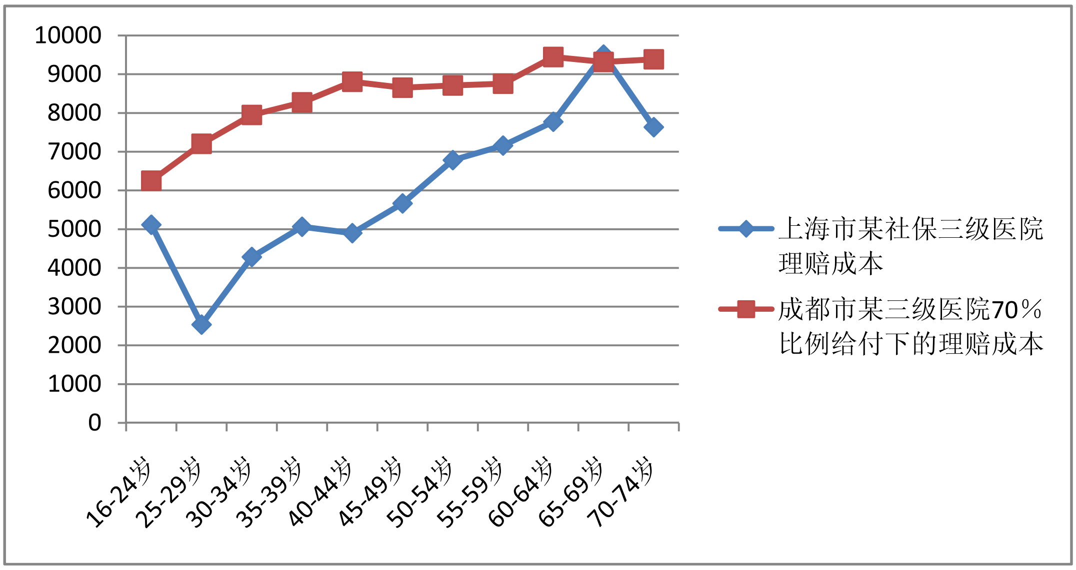



图 3：社保人群与医院人群的理赔成本比较

[7] 已经剔除了 10%假设下自费药的费用。

4 商保人群的医疗保险损失

本文中的商保人群是指某商业保险公司 2008 年一个医疗保险产品是一种补偿型住院医疗费用保险，针对的是无社保的人群，但是设置了床位费的平均每日限额和总限额、药品费的平均每日限额和总限额、护理费用限额、诊疗费用限额、治疗费用限额、检查化验费用限额以及手术费用限额、终止保证续保的限额等，在社保规定范围内给付比例 80%。粗略估算一下，总的限额大概在 2 万元左右。

表 6 某商保人群下类似保险产品的理赔成本

| 年龄组 | 16-24 岁 | 25-29 岁 | 30-34 岁 | 35-39 岁 | 40-44 岁 | 45-49 岁 | 50-54 岁 | 55-59 岁 |
|---|---|---|---|---|---|---|---|---|
| 平均理赔成本 | 1855.96 | 1221.95 | 1962.43 | 2741.18 | 1596.44 | 3144.59 | 1519.66 | 3963.57 |

表中数据显示，30-34 岁的人理赔成本大约为 2000 元，如果以 8%的住院率，35%的费用率测算，保费大概也仅为 250 元。而目前市场上同类产品同类人群的保费大概在 700 元左右。

综上所述，保险公司对于理赔成本的假设更多地依赖于不同的保险计划和不同的人群划分，但是从各类人群不同渠道看，保险公司的理赔成本确实存在着或多或少偏高的情形，也存在着人群不够细分的问题（目前几乎所有的商业医疗保险在费率厘定上仅对年龄和性别进行了划分）。

四、数据与模型

本文以 20 万元限额，70%比例给付下的保险计划为例，以赔付成本为结果进行实证分析。一共有三组数据：某商业保险公司某医疗保险的理赔数据，可以考虑的自变量因素有：性别、年龄、保障档次、地区、医院级别。某新农合保险理赔数据，可以考虑的自变量因素有年龄、性别、医院级别。某三级医院的住院医疗费用数据，可以考虑的自变量因素有：性别、年龄、病人来源、婚姻状况、职业。

分别对各组数据建立广义线性模型（GLM，具体模型的理论可参考 Lindsey, J. K. (1997)）发现在医疗保险的人群细分上有如下的特征：（1）年龄肯定是一个显著的风险因子。但是性别的风险因子并不是必然的。比如此处某三级医院的数据发现性别并不显著，因此保险公司在某些医疗保险险种上并没有对男女进行差别费率。目前，有些国家为了防止性别歧视，也取消了商业保险的性别差别费率（比如欧盟规定各保险公司必须从 2012 年 12 月 21 日起，取消汽车、人寿、医疗等保险业务中存在的性别歧视条款）。（2）除了年龄和性别外，医院级别、保障档次、婚姻状况、地区都有可能是费率厘定的因素，仅仅是表现形式和影响程度不同而已。所以为了到达合理保费的目的，我们有必要对风险因子进行更细得划分。

为了做进一步的分析，我们选择某三级医院的住院医疗费用数据进行细致的实证。从医院数据中我们筛选出无社保无公费医疗的个体（有效个体为 89909），人为地给予限额 20 万，10%的自费药，70%的比例给付的假设。应变量 $y$ 表示在上述条件下的医疗保险的理赔成本。自变量包括：（1）住院天数。（2）年龄，以岁为单位。（3）性别，分为男性和女性。（4）婚姻状况。分为未婚、已婚、离异、丧偶。（5）职业，分为农民、学生、工人、儿童、干部、其它；（6）病人来源，分为市区、市郊、省内、省外。

本文采用本文使用 Gamma 分布广义线性模型，联结函数取为 $\log$。这样具体的模型为：

$$\log(y) = \beta_0 + \beta_1 \log（住院天数）+\beta_2 年龄+\beta_3 \lambda_i^{性别}+\beta_4 \lambda_j^{婚姻状况}+\beta_5 \lambda_k^{职业}+\beta_6 \lambda_l^{病人来源}$$

五、实证结果与分析

通过对数据的处理，Pearson Chi-Square 值/自由度为 1.0237，小于 2，说明模型拟合的较好。下表 7 是详细的参数估计值和 95％置性区间。

表 7　参数估计值和 95％置信区间

| 参数 | | 自由度 | 估计值 | 标准差 | 95％置信区间上下线 | | 卡方值 | P 值 |
|---|---|---|---|---|---|---|---|---|
| 截距 | | 1 | 6.4929 | 0.0180 | 6.4576 | 6.5283 | 129674 | <.0001 |
| Log（住院天数） | | 1 | -0.0779 | 0.0034 | -0.0845 | -0.0712 | 524.21 | <.0001 |
| 年龄 | | 1 | 0.0033 | 0.0002 | 0.0030 | 0.0037 | 331.00 | <.0001 |
| 性别 | 男 | 1 | 0.0714 | 0.0051 | 0.0614 | 0.0814 | 195.48 | <.0001 |
| 性别 | 女 | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | . | . |
| 婚姻状况 | 离异 | 1 | -0.2347 | 0.0356 | -0.3045 | -0.1649 | 43.47 | <.0001 |
| 婚姻状况 | 丧偶 | 1 | -0.0945 | 0.0465 | -0.1856 | -0.0034 | 4.14 | 0.0420 |
| 婚姻状况 | 未婚 | 1 | -0.1549 | 0.0109 | -0.1762 | -0.1335 | 202.70 | <.0001 |
| 婚姻状况 | 已婚 | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | . | . |
| 职业 | 儿童 | 1 | 0.1098 | 0.0159 | 0.0786 | 0.1411 | 47.44 | <.0001 |
| 职业 | 干部 | 1 | -0.0214 | 0.0168 | -0.0542 | 0.0114 | 1.63 | 0.2015 |
| 职业 | 工人 | 1 | 0.0334 | 0.0150 | 0.0039 | 0.0628 | 4.93 | 0.0263 |
| 职业 | 农民 | 1 | -0.0629 | 0.0145 | -0.0913 | -0.0346 | 18.91 | <.0001 |
| 职业 | 其他 | 1 | 0.0168 | 0.0125 | -0.0077 | 0.0413 | 1.81 | 0.1783 |
| 职业 | 学生 | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | . | . |
| 病人来源 | 国外 | 1 | 0.3003 | 0.0897 | 0.1244 | 0.4762 | 11.20 | 0.0008 |
| 病人来源 | 省内 | 1 | 0.0864 | 0.0063 | 0.0740 | 0.0988 | 187.77 | <.0001 |
| 病人来源 | 省外 | 1 | 0.0458 | 0.0113 | 0.0236 | 0.0679 | 16.41 | <.0001 |
| 病人来源 | 市郊 | 1 | 0.0549 | 0.0080 | 0.0392 | 0.0706 | 47.08 | <.0001 |
| 病人来源 | 市区 | 0 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | . | . |
| 尺度参数 | | 1 | 1.8612 | 0.0083 | 1.8450 | 1.8776 | | |

我们发现，住院天数、年龄、性别、婚姻状况、职业、病人来源都是影响理赔成本的显著变量，也就是说目前商业医疗保险在理赔成本做假设时，仅考虑年龄和性别因素是不太妥当的。在数据具备条件下，应更细致地加入考虑诸如婚姻、职业等因素。

下面，我们以仅加入考虑婚姻状况因素为例，考虑理赔成本的变化。

表 8 某三级医院 GLM 模型下理赔成本的估计及其基础上的保费（单位：元）

| 年龄段 | 性别 | 婚姻状况 | 理赔成本 | 保费[8] | 市场费率 |
|---|---|---|---|---|---|
| 16-24 岁 | 男 | 离异或丧偶 | 4102.4 | 282.5607 | 1700－1800 |
| | | 未婚 | 7206.96 | 496.3932 | |
| | | 已婚 | 7903.59 | 544.375 | |
| | 女 | 离异或丧偶 | 13013.26 | 896.3133 | |
| | | 未婚 | 6386.05 | 439.8515 | |
| | | 已婚 | 7243.55 | 498.9134 | |
| 25-29 岁 | 男 | 离异或丧偶 | 4646.80 | 456.8877 | 2600－2700 |
| | | 未婚 | 7495.10 | 736.9413 | |
| | | 已婚 | 8492.59 | 835.0176 | |
| | 女 | 离异或丧偶 | 4378.59 | 430.5164 | |
| | | 未婚 | 7116.84 | 699.7496 | |
| | | 已婚 | 6984.27 | 686.7149 | |
| 30-34 岁 | 男 | 离异或丧偶 | 9426.17 | 922.0244 | 3100-3200 |
| | | 未婚 | 8058.60 | 788.2551 | |
| | | 已婚 | 8995.95 | 879.9423 | |
| | 女 | 离异或丧偶 | 6453.53 | 631.2545 | |
| | | 未婚 | 7581.67 | 741.604 | |
| | | 已婚 | 7183.35 | 702.6421 | |
| 35-39 岁 | 男 | 离异或丧偶 | 5465.91 | 601.2501 | 3700-3800 |
| | | 未婚 | 7376.93 | 811.4623 | |
| | | 已婚 | 9005.45 | 990.5995 | |
| | 女 | 离异或丧偶 | 7511.22 | 826.2342 | |
| | | 未婚 | 6973.43 | 767.0773 | |
| | | 已婚 | 7492.79 | 824.2069 | |
| 40-44 岁 | 男 | 离异或丧偶 | 9789.37 | 1162.977 | 4100-4200 |
| | | 未婚 | 8846.23 | 1050.932 | |
| | | 已婚 | 9147.05 | 1086.67 | |
| | 女 | 离异或丧偶 | 7849.21 | 932.4861 | |
| | | 未婚 | 5886.18 | 699.2782 | |

[8] 住院率按照图 1 中某公司 A 的住院率假设，安全附加假设为 10%，费用率假设为 35%。

| | | | | | |
|---|---|---|---|---|---|
| | | 已婚 | 7758.74 | 921.7383 | |
| 45-49 岁 | 男 | 离异或丧偶 | 8024.34 | 942.4279 | 4800-4900 |
| | | 未婚 | 7927.00 | 930.9957 | |
| | | 已婚 | 9336.09 | 1096.488 | |
| | 女 | 离异或丧偶 | 6401.86 | 751.8738 | |
| | | 未婚 | 4531.74 | 532.2354 | |
| | | 已婚 | 7827.02 | 919.2534 | |
| 50-54 岁 | 男 | 离异或丧偶 | 7330.68 | 1141.33 | 5800-5900 |
| | | 未婚 | 8263.71 | 1286.596 | |
| | | 已婚 | 9419.06 | 1466.475 | |
| | 女 | 离异或丧偶 | 6976.79 | 1086.233 | |
| | | 未婚 | 8076.97 | 1257.522 | |
| | | 已婚 | 8049.00 | 1253.167 | |
| 55-59 岁 | 男 | 离异或丧偶 | 6611.81 | 1057.381 | 6800-6900 |
| | | 未婚 | 8921.60 | 1426.77 | |
| | | 已婚 | 9555.01 | 1528.067 | |
| | 女 | 离异或丧偶 | 6941.09 | 1110.04 | |
| | | 未婚 | 7938.63 | 1269.57 | |
| | | 已婚 | 8365.82 | 1337.888 | |
| 60-64 岁 | 男 | 离异或丧偶 | 7375.28 | 1887.164 | 7800-7900 |
| | | 未婚 | 12104.41 | 3097.239 | |
| | | 已婚 | 9800.58 | 2507.742 | |
| | 女 | 离异或丧偶 | 8263.06 | 2114.326 | |
| | | 未婚 | 7703.11 | 1971.048 | |
| | | 已婚 | 8455.13 | 2163.473 | |
| 65-70 岁 | 男 | 离异或丧偶 | 8227.78 | 2403.271 | — |
| | | 未婚 | 9624.62 | 2811.277 | |
| | | 已婚 | 10004.50 | 2922.237 | |
| | 女 | 离异或丧偶 | 8152.94 | 2381.411 | |
| | | 未婚 | 5164.76 | 1508.587 | |
| | | 已婚 | 8976.59 | 2621.993 | |

我们拿数据中男性已婚人群、女性已婚人群、男性未婚人群和女性未婚人群按年龄和表2做进一步的比较。

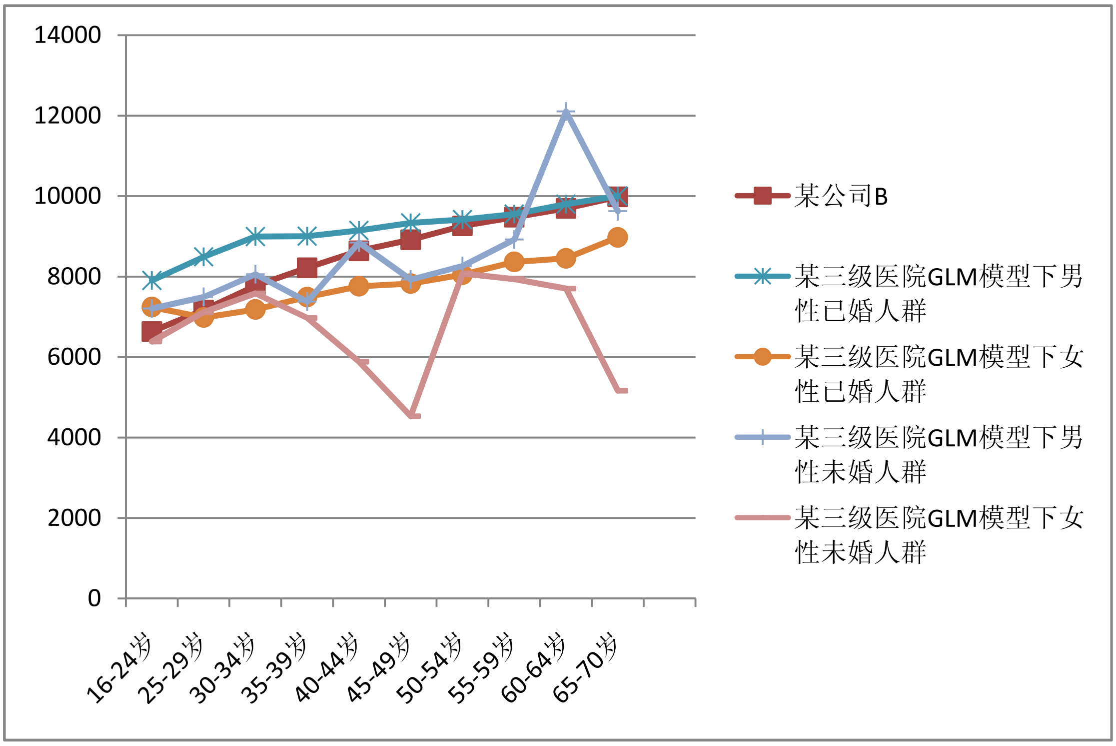



图 4：广义线性模型下各类人群理赔成本比较

以某公司 B 的同类保险计划的理赔成本为比较对象，显然，无论是已婚还是未婚，女性人群的理赔成本都低于某公司 B 的理赔成本。而男性非婚人群除了个别年龄段外，也普遍低于公司 B 的假设。只有男性已婚人群的理赔成本高于公司 B 的假设。

此外，上述模型仅建立在三级医院的数据基础上，而一般保险公司的医疗保险产品的补偿规定为二级以及以上医院。通常来讲，二级医院的住院医疗费用要低于三级医院的住院医疗费用。因此，在做更细致的人群细分后，目前补偿型住院医疗保险产品在大部分人群中有较大的降价空间。

比如，某公司通常的一款保险金额在 20 万元费用补偿型住院医疗保险产品（25-40 岁）的费率大概在 1500 元—2500 元之间。而利用表 8 的理赔成本假设，类似保险计划下 25—40 岁的未婚女性的费率不过超过 1000 元左右。当然这还要根据更细致的保险条款。此处，表 8 中市场费率过高的原因在于它还补偿了 70％的住院前后的门诊费用以及规定了自己的网络医院（包括一些私立医院）。但是即便如此，市场费率也是过高了。

我们知道，目前商业医疗保险一般不承保 65 岁以上的老年人群，即使承保也假设了很高的理赔成本，比如表 2 中某再保公司 A 对 65-70 岁的被保险人假设了 14000 以上的理赔成本。但是从表 4、表 5、表 8、图 3 和图 4 中我们看到，并不是老年人群的理赔成本有突发性的上升，反而在某些情况下有下降的趋势。因此，在合理的成本估计下，完全可以填补 65 岁以上老年人医疗保险的空白。除此之外，在医疗保险中，对于老年人的高风险，可以用风险调节保费补贴的办法，Wynand et al.（2000）论证了保费补贴的办法可以有效地扩大高风险人群健康保险的覆盖。

## 六、结论与建议

本文综合使用了综合医院人群、特定医院人群、社会医疗保险人群以及商业医疗保险人群的住院医疗费用或者住院医疗保险赔付信息

讨论了现行的补偿型住院医疗保险的费率问题，最后在特定医院的住院医疗费用数据基础上，采用 GLM 模型做了实证分析。结果显示：

（1）目前商业医疗保险的费率结构普遍简单，通常除了考虑年龄和性别风险因素外，还需要考虑婚姻状况、职业、病人来源、地区等其他风险因素。如果仅简单地考虑年龄和性别风险因素作为基础费率，会导致费率的不公平性。正如孟生旺（2008）认为我国交强险费率结构由于没有考虑地区因素，而导致西部地区的交强险保费补贴了东部地区的交强险保费。

（2）在住院医疗保险的费率厘定的几个假设中，最重要的是住院率和理赔成本的假设。撇开住院率的假设，各类人群下的理赔成本假设差别很大，即使同在商业医疗保险行业内，类似产品的理赔成本的假设也存在较大差异。而事实上理赔成本除了跟保险方案和计划有密切关系外，总是存在这一个合理的必须的真实的成本。保险公司的理赔成本存在太保守的问题，太高的理赔成本假设必然导致过高的保费，这样会导致商业医疗保险在我国医疗保障体系中的补充地位名存实亡。

（3）对理赔成本假设，除了年龄和性别风险因子外，再加上婚姻状况这个风险因素，结果表明能显著地降低部分人群的住院医疗保险的保费。而且老年人群医疗保险的保费也并不会存在突发性的需要提高的问题。

（4）本文以一个较常见的保险计划为例，大致估算出各人群的住院医疗保险保费大致在 500 元－2000 元这个区间范围内，详细见表 8。而市场上类似的保险产品（可能在保障范围和服务上略全面）都在 2000 元－8000 元之间。可见目前商业的住院医疗保险普遍存在较大的降价的空间。换一个角度来讲，保险公司可能需要进一步考虑是追求小部分的高端人群还是适当降低保险费（势必造成某些服务和保障程度的降低）来满足大部分人群的旺盛的医疗保险的需求。

本文讨论现行的医疗保险费率是否合理，以及揭示医疗保险的真实的理赔成本，对健康保险的经营和费率监管，以及对社会医疗保险的筹资的合理水平提供一些建议：（1）健康保险的经营在考虑小部分高端人群的医疗保险需求外，可以适当考虑降低保费来满足更多人群的医疗保险的需求，从而可以更好地发挥商业医疗保险在我国医疗保障体系中的作用。（2）对于保险监管者而言，目前商业医疗保险的费率结构有待于进一步的完善，需要考虑地区因子在内的更细化的风险因子。此外，医疗保险是一种特殊的保险产品，如果费率结构不合理或者费率过高，将影响投保人对医疗服务使用的公平性。监管者有责任和义务引导保险公司在社会责任方面发挥更大的作用。除此之外，（3）对于社会医疗保险来讲，保障方案对所有人群都是一致的，但必须坚持收支平衡的基本原则，这样合理常规必须的医疗保险赔付水平更是一个必须严格把握的指标。

参考文献

[1]. 胡洎（2011）.商业健康保险发展问题调研.华北金融，2011 年第 2 期：42-45
[2]. 梁涛主编（2010）.2009 中国人身保险市场监管与发展报告.中国财政经济出版社
[3]. 李玉泉（2011）.健康保险单独监管问题研究.保险研究，2011 年第 9 期：26-30
[4]. 孟生旺（2008）. 交强险的经营结果与费率结构分析. 统计研究，2008 年第 4 期：66-71
[5]. 莫红琴，王萍（2006）.我国商业健康保险发展研究.保险职业学院学报，2006 年第 3 期：27-28
[6]. 阎建军，王治超（2009）. 财产保险费率市场化的生成机制研究. 保险研究，2009 年第 4 期：34-40
[7]. 中国保险行业协会（2010）.中国健康保险发展报告.中国财政经济出版社
[8]. 周县华（2010）. 我国交通事故强制责任保险定价研究. 统计研究，2010 年第 5 期：81-86
[9]. Lindsey, J. K. (1997). *Applying Generalized Linear Models*. Springer
[10]. Thomas C. Buchmueller, Paul J.

Feldstein(1997). The Effect of Price on Switching among Health Plans. Journal of Health Economics 16(1997):231-247

[11]. Word Health Organization(2010).Health System financing: The Path to Universal Coverage. The Word Health Report.

[12]. Wynand P.M.M. van de Ven , Rene´ C.J.A. van Vliet, Frederik T. Schut, Erik M. van Barneveld(2000). Access to Coverage for High-risks in a Competitive Individual Health Insurance Market: via Premium Rate Restrictions or Risk-adjusted Premium Subsidies? Journal of Health Economics 19(2000)：311–33

# 我国补偿型住院医疗保险费率研究

## －基于理赔成本假设的分析

仇春涓[1] 陈滔[2]

1．华东师范大学金融与统计学院，金融与风险管理研究中心，上海，200241

2．西南财经大学保险学院，成都，611130

**摘要：**我国医疗保险市场存在有效供给不足的问题，其主要的原因在于医疗保险保费是否合理的问题以及消费者对于医疗保险定价背后的精算假设的不了解。本文利用四类人群（综合医院人群、特定医院人群、社会医疗保险人群以及商业医疗保险人群）对补偿型住院医疗保险背后的关键假设之一－理赔成本做了详细的比较分析。最后用广义线性模型进行了实证,结果显示目前商业住院医疗保险费结构普遍过于简单，并且存在一定的调整空间。建议商业医疗保险可以进一步优化费率结构，适当降低保费满足更多人群的医疗保险的需求，进而能更好地发挥在我国医疗保险体系中的补充作用。

**关键词：**住院医疗保险；理赔成本；保险费率

# Study on the Rising Path of China's Rural Residents' Life Insurance Demand

LI Jiaming

Anhui University of Finance and Economics

**摘要：**人寿保险业开始在全国范围内农村地区的发展要追溯到 1994 年，由于寿险业在农村地区的发展尚处在初级阶段，农村地区的寿险发展水平与城市相比还存在较大差距，如何有效提升我国农村居民对寿险的需求成为当前发展的一个亟待解决的问题。因此，选择对提升农村居民寿险需求具有重要影响的因素，对于增加农村居民寿险需求具有重要的理论和现实意义。

**关键词：**寿险需求，农村寿险市场，寿险保费

## 一、我国农村寿险市场发展情况的思考

### （一）我国农村寿险市场现状解析

目前我国寿险服务主要集中在县级以上的地市和省会城市，虽然保险深度和保险密度呈现逐年上升的态势（见表 1），但由于我国农村地区经济还较为落后，寿险在农村地区的覆盖率较低，寿险的保障作用还未充分被农村居民所利用。我国是一个农业大国，13 亿人口中有 9 亿在农村，在农村地区发展寿险意义重大。自党的十六届五中全会以来，党中央一直坚持将“三农”问题列为中央一号文件予以执行，并陆续出台了一系列支农惠农政策，加快农村各项事业的快速发展。

**表 1：2004～2009 年我国保险深度和保险密度表**

| 年度 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| 保险深度（%） | 2.7 | 2.7 | 2.6 | 2.6 | 3.1 | 3.3 |
| 保险密度（元/人） | 332 | 377 | 429 | 533 | 737 | 834 |

**资料来源：中国统计年鉴**

据国家统计局的调查显示，2009 年我国农村居民人均纯收入达到 5153 元（见表 2），再次实现了连续多年的正增长，农村居民具备了购买保险的经济基础。寿险想要在中国市场站稳脚跟，最根本的是要打开广阔的农村市场，让 9 亿农民参与寿险、受益于寿险，才能让他们乐意接受寿险。但就目前寿险的发展情况来看，我国农村地区寿险市场的发育程度仍然较低。

**表 2：2004～2009 年我国农村居民收入情况表**

| 年份 | 人均收入（元） | 人均收入增长率(%) |
|---|---|---|
| 2004 | 2936 | 12.00 |
| 2005 | 3255 | 10.12 |
| 2006 | 3587 | 10.20 |
| 2007 | 4140 | 13.36 |
| 2008 | 4760 | 14.98 |
| 2009 | 5153 | 8.20 |

**资料来源：中国统计年鉴**

然而我国农村市场对寿险存在巨大的潜在市场需求。首先，我国是世界上自然

灾害频发的国家之一，自然灾害给农村居民的生产生活带来了严重影响，农村居民渴望通过商业保险的手段转移风险。其次，我国农村居民已经进入老龄化阶段，广大农村地区的老年人依靠“家庭养老”的方式受到了严峻挑战。据统计显示，2015 年我国的老年人口将突破 2 亿，而到了 2040 年将达到 4 亿[①]。面对农村人口老龄化问题，我国政府在农村养老保障体系的构建中发挥的作用很有限，所以就需要商业寿险在这个方面发挥更多的作用。再次，随着近年来外出打工人数的增加，影响外出务工人员的人身安全问题也越来越多，一旦农民工丧失了劳动能力，他会给他的家庭的正常生活带来巨大影响。因此，农民工需要寿险来保障自身的人身安全，同时这也为他的家庭提供了必要的生活保障。

## （二）制约我国农村寿险市场发展的问题分析

虽然我国寿险公司在农村寿险市场的发展已经初步取得了一定的成果，但由于农村寿险市场的开发尚处于探索阶段，在开发市场的过程中难免会存在一些问题，分析和解决好这一系列问题才能更有效地促进寿险在农村市场的健康发展。

**1．从农村居民的角度来看**

**（1）我国农村居民保险意识有待加强**

由于我国大多数农村居民所受教育水平较低，截止 2009 年在我国农村居民中大专及以上水平的农村居民仅占总人口数 2.1%，较低的文化水平使得农民对于风险没有充分的认识，对于风险的处理方式主要是储蓄，农村居民愿意并且习惯用储蓄的方式来应付未来不确定事件的发生（见表 3）。而且由于保险公司在农村地区的宣传力度有限，广大农民对于寿险缺乏认识和了解，从而对于寿险产品望而却步。

①世界银行 2005 年的研究报告

**表 3 ：2004～2009 年全国人均储蓄存款表**

| 年份 | 全国人均储蓄（元） | 城镇人均储蓄（元） | 农村人均储蓄（元） |
|---|---|---|---|
| 2004 | 9197 | 18193 | 2743 |
| 2005 | 10784 | 20719 | 3298 |
| 2006 | 12297 | 18016 | 3908 |
| 2007 | 13051 | 23482 | 4539 |
| 2008 | 16407 | 28996 | 5808 |
| 2009 | 19548 | 34002 | 6911 |

资料来源：中国统计年鉴

**（2）农民收入水平与城镇相比较低**

尽管 2009 年我国农村居民的人均纯收入已达到 5153 元增长了 8.2%的，但相比于我国城镇居民（见图 1），农村居民的收入水平还较低。与城镇居民较大的收入差距导致农村居民将把收入的大部分投入到子女教育的投资中，导致投入保险的资金有限。

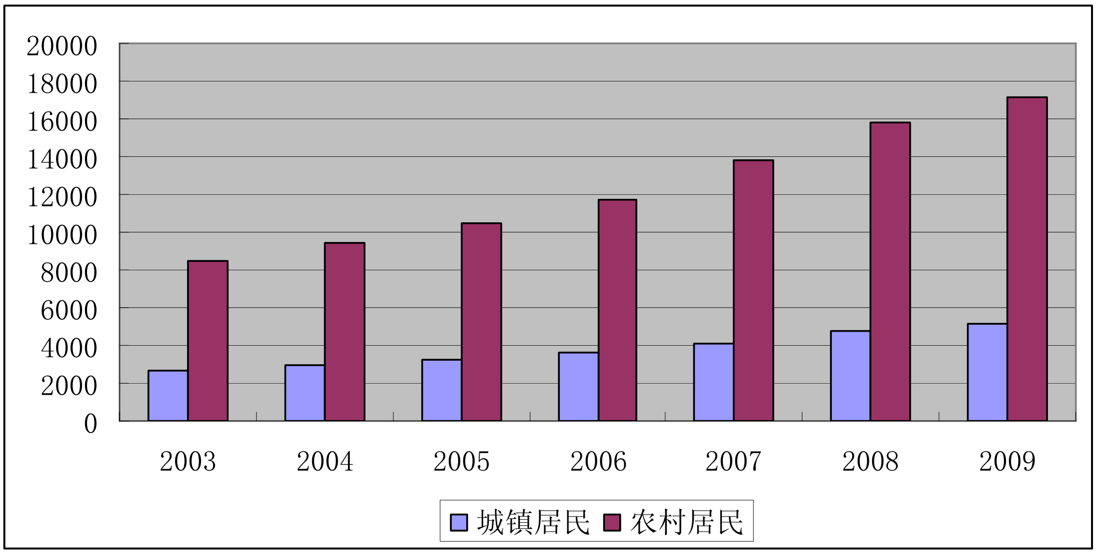



**图 1：2003～2009 年我国农村居民与城镇居民收入对比图（单位：元）**

资料来源：中国统计年鉴

**（3）我国广大农村自然环境较差**

在我国广大农村地区，由于经济落后、较差的交通和通讯条件导致寿险公司展业成本较高。而且农村居民的居住较分散，给销售人员与保户之间的交流带来很大的不便，不利于寿险产品在农村地区的销售和持续性管理。

总之，在我国农村地区推广寿险对农民来说具有重要的实际意义，并且现阶段我国农村地区已具备发展寿险的客观条件，但由于当前我国农村市场中寿险并没有得到充分的开发，对于巨大的市场潜力我们需要进一步发掘农村居民潜在的寿险需求，促进寿险在广大

农村地区的发展。

**2．从寿险公司的角度来看**

**（1）寿险产品价格超出多数农村居民的购买力**

合理的保险产品的价格应该是根据不同地域、不同消费者需要保障风险的程度、生活水平以及保险公司的运营成本来核算的。然而现阶段在我国农村地区销售的寿险产品，并不是根据农村地区风险的具体状况和农民收入低且不稳定的特点来设计的，保费额和缴费期限都超出了农民能够承受的范围。农村和城市收入水平悬殊较大，在这两个收入水平不同的地方销售相同的寿险产品，对于农村居民来说已经大大超出了他们所能够承受的范围。

**（2）寿险产品品种单一**

目前，我国寿险公司在农村地区推广的寿险产品大都是从城市寿险公司中照搬过来的，再从中挑选出较为低端的产品。这些产品本身就是针对城市居民设计的，不能符合农村居民的实际需求。由于在农村地区销售的保险产品品种相当有限，寿险的险种销售主要集中在储蓄型险种，寿险公司向农村地区销售的寿险品种和规模远远不能满足农村居民对于分散风险的需要。

## 二、开发我国农村寿险市场效果分析

### （一）我国农村寿险市场开发的宏观效果分析

**1．开发农村寿险市场可以解决就业**

寿险的开发有利于提高我国农村地区的就业水平，首先，寿险的销售会给公司带来资本投入量的增加，从而会带来更多的就业机会；其次，寿险在农村地区设立机构必定需要一支庞大的管理和销售队伍，这就给农村居民的就业带来机遇。随着寿险在我国农村地区的深入发展，会有越来越多的农民加入到寿险的销售和管理中来；寿险公司良好的培训体系会提高从业人员的素质，从全方位提高从业人员沟通和解决问题的能力，从而加快寿险在农村地区的推广，实现寿险销售和解决就业问题的双赢。

**2．开发农村寿险市场可以拉动消费**

在经济发展的过程中，由于农村居民对于未来收入和支出的不确定性增加，金融市场中存在着农民储蓄率居高不下的状况，农村金融市场发育不良。面对农村巨大的购买力，在农村地区推广寿险，让寿险分散风险的功能充分发挥，从而提高农村居民对寿险的边际消费倾向。一旦农村居民对于未来损失的不确定性有所降低，农村的消费水平就能得到提高，整个消费市场的现状会得到很大转变。

### （二）我国农村寿险市场开发的中观效果分析

**1．开发农村寿险市场有助于补充和完善农村金融体系**

一个完善的金融体系可以给国家、企业和居民带来不同的投融资渠道，从而促进经济社会的协调发展。经济学的

理性经济人假设说明在金融活动中，不同的金融主体所选择的金融机构和金融工具会有所差异。因此，为了提高我国的金融水平促进储蓄向投资的转化，就需要有多元化的投资渠道供投资者选择。从我国目前农村金融市场的发展状况来看，传统的银行机构以及存贷款业务占据了农村金融市场的主体，寿险业在中国农村的发展较为缓慢。人寿保险是保险业务的重要组成部分，提升农村居民对于寿险的需求，是补充我国农村金融体系、促进金融工具多样化的一个重要方面。

**2．开发农村寿险市场有助于实现保险业的可持续发展**

随着我国加入 WTO，国内的金融机构开始受到外资银行以及保险公司的强烈竞争。为了更有利地抢占国内市场，外资保险公司在国内城市展开了大规模的价格和服务竞争。面对这一严峻的发展态势，国内的寿险公司开始将眼光转到农村市场，开发和培育农村市场成为寿险公司与外资保险公司竞争的又一法宝。为了积极推动农村寿险业的发展，寿险公司需要坚持保障适度、保费低廉、覆盖宽广、农民购买方便的原则，开发适合农民需要的寿险产品，这对于应对外资保险公司的竞争、促进保险业和谐发展有着至关重要的作用。

### （三）我国农村寿险市场开发的微观效果分析

**1．开发农村寿险市场有助于农村家庭经济平稳过渡**

虽然我国农村居民的收入水平呈现出逐年增加的态势，但是相比城镇居民还有较大的差距，并且随着农村家庭结构的小型化和人均土地量的逐年减少，越来越多的农村居民选择进城务工。进城务工的农村居民收入水平可能有所提高，但是承担的风险也较大，一旦发生意外会给农村家庭带来更大的打击。寿险的出现可以解决目前我国农村家庭保障程度低的现状，它能承担农村家庭可能遭遇的风险，在家庭中的主要收入者发生意外或遭遇特定的保险事故时，给承保的农户以补偿，帮助他们度过风险避免他们的生活陷入困境。

**2．开发农村寿险市场给农民带来安全稳定的收益**

随着农民人均年收入的逐年增加，越来越多的农民开始选择储蓄之外的投资理财产品，寿险产品的出现给农村居民多了一种选择方式。由于寿险公司会对长期寿险的投保人缴纳的保险费计息，在期满时给付的保险金额会大大高于投保人所缴纳的保费，并且寿险的无风险、收益安全稳定的性能能够在保障农民资金安全的同时带来收益，使得越来越多的农民开始接受寿险作为一种理财投资的手段。并且寿险保单可以作为个人金融资产向寿险公司抵押贷款，可以有效解决目前我国农村居民融资难的局面。

## 三、我国农村居民寿险需求影响因素的计量分析

在保险学中，衡量农村地区寿险需求的主要指标有寿险保费收入、保险深

度和保险密度等，我们将选用 2000 到 2009 年农村居民寿险的保费收入(PI)来衡量农村居民的寿险需求。

本文实证模型的建立所要运用的有关数据（见表 4）主要来源于《中国统计年鉴》、《中国保险年鉴》、中国资讯行数据库以及中国保险业监督管理委员会网站上的统计数据信息

。

**表 4：计量分析所需要的基本变量表**

| 年份 | 保费（亿元） | 农民人均年收入（元） | 农民储蓄余额（元） | 农村人口（万人） | 高中以上比例（%） | CPI（上年为100） | 少年抚养比(%) | 老年抚养比(%) |
|---|---|---|---|---|---|---|---|---|
| 2000 | 479.9 | 2253.4 | 1530.2 | 80837 | 9.3 | 0.4 | 38.06 | 9.27 |
| 2001 | 633.2 | 2366.4 | 1737.2 | 79563 | 9.7 | 0.7 | 36.65 | 10.07 |
| 2002 | 909.2 | 2475.6 | 1967.5 | 78241 | 9.8 | -0.8 | 34.3 | 10.61 |
| 2003 | 1201.39 | 2622.2 | 2363.8 | 76851 | 9.7 | 1.2 | 32.61 | 10.65 |
| 2004 | 1332.11 | 2936.4 | 2743.2 | 75705 | 10.1 | 3.9 | 30.42 | 10.71 |
| 2005 | 1478.9 | 3254.9 | 3298.4 | 74544 | 10.3 | 1.8 | 30.71 | 11.96 |
| 2006 | 1514.9 | 3587.0 | 3908.4 | 73742 | 10.5 | 1.5 | 30.2 | 11.88 |
| 2007 | 1930.7 | 4140.4 | 4539.8 | 72750 | 11.0 | 4.8 | 28.67 | 11.97 |
| 2008 | 3083.8 | 4760.6 | 5808.4 | 72135 | 11.4 | 5.9 | 27.95 | 12.13 |
| 2009 | 3455.4 | 5153.2 | 6911.3 | 71288 | 11.7 | -0.7 | 26.79 | 12.3 |

资料来源：中国统计年鉴和中国保险年鉴数据的汇总

## （一）最小二乘法估价

根据上述数据我们对 PI、PC、DC 和 RP 取对数这样可以在一定程度上消除它们间的异方差，$\varepsilon_t$ 表示残差，得出最小二乘法的模型为：

$$\text{LNPI}= C+\beta_1 \text{LNPC} +\beta_2 \text{LNDC} +\beta_3 \text{RP} +\beta_4 H +\beta_5 \text{CPI} +\beta_6 Y+\beta_7 A +\varepsilon_t \quad (3\text{-}1)$$

运用 Eviews 软件得到以下最小二乘法的输出结果（见表 5），出来 LNDC 通过了变量的显著性检验以外，其他的解释变量均没有通过，说明得出的最小二乘模型需要进一步的改进。

**表 5：最小二乘法输出结果**

| 变量 | 系数 | 标准差 r | t 统计量 | 显著性水平 |
|---|---|---|---|---|
| C | -38.34436 | 35.34989 | -1.084709 | 0.3914 |
| LNPC | -3.220646 | 3.431612 | -0.938523 | 0.4470 |
| LNDC | 3.994463 | 1.860616 | 2.146849 | 0.1649 |
| RP | 0.000548 | 0.000324 | 1.688617 | 0.2334 |
| H | 0.154285 | 0.530100 | 0.291048 | 0.7984 |
| CPI | 0.030616 | 0.024994 | 1.224957 | 0.3453 |
| Y | -0.225438 | 0.137358 | -1.641240 | 0.2424 |
| A | 0.319182 | 0.272783 | 1.170095 | 0.3625 |
| 拟合优度 | 0.994158 | F 统计值 | | 48.62413 |
| 调和拟合优度 | 0.973713 | DW 值 | | 2.154703 |

## （二）时间序列的平稳性分析

首先，为了防止虚假的结果产生虚假回归，我们需要对时间序列数据的平稳性进行检验，本文采用 Dickey-Fuller（ADF）检验，检验方程如下：

$$\Delta Y_t = a + b_t + (c-1)\, Y_{t-1} + \sum_{i=1}^{n} X_i Y_{t-1} + \mu_t \qquad (3\text{-}2)$$

上面的式中，a、b、c 为参数，$\mu_t$ 是随机误差项，它服从独立同分布的白噪声过程，方程的原假设为 $Y_t$ 有一个单位根，即非平稳。本文将采用麦金农临界值，在方程残差不相关的前提下同时运用 SC 准则和 AIC 准则来当作最佳时滞的标准，当这两个值达到最小滞后长度就是最佳长度，检验结果见下表（见表 6）。

**表 6：实证分析变量的单位根检验结果①**

| 变量 | 检验形式 (I,T,P) | ADF 值 | 临界值 | 是否平稳 |
|---|---|---|---|---|
| LNPI | (I,T,1) | -3.60 | -3.54** | 是 |
| LNPC | (I,T,2) | -3.91 | -3.63** | 是 |
| LNDCCI | (N,N,1) | 3.67 | -2.96 | 否 |
| △LNDCCI | (I,T,0) | -4.88 | -4.20* | 是 |
| RP | (I,N,0) | -3.63 | -3.27* | 是 |
| LNHSER | (N,N,1) | 2.12 | -2.97 | 否 |
| △LNHSER | (I,T,1) | -10.89 | -6.13 | 是 |
| LNCPI | (I,T,1) | -5.99 | -5.75 | 是 |
| LNYDR | (N,N,0) | -4.79 | -2.91 | 是 |
| LNADR | (I,N,1) | -2.13 | -4.46 | 否 |
| △LNADR | (N,N,0) | -2.58 | -1.99* | 是 |

通过单位根检验，我们可以看出 LNPI 和 LNPC 在 10%的显著性水平下通过检验，RP 通过了 5%显著性水平下的检验，LNCPI 和 LNYDR 在 1%的显著性水平下通过了检验，这些变量都是平稳的变量为 I(0)。剩下的变量都没有通过 10%显著性水平下的检验，运用一阶差分 LNDCCI、LNHSER 和 LNADR 分别在 1%和 5%的显著性水平下拒绝了单位根的假设，这些变量为 I(1)。

## （三）时间序列模型

改写原时间序列模型：

$$\text{LNPI}= C+\beta_1\,\text{LNPC}+\beta_2\,\text{D(LNDC)}+\beta_3\,\text{RP}+\beta_4\,\text{D(H)}+\beta_5\,\text{CPI}+\beta_6\,\text{Y}+\beta_7\,\text{A}+\varepsilon_t \qquad (3\text{-}3)$$

对上述数据做最小二乘的估计以后，得出以下估计结果（见表 7）。

①表中的 I 表示截距项，T 表示趋势项，P 为滞后阶数，N 为检验方程中对应项不存在。*表示单位根检验的 5%显著水平下的临界值，**表示 10%显著水平下的临界值，而不带*的是 1%显著水平下的临界值。

**表 7:第一次模型改进后的输出结果**

| 变量 | 系数 | 标准差 | t 统计量 | 显著性水平 |
|---|---|---|---|---|
| C | -28.15557 | 8.147813 | -3.455598 | 0.1793 |
| LNPC | 2.255675 | 0.361260 | 6.243910 | 0.1011 |
| D(LNDC) | 1.436197 | 0.832932 | 1.724266 | 0.3346 |
| RP | 0.000298 | 7.83E-05 | 3.804864 | 0.1636 |
| D(H) | -0.439354 | 0.177165 | -2.479911 | 0.2440 |
| CPI | 0.004024 | 0.013598 | 0.295904 | 0.8168 |
| Y | -0.209581 | 0.034194 | -6.129175 | 0.1030 |
| A | 0.104636 | 0.080102 | 1.306286 | 0.4159 |
| 拟合优度 | 0.999521 | F 统计值 | | 298.0817 |
| 调和拟合优度 | 0.996168 | DW 值 | | 3.614495 |

由表 7 可以看出，模型的拟合优度得到了很大的改善，模型中的解释变量除了 CPI 和 Y 都得到了极大的改善，去掉这两个变量得到以下输出结果（见表 8）。

**表 8:第二次模型改进后的输出结果**

| 变量 | 系数 | 标准差 r | t 统计量 | 显著性水平 |
|---|---|---|---|---|
| C | -20.00944 | 3.652533 | -5.478236 | 0.0120 |
| LNPC | 2.059345 | 0.209477 | 9.830887 | 0.0022 |
| D(LNDC) | 1.619866 | 0.425394 | 3.807915 | 0.0318 |
| RP | 0.000211 | 3.49E-05 | 6.061000 | 0.0090 |
| D(H) | -0.413843 | 0.078867 | -5.247356 | 0.0135 |
| A | 0.174243 | 0.020426 | 8.530259 | 0.0034 |
| 拟合优度 | 0.998683 | F 统计值 | | 455.0029 |
| 调和拟合优度 | 0.996488 | DW 值 | | 3.424574 |

由表 8 可以看出模型第二次改进结果中，基本上每个解释变量都通过了显著性检验，因此模型最后确定为：

$$\mathrm{LNPI} = \mathrm{C} + \beta_1 \mathrm{LNPC} + \beta_2 \mathrm{D(LNDC)} + \beta_3 \mathrm{LNRP} + \beta_4 \mathrm{D(H)} + \beta_5 \mathrm{A} + \varepsilon_t \tag{3-4}$$

最后对模型的残差进行单位根检验，考察其是否平稳即可得到 LNPI、LNPC、

LNDC、H和A之间是否存在协整关系（见表9）。结果可以看出-4.3649小于-3.4239，从而拒绝了残差序列有单位根的原假设，故$\varepsilon_t$是平稳的，上述变量之间存在协整关系。因此，我国农村居民寿险需求的模型最终可以确定为：

$$LNPI = -20.0094 + 20.0593\ LNPC + 1.6198\ D(LNDC) + 0.0002\ LNRP - 0.4138\ D(H) + 0.1742\ A \quad (4\text{-}7)$$

**表 9: $\varepsilon_t$ 单位根检验**

| 检验变量 | ADF 统量 | 检验类型 | 临界值 | 显著性水平 |
|---|---|---|---|---|
| $\varepsilon_t$ | -4.3649 | （I，N，1） | -3.4239 | 5% |

## 四、提升我国农村居民寿险需求的路径选择

### （一）促进城乡一体化增加农民收入

本文之所以要将农村居民的寿险需求作为研究对象，主要还是由于农村居民的寿险需求在现阶段和城镇居民之间仍存在较大差距，通过上文的实证分析我们可以看出，加快农村经济的发展、提高农村居民的收入水平是现阶段提升农村居民需求的路径中最重要也是最首要的。因此，要将我国农村地区潜在的寿险需求得到释放的最关键路径，只能依靠经济的发展和农村居民收入的提高。

我国长期以来的城乡二元经济结构把农村居民的寿险需求抑制了，加快城乡一体化进程，实现城乡在政策上的平等、产业发展上的互补、国民待遇上的一致，让农村居民能够享受到与城镇居民同样的文明和实惠，使整个城乡经济社会呈现全面、协调、可持续发展的局面。我们在上文的实证分析中可以得出，储蓄余额的增长对我国农村居民的寿险需求具有促进作用。因此只有当农村居民的收入增加了，他们的储蓄余额也才会进一步增加，从而促进寿险需求的提升。从一定程度上说，农民储蓄余额的增长还是依赖于收入的增加，因此加快城乡一体化建设、增加农民收入，对于这两个因素都有促进作用。只有农民收入增加了，在保证其日常生活不受到影响的基础上，广大农民才会拿出钱来投资到寿险中。

### （二）引导寿险公司合理分布网点

针对农村地区寿险发展相对落后的现状，国家需要寻找有效的途径，鼓励和引导寿险资源在广大农村市场的重新配置，避免寿险公司在沿海发达城市的低水平重复集中，从而造成“恶性竞争”的局面。对于相对偏远的农村地

区，政府可以通过现有的各级农村机构来推广寿险产品，从而降低农村地区销售寿险的成本，另外政府也可以帮助农民负担一部分保费来推动寿险业务在农村的发展。

农村地区寿险公司的数量除了受到国家政策的影响外，还有市场垄断带来的不利影响制约着新兴寿险公司进驻农村地区。要加强寿险公司在农村地区的发展，需要打破寡头垄断的局面，让寿险公司在公平公正的环境下开展竞争，保持各个公司之间产品的差异性、有效防止消费者转而购买其他的投资工具。因此，改变目前寿险公司在农村地区的寡头垄断局面可以刺激各个寿险公司努力开发具有特色的产品，让消费者拥有更多的选择空间，满足他们不同的寿险需求。

### （三）给予寿险在农村发展的政策优惠

1．农民购买寿险的优惠政策

我国的农村居民保险意识淡薄，国家的财力不足以为社会保障体系的建立提供更多的财力支持。当社会保障的滞后问题严重影响到农村社会的稳定和农民生产生活的安全时，也会影响到国家经济的发展。因此，制定鼓励和支持农村居民购买寿险产品的优惠政策，按照购买居民购买寿险产品的数量抵缴或减免个人所得税，国家将以最小的财力支持，借助于民间财力建设，得到完善的社会保障体系的最大社会效益。国家出台优惠的税收政策，鼓励和支持农村居民购买寿险产品，必将为建立完善的农村社会保障体系、提高社会保障程度、促进社会的发展与进步、加速实现全面建设小康社会战略目标的进程产生良好的影响，也必然会提升农村居民的寿险需求。

2．寿险公司在农村地区经营的优惠政策

我国寿险公司进驻农村地区的时间还不长，面对着金融市场上激烈的竞争环境，需要国家给予寿险公司政策上的支持和鼓励，使其在发展的进程中多一分机会。国家制定寿险公司在农村地区发展的优惠税收政策，减免寿险公司在农村地区经营的所得税、营业税，可以在一定程度上降低寿险公司在农村地区的展业成本，将有利于寿险公司在农村地区的发展。优惠的税收政策可以给寿险公司在农村地区经营的高成本带来相应的抵消，从而会使得寿险产品的价格得到优惠，使寿险产品富有价格上的竞争力更易于被农民所接受。

### （四）制定农村寿险发展的统一战略规划

对于战略规划的实施，要合理把握寿险在农村地区的发展节奏。由于现阶段我国农村地区的寿险覆盖面较窄、农民对寿险的认识不充分，任何涉及到寿险公司给农民权益带来伤害的行为，都将会造成农民对寿险的信任危机。又因为农村地区是一个发放程度较低、较封闭的熟人社会，在这里所有的社会行为和心理极易被传染和模仿，若寿险公司一味地追求销售量而不顾及服务质量，就会导致寿险在农村市场的破坏。因

此，寿险在农村地区的发展首先应解决覆盖面不足的问题，再解决竞争不充分的问题，引导已经在服务“三农”方面具有网络和经验的中国人寿、中国平安等先行试点，再将中小型寿险公司逐步打入农村市场，稳步推进、合理有序地推动寿险在农村地区的发展。

## 参考文献

[1] 楚军红．通货膨胀与中国的人寿保险［M］. 北京：北京大学出版社，1998：22-59

[2] 祝向军．保险商品价格形成的经济学分析［M］. 北京：中国金融出版社，2004：39-79

[3] 赵卫亚．计量经济学教程［M］. 上海：上海财经大学出版社，2005：67-163

[4] 易丹辉．数据分析与 Eviews 应用［M］. 北京：中国经济出版社，2005：49-78

[5] 苗复春，林岱仁．县域保险发展研究报告［M］. 北京：中国财政经济出版社，2006：29-59

[6] 徐美芳．中国寿险需求决定因素研究［M］. 上海：上海社会科学院出版社，2006：43-55

[7] 高铁梅．计量经济分析方法与建模［M］. 北京：清华大学出版社，2007：33-109

[8] 刘珺．中国农村人身保险市场开发研究［M］. 北京：经济科学出版社, 2007：185-206

[9] 魏华林，李金辉．人寿保险需求［M］. 北京：中国财政经济出版社，2009：318-346

[10] 于少晶．山东省寿险需求的实证分析［D］. 山东大学，2005：44-50

# 中国农村居民寿险需求提升的路径研究

李加明
安徽财经大学保险系 蚌埠市 233041

作者信息：

李加明

安徽财经大学保险系主任、保险专业硕士中心主任

保险学硕士生导师;中国保险学会理事；安徽保险学会常务理事

0552-3112946；13004073567;lijiamingdoudou@sohu.com

# The Study on the Impact of Inflation on Profitability of Property Insurance Companies in China Insurance

LI Bomeng

College of Economics, Beijing Technology and Business University, Beijing, China, 100048

**Abstract:** As a kind of inevitable economic phenomenon, inflation has a certain impact on the development of the financial industry. Insurance as the pillar of the financial industry, also be affected by inflation in many aspects. For property insurance, inflation will bring higher claims costs and uncertainty of business. Thus, reduce the profits of company. For the relationship between inflation and the profits of property insurance companies, this paper uses The DuPont System to measure the profits of property insurance companies and The Distributed Lag Model to research their relationship. At last, we put forward policy recommendations on how to strengthen the profitability of insurance company on the sight of government and company.
**Keywords:** inflation; property insurance company; profits; The DuPont System; The Distributed Lag Model

## Ⅰ.引言

自各国采用纸币作为统一货币以来，通货膨胀也成为一种常见的经济现象。近几年来，由于各国推行量化宽松货币政策，全球大宗商品价格仍将面临新一轮上涨，从而导致输入型通货膨胀压力的增加。而且目前的经济形势并非乐观，欧债危机对世界经济的影响，人民币几度面临升值压力，中国贸易顺差额的减少，都给我国财产保险业务的发展带来了种种风险。虽然 2012 年物价指数会有所下降，但通货膨胀对保险业来说，依然是一长期的风险与挑战。

我国的通货膨胀，并不仅限于输入型通货膨胀或结构性通货膨胀的阶段，而是具有全面通货膨胀的属性。通货膨胀对保险业的影响比较复杂，主要体现在对保险业投资、利润、结构等微观方面，以及对宏观保险市场总体影响的综合结果。通货膨胀是保险公司面临的一项重大风险，会给它带来盈利的不确定性，如果能够找到通货膨胀与财产保险公司盈利的关系，对“十二五”规划期间财产保险业的发展会有一定的指引作用。

本文通过运用杜邦分析体系来衡量我国财产保险公司的盈利水平，主要通过股本回报率（ROE）来体现，并通过分布滞后模型研究通货膨胀率和股本回报率两者的关系，并试图建立通货膨胀与我国财产保险公司盈利能力的关系，得出相应结论，从而为财产保险公司提供应对通货膨胀风险的依据。

## Ⅱ. 通货膨胀对财产保险公司盈利影响的基本理论分析

财险公司的利润来源可以分为两大部分：一是承保利润，二是投资收益。承保利润体现为保费收入与费用之间的差值，投资收益是指财险公司对外投资所取得利润、股利、债券利息等收入减去投资损失后的净收益。

### A.通货膨胀对财产保险公司承保利润的影响

通胀对保费需求的影响主要基于以下三个效应：价格效应、收入效应和替代效应。

当发生通胀时，财产保险产品的名义价格上涨，财产保险产品作为正常商品，其价格与需求呈负相关关系，所以价格效应会导致其需求下降。通胀时期，由于物价的上涨使得消费者可支配收入减少，从而对财产保险产品需求的收入也相对减少，由于收入与需求呈正相关，收入效应也会导致对财产保险产品的需求减少。通胀使得财产保险产品名义价格上涨，会引起保险产品与其他金融产品的相对价格发生变化，趋利性会使得人们选择价格相对较低的产品。则替代效应使得人们的财产保险需求降低。

从对理赔的影响来说，通胀会带来更高的理赔成本，其影响程度取决于具体险种费率调整的灵活程度，费率调整越迅速，通胀所带来索赔成本的上涨也越少。另外，管理费用在通胀期也会上升，对于一些固定保费的长期保单而言，实际管理费用将超过假设的费用。与此同时，按通胀调整产品的索赔和给付将增

加，而这些保单因为有较高的抵御通胀的价值，其解约率较低[1]。

综上，通胀带来的需求减少和理赔成本及费用的增加势必会削弱影响财险公司的承保利润。

## B. 通货膨胀对财产保险公司投资收益的影响

投资收益主要来源于财产保险公司把资本投入社会再生产过程所获得的纯收益。由于保险投资在我国受到严格的监管，保险公司只能将保险资金投资在存款、债券、股票、基金、债权投资计划等渠道。由于财险与寿险资产负债情况有很大区别，所以在投资工具的选择上也不尽相同。财险公司对流动性要求较高，而寿险公司更看重投资回报率[2]。在股票的配置比例上，两者有很大区别，但对于银行存款和债权来说，都作为财险公司和寿险公司的主要投资工具。考虑到数据披露等原因，我们以整个保险行业投资收益数据为例进行说明，2010 年保险业的总投资数额达到 4.6 万亿元，其中银行存款投 1.39 万亿元，约占总投资的 30.21%，收益率达到 3.19%；债券投资 2.3 万亿元，约占总投资的 49.85%，收益率达到 4.48%；证券投资基金投资 0.26 万亿元，约占总投资的 5.69%，收益率达到 10.9%；股票投资 0.51 万亿元，约占总投资的 11.11%，收益率 8.46%。从以上数据可以看到，债券和银行存款构成了保险投资的绝大部分，所以在衡量通货膨胀对保险投资的影响时，最主要的实际上是衡量通货膨胀对债券和银行存款的影响。

当出现通货膨胀时，债券的到期收益率会相应上升，那么财险公司对新投资的债券会获得较高的收益率，而对于已经持有的债券，收益率的上升会带来其市场价格的下跌，形成未实现损失3，但这个损失是有限的。综合来看，通货膨胀对财险公司债券投资的收益率会提高。通货膨胀对于银行存款的影响可以类比对债券的影响，当通货膨胀率升高时，银行存款利率也会随之上调，那么财险公司投资的资产也会出现收益率上升的趋势。

综上，在其他因素不变的情况下，通货膨胀与财险公司的投资收益有着正相关的关系。

# III. 我国财产保险公司盈利现状及面临问题

## A.我国财产保险公司盈利现状

通过对我国财产保险公司利润总额的数据进行比较，可以看到在 2010 年财产保险公司的盈利水平得到了很大改善，实现利润总额 225.59 亿元，同比增加 190.5 亿元，增长 542.9%。2008 年由于金融危机的影响严重，财产保险公司出现了巨额亏损，损失了 83.47 亿元。2006 年利润值也相对较低，为 1.78 亿元。其余年份盈利水平均维持在 30 亿元左右，盈利水平相对稳定。

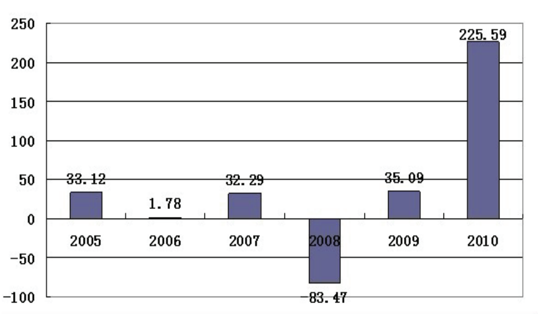



图 1　2005 年—2010 年我国财产保险公司利润总额　单位：亿元

资料来源：保险年鉴

## B. 我国财产保险公司面临问题

尽管近些年来我国财产保险公司得到了很大的发展，但仍然面临很多的矛盾，这些问题严重阻碍了财产保险公司的盈利能力。

**1）承保风险增加**

由于财产保险公司过分注重投资收益，为了增加资本不惜采用“现金流承保”，降低对保险标的风险的审核条件，从而导致了承保风险的增加，带来未来赔付支出数额的增长，不利于财产保险公司业务的稳健经营和利润的增长。

**2）偿付能力不足**

由于财产保险业务其保费制定主要依据财产损失率，而财产损失的发生并没有一定规律性，没有寿险产品费率制定的精确性，而且对于准备金的提取并不规范，往往导致财产保险公司的偿付能力不达标。

**3）投资风险因素增多**

近几年来，保险投资渠道逐步开放，已由存款、债券、基金、股票等传统领域扩大到基础设施、境外市场、未上市股权、不动产等新的领域，保险机构的投资工具增加，交易对手增多，操作方式复杂，风险程度加大，但风险

[1]Sigma 杂志,《通胀对保险公司的影响》,2010,4,第 16 页
[2]王辉,《财险公司资金运用浅析》,《证券保险论坛》,2006,2,第 53 页
[3]李健,《通货膨胀对保险公司资产、负债及经营结果的影响》,《宁夏社会科学》,2010,5(3),第 47 页

意识、控制手段以及风险管理能力却依然存在很多薄弱环节，需要财产保险公司给予高度重视，谨慎对待。

**4）投资管理能力欠缺**

当前，财产保险公司投资最突出的问题不是渠道不多，而是投资管理能力不足。随着新的渠道拓展，行业资金将进入实体经济和国际市场，需要更多的高层次专业投资人才。受线性激励机制、文化理念等因素的制约，财产保险投资的吸引力不强，专业人才不足，一些机构对新的投资领域认识不足，投资能力和风险能力跟不上市场发展需要，需要进一步加强专业化投资队伍的建设，培育资金运用的核心竞争力，增强财产保险公司的风险管控能力，并且要加强资产的监管水平。

# Ⅳ.通货膨胀对财产保险公司盈利影响的实证分析

## A.杜邦分析体系

杜邦分析法是利用各种主要财务比率指标间的内在联系，对企业财务状况及经营成果进行综合、系统分析与评价的方法。

1999年，美国学者巴里·D.史密斯(BarryD.Smith)博士提出，要使用杜邦财务分析体系对财产保险公司的财务绩效进行分析。他根据财产保险公司的经营特点，对杜邦财务分析体系进行了调整。Smith 对传统的ROE 指标进行调整，并给每个比率重新定义，使每个指标都有保险业特殊称谓，推导过程[1]如下：

$$ROE=\frac{(\text{承保净利润}+\text{投资收益})}{\text{保费收入}}\times\frac{\text{保费收入}}{\text{总资产}}\times\frac{\text{总资产}}{\text{所有者权益}} \quad (1)$$

$$ROE=(\frac{\text{承保净利润}}{\text{保费收入}}+\frac{\text{投资收益}}{\text{保费收入}})\times\frac{\text{保费收入}}{\text{所有者权益}} \quad (2)$$

$$ROE=(\frac{\text{承保净利润}}{\text{保费收入}}+\frac{\text{投资收益}}{\text{总资产}}\times\frac{\text{总资产}}{\text{保费收入}})\times\frac{\text{保费收入}}{\text{所有者权益}} \quad (3)$$

$$ROE=[\text{承保净利润}+(\text{投资收益率}\times\text{投资收益系数})]\times\text{肯尼系数} \quad (4)$$

公式（4）中考虑了影响保险业务收益的两个重要指标——承保净利率和投资收益率，更符合保险业务的特点。由于承保利润与投资收益是衡量保险公司的利润来源两项重要指标，投资业务对于保险公司的利润贡献也尤为重要，因为，改进后的杜邦分析方法能够更全面、科学、合理的分析财产保险公司的盈利水平。

## B. 分布滞后模型

在关于时间序列数据的模型中，如果模型除了包含本期自变量外，还包含以往若干期的自变量，这种模型可称为分布滞后模型。

滞后效应是引入分布滞后模型的客观依据。对于自变量的任何变化，因变量都会做出反应，而这种反应往往要经过一段时间后才表现出来，这种现象即为滞后效应。

## C. 变量选取及数据来源

本文目的主要是分析通货膨胀率对财产保险公司盈利的影响分析。作为财产保险公司盈利指标，用整体指标ROE来衡量，由于通货膨胀率是时间序列数据，其对ROE的影响可能会存在滞后效应，所以本文采用分布滞后模型来分析通货膨胀率与ROE间的关系。

通货膨胀率数据来源于中国统计局官方网站，由居民消费物价指数的增长幅度得到同期通货膨胀率的数据。

为了保证数据的连贯性及稳定性，对于财产保险公司 ROE 的计算我们主要选取了 2005 年到 2010 年的数据，且只选取了市场占有率相对较高的财产保险公司[2]的数据进行分析。

## D. 实证结果及分析

**1）实证结果**

通过对我国财产保险公司数据结果进行简单平均后结果如下（表1）。

表 1　我国财产保险公司 2005 年—2010 年盈利指标　单位：%

| 年份 | CPI | 承保收益率 | 投资收益率 | ROE |
|---|---|---|---|---|
| 2005 | 1.80 | 1.63 | 1.10 | 11.99 |
| 2006 | 1.50 | 1.43 | 2.47 | 20.20 |
| 2007 | 4.77 | 3.72 | 6.55 | 54.32 |
| 2008 | 5.86 | -2.15 | 3.49 | 17.29 |
| 2009 | -0.69 | 2.24 | 2.63 | 24.34 |
| 2010 | 3.32 | 5.40 | 2.62 | 38.04 |

结合2005年—2010年的CPI变动数据对财产保险公司ROE进行回归分析，以通货膨胀率作为自变量，ROE作为因变量，采用分布滞后模型进行估计。

[1]王艳,姚寅:《杜邦分析体系视角下我国非寿险业经营绩效评价》,《会计之友》2009,2,第 19 页

[2]人保财产保险、大地、中国信保、太保财产保险、平安财产保险、华泰财产保险、天安保险、大众保险、太平保险

令$y_t=c+\beta_0x_t+\beta_1x_{t-1}+\cdots+\beta_kx_{t-k}+\cdots+u_t$
对$x_t$进行替换，令$z_0=x_t$，$z_1=x_{t-1}$，…，$z_k=x_{t-k}$
$y_t=c+\beta_0z_0+\beta_1z_1+\cdots+\beta_kz_k+\cdots+u_t$

**2）最小二乘法（OLS）检验**

带入不同K值进行OLS估计检验，发现当K=3时检验效果最理想，所得结果如下：

$$\hat{y}_t=52.19069-6.74317x_t-1.16048x_{t-1}-9.65165x_{t-2}+13.60261x_{t-3}$$

se=(10.3279) (-7.8582) (-2.1504) (-8.8748) (13.1168)

R2=99.6414，F=69.45592

整体拟合效果很好，但是Z2的系数没有通过t检验，是由于数据之间的多重共线性引起的，排除引起多重共线性的自变量xt-1后，得到估计模型为：

$$\hat{y}_t=45.24984-6.391289x_t-9.168820x_{t-2}+14.14740x_{t-3}$$

se=(6.93968) (-4.5245) (-5.1382) (8.38931)

R2=97.9828%，F=32.38308。

模型整体及自变量均通过了显著性检验。

通货膨胀与承保收益率的关系结果为：$R^2$=51.8641%，整体显著性并不明显，相关系数为-1.409804，两者呈现很弱的负相关；通货膨胀与投资收益率的关系结果为：$R^2$=48.8227%，整体显著性也不明显，相关系数为0.71188，两者呈现很弱的正相关。

**3）结论**

通货膨胀对我国财产保险公司盈利能力的影响具有滞后性，且滞后阶数K=3。再把CPI和ROE数据分别除以其各自峰值进行处理后，得到两者间的趋势图（如图2），两者大致呈现正相关，但由于数据较少，两者的曲线并不平滑，如果增加数据两者间的关系会更明显。由于CPI对承保收益率和投资收益率的效果是不同的，可以粗略判断CPI对投资收益率的正向影响效应大于对承保收益率的负向效应。

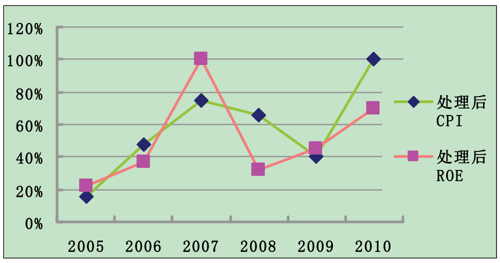



图 2　2005 年-2010 年处理后 CPI 与 ROE 的关系

产生以上结果的原因可能有以下几点：

第一，CPI对财产保险保费需求影响的传导机制复杂。CPI虽然对财产保险保费需求有影响，但是需要通过很多中间环节来间接产生作用。首先通货膨胀影响货币实际购买力，从而影响人们实际生活中购买行为的变化，从而影响到对财产保险产品需求的意识，最终影响保费收入。

第二，投保者心理原因带来的滞后效应[1]。当CPI变动后，一方面，人们由于受到习惯势力的影响，往往不能迅速调整自己的购买行为，另一方面，由于人们对市场行业信息了解的不全面，因而面对CPI的变动发应迟钝，从而导致财产保险公司盈利水平的变动具有滞后性。

第三，财产保险公司决策具有滞后性。面对CPI的变动，财产保险公司经营管理者从意识到问题，制定决策到最终决策产生影响会需要很长一段时间，这就产生了滞后效应。

第四，可支配收入的减少导致保费需求减少。通货膨胀导致的物价上涨，使得人们的可支配收入减少，削弱了货币的实际购买力，财产保险产品作为正常商品，其收入弹性为正值，实际收入的减少导致对财产保险产品的需求下降，从而导致财产保险公司保费收入的减少。

第五，主要资产类别在长期内的投资回报率高于通货膨胀率。长期来看，财产保险公司的投资回报率均高于通货膨胀率（见表2），即便CPI的增长会带来成本的上涨与保费收入的减少，但当投资收益率的涨幅高于两者上涨幅度的话，财产保险公司的整体盈利水平是会随着CPI的增长而增加的。

表 2　1998 年-2009 年主要资产类别的平均回报率和波动程度　单位：%

| 资产类别 | 指标 | 年复合回报率 | 回报率标准偏差 |
|---|---|---|---|
| 通胀 | CPI | 2.4 | 1 |
| 短期国债 | 3个月票据 | 2.9 | 2 |
| 中期国债 | 10年期债券 | 6.0 | 10 |
| 长期国债 | 30年期债券 | 7.4 | 18 |
| 通胀保值国债（TIPS） | 巴克莱TIPS指数 | 6.8 | 6 |
| 美国股票 | 标普500 | 4.2 | 21 |
| 非美国股票 | EAFE | 6.4 | 26 |
| Commodiites | 标普高盛商品指数 | 5.3 | 32 |
| 房地产 | NCREIF地产指数 | 8.5 | 11 |

资料来源:sigma 杂志《通胀对保险业务的影响》,2010,4,第 17 页

## Ⅴ.政策建议

2012 年，整体的经济形势并非很乐观，而且伴随经济的发展 CPI 的上涨依旧是大概率事件[2]。面对通货膨胀给财产保险公司带来的

[1]李宝仁,王琴英,乔云霞:《计量经济学》,机械工业出版社,2008 版,第 126 页
[2]徐雅琴:《论 CPI 对我国产险保费增长的影响》,《保险职

盈利不确定性，财产保险公司需要采取必要的策略控制通货膨胀带来的不利影响。

## A. 从政府层面来说

**1）完善法律法规制度，营造公平竞争环境**

一个良好的市场环境更能促进企业的发展，政府应该从立法层面加强对业务的规范与约束，金融市场的发展与成熟能够促进财产保险公司的良性竞争，淘汰落后的企业，达到资源的合理优化配置。

**2）加强各金融监管当局的协调配合，完善监管信息**

由于我国目前实现混业经营的条件还不具备，在当前情况下实现分业监管自然有它的优势，但未了避免分业监管带来的信息不完善的弊端，我国各金融监管当局应加强配合，对交叉领域实行联合监管，避免重管或监管疏漏。完善的监管机制能够规范财产保险业务，并且有效控制风险，使得财产保险业务得以可持续性发展。

**3）完善对费率调整的监管[1]，保证价格的合理性**

对于责任险业务来说，费率监管也是风险。责任险要求对保险费率进行定期调整，在通货膨胀下降时期对费率进行充分调整，而在通货膨胀上升时期限制了费率充分调整的能力，影响了财产保险公司利润。所以，监管部门要根据工资和价格的变动，加强对费率变动的监管，保证财产保险公司产品的价格合理性。

**4）加强对资金运用的监管，维护保险资产的安全性**

保险资金运用是防范风险的关键领域，由于对投资渠道的放宽，使得财产保险业务的资产配置带来了更大的风险，保监会要加强对不同渠道投资比例的控制，有效防范财产保险业务的投资风险。

**5)加强对偿付能力的监管，确保经营的稳健性**

通货膨胀带来赔款支出的增加，财产保险公司提取的准备金不足导致公司偿付能力的不足。所以，政府要加强对财产保险公司偿付能力的监管。一是通过对再保险比例的严格审核，降低财产保险公司亏损率，二是加强对准备金提取的核算精确性，从而保障业务经营的稳健性。

业学院学报》,2011,4,第25卷

[1] Sigma 杂志:《通胀对保险公司的影响》,2010,4,第9页

## B. 从财产保险公司层面来说

**1）提高对通货膨胀的预测能力**

由于通货膨胀对财产保险公司业务的影响具有滞后性，所以财产保险公司面对 CPI 波动应该提前采取预防措施来合理安排业务的经营，以应对 CPI 波动产生的负面影响。

**2）提升承保风险管理水平**

由于通货膨胀对保费收入带来的负面影响，所以财产保险公司更要严格控制承保标准，对保险标的物的情况进行分析和审核，根据公司的经营状况和承保能力决定是否承保，并做好承保风险的评估，根据风险程度制定合理的费率，为企业承担的风险提供相适应的收益补偿[2]。

**3）提高投资收益能力**

财产保险公司的盈利性对投资收益率非常敏感，投资收益率每升高（或降低）1 个百分点，ROE 就会升高（或降低）大约 2 个百分点[3]。所以财产保险公司要尽量扩大通货膨胀对投资带来的正效应。在通货膨胀时期, 应选择那些与通货膨胀呈正相关、对通货膨胀的敏感性更高的投资工具,如短期国债、通胀保值国债等，以提高整个投资组合带来的收益。并且同时加强投资管理，防范风险。

表 3 1998 年-2009 年资产年度回报率与 CPI 之间的相关性[4]

| 资产类别 | 与CPI的相关度 |
|---|---|
| 短期国债 | 0.64** |
| 通胀保值国债（TIPS） | 0.48 |
| 房地产 | 0.43* |
| 大宗商品 | 0.34* |
| 美国股票 | -0.09 |
| 非美国股票 | -0.1 |
| 中期国债 | -0.31* |
| 长期国债 | -0.39** |

**4）进行财产保险产品创新**

面对通货膨胀，财产保险公司应加强开发抵御通货膨胀的产品。一是从保险金额的制定来说，要考虑到未来通货膨胀的影响，对金额进行合理调整，从而促进投保人的购买欲望，二是从支付方式来说，可以与投保人约定

[2]周苏玉:《我国财险公司经营管理效率现状及对策分析》,《商场现代化》2011,1,第 35 页

[3]Sigma 杂志:《全球非寿险业处于承保能力短缺的时期》,2002,4,第 12 页

[4] Sigma 杂志:《通胀对保险公司的影响》,2010,4,第 17 页

**表示在99%置信度下统计显著，

*表示在95%置信度下统计显著，采用了1979年以来各类资产（房地产数据从1978年开始，通货膨胀保值国债数据从1998年开始）的年度回报率数据来衡量显著性

进行长期性返还，避免财产保险公司由于巨大的赔付支出对业务经营带来的波动性，而且能够增加对资金的占用时间，可以从投资收益来弥补占用投保人资金的利息支出。

**5）合理设定赔付限额**

从索赔发生到进行赔付时间内，保险标的价值会随着 CPI 的上涨而上升，所以在保险产品条款中要设定适当的赔付限额，防止通货膨胀的长期上升带来的赔付金额的过渡增长。

通货膨胀风险只是财产保险公司经营中面临的诸多风险的一种，有效控制通货膨胀风险的关键在于建立健全的保险公司风险管理机制。财产保险公司只有具备了灵敏有效、全面涵盖经营各个环节的风险管理体系，才能及时识别和衡量通货膨胀风险，并从业务发展、产品开发、投资管理等方面进行全面的风险控制。

通货膨胀时期随着会伴随着保险行业低产品价格、高投资比例、短期产品结构及低流动资产比例等不确定因素，但通货膨胀时期也是保险业发展的机遇期，如果能够抓住通货膨胀带来的机遇，合理规划产品的结构，防范通货膨胀带来的不确定性风险，必将使我国财产保险业的发展进入一个新的阶段。

## 致谢

首先，谢谢王绪瑾教授对我论文的指导，在文章数据搜集和写作阶段，王老师都对我予以极大帮助，对王老师的感谢之情我将铭记于心。同时也是谢谢吉彩红老师对我论文的批改，谢谢我们保险专业的每一位老师，她们的教诲给了我莫大的帮助。也要谢谢学长学姐，谢谢张园同学，谢谢我宿舍的朋友们，给了我思维上的灵感，帮助我搜集数据，从我精神上和行动上支持我。

由于我水平能力的局限，论文写作中会有很多不完善之处，恳请各位专家评委批评、指正。

## References

[1]Wang Xujin, Principles of Insurance, Higher Education Press, 2011.
王绪瑾，保险学，高等教育出版社，2011 年。

[2]Zhang Guobiao and Cai Yuan, The Analysis of How to Improve Small and Medium-sized Property Insurance Company’s benefits ,Economic Herald,2012.1.
章国标、蔡源，中小财险公司提高承保效益的途径探析，经济导刊，2012 年第 1 期。

[3]Zhang Quan, The Think about the Risk Management of Insurance Fund Investment,China Collective Economy ,2011,24.
张全，有关保险资金运用风险管理的思考，中国集体经济，2011 年第 24 期。

[4] Swiss Reinsurance Company Ltd, Product Innovation in Non-life Insurance,Sigma,2011,4.
瑞士再保险股份有限公司.非寿险市场产品创新“大”、“小”创新并存，瑞再 Sigma，2011 年第 4 期。

[5]Zhu Xiangjun and Liu Lingling,Analysis of Profitability for Property Insurance Companies in China Insurance, 2010,5.
祝向军，刘玲玲，我国财险公司盈利能力分析，中国保险，2010 年第 5 期。

[6] Wang Xujin, An analysis on the Property Insurance Market in China,Insurance Studies.
王绪瑾，中国财产保险市场分析，保险研究，2009 年第 1 期。

[7]Zhang Li, Xiao Wei, Diao Huimin and Sun Da, Our National Property Insurance Development Situation and Problem Analysis, Economic Research Guide,2007,12.
张丽，肖玮，刁慧敏，孙达.我国财产保险业发展现状与问题分析，经济研究导刊，2007年第12期

# 通货膨胀对我国财产保险公司盈利影响研究

栗博盟

经济学院，北京工商大学，北京，中国，100048

**摘　要：**通货膨胀作为一种必然存在的经济现象，对金融业的发展有着一定的影响。保险业作为金融行业的一个支柱，通货膨胀对也其有着多方面的影响。对于财产保险业务来说，通货膨胀会带来更高的理赔成本和经营的不确定性，从而侵蚀公司盈利。针对通货膨胀与财产保险公司盈利的关系，本文使用杜邦分析体系对财产保险公司盈利指标进行衡量，并运用分布滞后模型研究两者之间的关系，站在政府和公司角度，提出如何加强财产保险公司盈利能力的政策建议。

**关键词：**通货膨胀;财产保险公司;盈利能力;杜邦分析体系;分布滞后模型

# Discussions on Current Situation and Problems of Chinese Commercial Health Insurance under the New Medical System Reform[1]

LIU Xu, JI Caihong
School of Economics, Beijing Technology and Business University, Beijing, China, 100048

Abstract: In recent years, with the acceleration of the pace of the Chinese policies of reform and opening to the outside world, people's living standards increase year by year and the quality of people’s lives has been improved as well. Thus, the concept of "Commercial Health Insurance" gradually incorporates into people's lives. More and more people choose to purchase commercial health insurance to reduce their health risks probability. But as the purchasing rate of commercial health insurance has been increased, problems ensue. Due to the fact that China is still one of the developing countries and commercial health insurance in China started relatively late, the market is not mature. Development status is far behind the developed countries, such as Europe and the U.S, On current development situation of commercial health insurance in China, the equivalent of level of 50-80s of the last century in developed countries such as Europe and the U.S. From international experience, we learn that early in the development of commercial health insurance, governments all over the world will unveil a number of policies to support its development, our country is no exception. On January 2009 Executive meeting of the State Council adopted a project on *Deepening Medical Health System Reform* and *the Implementation of Deepening the Reform of Medical and Health in 2009-2011,* which indicates that a new round of medical care reform project has been officially unveiled. New medical system reform is a indispensable foundation to reach the great goal of the right of access to basic medical health service.

This dissertation discusses the background of implementation of the new medical system reform, involves contents of what opportunities and challenges Chinese commercial health insurance will encounter under the new medical system reform and how to grasp the opportunities as well as to cope with challenges in the medical system reform in such a case. Meanwhile, what we also cannot ignored is that although there are some welcomed advantages in the commercial health insurance in China, several unreasonable problems still exists due to the reason that commercial health insurance in China is still in the early stages of development. Situation of commercial health insurance in China is not optimistic. The dissertation analyses the development of commercial health insurance in China as a clue to its current situation, its advantages, problems one by one. In light of the current status of commercial health insurance in China and the new medical system reform background, offered the prospects of commercial health insurance in China and made a number of commercial health insurance proposals as well

*Keywords:* Opportunities and challenges; Current Situation; Problems; Prospects

[1] This dissertation is sponsored by Undergraduate Project in Science Research of Beijing Technology and Business University (BTBU)

# I. 新医改对我国商业健康险实施的背景

## A. 何为新医改

新医改是中共中央、国务院向社会公布了关于深化医药卫生体制改革的意见。《意见》提出了“有效减轻居民就医费用负担，切实缓解“看病难、看病贵”的近期目标，以及“建立健全覆盖城乡居民的基本医疗卫生制度，为群众提供安全、有效、方便、价廉的医疗卫生服务”的长远目标。

## B. 新医改下对商业健康险的影响

对于商业健康保险来说，其服务的宗旨在于实现“新医改”的基本方针。“十二五”期间，继续促进基本公共卫生服务均等化，同时不断探索有效的保障机制和实施途径，努力实现基本公共卫生服务均等化的制度化、系统化、规范化和标准化是“新医改”的基本要求。

由于商业健康保险业务的特点，通过财务手段集中与分散风险，经过保险所特有的经济或财务安排，使得作为被保险人的患者一旦患病可以通过获得保险金来支付医疗费用。给商业保险提供了便利的同时也创造了和谐的社会环境。

新医改的出台给商业健康险的进步一步发展提供了很好的契机。

## C. 新医改为商业健康险提供的良好契机

### 1）新医改有助于拓展商业健康保险需求空间

众所周知，仅靠政府的提供的社会医疗无法满足人们多样化的医疗保障需求。而且,在现实生活中,每个人的风险意识、经济收入状况、个人偏好等方面都存在差异，因而对医疗卫生服务的要求也将会千差万别。而将有限的公共资源运用到不同的人身上，就会存在明显的边际效用差异，尤其是对医疗保障水平要求保障需求，这就需要商业保险来保障社会医保中没有涵盖或涵盖不充分的项目。

对此，《新医改》也明确提出:“鼓励商业保险机构开发适应不同需要的健康保险产品，简化理赔手续，方便民众，满足多样化的健康需求。鼓励企业和个人通过参加商业保险及多种形式的补充保险解决基本医疗保障之外的需求。”这为更好地发挥商业健康险的作用提供了重要契机。如果商业保险与社会医保协作，创造出差异化的产品和服务，与社会医保互为补充、有效互动，那么社会医保的广泛发展对商业健康险市场不仅不会造成冲击，反而会将更多、更高端的健康保障服务留给商业健康险，拓展其发展空间,扩大商业健康险的需求。

### 2）新医改有助于商业健康险机构通过与政府合作来提高医疗保障服务质量

《新医改》方案明确提出：“在确保基金安全和有效监管的前提下，积极提倡以政府购买医疗保障服务的方式，探索委托具有资质的商业保险机构经办各类医疗保障管理服务。”这无疑在一定程度上为商业健康险在新医改环境下的发展指明了方向。政府对医疗卫生服务的财政投入是取之于民、用之于民的。因此如何确保政府的财政投入合理分配和高效运行，将是医疗卫生制度改革成功与否的关键所在。基于政府财力的有限性和公共医疗卫生的公益性，政府与商业健康险机构携手推动社会医疗服务的发展，就十分有必要。这样，不仅使政府在医疗服务方面的财政投入得到有效利用，还使商业健康险机构获得政府提供政策支持和业务发展平台，有利于结合型健康险业务的积极运行,提高医疗保障服务的质量。

### 3）新医改有利于商业健康险机构控制风险和减少健康险赔付

目前，我国大部分医院的利润一半以上来自于药品收入，甚至有些医院的药品收入在总利润中的占比高达80%以上,远超过世界卫生组织要求的不超过15% 的标准。由于我国目前普遍存在着可以“以药养医”的腐败现象，医院在自身利益的驱动下,利用其在不对称信息中的优势地位，诱导患者增加不必要的医药开支，致使医患合谋、“一人投保、全家吃药”等现象的普遍存在。大处方、过度医疗加重了保险公司的医疗费用负担，给健康险的长期有序经营带来了很大的危害。

《新医改》方案中针对这一现象提出:“转变基层医疗卫生机构运行机制,探索实行收支两条线、公共卫生和医疗保障经费的

总额预付等多种行之有效的管理办法，建立规范的公立医院运行机制，推进医药分开，积极探索多种有效方式逐步改革以药补医机制。通过实行药品购销差别加价、设立药事服务费等多种方式逐步改革或取消药品加成政策，同时采取适当调整医疗服务价格、增加政府投入、改革支付方式等措施完善公立医院补偿机制。”随着收支两条线、医药分开等措施的进一步实施，随着药品加成政策的逐步取消，医疗费用上涨的路径将有效切断，“以药养医、以患养医”的局面将得到极大改善。同时，保险机构与医疗机构也随之建立起“风险共担、利益共享” 机制。医疗经费总额预付及按医疗服务收费向按病种收费的支付方式的转变，将有利于健康险机构形成对医疗机构费用的约束机制，控制医疗费用的不合理支出，减少因信息不对称而产生的道德风险。这些政策措施，最终将有效地减少阻碍商业健康险发展的外部因素，促进商业健康险快速发展。

## II. 我国商业健康保险在新医改下发展现状和问题

### A. 我国商业健康险在新医改下的发展现状

1）民众对商业健康险的认识的匮乏

在我们小组在北京地区发放了近千份关于北京工薪阶级居民对社会医疗保险和商业健康险的认识的调查问卷，从回收的500份有效问卷的统计结果来看，有13%的人群认为商业健康险的保费过高，而有41%的人群认为理赔时的赔付金额过少，大部分人对商业健康险带来的保障作用并不以为然，认为保费缴的越少越好，赔付的时候则是越多越好。

1870 年改革开放以来，至今已有 30 余年，我国国民经济水平逐年攀升，年 GDP 增长已达到 8%以上。虽然人民的生活水平越来越高，但是对于商业健康险的意识却极为匮乏。在我们小组在北京随机抽查的近千人的调查问卷中显示，有 32%的男性和 64%的女性认为已经参加了社会保险，保障程度已经足够，没必要再去投保商业健康险。北京的经济在全国还算比较发达的，但是还有这么高比例的人群对商业健康险存在误解，可见我国商业健康险的发展仍滞后于经济和社会发展需要。尽管商业健康险在人民的生活中不可或缺，但由于人们普遍对商业健康风险的管理意识不强，导致商业健康险所占的市场份额不发从根本上进行扩大。

表 1. 我们小组的调查问卷——男性对于商业健康保险的看法

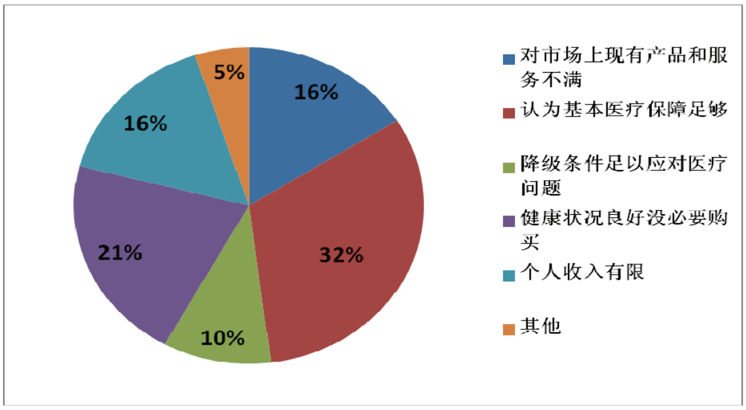
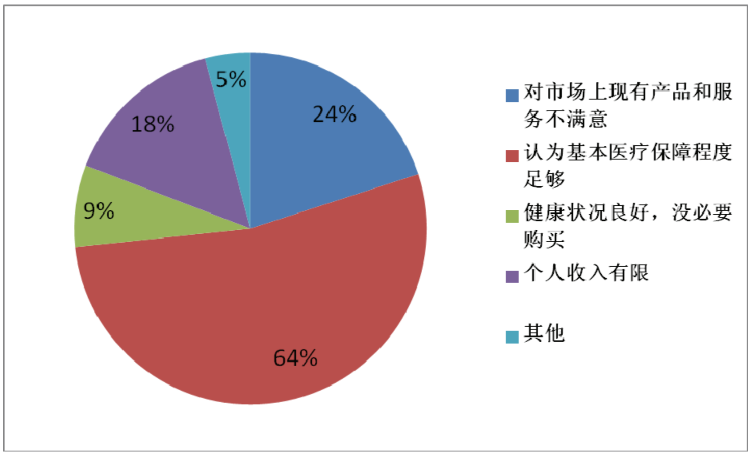



表 2. 我们小组的调查问卷——女性对于商业健康保险的看法




2）商业健康险保险公司难以赔付逐年上升的医疗费用

近年来，我国医疗费用支出大幅飙升，1980 年的卫生医疗总费用为143.2亿元，到2012 年就上升到10488 亿元，32年增长了369 倍，而2002 年到2005 年门诊和住院费用年平均增长率分别为8%和9.8%。医疗费用的大幅度上涨对于商业健康险公司来说可是福大于祸。大致有以下几个原因导致：

（1）医院为了自身利益，扩张医疗费用

医疗机构以追逐自身利益为目标，而施行的“医药合作制度”，在缺乏有效监督的情况下容易产生“以药养医，以患养医”的医药合谋现象，造成医疗资源的极大浪费，促使医疗服务成本的提高，商业健康保险的经营风险大增。

（2）被保险人的买单模式助长医疗费用的上涨

商业保险对健康保险市场的很难开拓其潜在市场与目前买单式健康险模式以及现行的医药体制成为制约健康保险业务有很大关系。买单式健康险模式，即保险公司对被保险人发生的医疗费用采用“先自负，后报销”的第三方付费模式。这种模式中，商业健康险公司仅仅充当第三方付费的角色，并不介入到医疗服务的过程，这就使得保险公司在风险管控方面增大了难度。

因为这种“先自负、后报销“的制度，使得保险公司为被保险人就医行为买单，从而使得被保险人没有动机去关心或监督医疗服务和成本，更有可能出现被保险人因为医疗服务的边际成本下降，而诱发对医疗服务的过度需求和过度使用，最终导致医疗费用节节攀升的后果。

3）保费收入逐年增加，但发展程度仍远远落后于欧美等发达国家

从保费收入情况来看，我国的商业健康险的保费呈持续增长状态。从2007年1月，商业健康险的承保数量就已经达到了456.93亿元，到2008年1月这个数字还在持续增长，更是达到了762.83亿元，比前一年增长了48.62%。截止到2012年，光健康险保费就已经突破575亿元，这对我国整体商业保险市场是一件好事，对商业健康险更是。但是，相比于欧美发达国家的成熟商业保险市场来说，我国健康险的发展还远远不够。成熟市场上，商业健康险保费收入占总保费的30%左右，由此可见，我国商业健康险市场还有待进一步完善。

4）商业健康险在商业保险中处于比较弱小的地位

我国的商业保险分为两部分，即财产险和人身险。人身险包括寿险、人身意外伤害险和健康险，无论是从保费收入还是从赔付支出来看，商业健康险仅属于人身险中比较弱小的险种。从表3和表4中就可以看出，2012年1-4月，在全国范围内，商业健康险的保费收入为2874564.06万元，商业健康险仅占了总保费的4.85%，比起将近占到90%市场份额的寿险市场来说，商业健康险还有很长的路要走。

表3. 2012年1—4月保险业经营情况

| | 单位：万元 |
|---|---|
| 原保险保费收入 | 59220683.41 |
| 人身险 | 41766841.08 |
| 1）寿险 | 37554818.85 |
| 2）健康险 | 2874564.06 |
| 3）人身意外险 | 1337458.17 |

表4. 2012年1-4月全国各地区原保险保费收入情况表

| | | | | 单位：万元 |
|---|---|---|---|---|
| 地区 | 合计 | 寿险 | 意外险 | 健康险 |
| 全国合计 | 59220683.41 | 37554818.85 | 1337458.17 | 2874564.06 |
| 北京 | 3456819.34 | 2167915.50 | 83338.46 | 299351.61 |
| 上海 | 3207560.60 | 1952271.12 | 81714.07 | 195815.03 |
| 深圳 | 1401745.31 | 826788.24 | 40963.97 | 80336.97 |

**资料来源**:中国保险监督管理委员会网站历年数据

总体来看，商业健康险在保费收入和赔付支出的绝对水平上，在过去的若干年内还是去得了一定的发展，问题是其发展速度没有其他的保险业务块。因此我们更要从人身保险中的三大险种中进行横向对比分析，找出商业健康险存在的问题，从而扩大健康险在人身保险的市场份额。

### 5）商业健康险发展潜力巨大

虽然我国的商业健康险的发展程度离欧美发达国家还有一段距离，并且在国内的人身险市场上还处于比较弱小的险种，但是从各方调查和预测来看，我国商业健康险显示出巨大的发展潜力。我国国务院发展研究中心2010年对我国50个城市的保险市场调研结果显示，在准备购买商业保险的人群中，有将近67%的居民表示想要购买商业健康保险。据瑞士再保险《Sigma》研究报告显示，09年中国医疗保健支出超过1.5万亿元，其中商业医疗保险支付的比例还不到6.5%，这也就意味着市场潜在的商机可以达到14,025万亿元。据欧洲健康险巨头DKV的最近预测，至2015年，我国商业健康险总保费预计超过2007年的3倍，将首次突破1,200.0亿元。

## B. 我国商业健康险在新医改下发展中的问题

### 1）商业健康险的道德风险与逆选择问题突出

作为商业保险公司，防范道德风险和逆选择就成为一道不可或缺的程序。商业健康险公司尤为如此。比如最常见的道德风险是被保险人往往利用现有医疗管理的缺陷不择手段过度消费，“一人投保，全家吃药”的现象屡见不鲜，或者以伪造、变造的有关证明、资料或其它证据，编造虚假事故原因或夸大损失程度等，而保险公司对于这些恶意行为，如果得不到医疗机构的配合，取证调查就会非常困难，商业健康险公司的经营也会随之每况愈下，最后受害的只会是整个社会。

### 2）新医改占据健康险原有的空间

政府在医保中都占据着主导地位，而商业保险是辅助地位。这就容易给人们造成一种有“社会医保就足够了，商业保险只是作

为补充可有可无”的假象。针对这种现象《新医改》 提出“基本医疗保障制度全面覆盖城乡居民，三年内城镇职工基本医疗保险、城镇居民基本医疗保险和新型农村合作医疗参保合率均达到90% 以上”的目标在一定程度上造成商业健康保险的利润萎缩。

随着基本医疗保障覆盖面的不断扩大，商业健康险机构逐渐失去原先占有的市场，使更多的商业保险客户不再续保，客户对商业保险需求将相应变小，从而致使利润萎缩，这在一定程度限制了商业健康保险的发展。《新医改》方案要求“建立由城镇职工基本医疗保险、城镇居民基本医疗保险、新型农村合作医疗和城乡医疗救助共同组成基本医疗保障体系”，这使得以前没有享受到社会医疗保险保障的乡镇企业、私营企业职工、农民等绝大多数社会成员几乎都得到保障。于是商业健康保险失去了一块巨大的潜在市场，这对商业健康险机构拓展其业务覆盖面以及创新产品方面提出更高要求。

3）新医改限制了商业健康险的补充空间

《新医改》提出，“逐步提高筹资和保障水平，未来三年内城镇职工或居民医保最高支付限额分别逐步提高到当地职工年平均工资和居民可支配收入的6倍左右，新农合最高支付额逐步提高到当地农民人均纯收入的6倍以上；逐步提高城镇职工基本医疗保险、城镇居民基本医疗保险和新农合范围内的住院费用报销比例，逐步扩大和提高门诊费用报销范围和例，有效减轻城乡居民个人医药费用负担。”医保提高了最高支付限额，让居民获得较以前更充分的保障，这是对全体中国公民的医疗待遇提高的好政策，但是对于本不发达的商业健康险却是雪上加霜，因为这样让起补充作用的商业健康险变得可有可无，致使许多原来投保商业健康险的客户在决定是否续保时犹豫不决，更愿意以社保替代商业健康险。居民医疗费用自付比例的降低，将直接挤压商业健康险的发展空间，降低居民对基本医疗以外的商业医疗保险的需求，商业健康险的总体保费规模会不可避免地呈现出下降趋势。商业健康险面临着极大的挑战。

4）我国商业健康保险经营管理的专业化程度还不高。

在欧美这样的发达国家，商业健康保险都是专业化的发展。而在我国，商业健康保险还要依附于人寿保险，正处于起步阶段。目前，我国有100多家保险公司开办了商业健康保险业务，专业性商业健康保险公司仅有四家，即人保健康、平安健康、昆仑健康、和谐健康，而且其规模和市场份额都不大。根据2012年中国保险监督管理委员会网站的数据显示，人保健康、平安健康、昆仑健康、和谐健康的保费收入分别为405580.77万元、6241.89万元、5184.86万元和4.71.70万元。在这四家中，人保健康算是比较大的商业保险公司，其余的三家规模还都处于发展中的阶段。

在商业健康保险的发展中，专业化程度低是制约健康险发展的最大因素。健康险的风险在市场营销、风险控制、保费精算、理赔支出、健康管理等方面均不同于寿险、意外险和财险。在市场营销方面，健康险主要是团险营销模式；在理赔方面，健康险既要控制承保人的道德风险还要控制医疗机构的道德风险；健康险管理模式也是在其他保险业务中完全没有的。因此，在欧美发达国家，健康险的理赔业务甚至走上了外包交给第三方管理的道路。

另一个专业化不足的表现是缺乏专业化的人才。商业健康保险业相当缺乏具有经验的精算师、能够开拓团险业务的营销人员和能够有效运用多元付费方式的组合对医疗服务行为加以监测和控制的专业人士来服务于商业健康险。人才的缺乏，是导致我国商业健康险至今落后于发达国家的又一重要因素。

5）健康险行业的制度、组织与技术上的基础设施有欠发达。

千万不可小看健康险的行业制度和基础设施。因为健康险需要控制来自承保人和医疗机构两方面的风险，因此需要建立一整套风险信息搜集的制度、组织和技术，比较具有代表意义就是行业内包含承包人的医学和非医学的行为数据库、消费者的信息调查公司、可以信息共享的网络技术以及消费者病历信息披露的法律权限。所有这些制度和基础设施的建设，都需要健康保险业的行业协会和监管者以及国家有关的立法和监管机关的一起努力。。

## III. 在新医改下，对我国商业健康险发展的建议

### A. 实现商业健康险的专业化经营

商业健康保险的经营具有很强的特殊性，在产品定价、核保理赔等方面与财险和寿险有着显著的区别。再加上道德风险偏高、逆向选择比较严重、风险控制难度较大等原因，采用财险、寿险的传统模式经营商业健康保险将举步维艰。所以商业健康险要想在新医改的大背景下克服阻碍，有所突破，就必须摆脱传统观念的束缚，走专业化经营的道路。

在大力发展专业健康保险公司的同时，保险机构内部也要构建专门的产品设计、精算、核保核赔、风险监控制度并研究建立专业化健康管理服务体系，以发挥规模效应，打造适合商业健康保险运行模式的经营管理平台，实现专业化经营。

## B. 注重产品差异性和多样化

商业健康险公司尤其是专业健康保险公司，应进一步提升自身的服务能力，发挥好在“ 提高基本医疗保障管理服务水平”中的作用，必须注重市场调研，掌握不同地区、不同收入层次、不同年龄群体对商业健康保险的需求状况，设计出的险种保障更加全面、保费更加低廉的产品，以满足不同消费者对保险产品的需求，为城乡居民提供多样化多层次的健康保障服务，如社会基本医疗保障以外的疾病、护理、失能收入损失等保险保障和健康管理服务。

## C. 打造商业健康险产业化价值链接

在目前医疗卫生体制下，仅靠新医改的力量还无法构建对医疗机构的有效约束机制。商业健康险公司作为独立于医患双方的第三方支付人，若想真正控制医疗费用的不合理支出、降低赔付率，还必须从健康管理产业分工和协作的关联角度出发，通过建立资本纽带关系或战略合作系，控制社会医疗网络资源，打造由保险公司、医院、社保机构及相关的各地政府、监管机构、供应商、保险中介组成的健康保险价值链，相互协作，实现共赢。而这其中，最关键的问题是如何建立一个有效的保险公司与社保机构、医院的合作模式。

首先，商业保险机构应积极与社保机构合作，加强与社会医疗保险的融合，大力发展社保补充业务。这样，一方面有利于商业保险机构获得社保系统的医疗保险数据，构建疾病发生数据库和医疗费用数据库，实现数据共享；另一方面，还可挖掘和发展委托业务和社保补充业务客户资源。利用社保业务积累的客户信息，开发企业和个人客户，扩大其业务市场。同时，在与社会医疗保险的融合过程中，还可以发挥保险公司的长处，在投资、服务、管理等领域与社会医疗保险展开更多的接触和尝试。

其次，商业保险机构要与医疗机构建立起深层次合作机制，以控制不合理的医药费用。保险公司要积极寻求投资医疗机构的机会，充分抓住技术水平高、社会声誉好、经营效益佳的大型医院和专科医院新建、扩建、转轨改制等有利时机，争取通过参股、控股甚至收购等方式进行股权投资。这样既可以获得稳定的投资回报，也可以控制过度医疗等费用不合理的支付，进而从源头上降低赔付率水平，有利于保险公司的长久发展。

## 致谢：

在论文完成之际，我要特别感谢我的指导老师吉彩红的热情关怀和悉心指导。在我撰写论文的过程中，吉老师倾注了大量的心血和汗水，无论是在论文的选题、构思和资料的收集方面，还是在论文的研究方法以及成文定稿方面，我都得到了吉老师悉心细致的教诲和无私的帮助，特别是她广博的学识、深厚的学术素养、严谨的治学精神和一丝不苟的工作作风使我终生受益，再次表示真诚的感谢和深深的谢意。

在论文写作过程中，也得到了许多同学的宝贵建议，同时还得到许多在工作中同事的支持和帮助，再次一并致以诚挚的谢意。

感谢所有关心、支持、帮助过我的良师益友。

最后，向百忙中抽出时间对本文进行审阅并提出宝贵意见的各位专家表示中心的感谢！

## 参考文献：

[1] Qian HUANG, Chinese Health's Development Under the New Medical Reform, [A], Insurance College of Southwest University of Finance and Economics, Economy World.

黄倩.《论新医改下中国健康险的发展》.(A)西南财经大学保险学院.《经济论丛》

[2] Xiaoling XIAN, Great Development of Health Insurance Promoted by New Medical Reform, [J], Xin Hua Insurance Company Co., Ltd, 8/18/2009, 12th edition.

覃晓玲.《新医改促进健康险大发展》. [J]新华保险人寿股份有限公司.2009 年 8 月 18 日第 012 版

[3] Kai DONG and Jingyu ZHU, First Step of New Medical Reform to Our Commercial Medical Insurance's Influence, [J], Economy College of Fudan University, 200433

董凯、朱靖宇.《新医改对我国商业医疗保险行业影响初探》[J].复旦大学经济学院 200433

[4] Lu CHE, the Influence of New Medical Reform to Our Commercial Health Insurance, [J], 2010

车路.《新医改对我国商业健康险的影响》[J].2010 年

[5] Zongzhong HOU and Pengcheng FENG, the Revelations and development of American Commercial Health Insurance, [J], Insurance College Newspaper, 02/2009, 1st edition.

侯宗忠、冯鹏程.《美国商业健康保险市场的发展及启示》[J].《保险职业学院学报》2009 年 2 月第 1 期

[6] Baochun WANG, Perspectives of Health Insurance Developed Under the New Medical Reform, [R], Chinese Health Insurance Co.Ltd.Shandong Branch. Jinan, Shandong, 250014

年第 7 期.总第 329 期

王宝春.《新医改背景下健康保险的发展前景》[R]中国人民健康保险股份有限公司山东分公司，山东济南 250014

[7] Meng DING and Xuezhi LIN, Influence of Commercial Health Insurance from the project of New Medical Reform, [J], Entrepreneurship all over the world, 2009(06).

丁孟,林学智.《新医改方案对商业健康险的影响及对策》.[J].《中外企业家》, 2009(06).

[8] Guogui TUO and Debao WANG, Opportunities of Chinese Commercial Health Insurance Developed under the New Medical Reform, [J], China Insurance, 2009,(06)

庹国桂,王德宝.《新医改下我国商业健康险的发展契机》[J].中国保险,2009,(06).

[9] Xiu LI, Chinese Commercial Health Insurance's Development under the Background of New Medical Reform, [J], China Finance, 2009,(14).

凌秀丽.《新医改背景下中国商业健康险的发展》[J].《中国金融》,2009,(14).

[10] Yingting LI, Path to the development of Commercial Health Development, [J], Southwest Finance, 2008,(08)

李英亭.《商业健康保险发展路径》[J].《西南金融》,2008,(08).

[11] Qiaoling DONG, How Much do You Know about Health insurance, [J], Public Finance Advisor, 2009, (07).

童巧玲.《健康险知多少》[J].《大众理财顾问》, 2009, (07).

[12] Meng XU, Research on Our Commercial Health Insurance, [A], 2009, 7th edition, 329th total edition.

徐梦.《我国商业健康保险研究》[A].2009

# 浅议新医改下我国商业健康险的现状与问题[2]

刘　旭，吉彩红

经济学院，北京工商大学，北京，中国，100048

摘　要：近些年来，随着改革开放步伐的加快，人民生活水平在逐年提高，生活质量也在慢慢改善，“商业健康险”的概念逐渐融入人们的生活。越来越多的人群开始选择购买商业健康险来降低自己在健康方面所患风险的概率。但是随着商业健康险购买率的提高，相应的问题也接踵而至。由于我国尚处于发展中国家，我国的商业健康险起步较晚，其市场还不成熟，发展状况远远落后于欧美发达国家，就我国目前的商业健康险的发展水平来说，仅相当于欧美发达国家上世纪50～80 年代的水平。从国际经验来看,在健康险发展的初期,各国政府都会出台一些支持其发展的政策措施,我国也不例外。2009 年 1 月国务院常务会议通过了《关于深化医药卫生体制改革的意见》和《2009-2011 年深化医药卫生体制改革实施方案》，表明新一轮的医疗体制改革方案正式出台，新医疗体制改革是逐步实现人人享有基本医疗卫生服务远大目标的一个不可或缺的基本前提。

本文就新医疗体制改革的实施背景展开讨论，内容涉及在新医疗体制改革下，我国商业健康险所面临的机遇与挑战以及我国的商业保险如何在这场医疗体制改革中把握好机遇从容地应对挑战。同时不容忽视的是，虽然我国的商业健康险存在一些令人欣喜的地方，但是由于我国商业健康险目前仍处于发展初期阶段，还有很多问题亟需解决，我国商业健康险的现状不容乐观。本文依照我国商业健康险的发展历程为线索，对其现状、存在的优势以及存在的问题一一进行分析，并依照我国目前商业健康险市场的现状和新医疗体制改革的大背景，对我国商业健康险市场进行展望，提出了一些商业健康险的发展建议。

关键词：机遇与挑战；现状；问题；前景展望

[2] 本文受北京工商大学本科生科学研究计划项目资助

# Questionnaire Study on Life Insurance Demand Based on Correspondence Analysis

LIU Xuening[1], LI Fengfeng[2]
[1,2] School of Economics, Qingdao University, Qingdao, China, 266071

**Abstract:** The classic theories of life insurance demand think that the life value, the income and the life cycle have an important impact on the life insurance demand. Based on data from the microscopic survey in Qingdao, the correspondence analyses are performed respectively between household income and life insurance premium, the marital status and life insurance premium, and the cognition level of life insurance and life insurance premium using the correspondence analysis of SPSS. And it is found that 1) there exists an inverted u-shaped relationship between the family income and life insurance demand; 2) there exists a correlation between marital status and life insurance demand, and married people with children tend to buy more life insurance than those without children and unmarried people; and 3) there exists a significant positive correlation between the cognition level of the life insurance and life insurance demand. Moreover, the survey also shows 1) that most people learn about the knowledge of life insurance from life insurance agents and/or their friends, and buy life insurance through life insurance agents. The approaches to cognition and purchase are single; 2) that participating life insurance is the most product bought by citizens, which reflects the citizen cares much about the financial function of life insurance.

**Keywords:** life insurance demand; correspondence analysis; questionnaire

## Ⅰ.引言

休伯纳的生命价值理论认为，人的生命价值是对个人未来的实际收益和服务价值的一种衡量，即扣除掉自身消耗成本的个人未来净收益的资本化[1]。人寿保险对人的生命提供风险保障，生命价值决定其寿险需求。生命价值理论确立了个人收入决定了寿险需求的理论基础，寿险需求随着其收入水平的提高而提高。莫迪利亚尼的生命周期假说理论认为，一定时期的消费取决于对一生收入的预期，而预期收入与人的生命周期有关。年轻时收入低，会举债；工作以后收入逐渐增加，中年时达到顶峰，偿还过去的债务，并为退休后的岁月进行储蓄；退休后则消费过去积累的财富。Yaari 建立寿命不确定情况下的最优消费、储蓄模型，认为追求生命周期消费效用最大化的人，面临寿命不确定性风险时，可以通过购买寿险和年金来应对这种风险，克服了寿命不确定性对效用水平的负面影响，获得最优消费[2]。Lewis 模型从利他主义的角度研究寿险需求，考虑遗产动机和受益人的利益，发现保单受益人的数量对寿险需求有明显影响[3]。

资助信息：山东省高校人文社科研究项目 J12WG01；
青岛市社科规划项目 QDSKL110201。

生命价值理论、Yaari 模型和 Lewis 模型是寿险需求研究的经典理论模型，以后的寿险需求研究多以此为依据。在收入对寿险需求的影响方面，国内文献[2-4]研究结论比较一致：个人可支配收入与寿险需求显著正相关，寿险需求弹性系数均大于 1。但是这类研究多数以宏观数据为基础，难以反应出不同收入水平的寿险需求特征。在生命周期与寿险需求的方面，目前研究相对较少，其中对浙江省寿险需求调查中发现，与 30 岁以下、30-45 岁的受访者相比，45 岁以上受访者购买养老保险的比例更高[5]。从遗产及受益人角度分析寿险需求，多数以幼年人口比重或老年人口比重作为替代指标进行宏观分析，研究结论差异较大，文献[6,7]发现幼年人口比重对寿险需求的影响显著为正，而文献[8]发现其影响显著为负，文献[2]则发现其影响并不显著-。

本文通过微观调查数据对收入、生命周期阶段以及对寿险的认知与寿险需求的关系进行分析，以验证不同收入水平的寿险需求差异性，收入增加是否带来寿险需求等比例上升？不同家庭结构和年龄段是否会影响寿险需求？居民的寿险认知水平对寿险需求会产生多大程度的影响？

## Ⅱ.居民对寿险的认知及购买行为特征

在青岛市对居民寿险需求进行问卷调查，共回收问卷 345 份，剔除无效问卷，有效问卷共 273 份。调查对象涉及不同职业、 不同年龄段、不同收入水平的人群，有效调查样本基本信息如下：男女性别比例为 49.08%、50.92%；受调查者年龄比例为 21-30 岁占 35.5%、31-40 岁占 26.7%、41-50 岁占 31.5%、51-60 岁占 4.4%、61 岁以上的占 1.8%；受教育程度的分布为小学 0.4%、初中 11.2%、高中及中专

27.9%、大专及本科 53.1%、硕士以上 7.4%；收入水平分布为家庭月收入 5000 元以下占 46.5%、5000-10000 元占 36.9%、10000-15000 元占 9.6%、15000-20000 元占 2.6%、20000 元以上的占 4.4%。由于调查范围主要在市区，所以调查对象受教育程度相对较高、年龄结构相对年轻，但受访者样本具有代表性，其特征能够能够反映城市居民寿险需求的基本状况。

以下根据调查数据分析青岛市居民对寿险的认知和寿险购买行为特征。

## A. 居民对寿险认知

调查将对寿险的了解程度分成不了解、一般、很了解和其它四类。调查显示，67%的受访者自认为对寿险了解程度一般，认为对寿险不了解的占受访者的 23%，认为对寿险很了解的仅占受访者的 9%。

1）对寿险的了解途径

调查将了解寿险的途径归为以下几类：寿险营销员、银行或邮政等中介、电视、网络、广告、亲戚朋友、其他。统计数据分析见表 1。

表 1. 了解寿险途径的统计表

| | 了解寿险的途径 | | | | | | |
|---|---|---|---|---|---|---|---|
| | 寿险营销员 | 银行、邮政 | 电视 | 网络 | 广告 | 亲戚、朋友 | 其他 |
| 人数 | 118 | 23 | 16 | 28 | 44 | 65 | 27 |
| 比例 | 36.76% | 7.17% | 4.98% | 8.72% | 13.71% | 20.25% | 8.41% |

调查显示，受访者了解寿险最主要的途径是"通过寿险营销员"，占比 36.76%。另外，考虑到目前"缘故法"是寿险营销员最重要的销售方法，通过"亲戚、朋友"了解的受访者中有部分也是由寿险营销员影响的。因此，我们认为受访者中直接或间接因为寿险营销员了解寿险的比重可以达到 40%-50%。随着近年来保险广告投入增加，受访者通过广告获得寿险信息的比较高，达到 13.71%。随着网络在信息传递和人际交往中日益重要，电视的信息传递功能趋弱，两种媒介对寿险信息传递能力也不同，分别为 8.72%和 4.98%。虽然银邮保险发展迅速，但从调查结果来看，它对寿险的宣传介绍方面的功能比较弱，仅占 7.17%。

2）对寿险功能的认知

调查问卷将寿险的用途分为意外伤害保障、支付医疗费用、储备养老金、作为理财工具、积累教育金和其他六类，受访者的选择见表 2。

表 2. 对寿险功能认知统计表

| | 认为寿险有什么用途 | | | | | |
|---|---|---|---|---|---|---|
| | 意外伤害保障 | 支付医疗费用 | 储备养老金 | 理财工具 | 积累教育金 | 其他 |
| 人数 | 150 | 75 | 122 | 46 | 30 | 21 |
| 比例 | 33.78% | 16.89% | 27.48% | 10.36% | 6.76% | 4.73% |

从统计数据来看，公众对寿险的保障功能有比较高的认同，认可度最高的是"意外伤害保障"，占 33.78%；其次是"储备养老金"，占 27.48%；排在第三位的是"支付医疗费用"，占 16.89%。而认为寿险"作为理财工具"和"积累教育基金"的比例相对较少。

## B. 居民的寿险购买行为特征

调查显示，被调查者中购买寿险的比例高达 77.29%，寿险投保率较高。在已购买寿险的受访者中，年缴保费 3000 元以下的占 42.86%，3000-5000 元的占 21.25%，5000 元以上的占 35.89%。下面从给谁购买寿险、购买产品类型、购买寿险途径等方面分析受访者的寿险购买行为。

**1）给谁购买寿险**

调查问卷中"给谁购买寿险"问题给出四个选项，分别是给孩子、自己、配偶、老人。按照选择人数来看，给自己购买寿险的最多，其次是给孩子购买寿险，第三是给老人购买，给配偶购买寿险的人数最少。考虑到有受访者中存在 29.78%和 8.8%的未婚和已婚无子女者，我们将"婚姻状况"（分为未婚、已婚无子女和已婚有子女）与"给谁购买寿险"两个问题结合起来分析，统计结果见表 3。

从表 3 中可以看出，在不同婚姻状况的寿险购买情况存在较大差异。我们从以下几个方面具体分析。

首先，从总量上看，给自己购买寿险人数最多，总共有 102 人次给自己购买寿险，从比例上来看，未婚者、已婚无子女者到已

表 3：各婚姻状况下给谁购买保险

| 婚姻状况 | 未婚 | | 已婚无子女 | | 已婚有子女 | |
|---|---|---|---|---|---|---|
| | 人数 | 比例 | 人数 | 比例 | 人数 | 比例 |
| 给孩子买保险 | 1 | 1.23% | 0 | 0 | 80 | 31.25% |
| 给自己买保险 | 29 | 35.80% | 8 | 28.57% | 65 | 25.39% |
| 给配偶买保险 | 0 | 0 | 3 | 10.71% | 46 | 17.97% |
| 给老人买保险 | 27 | 33.34% | 10 | 35.71% | 37 | 14.45% |
| 其它 | 24 | 29.63% | 7 | 25.00% | 28 | 10.94% |
| 总数 | 80 | 100% | 28 | 100% | 256 | 100% |

注：由于存在受访者既给自己又给他人购买保险的情况，此处的人数与总数表示的

是人次数，故总数比问卷数多。

婚有子女者三类受访者为自己购买寿险比例依次降低。其次，给配偶购买寿险的总人数最少，这主要是因为受访者中存在一定比例的未婚者。在已婚者中，与无子女者相比，有子女的受访者为配偶购买寿险的比例显著增加，从 10.71%增加到 17.97%。第三，在有子女的受访者中，给孩子购买寿险的比例最高，达到 31.25%，即有近三分之一有子女的受访者为孩子购买了寿险，超过了给自己、给配偶和给老人购买的比例。看来，独生子女时代，“小皇帝”的称号从寿险购买中也可窥见一斑。最后，从给老人购买寿险来看，已婚无子女者购买比例最高，达 33.34%，已婚有子女者为老人购买比例则最低。

从表 3 可以看出，从未婚、已婚无子女到已婚有子女三类受访者为子女、为配偶购买寿险比例上升，而为老人、为自己购买寿险比例下降。总体上，已婚有子女者的寿险需求最强。究其原因，一方面是因为有孩子之后责任增加，寿险需求也相应增加，另一方面已婚有子女的家庭阶段具有更强的支付能力。同时，在支付能力范围内，寿险购买选择更倾向于孩子，居民的寿险购买意识仍存在偏差。

**2）购买寿险产品的类型**

为了了解受访者对不同类型寿险产品的购买选择，问卷将寿险产品分为分红型寿险、投资型寿险、传统型寿险三种，由于存在多项选择的情况，按照每个选项被选择的人次数进行统计，选择购买分红型寿险的比例为 47%，选择购买传统型寿险的比例为 32.2%，选择购买投资型寿险的比例为 20.8%。分红型寿险仍然是目前寿险市场最受欢迎的产品类型。

**3）购买寿险的途径**

购买寿险的途径有多种，本次调查将其归为以下几类，调查结果统计见表 4。

**表 4. 购买寿险渠道数据统计**

| | 购买此寿险的渠道 | | | | | |
|---|---|---|---|---|---|---|
| | 寿险营销员 | 银行、邮政等中介 | 直接到保险公司 | 电话 | 网络 | 其他 |
| 人数 | 119 | 23 | 54 | 2 | 0 | 18 |
| 比例 | 55.1% | 10.65% | 25% | 0.93% | 0 | 8.32% |

调查结果显示，青岛市居民购买寿险主要渠道是寿险营销员，占 55.1%，25%的购买者直接到保险公司购买，该比例高于银邮渠道 10.65%的比例，究其原因，可能是与寿险公司通过销售大厅办理投保缴费业务，使得部分这类营销员业务被投保者认为是直接到保险公司购买。另外，新兴的电话、网络销售渠道仅占 0.93%，显示出青岛居民对这类销售模式的认可度较低。

对于购买者最希望通过哪个渠道来购买寿险产品，调查数据显示，55.75%的受访者认为希望直接到保险公司购买，26.13%的受访者认为希望通过营销员购买，9.06%的受访者认为希望通过银行和邮局购买，另有不足 10%的受访者认为希望通过电话、网络和电视等其它方式购买寿险产品。

根据调查发现，在销售渠道上存在两个矛盾，一是寿险营销员向 55.1%的客户销售了寿险产品，但实际上只有 26.13%的人希望通过他们购买寿险；二是 55.75%的受访者认为希望直接到保险公司购买，而实际上只有 25%的购买者直接到保险公司购买。这一方面反映了寿险销售模式与寿险需求不匹配，另一方面也显示出寿险营销员粗放式推销模式并不被消费者认可。

# Ⅲ.寿险需求的相关性分析

调查数据为定性数据，我们采用相应分析——列联表对数据进一步处理。以调查者每年所交寿险保费金额作为描述寿险需求的指标，保费为 0 为未购买寿险者，购买者年缴保费金额分别为 3000 元以下，3000-5000 元，5000-8000 元，8000-10000 元及 10000 元以上共五类。根据前述理论分析及相关文献，调查设定性别、年龄、婚姻状况、职业、受教育程度、家庭月收入、家庭资产状况等可能是影响寿险需求的因素。使用 spss18.0 对以上各因素与寿险保费进行相应分析，研究它们与寿险需求之间的相关性。

## A.生命周期与寿险需求的相应分析

问卷以不同年龄段和婚姻状况作为生命周期的代表指标。

年龄分为 21-30 岁、31-40 岁、41-50 岁、51-60 岁和 60 岁以上五类。使用 spss18.0 对年龄与保费的独立性检验，结果显示卡方值为 24.041，P 值 0.241>0.05，接受原假设，即年龄与年缴保费金额之间相互独立，没有相关关系。

婚姻状况分为未婚、已婚无子女和已婚有子女三种状态。先对婚姻状况与年缴保费进行独立性检验，检验结果见表 5。

**表 5. 婚姻状况与年缴保费的独立性检验结果(卡方检验)**

| | 值 | 自由度 | 渐进 Sig.(双侧) |
|---|---|---|---|
| Pearson 卡方 | 21.950[a] | 10 | .015 |
| 似然比 | 26.798 | 10 | .003 |
| 线性和线性组合 | 12.132 | 1 | .000 |
| 有效案例中的 N | 273 | | |

a. 6 单元格(33.3%)的期望计数小于 5。最小期望计数为.62。

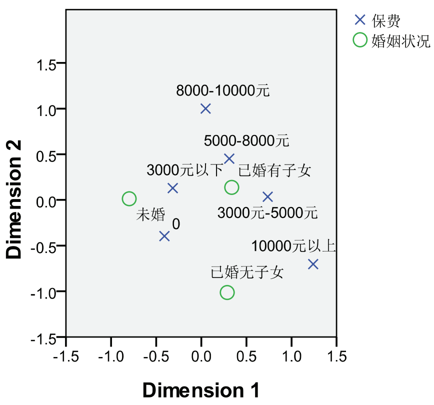



图 1. 婚姻状况与年缴保费相应分析二维表

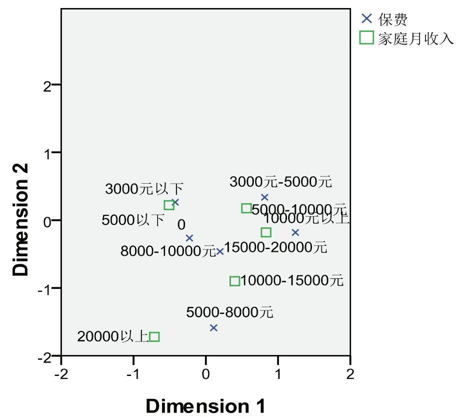



图 2. 家庭月收入与年缴保费的相应分析二维表

结果显示，$\chi^2$=21.950，P=0.015<0.05，因此拒绝原假设，即婚姻状况与年缴保费具有相关性。接下来进行相应分析，相应分析二维表见图 1。

从二维表中，我们可以看出未婚者与保费 3000 元以下和 0 比较接近，已婚有子女者与保费 3000-5000 元、5000-8000 元比较接近，而已婚无子女者与保费 10000 元以上接近。

根据生命周期理论，多数未婚者可能处于相对年轻阶段，收入低，甚至会举债，通过寿险积累财富、留遗产的动机较弱，故倾向于不购买寿险或者倾向于购买较少的寿险。已婚有子女者倾向于投保保费比较高的寿险，年缴保费集中在 3000-10000 元之间，这个阶段的受访者收入开始提高，有子女对生命风险保障的需求增加，同时也具有积累养老金、教育金和留遗产的需求，寿险需求相对较高。二维表中比较特殊的是已婚无子女者与年缴保费 10000 元以上最接近，这可能与调查样本中已婚无子女的人数较少有关。

## B.收入水平与寿险需求的相应分析

问卷将家庭的月收入分为 5000 元以下、5000-10000 元、10000-15000 元、15000-20000 元和 20000 元以上五个档。先对家庭月收入与年缴保费进行独立性检验，独立性检验结果见表 6。

表 6. 家庭月收入与保费的独立性检验结果(卡方检验)

| | 值 | 自由度 | 渐进 Sig.(双侧) |
|---|---|---|---|
| Pearson 卡方 | 46.041[a] | 20 | .001 |
| 似然比 | 45.709 | 20 | .001 |
| 线性和线性组合 | 4.520 | 1 | .033 |
| 有效案例中的 N | 271 | | |

a. 17 单元格(56.7%)的期望计数小于 5。最小期望计数为.18。

结果显示，P=0.001<0.05，拒绝原假设，即家庭月收入与保费不独立，具有相关性。接下来进行相应分析，相应分析二维表见图 2。

结果显示，家庭月收入 5000 元以下倾向于不购买寿险产品或购买寿险的年缴保费在 3000 元以下；家庭月收入 5000-10000 元购买寿险的年缴保费倾向于 3000-5000 元之间，家庭月收入 10000-15000 元购买寿险的年缴保费倾向于 8000-10000 元之间；家庭月收入 15000-20000 元购买寿险的年缴保费倾向于保费 10000 元以上；而家庭月收入为 20000 元以上的受访者，其年缴保费没有继续上升，却与 5000-8000 元的年缴保费相关性较大，这可能是因为，一方面高收入者有较高的风险承担能力，没有以高额寿险来保障其经济利益；另一方面，根据前面调查结论，本地区寿险需求表现出较强的理财投资功能，而高收入者有更多可供选择的理财投资工具，其寿险需求并没有随其收入增长而同比上升。 这一结果从微观调研数据上显示：随着收入的增长，寿险需求的增长呈现倒“U”型 的形态。

## C.教育水平与寿险需求的相应分析

已有文献发现教育程度与寿险需求存在一定程度的相关性[2,5]，本次调查问卷中把教育程度分为小学、初中、中专及高中、大专及本科、硕士及硕士以上五类。一个人的受教育程度与其对新事物的接受程度和对未来的主动规划有关，故我们预判，教育程度与寿险需求有关，受教育程度越高其寿险需求越强，相反，教育程度越低寿险意识就越弱。

先对教育程度与寿险需求进行独立性检验，检验居民受教育程度与保费之间是否具有相关性，检验结果见表 7。

表 7. 受教育程度与保费的独立性检验结果(卡方检验)

| | 值 | 自由度 | 渐进 Sig.(双侧) |
|---|---|---|---|
| Pearson 卡方 | 58.880[a] | 20 | .000 |
| 似然比 | 25.493 | 20 | .183 |

| | | | |
|---|---|---|---|
| 线性和线性组合 | 3.013 | 1 | .083 |
| 有效案例中的 N | 269 | | |

a. 18 单元格(60.0%) 的期望计数少于 5。最小期望计数.02

从结果显示中可知，P=0<0.05，拒绝原假设，因此受教育程度与保费不独立，具有相关关系。下面使用列联表做相应分析，相应分析二维表见图 3。

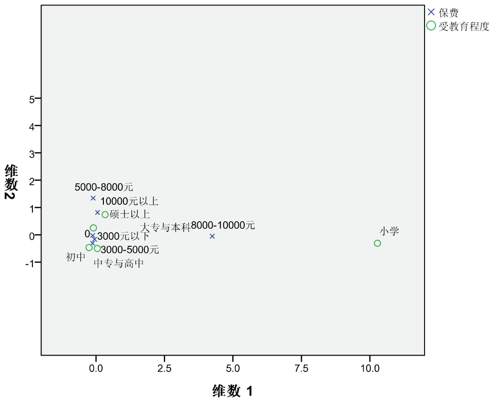



图 3. 受教育程度与保费的相应分析二维表

从图 3 可以看出，硕士以上受教育程度的寿险需求与其他教育程度的寿险需求区别度较高。硕士以上教育程度的受访者与年缴保费与 5000-8000 元和 10000 元以上两类相关度较高，初中、中专与高中和大专及本科的教育程度与 3000 元以下及 3000-5000 元年缴保费相关度较高。

## D.其他因素与寿险需求的相应分析

### 1）对寿险的看法与寿险需求

态度决定行为，我们认为受访者对寿险的看法会对其寿险购买行为会产生影响。调查问卷中以“寿险的有用性”作为对寿险的看法的指标，寿险的有用性从五个选项中选择：没有用处、一般、有用、非常有用、不知道。对寿险的看法与年缴保费进行独立性检验，检验结果见表 8。

表 8. 寿险是否有用与保费的独立性检验结果(卡方检验)

| | 值 | 自由度 | 渐进 Sig.(双侧) |
|---|---|---|---|
| Pearson 卡方 | 58.768[a] | 20 | .000 |
| 似然比 | 52.531 | 20 | .000 |
| 线性和线性组合 | .000 | 1 | .993 |
| 有效案例中的 N | 271 | | |

a. 20 单元格(66.7%) 的期望计数小于 5。最小期望计数为.26。

表 8 结果显示，P=0.000<0.05，拒绝原假设，即对寿险的看法与其年缴保费具有相关性。对二者作相应分析，相应分析二维表见图 4。

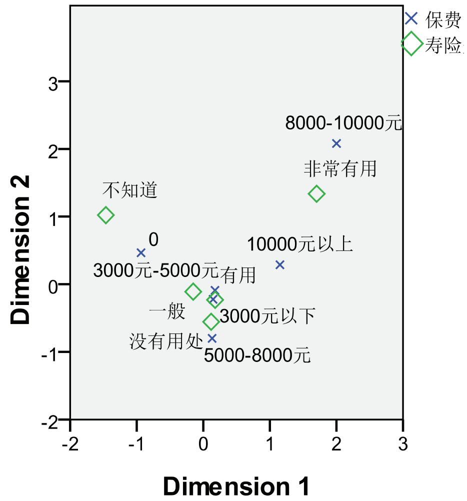



图 4. 对寿险的看法与保费的相应分析二维表

由图 4 可以看出，有四组比较明显的关系可以验证“对寿险的看法决定了其寿险需求”，保费为 0 即不购买寿险与不知道寿险是否有用相关性较大；认为寿险一般有用和有用的与保费 3000 元以下和 3000-5000 元相关性较大；年缴保费 8000-10000 元与认为寿险非常有用相关性较大；而年缴保费在 10000 元以上与对寿险的看法为有用和非常有用有一定相关性。

### 2）对寿险的了解程度与寿险需求

从前面的统计分析中，营销员在居民寿险购买中起了重要作用，55.1%的受访者通过营销员购买寿险产品，但是从购买意愿来看，55.75%的受访者希望直接到保险公司购买，仅有 26.13%的受访者希望通过营销员购买。我们产生这样的疑问，寿险购买是迫于营销员的压力，还是出于对寿险的理解与认可？在问卷中，我们设置了问题“对寿险的了解程度”，包括不了解、一般了解、很了解、非常了解和不知道五种情况。试图通过分析受访者对寿险的了解程度与其年缴保费之间的关系来解答上述疑问。如果对寿险的了解与保费之间不存在相关关系，说明存在迫于营销员压力而购买寿险的情况。首先对了解程度与年缴保费的独立性进行检验，检验结果见表 9。

表 9. 寿险了解程度与保费的独立性检验结果(卡方检验)

| | 值 | 自由度 | 渐进 Sig.(双侧) |
|---|---|---|---|
| Pearson 卡方 | 38.611[a] | 15 | .001 |
| 似然比 | 42.182 | 15 | .000 |
| 线性和线性组合 | 27.550 | 1 | .000 |
| 有效案例中的 N | 271 | | |

a. 14 单元格(58.3%)的期望计数小于 5。最小期望计数 .03。

结果显示，P=0.001<0.05，拒绝原假设，了解寿险程度与其年缴保费具有相关性。对二者进行相应分析，相应分析二维表见图 5。

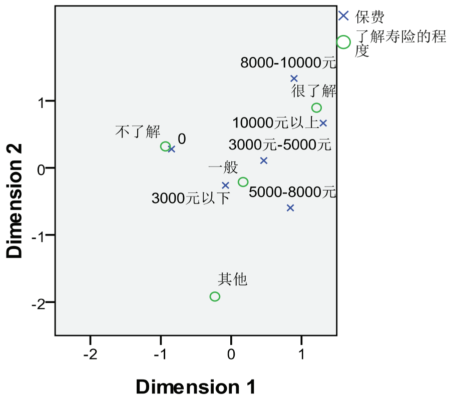



图 5. 寿险了解程度与保费的相应分析二维表

图 5 显示，不了解寿险者一般倾向于不购买寿险；一般了解寿险者倾向于购买年缴保费为 3000 元以下、3000-5000 元、5000-8000 元的寿险；很了解寿险者与年缴保费 8000-10000 元、10000 元以上相关性较大。可见，寿险了解程度与年缴保费有比较明显的正向相关关系，说明购买寿险的受访者对所购买的寿险是了解的。考虑到 36.76%的受访者通过营销员了解寿险，55.1%的受访者通过营销员购买寿险这两个因素，我们可以认为营销员在销售过程中发挥了向投保人传播寿险知识、说明寿险产品的作用。

根据休伯纳的生命价值理论、莫迪利亚尼的生命周期理论、Yaari 和 Lewis 不确定性条件下寿险需求模型等经典寿险需求理论以及已有的研究文献，论文总结出生命周期、收入、教育水平和对寿险的认知是影响寿险需求的主要因素。据此设计调查问卷，并在青岛地区进行问卷调查，通过对调查所得数据，使用相应分析等统计方法对青岛的寿险需求进行分析，得出以下结论：

在对寿险的认知方面，有 36.76%的受访者是通过寿险营销员了解寿险的，同时，根据相应分析发现寿险购买与对寿险的看法、对寿险的了解程度有明显的正相关性，说明寿险营销员对寿险市场有比较强的教育功能。

寿险购买行为与家庭阶段有密切关系，已婚者比未婚者更易投保，而已婚有子女者购买寿险最多，已婚无子女者其次，未婚者最少，与生命周期理论吻合。从结构来看，已婚有子女者所购买的寿险中，给孩子的比例最高，以后依次是给自己、配偶和老人购买。从给自己购买寿险的比例来看，已婚有子女者的购买比例也是最高的。

在购买的类型方面，有 61.54%的人购买分红险，超过传统型和投资型寿险产品。在购买原因方面，医疗和养老需要是寿险购买的主要原因，占到 9 成以上。

家庭收入与寿险需求成倒 U 型关系，家庭月收入 5000 元以下倾向于不购买或购买较少寿险；家庭月收入从 5000 元到 20000 元之间，随着收入提高，寿险需求逐步增加；而家庭月收入达到 20000 元以上后，寿险需求下降。

[1]S.S.Huebner, Meng Zhaoxia, the Economics of Life Insurance, China Financial Publishing House,1997
S.S.Huebner, 孟朝霞等译，人寿保险经济学，中国金融出版社，1997。
[2]Yaari, M. E.Uncertain Lifetime Life Insurance, and the Theory of the Consumer, Review of Economic Studies, April 1965,32,137-50.
[3]Lewis, F.D. Dependents and the Demand for Life Insurance,1989,38:563-70
[4] Zhu Minglai and Chen Xueying, An Empirical Analysis on the Life Insurance Demand in China[J],Productivity Research, 2007(9):32-33
朱铭来、谌雪莺，我国寿险需求的实证研究，生产力研究，2007(9)。
[5] Chen Zhichu and Liu Xiaojing, Analysis on the Determinants of Life Insurance Demand in China, Insurance Studies,2004(6)
陈之楚、刘晓敬，我国寿险需求决定因素分析，保险研究，2004(6)。
[6] Zhao Guiqin, Examination on the Determinants of Life Insurance Demand in China, Journal of Zhongnan University of Economics and Law,2006(1)
赵桂芹，中国寿险需求影响因素的检验，中南财经政法大学学报，2006(1)。
[7] Zhou Haizhen, Investigation and Analysis on Life Insurance Demand of Residents in Zhejiang, Shanghai Insurance,2004(10)
周海珍，浙江省居民寿险需求的调查与分析，上海保险，2004（10）。
[8] Xia Yiguo, Empirical Analysis on the Determinants of Life Insurance Demand in China, technical economy,2007(6)
夏益国，我国寿险需求影响因素的实证分析，技术经济，2007（6）。
[9] Bai Li and Li Haigang, Model Analysis on Life Insurance Demand Based on Time Series Analysis, Science Technology and Engineering,2010(5)
白丽、李海刚，基于时间序列分析的寿险需求模型分析，科学技术与工程，2010（5）。
[10] Yang Pingli and Wang Xueliang, Analysis on the Determinants of Life Insurance Demand in Shanxi, Technology and Economy Market,2010(7)
杨平利、王学良，陕西省寿险需求影响因素的分析，科技经济市场，2010（7）。

# 基于相应分析的寿险需求调查研究

刘学宁 ，李风风
经济学院，青岛大学，青岛，中国，266071

**摘　要**：经典寿险需求理论认为，生命价值、收入、生命周期等因素对寿险需求有重要影响。根据对青岛地区的问卷调查，运用 SPSS 分别进行家庭收入、婚姻状况、对寿险的认知与寿险年缴保费的相应分析，发现家庭收入与寿险需求成倒 U 型关系；婚姻状况与寿险需求具有相关关系，已婚有子女者比已婚无子女者和未婚者更倾向于购买寿险；寿险认知程度与寿险需求之间有明显的正向相关关系。另外，调查显示，绝大部分人通过寿险营销员以及亲戚朋友了解寿险，主要通过营销员购买寿险，途径单一；居民购买的寿险产品以分红型为主，反映出居民侧重于寿险的理财功能。

**关键词**：寿险需求；相应分析；调查问卷

# Study on Critical Illness Insurance Rate in China

MA Shaodong
School of Finance, Guizhou University of Finance and Economics, Guiyang, China, 550004

**Abstract**: The critical illness insurance is(CII) flourishing in China. The survey display that CII is the most popular insurance product in market in China. In fact, the market rate of CII is actual high, this may restrain many people's demand of insurance. The rate of CII in Chinese Market are adopted guarantee rate, this may lead great risk. So we must explore the adjustment mechanism of CII further. The ratemaking of CII based on the measurement of inception rate of critical illness and the probability of survey, but there is no public data in China now. The article discusses the measurement of inception rate of critical illness, proposed some methods to measure the inception rate of critical illness. Based the measurement result, combining the main CII product in Chinese insurance market, the article determined the rate of accelerated CII, and evaluated the market rate. And then, the article proposed the adjustment mechanism to against guarantee rate.

**Keywords**: critical illness insurance; rate adjustment; inception rate of critical illness

## Ⅰ.引言

重大疾病保险自 1995 年进入中国市场以来，历经了普通重大疾病保险产品的出现与初步发展阶段、分红型重大疾病保险的出现与停售阶段与重大疾病保险的规范化发展阶段[1]。在现阶段，重大疾病保险正处于蓬勃发展时期，据调查研究显示，重大疾病保险是中国保险市场上深受欢迎的保险产品，年新业务销售量超过 600 万份[5]。

在看到中国重大疾病保险发展势头喜人、业务逐年扩大局面的同时，也要看到其中存在的很多问题：产品结构不合理、产品缺乏有效创新、产品设计缺陷、费率结构不合理、重大疾病定义方面的问题、行业性的全面的重大疾病经验分析缺乏以及基础研究不足等。重大疾病保险基础研究不足是其中最重要的问题，基础数据缺乏导致经营主体只能从再保险公司获得产品开发所需要的数据，这必然导致各经营主体提供的产品同质、缺乏差异化等问题。科学合理地测量重大疾病发生率是有效解决这些问题的关键。

## Ⅱ.重大疾病发生率测量

根据重大疾病保险的特点，重大疾病风险测量至少应该包括以下两个方面：一是重大疾病发生率，即重大疾病风险事件发生的可能性；二是重大疾病风险事件发生以后，被保险人的生存时间，这点很容易被忽视。事实上，根据开发重大疾病保险最初的本意来看，在保单条款中设置生存期是必须且合理的。生存期的长短反过来又影响重大疾病索赔率的经验结果，生存期越长，符合保单条件的重大疾病索赔就越少，从而重大疾病经验索赔率就越低，反之亦然。生存期的设置必须基于重大疾病患者的生存时间度量，遗憾的是，在国内的保险实践中，关于这方面的统计研究极为欠缺。

一般而言，根据可利用的数据，测量重大疾病发生率的途径有两种：一种是从一般人群统计数据出发测量发生率，然后将之调整为适用于被保险人群的发生率；另一种是基于保险行业的经验索赔数据测量得到重大疾病的经验发生率。一般人群统计数据比保险索赔经验更加可靠，但一般人群数据也并非为保险目的，缺乏与重大疾病保险经营的直接相关性。具体选择哪种途径来获得需要的结果，则依赖于所取得的数据资源，没有哪一种获取途径在其基础上是绝对理想的，必须对这两种不同途径得到的测量结果进行比较，从而得到更为合理的测量结果。具体而言，人群统计数据能够给出发生率在年龄段间的差异，而保险经验数据能够得到发生率的具体强度和大小。通常，一般人群数据特别是国家权威机构的统计数据能提供详细的死因统计，在资料缺乏时，可以从死因统计中估计重大疾病发生率，但这会带来很大误差。但与保险人群统计数据结合使用能取得最佳效果。

### A.基于一般人群数据的重大疾病死因统计

与重大疾病相关的一般人群统计数据能从许多数据资源中获取，如政府卫生和统计部门、慈善团体、医学和学术研究机构的研究论文等。对于大部分的重大疾病，这些统计资料可靠而且比较详尽，但与被保险人群相比，这些数据是基于更广泛的、不同的人群的统计结果，在应用时必须对一般人群统计数据结果进行一定的调整，如按年龄和性别来测量重大疾病发生率时资料可能是可用的，但如果考虑到影响重大疾病发生的因素如进一步按是否吸烟来细分风险则可能是不可用的。相对于重大疾病而言，人群统计资料更适合于死因统计和非保险目的测量，这时必须使用间接方法来测量重大疾病发生率。对于某些重大疾病，可能要参考其他国家或地区的经验数据。

在测量方法上，一般人群统计数据下关于率的测量都使用发生数/暴露数法，分子是特定风险事件的发生次数，分母是特定人群的调查人数，其统计结果一般用万分率和十万分率来表示。

从一般人群数据的来源来看，政府卫生和统计部门的资料具有可靠性和权威性，但这种数据资料缺乏一定的针对性。尽管如此，这类数据也是重大疾病发生率测量的一般人群首选数据资料，在中国大陆尤其如此。中国大陆的这类统计资料最具权威性的是卫生部公布的统计数据，包括中国卫生统计年鉴、卫生服务调查研究报告以及全国死因回顾抽样调查报告等出版物。特别是全国死因回顾抽样调查报告在重大疾病发生率的测量中起到很大的作用，卫生服务调查研究报告和卫生统计年鉴中的关于患病率的资料也能作为重大疾病发生率调整的参考。

一般而言，大多数重大疾病的死亡率较高，其生存时间并不长，特别是恶性肿瘤、终末期肾病等。死因调查报告中的死因非常详细，能够从中整理出与重大疾病保险定义接近的死因死亡率，这一死亡率事实上可以看作是重大疾病发生率的一种近似，经过调整后可以作为重大疾病保险产品定价时的精算假设。笔者根据卫生部的统计出版物《全国第三次死因回归抽样调查报告》[2]，基于上述思路，整理出与中国重大疾病定义接近的死因死亡率，结果见下表[1]。

**表 1 全国样本地区重大疾病死亡率（1/10 万）**

| 年龄 | 男 | 女 | 年龄 | 男 | 女 |
|---|---|---|---|---|---|
| 0- | 0.00083 | 0.00063 | 45-49 | 0.00362 | 0.00171 |
| 1-4 | 0.00049 | 0.00060 | 50-54 | 0.00596 | 0.00307 |
| 5-9 | 0.00032 | 0.00033 | 55-59 | 0.00901 | 0.00479 |
| 10-14 | 0.00028 | 0.00017 | 60-64 | 0.01249 | 0.00693 |
| 15-19 | 0.00059 | 0.00017 | 65-69 | 0.01992 | 0.01157 |
| 20-24 | 0.00075 | 0.00027 | 70-74 | 0.03342 | 0.01975 |
| 25-29 | 0.00080 | 0.00033 | 75-79 | 0.05021 | 0.03186 |
| 30-34 | 0.00115 | 0.00045 | 80-84 | 0.07838 | 0.05275 |
| 35-39 | 0.00181 | 0.00077 | 85- | 0.10136 | 0.08144 |
| 40-44 | 0.00263 | 0.00120 | | | |

由于一般人群下的死因与重大疾病定义有区别，其中的某些死因并非重大疾病保险所承保的范围，但一般人群数据关于这点并没有详细的分类无法将之剔除，故而一般人群数据的结果可能会高于重大疾病保险所承保的重大疾病的实际发生率。因此，上述结果必须根据其他来源的数据进行调整，或者作为调整其他来源数据的参考。

根据索赔经验来对人群发生率进行调整是最理想的。如果市场没有重大疾病被保险人的索赔经验，通过社会经济团体的重大疾病的数据变异程度或通过被保险人群与一般人群死因之间的联系来推断一般人群测量结果的调整幅度也是可行的。对于新型的市场，由于缺乏国内数据，可采用的方法是对死亡率/疾病率进行国际比较，然后对国外的被保险人群发生率进行调整以符合本国的情况。

[1] 与健康保险重大疾病定义（中国保险行业协会2007 标准化定义）相近的死因主要包括：恶性肿瘤、良性肿瘤、贫血、精神障碍、脑膜炎、急性心肌梗死、其他冠心病、脑血管病、肝疾病、病毒性肝炎以及损伤和中毒等外部原因。

## B.基于保险人群数据的重大疾病发生率测量

重大疾病保险在被保险人罹患保单约定的重大疾病或手术时，保险人给付保险金，保险责任中止。因此，从重大疾病保险理赔数据中一般不能获得被保险人在罹患重大疾病后的生存时间、死亡时间等信息。在测量重大疾病发生率时，最适合的测量方法是发生数/暴露数法，但可以讨论重大疾病发生率的趋势、影响因素等。

在使用发生数/暴露数法测量重大疾病发生率时，分子为重大疾病发生次数，分母为观察期内被保险人的风险暴露数。由于被保险人在观察期内有进入、退出或死亡等因素的影响，必须对每一位被保险人，计算观察期内的被保险期间。观察年度采用日历年法（calendar anniversary）。

暴露数保险年龄 $x$ 一般采用最近生日法(age nearest birthday basis）计算。各保险年龄的经验暴露数 $E_x$ 的计算，采用逐单法(seriatim method)，计算公式为：保险年龄 x 岁的实际投保天数/365。若将观察年度内所有被保险人的在年龄 x 岁的经验暴露数求和，就可以得到保险年龄 x 岁在观察年度内的经验暴露数 $E_x$，即

$E_x=\sum_{任意投保人}$实际投保天数/365

一般而言，基于一般人群和保险人群测量得到的是分年龄组结果，必须将这些年龄组结果经过平滑得到单个年龄的发生率。平滑年龄组的方法一般有两种：一种是将发生率看作是年龄、性别的函数，采用广义线性回归方法来拟合；另一种方法是样条插值。

保险人群数据主要来自某再保险公司针对东南亚保险市场所作的重大疾病调查 2000－2004，此次调查几乎涵盖了 100%的中国重大疾病保险产品。在此次重大疾病统计中，共考察了 36 种重大疾病，包含了中国保险行业协会规定的 25 种重大疾病，故而此次的调查结果对中国大陆重大疾病保险产品开发和费率厘定有十分重要的参考和实用价值，以此作为中国重大疾病保险产品的定价基础也是合理的。此次重大疾病调查中测量得到了包括中国保险行业协会发布的《重大疾病保险的疾病定义使用规范》中所规定的 25 种重大疾病在内的 36 种重大伤病发生率（表 2 仅列出了部分年龄）。

表 2 重大疾病发生率

| 年龄 | 男性 | 女性 | 年龄 | 男性 | 女性 |
|---|---|---|---|---|---|
| 0 | 0.00077 | 0.00062 | 72 | 0.02305 | 0.01631 |
| 1 | 0.00090 | 0.00059 | 73 | 0.02403 | 0.01706 |
| 2 | 0.00072 | 0.00056 | 74 | 0.02505 | 0.01785 |
| 3 | 0.00063 | 0.00053 | 75 | 0.02611 | 0.01867 |
| 4 | 0.00061 | 0.00051 | 76 | 0.02722 | 0.01952 |
| … | … | … | … | … | … |
| 15 | 0.00058 | 0.00048 | 87 | 0.04301 | 0.03175 |
| 16 | 0.00061 | 0.00050 | 88 | 0.04480 | 0.03319 |
| 17 | 0.00063 | 0.00051 | 89 | 0.04666 | 0.03469 |
| 18 | 0.00067 | 0.00055 | 90 | 0.04860 | 0.03626 |
| 19 | 0.00071 | 0.00057 | 91 | 0.05062 | 0.03790 |
| … | … | … | … | … | … |
| 30 | 0.00103 | 0.00113 | 102 | 0.07925 | 0.06166 |
| 31 | 0.00107 | 0.00123 | 103 | 0.08255 | 0.06445 |
| 32 | 0.00111 | 0.00134 | 104 | 0.08598 | 0.06736 |
| 33 | 0.00121 | 0.00142 | 105 | 0.08956 | 0.07041 |
| 34 | 0.00130 | 0.00151 | | | |
| 35 | 0.00140 | 0.00161 | | | |

从实务上看，重大疾病保险分为额外给付型和提前给付型两种产品形态。表 2 事实上是额外给付型重大疾病保险产品的重大疾病发生率。提前给付型重大疾病保险的保险金在死亡或重大疾病首次发生时赔付，因此死亡发生率必须加到发生率中。提前给付型重大疾病保险的总发生率的一般模型为 $i_x+(1-k_x)q_x$,，其中 $i_x$ 是重大疾病发生率，$q_x$ 是全人群死亡率，$k_x$ 是因重大疾病导致的死亡占全部死亡的比例（基于死因调查结果）。

中国第三次死因回顾抽样调查报告显示[2]，脑血管疾病和恶性肿瘤是中国第一和第二死亡原因，两种疾病的死亡率十分接近，分别占总死亡数的 22.45%和 22.32%。也就是说，目前中国仅 45%的死者死于脑血管和恶性肿瘤疾病。第三、第四位呼吸系统疾病和心脏病分别占死亡人数的 15.8%和 14.8%，第五位损伤和中毒占死亡人数的 10.1%。由此可以看出，前五位死因累积占总死亡人数的近 85%。

因此，死于重大疾病的死亡率近 60%（主要为脑血管疾病、恶性肿瘤和心脏病，男性 59.55%，女性 59.63）。同时，再保险公司针对东南亚保

险市场所作的重大疾病调查 2000－2004，中国大陆前十位理赔原因显示，癌症仍是中国大陆重大疾病保险的首要理赔原因，95%的理赔集中在前十种疾病（表 3，4）。

**表 3　中国大陆前十位理赔原因－男性**

| 理赔原因 | 排序 | 占比 |
|---|---|---|
| 癌症 | 1 | 60.7% |
| 急性心肌梗塞 | 2 | 18.6% |
| 中风 | 3 | 6.6% |
| 肾脏衰竭 | 4 | 4.9% |
| 冠状动脉搭桥手术以外的心脏手术 | 5 | 1.6% |
| 冠状动脉搭桥手术/其它严重心脏病 | 6 | 1.2% |
| 瘫痪 | 7 | 1.2% |
| 良性脑肿瘤 | 8 | 0.8% |
| 严重烧伤 | 9 | 0.5% |
| 爆发性病毒肝炎 | 10 | 0.4% |
| 前 10 位合计 | | 96.5% |

**表 4　中国大陆前十位理赔原因－女性**

| 理赔原因 | 排序% | 占比 |
|---|---|---|
| 癌症 | 1 | 84.3% |
| 中风 | 2 | 3.9% |
| 肾脏衰竭 | 3 | 2.9% |
| 急性心肌梗塞 | 4 | 2.4% |
| 冠状动脉搭桥手术以外的心脏手术 | 5 | 1.2% |
| 良性脑肿瘤 | 6 | 1.1% |
| 瘫痪 | 7 | 0.7% |
| 原位癌 | 8 | 0.6% |
| 严重烧伤 | 9 | 0.2% |
| 冠状动脉搭桥手术/其它严重心脏病 | 10 | 0.4% |
| 前 10 位合计 | | 97.7% |

从表 3 和 4 中看出，癌症、良性脑肿瘤、中风、急性心肌梗塞、冠状动脉搭桥手术以外的心脏手术、冠状动脉搭桥手术/其它严重心脏病等占索赔的近 90%（男性 89.5%，女性 93.9%）。综合表 2、3、4、5，根据审慎性原则，$k_x$的值应该在 40%－60%之间。在此，笔者取 $k_x$=40%对额外给付型重大疾病保险的重大伤病发生率进行调整以得到提前给付型重大疾病保险的总发生率（表 5，详见附表 1）。

**表 5 重大疾病总发生率（提前给付型）**

| 年龄 | 男性 | 女性 | 年龄 | 男性 | 女性 |
|---|---|---|---|---|---|
| 0 | 0.001603 | 0.001017 | 72 | 0.04326 | 0.029939 |
| 1 | 0.001262 | 0.000912 | 73 | 0.046453 | 0.032347 |
| 2 | 0.001019 | 0.000814 | 74 | 0.049908 | 0.034987 |
| 3 | 0.00088 | 0.00073 | 75 | 0.053651 | 0.037863 |
| 4 | 0.000825 | 0.00067 | 76 | 0.057717 | 0.040998 |
| … | … | … | … | … | … |
| 15 | 0.000798 | 0.000595 | 87 | 0.134304 | 0.103368 |
| 16 | 0.000852 | 0.000625 | 88 | 0.145326 | 0.112848 |
| 17 | 0.000903 | 0.000646 | 89 | 0.15726 | 0.123222 |
| 18 | 0.000978 | 0.000697 | 90 | 0.170173 | 0.13457 |
| 19 | 0.001053 | 0.000728 | 91 | 0.18412 | 0.146965 |
| … | … | … | … | … | … |
| 30 | 0.001559 | 0.001374 | 102 | 0.41664 | 0.370187 |
| 31 | 0.001629 | 0.001489 | 103 | 0.444673 | 0.398811 |
| 32 | 0.001706 | 0.001619 | 104 | 0.473442 | 0.428498 |
| 33 | 0.001843 | 0.001718 | 105 | 0.68956 | 0.67041 |
| 34 | 0.001973 | 0.001827 | | | |
| 35 | 0.002116 | 0.001948 | | | |

在应用保险人群索赔经验测量结果时，必须结合公司的经营状况、国家/地区的疾病谱、人口统计特征等因素来选择。对于大多数保险市

场而言，可靠的重大疾病保险索赔经验仍然十分缺乏。即使再保险公司或专业团体集合了大多数保险市场的经验数据，其研究结果也应该谨慎使用，特别当这些结果被应用到特定的保险市场上时，可靠性就成了其中最大的问题。尽管如此，其他保险市场的索赔经验仍能成为新兴健康保险市场上重大疾病保险经营的有价值的参考。

保险公司的实际经验资料、再保险公司的统计资料以及国内外医疗研究机构的研究资料都可为保险经营提供数据基础，但这些数据也各有不足，如各个保险公司的实际经验数据资料数量不大、国内外经验统计资料并非涵盖全国所有人的医疗消费行为，从而导致发生率统计资料来源是否适用等问题。因此，在采用这些数据作为保险经营的数据基础时必须谨慎。

在本国或地区缺乏经验统计数据时，可以参考借鉴其它与本国具有相似人口、经济环境国家的经验数据。遗憾的是，并不是所有的市场都有充分的大量的数据。许多新兴保险市场的保险人因而被迫使用其他保险市场的结果，这样做需要考虑不同国家之间的差异，根据国情做适当的调整。为了得到更精确的精算基础，当然必须尽可能得到当地的一般人群的统计数据。如果没有可靠的国家统计数据可用，可以通过比较死亡原因将其他市场的经验数据移植过来。特别地，医疗水平是影响患重大疾病发生后生存概率的一个关键因素，不同地区的医疗水平是影响重大疾病生存概率的主要因素。在这时使用死因统计数据导致测量的发生率与实际发生率有重大差异。

# III. 中国重大疾病保险费率研究

## A 中国重大疾病保险费率水平

在健康保险实务中，重大疾病保险有两种形态：提前给付型和额外给付型（独立给付型）。提前给付型重大疾病保险承保死亡和重大疾病责任，在死亡和重大疾病之一发生时支付保险金，保险责任结束。额外给付型重大疾病保险仅在重大疾病发生时支付保险金，重大疾病原因以外死亡不给付保险金。在中国保险市场上，绝大多数产品是提前给付型产品。额外给付型产品多以附加险形式销售。

提前给付型重大疾病保险是最常见的最早的产品形态，关于其定价的研究也比较成熟，但提前给付型重大疾病保险产品的定价方法要比人寿保险的定价方法要复杂得多[6]。

目前国内有50余家寿险公司和30多家财险公司提供各种长短期重大疾病保险产品，产品主要是主险和附加险形式。产品种类近 500 余种，其中主险约占 24%，附加险 76%。额外给付型产品约占 18%，提前给付型产品占 82%。统计结果与 Gen Re 报告（80%为提前给付型）比较接近。从产品保障对象来看，性别类产品 40 多种，青少年产品 41 种，其它均为传统产品。

从保险责任来看，一是承保的疾病都包含了保险行业协会规定的 25 种重大疾病，除此以外，不同的公司也大多承保了其它医疗花费巨大但没有标准定义的疾病。二是为了竞争的需要，大多数产品的保险责任是多样化的，除了给付重大疾病保险金以外，还负有给付死亡保险金、重大疾病住院津贴、重大疾病手术津贴等多项责任。三是部分产品还提供重大疾病部分给付，根据重大疾病的严重程度来决定给付金额。

重大疾病保险的等待期一般为 180 天，目前尚无重大疾病保险设置生存期。从定价方法上看，国内保险公司所采用的方法与本章中的方法基本一致。对于重大疾病保险定价的预定重大疾病发生率，《精算规定》并没有给出统一的规定，以前业内一般借用再保险公司提供的东南亚人群的重大疾病发生率，有时会根据需要做一定的修正。目前中国大陆也有了重大疾病保险发生率的行业经验统计，尽管这一结果仅限于中国人寿等 12 家寿险公司，其他保险公司仍可以通过再保险公司获得这一测量结果。

在此，笔者以提前给付型主险——长期重大疾病保险为例来研究中国重大疾病保险产品费率，精算假定如下：

（1）险种类别：长期健康保险

（2）保险期间：终身

（3）缴费期间：趸缴、5 年、10 年、15 年、20 年、终身

（4）预定死亡率：严格按照中国保险监督管理委员会的规定，采用中国人寿保险业经验生命表（2000-2003）之非养老金业务男/女表（CL1/CL2）；

（5）预定疾病发生率：表 5

（6）预定附加费用率：根据中国保险监督管理委员会的相关规定而确定。

（7）预定利率：2.5%

（8）中国保险行业协会《重大疾病保险的疾病定义使用规范》范围之内的 25 种重大疾病，另外包括终末期慢性呼吸功能衰竭疾病、多发性硬化、肌营养不良、终末期疾病、系统性红斑狼疮性肾炎、急性出血坏死性胰腺炎、克隆病。

根据上述假定，厘定得到了相应的重大疾病保险产品的费率（附表 2、3）。

## B.中国重大疾病保险市场费率评价

### 1)、中国重大疾病保险产品普遍偏高

从当前的国际经验来看，重大疾病保险几乎都以商业健康保险模式提供，在美国团体重大疾病保险尤为发达。随着医疗费用的上涨，重大疾病医疗花费非常昂贵，一般都在 20－30 万。若采用商业重大疾病保险来筹资，则保费由投保人全部承担。长期重大疾病保险本身就是一种比较“昂贵”的产品，根据本文的结果，以 30 岁为例，10 年、20 年、终身重大疾病保险的保费如表 6（10 万保额）。

**表 6 30 岁被保险人重大疾病保险保费（元）**

| | 男性 | | | 女性 | | |
|---|---|---|---|---|---|---|
| 缴费期 | 10 年 | 20 年 | 终身 | 10 年 | 20 年 | 终身 |
| 额外给付型 | 2419 | 1380 | 846 | 2336 | 1330 | 784 |
| 提前给付型 | 4210 | 2402 | 1472 | 3944 | 2246 | 1324 |

从上表可以看出，提前给付型终身重大疾病保险的均衡保费比额外给付型高很多，这是因为提前给付型包含了死亡给付责任的缘故。如果保险责任允许部分提前给付、回购等，则保费还会更高。

另一方面，收入是影响保险需求的重要因素，也是将潜在需求转化为有效需求的关键。尽管中国经济持续高速增长，城镇居民可支配收入和农村居民人均纯收入不断增长，增强了人们的购买力，释放了部分保险需求。但也要看到，中国的经济发展存在城乡不平衡、地区不平衡，城乡居民、东西部居民的人均收入存在差异，所有的居民能负担起商业健康保险仍还遥远。

**表 7 东、中、西部及东北地区城镇居民人均收入（2010）**

| | 东部地区 | 中部地区 | 西部地区 | 东北地区 |
|---|---|---|---|---|
| 人均全部年收入（元） | 23153.21 | 15539.39 | 15523.03 | 15842.64 |
| 人均可支配收入（元） | 20953.21 | 14367.11 | 14213.47 | 14324.34 |

**表 8 农村居民家庭平均每人纯收入（2010） 单位：元**

| 1990 | 1995 | 2000 | 2005 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|
| 686.3 | 1577.7 | 2253.4 | 3254.9 | 4760.6 | 5153.1 | 5919.0 |

从表 7 可以看出，2010 年，中国东部地区的城镇居民人均纯收入比中部、西部、东北部地区高出近 45%，而中部、西部、东北部地区的城镇人均纯收入相差不大。从表 8 可以看出，中国农村居民家庭人均纯收入远低于城镇居民，几乎是东部地区城镇居民的四分之一，中部、西部、东北部地区城镇居民的三分之一。

按照目前中国保险市场上的销售观点，认为个人年收入的 20%用于购买商业保险是合适的[2]。据此与表 7、8，可以测算得到城乡居民人均购买商业保险的能力（表 9）。

**表 9 城乡居民商业保险购买能力（2010） 单位：元**

| 城镇居民 | | | | 农村居民 |
|---|---|---|---|---|
| 东部地区 | 中部地区 | 西部地区 | 东北地区 | |
| 4190.64 | 2873.42 | 2842.69 | 2864.87 | 1030.63 |

[2] 事实上，这一比例对于较高收入人群可能是合适的，但对于大多数中低收入人群这一比例可能只有 10%或更低。在此都以 20%来估算，实际过高估计了中低收入群体的保险购买力。

从上表可以看出，城乡居民个人的商业保险购买能力还不足以支持人人都能享有商业长期健康保险（因为个人还可能购买寿险、意外险、补充保险等）。在东部地区，若以家庭为单位，每两个人中有一人可享有商业健康保险，而在中部、西部和东北地区，则每四个人中有一个可享有商业健康保险。而多绝大多数农村居民而言，享有商业健康保险还是神话。根据《中国统计年鉴2011》公布的数据，2010年城镇居民中高收入及最高收入人群占 20%，其人均可支配收入为23188.9元和41158元。据此估计，中国目前能享有商业长期健康保险的潜在人群大致在城镇人口的20%以内。

与市场上同类产品比较结果发现：从整体上看，重大疾病保险市场费率都偏高，是更为昂贵的产品（表11）。在此以30岁男性、终身保障、10万保额、10年或20年缴费、保障疾病为《重大疾病保险的疾病定义使用规范》规定的 25 种重大疾病及其他未定义疾病为比较基础。为了方便，在此对25种重大疾病以外的疾病编号如下：（1）慢性呼吸功能衰竭、（2）严重多发性硬化、（3）脊髓灰质炎、（4）全身性重症肌无力、（5）II 级重症急性胰腺炎、（6）肌营养不良症、（7）系统性红斑狼疮 － III 型或以上狼疮性肾炎、（8）急性坏死性胰腺炎开腹手术、（9）脑动脉瘤开颅手术、（10）终末期肺病、（11）严重冠心病、（12）原发性心肌病、（13）严重类风湿性关节炎、（14）严重克隆病、（15）因职业关系导致的人类免疫缺陷病毒（HIV）感染、（16）严重胰岛素依赖型糖尿病（I 型糖尿病）、（17）严重心肌病、（18）经输血导致的人类免疫缺陷病毒感染、（19）、终末期疾病、（20）细菌性脑脊髓膜炎、（21）植物人状态。

分析其中的原因，大致有以下几点：

（1）产品设计。重大疾病保险产品承保的重大疾病种类一般都包含保险行业协会规定的25种重大疾病，为了竞争许多产品还将其它一些没有标准定义但花费不菲的疾病也列为保险

**表 10 提前给付型重大疾病保险（主险）费率比较**

| 公司 | 10 | 20 年 | 保障疾病[3] |
|---|---|---|---|
| 本文结果 | 4210 | 2402 | （1）、（2）、（6）、（7）、（8）、（14）、（19） |
| 生命人寿 | —— | 3370 | （1）-（7） |
| 中国人寿 | 6500 | —— | （3）、（7）、（8）、（9） |
| 太平人寿 | —— | 3610 | （2）、（3）、（4）、（7）、（10）——（15） |
| 新华人寿 | —— | 4860 | （2）、（6）、（7）、（8）、（10）、（15）、（16） |
| 昆仑健康 | —— | 3250 | （2）、（6）、（7）、（10）、（13）、（17）、（18） |
| 人保人寿 | —— | 3640 | —— |
| 人保健康 | 6130 | 3480 | （1）、（2）、（6）、（7）、（8）、（14）、（19） |
| 海尔保险 | —— | 3502 | （1）—（5） |
| 君龙人寿 | —— | 3250 | 无其他疾病 |
| 汇丰人寿 | —— | 660（20 年定期） | 无其他疾病 |
| 恒安标准 | —— | 3700 | （2）、（3）、（7）、（10）、（12）、（13）、（15）、（20）、 |

责任，这加大了重大疾病发生风险，提高了保费。同时，很多产品在保险责任中还增加重大疾病住院津贴、重大疾病手术津贴等多项责任，这也是导致重大疾病保费偏高的原因。

（2）市场因素。目前，几乎所有的寿险公司都开发了重大疾病保险产品，产品同质性比较严重，这导致了重大疾病保险产品的价格相差不大。出于再保险及分散风险考虑，寿险公

[3] 在此仅列出25种标准定义以外的疾病。事实上，无标准定义的疾病的发生率非常小，对最终结果的影响并不大。

司在开发重大疾病保险产品时，重大疾病发生率大多来自再保险公司，寿险公司在再保险公司提供的发生率基础上进行了调整以降低定价风险。这当然提高了产品的市场价格。

（3）保证费率。中国大陆的重大疾病保险产品 80%以上是保证费率，而重大疾病保险是长期健康保险，保险责任长达数十年，出于降低定价风险和市场风险等考虑，公司在定价时采用了更为保守的定价假设和风险边际，这会导致费率的高水平。

（4）精算假设。提前给付型重大疾病保险在定价时，必须将因重大疾病死亡的概率剔除掉，但在实务中，为了给予更高的风险边际和基于审慎原则，$k_x$的取值较小或者为 0，这导致了提前给付型重大疾病保险产品的费率很高。

2）、保证费率导致未来风险估计不足

保证重大疾病保险费率已经成为一个引人争论的问题[5]。诸如马来西亚这样的以传统储蓄型为主的市场，费率保证产品备受推崇，新业务的 84%是保证费率。而在新加坡该类保证费率业务则下降至 40%。在英国约有 60％的重大疾病保单为房屋抵押保障型保单，大部分的重大疾病保单为保证费率形式。但越来越多的公司开始出售不保证费率的重大疾病保险产品。在中国大陆，近 80%的重大疾病保险产品是保证费率。

随着医疗技术发展和新的诊断技术的出现，许多重大疾病都能够得到早期诊断，也使得一些症状比较轻微的重大疾病得以提前诊断，如早期癌症、轻度中风、轻度心肌梗塞。疾病的早期诊断导致重大疾病保险赔付率的增加，而通常在重大疾病保险产品定价时并没有考虑到承担在这种早期诊断情况下的给付责任。另一方面，随着时间的推移，某些疾病的发生率正在呈增长的趋势，例如前列腺癌和乳腺癌，尤其是乳腺癌，几乎占了索赔的 20%[5]。由于过去的产品定价是以历史数据为精算基础的，并没有考虑到疾病发生率的趋势，因此目前的费率对于疾病发生率趋于增加的情况是不适应的。由此可见，医学的进步和人们生活方式的改变将持续不断地影响着重大疾病风险，使得重大疾病保险的索赔具有很大的不确定性，这可能使得保险人对未来风险估计不足，为了减轻这一风险的影响，实行较高的平准费率就成了其必然选择。

由于重大疾病保险的定价基础受医疗技术进步及疾病发生率趋势的影响，因此应严格限制使用单一费率，特别是对长期的重大疾病保险产品更不应该实行保费保证，保险人应根据疾病的发生变化情况适时调整保险费率，以降低经营风险。在实际经营中，重大疾病保险索赔率的逐年攀升，导致保险公司赔付支出大幅增加，为此应当考虑对现有的固定费率模式加以调整。如可以制定更保守的固定费率，使之尽量与保险人承担的风险水平一致。然而，产品定价的提高将会降低对重大疾病保险需求者的吸引力，甚至使本已较昂贵的重大疾病保险产品超出大多数保险客户的经济承受能力，在目前激烈竞争的市场条件下，轻易提价可能带来的是市场份额和竞争优势的丧失。因此，采用浮动费率的，保险期间为一年的，可保证续保的重大疾病保险产品可能是更好的选择，即费率每经过一定的给定区间（一般是五年）后可加以调整，通常是上浮，它充分考虑了诊疗技术进步等因素对产品的影响，使产品价格和保险公司承担的疾病风险更加一致。

3）、费率缺乏差异化

在中国大陆，几乎所有的重大疾病保险产品没有对吸烟者和非吸烟者实行费率差异化，使用的是综合费率。而在其它保险市场上，如英国、新加坡、南非等，绝大多数保单都对吸烟者和非吸烟者采用差别费率。综合费率增加了公司的定价风险和经营风险。

而且，重大疾病保险发生率事实上具有地域性差异——城市和农村不同、东部地区、中部地区和西部地区不同，因此从理论上讲，这些地区的人所面临的重大疾病风险水平不一致，其所承担的保费也应该存在差异。在当前，中国大陆的重大疾病保险实行的是同一费率，并没有体现出其中的地域性差异，这对不同地区低风险被保险人并不公平。

## C.中国重大疾病保险费率解决方案

根据本文的重大疾病保险费率结果与上述讨论，为了有效降低市场费率，提出以下解决方案：

1）、实行可调费率

重大疾病保险定价的特殊性表现在三个方面：一是定价基础是各种疾病的发生率和死亡

率，数据往往不够完备；二是医疗技术的进步可能导致疾病的诊断比预期提前，从而出现保险金给付比定价假设早；三是疾病定义的明确性将影响保险产品责任范围的界定，从而在很大程度上影响产品的定价。鉴于重大疾病保险定价的特殊性，实行保证费率并非一件明智的事情。

尽管大部分保险公司的重大疾病保险产品都含有非保证费率，但在实践中调整费率仍存在许多问题。对于已经出售的保单，如果提高费率，则客户可能难以接受，影响接受程度，存在大量退保风险，增加逆选择风险。另外，过于频繁的费率调整，也会影响公司的信誉。从技术上看，费率调整以后，保单后期准备金以及保单现金价值评估等处理起来会遇到很多麻烦。费率调整难免会造成退保率、失效率、逆选择风险的变化，这些变化都会给责任准备金及保单价值评估造成麻烦。不同费率下评估的准备金与现金价值的差异如何处理也是一个问题。但实行可调费率必定会降低重大疾病保险产品的费率水平，将风险更低的人纳入到保险中，这也可能会改善重大疾病索赔经验。因此，保费调整机制是重大疾病保险未来发展中必不可少的部分，是控制重大疾病保险的经营风险的重要手段。

当事前核保与事后理赔调查都无法有效控制理赔率，且实际损失大于预期损失时，就必须采用保费调整机制。保费调整有以下几点前提[3]：

（1）保单设计时，保单包含保费可调条款，否则不得事后以理赔率太高而调整保费，以免损害投保人的权益

（2）保费调整对象不能针对个人，必须是针对同类高风险的群体做调整，且只能调整未来保费，不可回溯

（3）保险公司调整健康保险费率，必须是以当年该险种年度损失率达到主管机构或被主管机构授权的精算机构所公布的标准为依据。

含有保费调整机制的长期健康保险(不仅仅是重大疾病保险)实务，可参考德国与美国的实际经验作为经验。在德国，因计算保费的精算因子改变而调整长期健康保险费，是必须符合保险监管法（Insurance Supervisory law）所规定的保费调整条款。也就是说，保险公司需逐年计算每人的平均理赔金额，只有当未来的预期给付(expected benefits)与精算给付(calculated benefits)的比率超过 105%，准许保险公司可调整保费；而当比率超过110%时，就必须调整保费。同时，为保护被保险人、投保人的利益，保险公司需要在征得精算受托人（Actuarial Trustee）的同意才能调整保费，该精算受托人则保证保险公司不会任意行使保费调整机制。

在美国可参考国家保险监督官协会（NAIC）的做法，根据不同的险种分别制定最低损失率，对保险公司经营风险越高者（如不可解约型保单），其最低损失率门槛就越低。

**表 11　NAIC 制定的健康保险的最低损失率（%）**

| | 任意续保 | 条件续保 | 保证续保 | 不可解约 |
|---|---|---|---|---|
| 实支实付 | 60 | 55 | 55 | 50 |
| 定额给付 | 60 | 55 | 50 | 40 |

至于保费的调整机制，则以实际损失率是否超过法定最低损失率为依据。

在时点 t 的实际损失率：

$$LR_t = \frac{AVPC_t - AVPR_t}{AVPG_t}$$

其中，$AVPC_t$：过去实际净理赔成本在$t$点的积累值

AVPRt:过去各年度保单责任准备金增加额在 t 点的积累值

AVPGt：过去已收总保费在 t 的积累值

在 t 点的保费调整幅度 K 可由下面的公式计算得出：

$$\frac{AVPC_t - PVFC_t}{AVPG_t - (1+K) * PVFG_t} = ALR$$

其中，PVFCt：未来净理赔成本在$t$点的现值

PVFGt：未来可收总保费在$t$点的现值

ALR：监管机构规定的损失率

调整后在时点 t 的责任准备金提存可由下述公式计算：

$${}_uV_x = PVFC_u - PVFAG_u * ALR$$

其中，$PVFAG_u$：未来可收的调整总保费在$u$点的现值

目前，尽管中国的保险监管机构和行业协会没有对长期健康保险的费率调整做出规定或指引，但以国际经验来看，根据索赔经验或医学进步等因素对重大疾病保险的费率进行调整是一种必然趋势。

**2)、实行费率差异化**

在对被保险人的风险程度进行评估时，吸烟与否是其中非常重要的风险因素。研究显示，多种重大疾病的发生率都受到吸烟习惯的强烈影响，数种重大疾病的发生率与被保险人是否吸烟高度相关。例如，90％的肺癌与吸烟有关，吸烟者心脏病和中风的风险大概是非吸烟者的两倍。吸烟对癌症、心肌梗死或绕道手术的发生率具有非常大的影响。

隐瞒吸烟习惯是一个常见的问题，统计数据表明保单中吸烟的比例严重低于全人群的实际比例[7]。如果发现隐瞒吸烟的事实，保险人可以按吸烟者的费率水平降低被保险人的保险金额，而不是提高费率或者解除保险合同，这种做法使投保人有隐瞒吸烟事实的动力。

许多保险市场针对吸烟者和非吸烟者制定不同的费率表，暗指吸烟者和非吸烟者的发生率不同。根据 Gen Re 的调查，在中国大陆以外的所有市场，几乎所有的重大疾病保险产品都对吸烟者与非吸烟者采用差异化费率。在香港、马来西亚和新加坡，大约 80%的重大疾病保单对吸烟者/非吸烟者采用差异费率，在英国和南非这一比例达到 100%。而在中国大陆，99%的产品是综合费率，这事实上是非吸烟者补贴了吸烟者，有违公平。

另外中国大陆的重大疾病保险产品没有对城市/农村、东部地区/中部地区/西部地区实行费率差异化，事实上重大疾病具有很强的地域性，实行统一费率对不同地区的被保险人并不公平。如果市场能进一步细分的话，实行地区费率差异化将会更好。

**3)、产品设计**

从产品设计角度来看，可以从以下几个方面来降低重大疾病保险的费率：

第一、中国健康保险市场上高端的、“贵”的重大疾病保险产品并不存在供给不足，而是中低端的、价格低的重大疾病保险产品存在供给不足。因此，开发费率较低的短期小额重大疾病保险满足中低收入群体和农村居民的需求是进一步拓展重大疾病保险市场的重要选择。

基于保险人群的重大疾病发生率可以看出，18 周岁以前的未成年人的重大伤病发生率很低，其对应的保险成本也较低，若以一年期商业重大疾病保险承保，保额 10 万，则男性被保险人的纯成本仅约 63 元，而女性则仅为 49 元，即使考虑费用率等因素，未成年人的保额为 10 万的一年期重大疾病保险的保费仅在 75～100 元之间。从投保人的角度来看，不足 100 元的保费，换来 10 万的重大疾病风险保障，对于中低收入人群和农村居民具有不小的吸引力，在经济上也能承受。对于 18～60 岁的成年人而言，一年期重大疾病保险（10 万保额）的纯风险成本在 350 元以内，若考虑费用率等因素，保费仅在 450～550 元之间，这个价格也能为多数被保险人所承受。

第二、合理的等待期、生存期设置等有利于降低充分费率，从而降低产品的市场价格。

第三、中国传统型重大疾病保险产品占比为 84%，其它类型的产品如性别类、特定年龄类、特定疾病类产品种类较少。在开发产品时，可以进一步细分市场，开发非传统型产品，可以以较低的费率满足消费者多样化的需求。

第四、加强产品创新。如将重大疾病进行分组，消费者在购买产品时可以根据自身的经济能力进行选择；根据被保险人罹患重大疾病后的生存时间来支付重大疾病保险金等都是可以考虑的方向。

当然，外部经济环境对重大疾病保险产品的费率也有很大影响，如更有利的健康保险税收优惠政策、更加充分的市场竞争等都有利于产品市场价格的降低，使得重大疾病保险能为更多的人提供保障。

## References

[1]Kong Yuehong, Yang Bo(2008). The Puzzledom, Breakthrough and innovation of Commercial Health Insurance in China—Study on the Compare of Health Insurance Products.[C] Shang Hanji: The System Reform of Medical and Health Insurance in China—Based on Statistical Analysis,

Fudan University Press

孔月红，杨博（2008）中国商业健康保险产品供给的困境、突破与创新——基于健康保险产品比较研究[C].载尚汉冀主编《中国健康保险与医疗保障体系改革——统计分析研究》，复旦大学出版社

[2] Chen Zhu(2008).The Third Cause of Death Nationwide Review of a Sample Survey.(2008).Peking Union Medical College Press.

陈竺（2008）.全国第三次死因回顾抽样调查报告[M].中国协和医科大学出版社

[3](Taiwan).Liang Zhengde,etl (2005).Study Report of Long-term Health Insurance Actuarial Practice. Taiwan: A Professional Insurance Think Tank and Database

（台）梁正德等（2005）.台湾长期健康保险精算实务研究报告[R].台湾：财团法人保险事业发展中心.

[4]Chen Tao, Ma Shaodong, He Linguang(2008). The Application of Morbidity Measurement in Health Insurance[C]. Shang Hanji: The System Reform of Medical and Health Insurance in China—Based on Statistical Analysis, Fudan University Press

陈滔，马绍东，何林广（2008）. 伤病发生率测量在健康保险中的应用研究[C].载《中国健康保险与医疗保障体系改革——统计分析研究》，尚汉冀主编，复旦大学出版社

[5] Gen Re(2008).Critical Illness Survey 2000－2004[R].

[6] Munich Re Group(2001).Critical Illness Insurance[R].

[7].PartnerRe(2009).Critical Illness Insurance-From Risk Evaluation to Successful Product Design[R].

# 附表

**附表 1 重大疾病总发生率（提前给付型）**

| 年龄 | 男性 | 女性 | 年龄 | 男性 | 女性 | 年龄 | 男性 | 女性 |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.001603 | 0.001017 | 36 | 0.002285 | 0.002081 | 72 | 0.04326 | 0.029939 |
| 1 | 0.001262 | 0.000912 | 37 | 0.00246 | 0.002218 | 73 | 0.046453 | 0.032347 |
| 2 | 0.001019 | 0.000814 | 38 | 0.002653 | 0.002519 | 74 | 0.049908 | 0.034987 |
| 3 | 0.00088 | 0.00073 | 39 | 0.002883 | 0.002817 | 75 | 0.053651 | 0.037863 |
| 4 | 0.000825 | 0.00067 | 40 | 0.003129 | 0.003117 | 76 | 0.057717 | 0.040998 |
| 5 | 0.000784 | 0.000614 | 41 | 0.003387 | 0.003418 | 77 | 0.062137 | 0.044416 |
| 6 | 0.000755 | 0.000581 | 42 | 0.003667 | 0.00371 | 78 | 0.066934 | 0.048156 |
| 7 | 0.000735 | 0.000543 | 43 | 0.003978 | 0.00407 | 79 | 0.072163 | 0.052262 |
| 8 | 0.000737 | 0.000549 | 44 | 0.004313 | 0.004442 | 80 | 0.077862 | 0.056754 |
| 9 | 0.000727 | 0.000545 | 45 | 0.004668 | 0.004779 | 81 | 0.084044 | 0.061702 |
| 10 | 0.000727 | 0.000541 | 46 | 0.005177 | 0.005114 | 82 | 0.090783 | 0.067146 |
| 11 | 0.000727 | 0.000549 | 47 | 0.005633 | 0.005453 | 83 | 0.0981 | 0.073107 |
| 12 | 0.000728 | 0.000559 | 48 | 0.006395 | 0.005846 | 84 | 0.106063 | 0.079649 |
| 13 | 0.000732 | 0.000571 | 49 | 0.007049 | 0.006264 | 85 | 0.114713 | 0.086836 |
| 14 | 0.000762 | 0.000587 | 50 | 0.007922 | 0.006704 | 86 | 0.124108 | 0.094726 |
| 15 | 0.000798 | 0.000595 | 51 | 0.008558 | 0.007054 | 87 | 0.134304 | 0.103368 |
| 16 | 0.000852 | 0.000625 | 52 | 0.009199 | 0.007387 | 88 | 0.145326 | 0.112848 |
| 17 | 0.000903 | 0.000646 | 53 | 0.00987 | 0.007988 | 89 | 0.15726 | 0.123222 |
| 18 | 0.000978 | 0.000697 | 54 | 0.010837 | 0.008592 | 90 | 0.170173 | 0.13457 |
| 19 | 0.001053 | 0.000728 | 55 | 0.011652 | 0.009177 | 91 | 0.18412 | 0.146965 |
| 20 | 0.001103 | 0.00077 | 56 | 0.012556 | 0.009766 | 92 | 0.199165 | 0.160478 |
| 21 | 0.001127 | 0.00081 | 57 | 0.013566 | 0.010412 | 93 | 0.21535 | 0.175192 |
| 22 | 0.001135 | 0.000849 | 58 | 0.014876 | 0.011144 | 94 | 0.232736 | 0.191184 |
| 23 | 0.00117 | 0.000907 | 59 | 0.016127 | 0.01189 | 95 | 0.251342 | 0.208509 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 24 | 0.001203 | 0.000953 | 60 | 0.017418 | 0.012691 | 96 | 0.271224 | 0.227222 |
| 25 | 0.001235 | 0.000998 | 61 | 0.018444 | 0.013749 | 97 | 0.292383 | 0.247385 |
| 26 | 0.001257 | 0.001023 | 62 | 0.020118 | 0.014921 | 98 | 0.314827 | 0.269029 |
| 27 | 0.001287 | 0.001057 | 63 | 0.021785 | 0.015786 | 99 | 0.33853 | 0.29215 |
| 28 | 0.001389 | 0.001153 | 64 | 0.023655 | 0.016795 | 100 | 0.363456 | 0.316761 |
| 29 | 0.001475 | 0.001262 | 65 | 0.02576 | 0.017979 | 101 | 0.389528 | 0.342795 |
| 30 | 0.001559 | 0.001374 | 66 | 0.027733 | 0.019266 | 102 | 0.41664 | 0.370187 |
| 31 | 0.001629 | 0.001489 | 67 | 0.029892 | 0.020666 | 103 | 0.444673 | 0.398811 |
| 32 | 0.001706 | 0.001619 | 68 | 0.032252 | 0.0222 | 104 | 0.473442 | 0.428498 |
| 33 | 0.001843 | 0.001718 | 69 | 0.034813 | 0.02388 | 105 | 0.68956 | 0.67041 |
| 34 | 0.001973 | 0.001827 | 70 | 0.037595 | 0.02572 | | | |
| 35 | 0.002116 | 0.001948 | 71 | 0.040314 | 0.027735 | | | |

附表 2 额外给付型重大疾病保险费率（男） 1000 元

| 年龄 | 趸缴 | 5 年缴 | 10 年缴 | 15 年缴 | 20 年缴 | 终身缴 |
|---|---|---|---|---|---|---|
| 0 | 143.53 | 24.56 | 13.07 | 9.26 | 7.37 | 3.55 |
| 1 | 145.58 | 24.9 | 13.25 | 9.38 | 7.47 | 3.62 |
| 2 | 148.04 | 25.31 | 13.47 | 9.54 | 7.59 | 3.7 |
| 3 | 150.81 | 25.78 | 13.71 | 9.71 | 7.73 | 3.79 |
| 4 | 153.76 | 26.28 | 13.98 | 9.9 | 7.88 | 3.88 |
| 5 | 156.81 | 26.8 | 14.26 | 10.1 | 8.04 | 3.98 |
| 6 | 159.96 | 27.34 | 14.54 | 10.3 | 8.2 | 4.09 |
| 7 | 163.21 | 27.89 | 14.84 | 10.51 | 8.37 | 4.2 |
| 8 | 166.58 | 28.47 | 15.14 | 10.73 | 8.54 | 4.31 |
| 9 | 170.04 | 29.06 | 15.46 | 10.95 | 8.72 | 4.43 |
| 10 | 173.6 | 29.67 | 15.78 | 11.19 | 8.91 | 4.56 |
| 11 | 177.25 | 30.29 | 16.12 | 11.42 | 9.1 | 4.69 |
| 12 | 181 | 30.93 | 16.46 | 11.67 | 9.3 | 4.82 |
| 13 | 184.84 | 31.59 | 16.81 | 11.92 | 9.5 | 4.96 |
| 14 | 188.78 | 32.27 | 17.18 | 12.18 | 9.7 | 5.11 |
| 15 | 192.8 | 32.96 | 17.55 | 12.44 | 9.92 | 5.26 |
| 16 | 196.91 | 33.67 | 17.93 | 12.71 | 10.13 | 5.42 |
| 17 | 201.09 | 34.39 | 18.31 | 12.99 | 10.35 | 5.58 |
| 18 | 205.36 | 35.13 | 18.71 | 13.27 | 10.58 | 5.75 |
| 19 | 209.7 | 35.87 | 19.11 | 13.56 | 10.81 | 5.93 |
| 20 | 214.11 | 36.63 | 19.51 | 13.85 | 11.05 | 6.11 |
| 21 | 218.63 | 37.41 | 19.93 | 14.14 | 11.29 | 6.3 |
| 22 | 223.27 | 38.2 | 20.35 | 14.45 | 11.53 | 6.5 |
| 23 | 228.05 | 39.02 | 20.8 | 14.77 | 11.79 | 6.71 |
| 24 | 232.94 | 39.86 | 21.25 | 15.09 | 12.05 | 6.93 |
| 25 | 237.94 | 40.72 | 21.71 | 15.42 | 12.32 | 7.15 |
| 26 | 243.05 | 41.6 | 22.18 | 15.76 | 12.6 | 7.39 |
| 27 | 248.29 | 42.5 | 22.67 | 16.12 | 12.89 | 7.64 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 28 | 253.64 | 43.43 | 23.17 | 16.48 | 13.19 | 7.9 |
| 29 | 259.03 | 44.36 | 23.67 | 16.85 | 13.49 | 8.17 |
| 30 | 264.48 | 45.3 | 24.19 | 17.22 | 13.8 | 8.46 |
| 31 | 270 | 46.26 | 24.71 | 17.6 | 14.11 | 8.75 |
| 32 | 275.64 | 47.24 | 25.24 | 17.99 | 14.44 | 9.06 |
| 33 | 281.4 | 48.24 | 25.79 | 18.39 | 14.78 | 9.38 |
| 34 | 287.21 | 49.25 | 26.35 | 18.8 | 15.12 | 9.72 |
| 35 | 293.07 | 50.28 | 26.91 | 19.22 | 15.48 | 10.07 |
| 36 | 299 | 51.32 | 27.49 | 19.65 | 15.84 | 10.44 |
| 37 | 304.97 | 52.37 | 28.07 | 20.09 | 16.21 | 10.83 |
| 38 | 310.98 | 53.43 | 28.66 | 20.53 | 16.6 | 11.23 |
| 39 | 317.03 | 54.5 | 29.26 | 20.99 | 16.99 | 11.65 |
| 40 | 323.09 | 55.57 | 29.87 | 21.46 | 17.4 | 12.09 |
| 41 | 329.16 | 56.65 | 30.48 | 21.93 | 17.81 | 12.55 |
| 42 | 335.23 | 57.74 | 31.11 | 22.42 | 18.24 | 13.03 |
| 43 | 341.27 | 58.83 | 31.74 | 22.91 | 18.68 | 13.53 |
| 44 | 347.27 | 59.91 | 32.38 | 23.41 | 19.14 | 14.05 |
| 45 | 353.19 | 61 | 33.02 | 23.93 | 19.6 | 14.6 |
| 46 | 359.04 | 62.08 | 33.67 | 24.45 | 20.08 | 15.17 |
| 47 | 364.65 | 63.14 | 34.31 | 24.97 | 20.57 | 15.76 |
| 48 | 370.13 | 64.2 | 34.95 | 25.5 | 21.06 | 16.37 |
| 49 | 375.13 | 65.17 | 35.56 | 26.01 | 21.55 | 16.99 |
| 50 | 379.81 | 66.09 | 36.14 | 26.51 | 22.05 | 17.62 |
| 51 | 383.91 | 66.91 | 36.68 | 26.99 | 22.53 | 18.26 |
| 52 | 387.71 | 67.68 | 37.21 | 27.47 | 23.02 | 18.91 |
| 53 | 391.2 | 68.42 | 37.72 | 27.96 | 23.52 | 19.59 |
| 54 | 394.37 | 69.12 | 38.24 | 28.45 | 24.04 | 20.29 |
| 55 | 396.9 | 69.72 | 38.71 | 28.92 | 24.56 | 21 |
| 56 | 399.04 | 70.28 | 39.17 | 29.4 | 25.09 | 21.73 |
| 57 | 400.81 | 70.8 | 39.62 | 29.89 | 25.63 | 22.49 |
| 58 | 402.23 | 71.27 | 40.07 | 30.38 | 26.2 | 23.27 |
| 59 | 403.1 | 71.66 | 40.49 | 30.87 | 26.78 | 24.06 |
| 60 | 403.62 | 72.01 | 40.9 | 31.37 | 27.37 | 24.87 |

附表 3 提前给付型重大疾病保险费率（男） 1000 元

| 年龄 | 趸缴 | 5 年缴 | 10 年缴 | 15 年缴 | 20 年缴 | 终身缴 |
|---|---|---|---|---|---|---|
| 0 | 243.05 | 41.6 | 22.14 | 15.68 | 12.48 | 6.01 |
| 1 | 247.1 | 42.27 | 22.49 | 15.93 | 12.68 | 6.14 |
| 2 | 251.69 | 43.04 | 22.89 | 16.21 | 12.9 | 6.28 |
| 3 | 256.71 | 43.89 | 23.34 | 16.53 | 13.16 | 6.44 |
| 4 | 262.04 | 44.79 | 23.82 | 16.87 | 13.43 | 6.62 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 5 | 267.57 | 45.73 | 24.32 | 17.23 | 13.72 | 6.79 |
| 6 | 273.29 | 46.71 | 24.84 | 17.6 | 14.01 | 6.98 |
| 7 | 279.19 | 47.72 | 25.38 | 17.98 | 14.32 | 7.18 |
| 8 | 285.27 | 48.76 | 25.93 | 18.37 | 14.63 | 7.38 |
| 9 | 291.51 | 49.82 | 26.5 | 18.78 | 14.95 | 7.6 |
| 10 | 297.92 | 50.92 | 27.09 | 19.2 | 15.29 | 7.82 |
| 11 | 304.5 | 52.04 | 27.69 | 19.62 | 15.63 | 8.05 |
| 12 | 311.25 | 53.2 | 28.31 | 20.07 | 15.98 | 8.29 |
| 13 | 318.17 | 54.38 | 28.94 | 20.52 | 16.35 | 8.54 |
| 14 | 325.26 | 55.6 | 29.6 | 20.98 | 16.72 | 8.8 |
| 15 | 332.51 | 56.85 | 30.26 | 21.46 | 17.1 | 9.07 |
| 16 | 339.9 | 58.12 | 30.95 | 21.95 | 17.49 | 9.36 |
| 17 | 347.43 | 59.42 | 31.64 | 22.44 | 17.89 | 9.65 |
| 18 | 355.09 | 60.74 | 32.35 | 22.95 | 18.3 | 9.95 |
| 19 | 362.88 | 62.08 | 33.06 | 23.46 | 18.71 | 10.26 |
| 20 | 370.79 | 63.44 | 33.79 | 23.98 | 19.13 | 10.58 |
| 21 | 378.86 | 64.82 | 34.53 | 24.51 | 19.56 | 10.92 |
| 22 | 387.12 | 66.24 | 35.29 | 25.05 | 20 | 11.27 |
| 23 | 395.59 | 67.69 | 36.07 | 25.61 | 20.45 | 11.64 |
| 24 | 404.25 | 69.18 | 36.87 | 26.19 | 20.92 | 12.02 |
| 25 | 413.1 | 70.7 | 37.69 | 26.78 | 21.4 | 12.42 |
| 26 | 422.16 | 72.26 | 38.53 | 27.38 | 21.89 | 12.84 |
| 27 | 431.44 | 73.86 | 39.39 | 28 | 22.4 | 13.28 |
| 28 | 440.93 | 75.5 | 40.28 | 28.65 | 22.92 | 13.74 |
| 29 | 450.57 | 77.16 | 41.18 | 29.3 | 23.46 | 14.22 |
| 30 | 460.37 | 78.86 | 42.1 | 29.97 | 24.02 | 14.72 |
| 31 | 470.36 | 80.59 | 43.04 | 30.66 | 24.58 | 15.24 |
| 32 | 480.55 | 82.36 | 44.01 | 31.36 | 25.17 | 15.79 |
| 33 | 490.94 | 84.16 | 45 | 32.09 | 25.78 | 16.37 |
| 34 | 501.49 | 86 | 46 | 32.83 | 26.4 | 16.97 |
| 35 | 512.2 | 87.87 | 47.03 | 33.6 | 27.05 | 17.61 |
| 36 | 523.07 | 89.77 | 48.08 | 34.38 | 27.71 | 18.27 |
| 37 | 534.09 | 91.71 | 49.16 | 35.18 | 28.4 | 18.96 |
| 38 | 545.26 | 93.67 | 50.25 | 36 | 29.1 | 19.69 |
| 39 | 556.57 | 95.67 | 51.37 | 36.85 | 29.83 | 20.46 |
| 40 | 568 | 97.7 | 52.51 | 37.72 | 30.59 | 21.26 |
| 41 | 579.55 | 99.75 | 53.67 | 38.62 | 31.36 | 22.1 |
| 42 | 591.21 | 101.83 | 54.86 | 39.53 | 32.17 | 22.98 |
| 43 | 602.98 | 103.94 | 56.08 | 40.48 | 33.01 | 23.91 |
| 44 | 614.84 | 106.07 | 57.32 | 41.45 | 33.88 | 24.88 |
| 45 | 626.77 | 108.25 | 58.6 | 42.46 | 34.78 | 25.91 |
| 46 | 638.78 | 110.46 | 59.91 | 43.5 | 35.73 | 26.99 |
| 47 | 650.75 | 112.69 | 61.23 | 44.56 | 36.7 | 28.12 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 48 | 662.74 | 114.95 | 62.59 | 45.66 | 37.72 | 29.31 |
| 49 | 674.5 | 117.18 | 63.93 | 46.77 | 38.76 | 30.54 |
| 50 | 686.15 | 119.4 | 65.29 | 47.9 | 39.83 | 31.83 |
| 51 | 697.51 | 121.56 | 66.64 | 49.04 | 40.93 | 33.17 |
| 52 | 708.81 | 123.74 | 68.02 | 50.22 | 42.08 | 34.57 |
| 53 | 720.04 | 125.93 | 69.43 | 51.46 | 43.29 | 36.06 |
| 54 | 731.21 | 128.16 | 70.9 | 52.75 | 44.58 | 37.63 |
| 55 | 742.11 | 130.36 | 72.37 | 54.08 | 45.91 | 39.27 |
| 56 | 752.89 | 132.6 | 73.9 | 55.47 | 47.33 | 41 |
| 57 | 763.54 | 134.87 | 75.48 | 56.93 | 48.83 | 42.84 |
| 58 | 774.03 | 137.16 | 77.11 | 58.47 | 50.42 | 44.78 |
| 59 | 784.2 | 139.42 | 78.77 | 60.06 | 52.09 | 46.8 |
| 60 | 794.16 | 141.68 | 80.47 | 61.72 | 53.86 | 48.94 |

# 中国重大疾病保险产品费率研究

马绍东
金融学院，贵州财经大学，贵阳，550004

**摘　要**：中国重大疾病保险正处于蓬勃发展时期，据调查研究显示，重大疾病保险是中国保险市场上深受欢迎的保险产品。事实上，中国健康保险市场费率普遍偏高，抑制了一部分人的保险需求。现行重大疾病保险的费率大多数采用保证费率，这隐藏了较大的风险，需要进一步探索重大疾病保险费率的调节机制。重大疾病保险费率厘定依赖于重大疾病发生率、重大疾病生存概率等基础数据，国内目前尚无公开的基于保险公司的经营经验的统计数据。本文首先探讨了重大疾病发生率的测量问题，给出了重大疾病发生率的测量方法。然后基于保险公司实际经营数据的测量结果，根据当前保险市场上主流重大疾病保险产品，厘定了提前给付型重大疾病保险的费率，并对当前的费率做了评价。然后针对保证保费的问题，提出了重大疾病保险费率的调整机制。

**关键词**：重大疾病保险　费率调整　重大疾病发生率

# The Demand Estimation of China’s Long Term Care Insurance and Development Strategy

SONG Zhanjun, ZHU Minglai
College of Economics, Nankai University, Tianjin, China, 300071

**Abstract:** In this paper we first estimate the number of the disabled population based on the 《*World Population Prospects: The 2010 Revision*》 during the year 2011- 2050, and then we estimate the gross expense on long term care. We also analyze the LTCI in America, Germany and Japan, then we put forward the development strategy for China’s LTCI.
**Keywords:** Gross demand; Gross expense; Development strategy

## Ⅰ.引言

2006 年全国老龄办发布的《中国人口老龄化发展趋势预测研究报告》，给我国人口老龄化形势进一步敲响了警钟：21 世纪的中国将是一个不可逆转的老龄社会。根据我国第四、第五和第六次人口普查的数据可知，1990 年我国老年人口扶养比为 8.35％，2000 年上升为 9.92％，到 2010 年上升为 11.9%，预计 2025 年老年人口扶养比为 18.67％，而 2050 年将达到 32.18％。

中国老年人口不仅规模巨大，老龄化迅速，而且日益呈现出重度老龄化和高龄化。伴随人口老龄化和高龄化而来的是老年人口健康问题的增加，因疾病、伤残、衰老而失去生活自理能力的老年人口数量增加，未来几十年内我国老年人口的生活照料问题显得尤为突出。

更令人担忧的是，发达国家是在经济社会发展水平较高的情况下进入老龄化的，人均国内生产总值 GDP 都在 5000-10000 美元以上。与发达国家比较，我国老龄化最显著的特征在于“未富先老”，老龄化超前于社会经济发展水平，是在经济水平尚不发达的情况下提前到来的，与经济发展不同步，有较大的偏离和超前性，形成了老龄化程度与经济发展水平的“时间差”。相关数据显示，我国 65 岁及以上老年人的主要生活来源随着年龄的增长，劳动收入占比急剧下降，而城市地区的老年人收入来源主要为离退休金、养老金的仅占人口的一半左右，农村地区这个比例非常低。可见老年人的社会保障覆盖面仍然不高，生活仍然高度依赖家庭成员供养。

另一方面，由于我国人口生育率的下降，我国的家庭结构日趋小型化，出现大量的“四二一”、“四二二”家庭结构，使得传统多个儿女分担养老负担的可能性日益降低，独生子女照顾一个或多个老年人将会成为普遍现象。在家庭规模缩小的同时，人口流动性的增大导致了大量“空巢家庭”的出现。《中国城乡老年人口状况追踪调查》显示 2006 年城市“空巢家庭”占家庭总数的 49.7%，农村占 38.3%，涉及 65 岁以上老年人 2340 万。由于家庭规模小型化、子女外出工作、求学增多等原因，身边无子女的纯老年人家庭户还在日益增加，高龄老人、独居老人增加已经成为人口老龄化过程中的重要特征，家庭代数的减少，表明老年空巢家庭增多，这部分老人往往难以得到家庭的照料。显然如果单纯依靠传统的家庭养老，我国年轻一代未来会背上“工作、老人、孩子”这三座大山艰难行进，人口老龄化将使劳动年龄人口的经济负担日益沉重，进而波及到整个国家经济发展进程和社会的和谐稳定。因此，我国要尽快改革“家庭供养为主，社会供养为辅”，转变为“社会供养为主，家庭供养为辅”

的养老模式，并据此确定老年长期护理保险制度在转变过程中所扮演的重要角色。

## Ⅱ. 文献综述

老年长期护理（Long-term Care，国际上简称 LTC）服务自上个世纪七十年代以来在西方发达国家迅速发展，其核心职能是为生活不能自理的老年人提供生活照料、卫生护理以及社会服务，对照顾老年人生活，保证老年人健康，帮助老年人安度晚年意义重大。而长期护理保险制度（Long-term Care Insurance，简称 LTCI）作为解决老年人护理资金问题的一项重要措施也随之应运而生，该制度利用保险原理筹集护理资金，实现护理产业的专业化发展，在很大程度上缓解了国民对公共福利需求的压力，同时保护老年人及家庭的资产安全，避免因支付护理费用而背上沉重的经济精神负担，切实保障老年人能够幸福地安度晚年。

三十年来，为应对人口老龄化危机，世界发达国家开始尝试构建老年长期护理保障制度，经济合作与发展组织（OECD）对此进行了专门的研究，取得了丰硕成果。研究表明，老年长期护理服务费用昂贵，且增长趋势明显，2000 年 OECD 中多数国家的长期护理费用支出占本国 GDP 比重为 0.5～1.6%，最高者竟达 2.89%（OECD，2005）。据测算，2006 年美国老年长期护理费用高达 1350 亿美元，占当年 GDP 的 1.04%（CBO，2004；Melnyk，2005）。如果政府不能采取合理的老年长期护理费用筹资机制，将会导致本国财政枯竭和经济困难，因而有必要运用国家和个人分摊的模式进行筹资（Davey，1998），同时国家还应制定相关法律法规，以保障老年长期护理服务的健康发展。另外，对于为长期护理提供融资的两种保险模式，即社会性护理保险和商业性护理保险，很多国外学者也进行了深入解析，指出在商业性长期护理保险的经营过程中，由于存在严重的信息不对称（Finkelstein and McGarry，2006），往往导致长期护理保险市场需求不旺、供给不足的两难困境（Brown and Finkelstein，2007，2009）；有鉴于此，德国、日本等国家为矫正市场失灵，实现社会公平，则以政府的强制力作为保障，建立了全民的长期护理社会保险制度（Geraedts，2000；Campbell and Ikegami，2003），取得了较好的效果。同时，鉴于老年长期护理保险具有强大的社会功效，各国普遍对其给予一定的税收优惠政策或财政补贴方式，以鼓励其积极发展（Chen，2001）。

近年来，国内学者就应对人口老龄化产生的老年护理问题也逐渐进行了深入研究。很多学者提出要借鉴国外经验，建立起我国的长期护理保险制度（尹成远等，2006；周琛，2006；荆涛，2006；戴卫东，2007）。但比较而言，我国该领域的研究基础还很薄弱，没有形成系统的理论体系来论证如何利用长期护理保障机制应对人口老龄化问题。现有研究成果也往往是一些国外经验的简单总结，缺乏结合我国实情的理论创新，也没有采用经济学中规范分析和实证分析的方法去探究、预测和解决我国构建长期护理保障制度的核心问题，即费用成本测算和融资方式选择问题。而这些正是本文研究的关键所在。

## Ⅲ. 我国老年长期护理需求及发展潜力预测

本文通过我国老年长期护理需求者数量、老年长期护理总费用等指标从需求方面反映我国老年长期护理服务的发展潜力。在估计老年长期护理总费用时，我们采用由下往上（Bottom-up-approach）估计方法，首先以国内老年人生活不能自理比例和未来老年人口发展预测估算出我国生活不能自理的老年人口数量，即老年长期护理需求者数量；再根据我国的有关经济指标获取老年长期护理需求者的年均费用支出样本，进而估算出老年长期护理总费用。

### A.依据我国人口趋势预测老年长期护理需求量

**1）我国未来人口发展预测数据资料的选取**

基于不同生育率变化的假设，有关专家和部门对我国未来人口发展作了多方案的预测。本文选取了由联合国经济与社会事务部人口司（United Nations, Department of Economic and Social Affairs, Population Division）公布的《世界人口展望 2010》所测得的数据，由于 2011 年以前的数据对现在已无预测功能，所以只选取 2011-2050 年的数据，如下表 1：

表 1 中国未来 60 岁以上分年龄人口数据（2011-2050） 单位：千人

| 年龄 | 2011 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|
| 60-64 | 59456 | 76472 | 74574 | 86096 | 110576 | 107750 | 83022 | 90731 | 108001 |
| 65-69 | 40312 | 50511 | 70322 | 68953 | 80107 | 103385 | 101002 | 78168 | 85781 |
| 70-74 | 30987 | 33298 | 43663 | 61364 | 60694 | 71094 | 92395 | 90762 | 70693 |
| 75-79 | 22213 | 23782 | 26144 | 34815 | 49572 | 49627 | 58796 | 77179 | 76393 |
| 80-84 | 12345 | 14239 | 15955 | 17948 | 24409 | 35380 | 36009 | 43356 | 57709 |
| 85-89 | 5217 | 6098 | 7692 | 8896 | 10307 | 14403 | 21361 | 22229 | 27337 |
| 90-94 | 1596 | 1720 | 2273 | 3001 | 3616 | 4355 | 6305 | 9648 | 10344 |
| 95-99 | 225 | 261 | 343 | 485 | 682 | 869 | 1104 | 1680 | 2687 |
| 100+ | 14 | 19 | 28 | 39 | 60 | 90 | 123 | 166 | 262 |

资料来源：联合国经济与社会事务部《 *World Population Prospects: The 2010 Revision*》。

**2）我国老年人生活不能自理能力状况数据的选取**

如果按照日常生活自理能力进行区分，根据国际通行的日常生活活动能力量（ADLs）表中的吃饭、穿衣、上下床、上厕所、室内走动和洗澡六个指标，判断标准是：如果回答都“不费力”，就属于完全自理；如果有至少一项回答“有些困难”，属于部分自理；如果有至少一项回答“做不了”，就属于不能自理。在本文中，我们将不能自理的老年人界定为完全失能，部分自理的老年人界定为部分失能。部分失能和完全失能的老年人共同构成我国长期护理保险的需求总量。根据上述判断标准，以 2006 年中国城乡老年人口状况追踪调查数据为基础，我国老年人日常生活自理情况如下表 2：

**表 2 2006 年分性别和年龄组的城乡老年人日常生活自理能力分布 单位：%**

| 性别 | 年龄组 | 合计 | 能够自理 | 部分自理 | 不能自理 |
|---|---|---|---|---|---|
| 合计 | 60-69 岁 | 100 | 89.3 | 7.7 | 3.0 |
| | 70-79 岁 | 100 | 77.1 | 15.7 | 7.1 |
| | 80 岁以上 | 100 | 45.9 | 31.9 | 22.2 |
| 男性 | 60-69 岁 | 100 | 91.4 | 6 | 2.6 |
| | 70-79 岁 | 100 | 81.5 | 13.3 | 5.3 |
| | 80 岁以上 | 100 | 50.7 | 29.6 | 19.7 |
| 女性 | 60-69 岁 | 100 | 87.2 | 9.4 | 3.5 |
| | 70-79 岁 | 100 | 73.1 | 18 | 8.9 |
| | 80 岁以上 | 100 | 42.8 | 33.3 | 23.9 |

资料来源：张恺悌，郭平.《中国人口老龄化与老年人状况蓝皮书》，中国社会出版社，2009 年，第 137 页。

**3）我国未来老年长期护理需求数量预测**

根据联合国经济与社会事务部 2010 年对我国未来人口发展预测所提供的我国未来老年人口数据和 2006 年中国城乡老年人口状况追踪调查数据，可以预测出我国未来老年长期护理需求者数量，如下表 3：

**表 3 2011-2050 年间我国老年长期护理需求者总量 单位：万人**

| 需求量 / 年份 | 2011 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|
| 部分失能 | 2222 | 2586 | 3050 | 3673 | 4446 | 5279 | 5861 | 6396 | 6938 |
| 完全失能 | 1108 | 1282 | 1514 | 1822 | 2222 | 2714 | 3066 | 3410 | 3809 |
| 需求总量 | 3330 | 3869 | 4564 | 5495 | 6668 | 7992 | 8927 | 9806 | 10747 |
| 总量增长速度% | 100.0 | 116.2 | 137.1 | 165.0 | 200.3 | 240.0 | 268.1 | 294.5 | 322.7 |

从以上预测结果可知，以 2006 年调查标准，2011 年我国需要老年长期护理服务的老年人总数为 3330 万人，其中部分失能老年人总数为 2222 万人，完全失能老年人总数为 1108 万人。到 2015 年，即“十二五”期末，我国需要老年长期护理服务的老年人总数为 3869 万人，其中部分失能老年人总数为 2586 万人，完全失能老年人总数为 1282 万人。到 2030 年，我国需要老年长期护理服务的老年人总数为 6668 万人，其中部分失能老年人总数为 4446 万人，完全失能老年人总数为 2222 万人。到 2050 年，我国需要老年长期护理服务的老年人总数为 10747 万人，其中部分失能老年人总数为 6938 万人，完全失能老年人总数为 3809 万人。2030 年和 2050 年老年长期护理服务需求总量分别是 2011 年的 2.03 倍和 3.22 倍，因此，这种老年人口护理需求基数和增长速度理应当引起我国对护理产业发展的足够重视。

## B.2010-2050 年间我国老年长期护理总费用预测

老年长期护理费用是指长期护理服务的提供者向不能自理的老年人提供康复、支持性服务所收取的相关费用，包括膳食费、床位费、各种医疗费、设备费、雇佣护工费，甚至交通费用。鉴于我国已经实行了基本养老保险、医疗保险，老年人生活费用可以由养老保险部分解决，而医疗费用由医疗保险来负担。所以本文所预测的我国老年人口长期护理费用是指除膳食费、医疗费之外的护理相关费用。

**1）老年长期护理等级的划分**

不同失能程度的老年人所需要的护理内容不同，从而理应对应不同的护理等级。由于部分失能的老年人拥有一定的自我护理能力，所以其接受的护理服务内容相对较少，因此本文将部分失能老人需要的护理等级界定为一级护理，即护理等级最低的护理。同时参照国际通行的 ADLs“吃饭、穿衣、上下床、上厕所、室内走动和洗澡”六项指标，将完全失能老人中，一到两项“做不了”的定义为“轻度失能”，老年人需要的护理等级界定为二级护理；三到四项“做不了”的定义为“中度失能”，老年人需要的护理等级界定为三级护理；五到六项“做不了”的定义为“重度失能”，老年人需要的护理等级界定为四级护理。根据 2011 年 3 月 1 日全国老龄办发布的《全国城乡失能老年人状况研究》新闻发布稿，2010 年末我国完全失能老年人中，84.3％的为轻度失能，中度和重度失能的比例，分别为 5.1％和 10.6％。

根据上述护理等级的界定，我们将 2011-2050 年间我国老年长期护理需求者总量对应不同的护理等级予以细化，继而可以在此基础上，针对不同的护理等级进行护理总费用的测算。

**表 4 2011-2050 年间我国不同护理等级老年长期护理数量 单位：万人**

| 护理级别 / 年份 | 2011 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|
| 一级护理 | 2222 | 2586 | 3050 | 3673 | 4446 | 5279 | 5861 | 6396 | 6938 |
| 二级护理 | 934 | 1081 | 1276 | 1536 | 1873 | 2288 | 2585 | 2875 | 3211 |
| 三级护理 | 56 | 65 | 77 | 93 | 113 | 138 | 156 | 174 | 194 |
| 四级护理 | 117 | 136 | 160 | 193 | 236 | 288 | 325 | 361 | 404 |

**2）老年长期护理总费用估算**

老年长期护理总费用估算的假设条件包括需求人数、护理等级、给付项目及给付标准。其中给付方式包括实物给付及现金给付，本文统一测算实物给付和现金给付对应的经济费用。从给付项目上看，实物给付包括居家护理、社区护理及机构护理等项。参照我国台湾地区当局2009年制定的《长期护理保险发展规划》，居家护理主要包括居家服务、家庭托顾、居家护理、居家复健、喘息服务，社区护理主要包括日间照顾、社区关怀据点、辅具、餐饮、无障碍环境改善，机构护理主要包括护理院、安养院等。居家和社区护理费用支出主要为护理人员劳务费用，机构护理费用支出主要为设施费用。护理人员主要包括护理师、物理治疗师、职能治疗师、照顾管理专员及督导。结合发达国家长期护理发展经验，给付项目的设计应以鼓励居家、社区护理为主，机构护理为辅。因此，本文假定原则上只有完全失能老人并且达到四级护理水平的失能才能才可以申请机构护理，特殊情况下除外。同时，结合我国台湾地区的测算结果，假定长期护理四级护理需求的老年人中申请机构护理的比例为30%。不同护理等级下居家/社区、机构三种给付项目给付比例如下表5所示。

**表5　不同护理等级长期护理给付项目结构占比**

**单位：%**

| 护理等级 | 居家/社区护理 | 机构护理 |
|---|---|---|
| 一级护理 | 100 | 0 |
| 二级护理 | 98 | 2 |
| 三级护理 | 95 | 5 |
| 四级护理 | 70 | 30 |

利用2011-2050年间我国不同护理等级老年长期护理数量，乘以不同护理等级之下给付项目结构占比，可得我国未来长期护理不同护理等级之下居家/社区护理和机构护理需求总量。

**表6　2011-2050年不同护理等级长期护理给付项目需求量　　单位：万人**

| 年份 | 2011 | | 2015 | | 2020 | | 2025 | | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| 给付项目 | 居家/社区护理 | 机构护理 | 居家/社区护理 | 机构护理 | 居家/社区护理 | 机构护理 | 居家/社区护理 | 机构护理 | 居家/社区护理 |
| 一级护理 | 2222 | 0 | 2586 | 0 | 3050 | 0 | 3673 | 0 | 4446 |
| 二级护理 | 915 | 19 | 1059 | 22 | 1251 | 26 | 1505 | 31 | 1836 |
| 三级护理 | 54 | 3 | 62 | 3 | 73 | 4 | 88 | 5 | 108 |
| 四级护理 | 82 | 35 | 95 | 41 | 112 | 48 | 135 | 58 | 165 |
| 年份 | 2035 | | 2040 | | 2045 | | 2050 | | 2030 |
| 给付项目 | 居家/社区护理 | 机构护理 | 居家/社区护理 | 机构护理 | 居家/社区护理 | 机构护理 | 居家/社区护理 | 机构护理 | 机构护理 |
| 一级护理 | 5279 | 0 | 5861 | 0 | 6396 | 0 | 6938 | 0 | 0 |
| 二级护理 | 2242 | 46 | 2533 | 52 | 2817 | 57 | 3147 | 64 | 37 |
| 三级护理 | 131 | 7 | 149 | 8 | 165 | 9 | 185 | 10 | 6 |
| 四级护理 | 201 | 86 | 228 | 98 | 253 | 108 | 283 | 121 | 71 |

据台湾地区统计资料，截至 2008 年底，每位照顾服务员平均需服务 6.1 位个案，平均每位个案每个月接受约 20 个小时之服务。2008 年 OECD 国家每千名 65 岁老人拥有专业长期护理工作人员 6.1 人。根据上述地区和国家的长期护理保险护理人员服务产能情况，假定我国长期护理服务人员（包括专业护理人员和非专业护理人员）服务产能情况如下：对于居家/社区护理，一级护理等级之下每位护理人员平均服务 6 位老人，二级护理等级之下每位护理人员平均服务 4 位老人，三级护理等级之下每位护理人员平均服务 2 位老人，四级护理等级之下每位护理人员平均服务 1 位老人。下表为不同护理等级之下护理人员人力需求总量。

**表 7 2011-2050 年间不同护理等级护理人员需求 单位：万人**

| 需求量 / 年份 | 2011 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|
| 一级护理 | 370 | 431 | 508 | 612 | 741 | 880 | 977 | 1066 | 1156 |
| 二级护理 | 229 | 265 | 313 | 376 | 459 | 560 | 633 | 704 | 787 |
| 三级护理 | 27 | 31 | 37 | 44 | 54 | 66 | 74 | 83 | 92 |
| 四级护理 | 82 | 95 | 112 | 135 | 165 | 201 | 228 | 253 | 283 |

假定居家/社区护理的老年长期护理费用主要为护理人员劳务费用和器械器具等设备费用，并进一步假定以我国按行业分城镇单位就业人员平均工资中居民服务和其他服务业的年平均工资为一级护理年均费用支出标准，同时假设二级、三级、四级护理人员劳务费用年均支出标准同比递增 20%、40%、60%，而居家/社区护理项目不同等级护理费用中的设备费用为相应等级护理人员劳务费用的一定比例 40%。

2010 年我国城镇单位就业人员中居民服务和其他服务业的年平均工资为 28206 元[1]，则一级护理人员劳务费用年均支出标准为 28206 元，设备费用为 11282 元，每人年均费用支出标准为 39488 元；二级护理人员劳务费用年均支出标准为 33847 元，设备费用为 13529 元，每人年均费用支出标准为 47387 元；三级护理人员劳务费用年均支出标准为 39488 元，设备费用为 15795 元，每人年均费用支出标准为 55284 元；四级护理人员劳务费用年均支出标准为 45130 元，设备费用为 18052 元，每人年均费用支出标准为 63181 元。

参照谢红等（2011）年对北京市护理院收费标准的研究[2]，护理院 ADL 重度功能障碍者收费标准为 2800 元/月，本文假定机构护理每人年均费用标准为 33600 元。

从宏观总量测算的角度出发，随着时间推移，未来老年长期护理费用要受经济因素，例如经济增长率、通货膨胀、利息率等方面的影响。本文假设老年长期护理费用的增长速度与职工平均工资的增长速度相同，并假定不同护理等级护理人员每人年均费用支出标准和机构护理费用按照职工平均工资的增长速度上涨。同时，根据相关文献设定 2010-2015 年为 4%，2016-2050 年为 3%，且以 2010 年不变价格计算。则 2011-2050 年间不同护理等级护理人员每人年均费用和机构护理每人年均费用标准如下表所示。

[1] 数据来源：《中国统计年鉴 2011》。
[2] 谢红等，北京市护理院收费方案和标准的探索性研究，《中国护理管理》2011 年第 6 期。

表 8　2011-2050 年间护理人员费用和机构护理费用年均支出　　单位：元 / 每护理人员

| 护理级别 / 年份 | 2011 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|
| 一级护理 | 41068 | 48044 | 55696 | 64567 | 74850 | 86772 | 100593 | 116615 | 135188 |
| 二级护理 | 49282 | 57652 | 66835 | 77480 | 89821 | 104127 | 120711 | 139938 | 162226 |
| 三级护理 | 57495 | 67261 | 77974 | 90393 | 104791 | 121481 | 140830 | 163260 | 189264 |
| 四级护理 | 65709 | 76870 | 89113 | 103307 | 119761 | 138836 | 160948 | 186583 | 216301 |
| 机构护理 | 34944 | 40880 | 47391 | 54939 | 63689 | 73833 | 85593 | 99225 | 115029 |

根据表 7 中 2011-2050 年间我国长期护理不同护理等级给付项目需求情况，以及表 8 中 2011-2050 年间护理人员费用和机构护理费用年均支出样本，我们可以预测出 2011-2050 年间我国老年长期护理总费用。

表 9　2011-2050 年间我国老年长期护理总费用　　单位：亿元

| 费用 / 年份 | 2011 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 |
|---|---|---|---|---|---|---|---|---|---|
| 一级护理费用 | 1521 | 2071 | 2832 | 3952 | 5546 | 7634 | 9826 | 12431 | 15633 |
| 二级护理费用 | 1127 | 1527 | 2090 | 2916 | 4123 | 5836 | 7645 | 9856 | 12761 |
| 三级护理费用 | 154 | 209 | 286 | 399 | 564 | 799 | 1046 | 1349 | 1746 |
| 四级护理费用 | 540 | 731 | 1001 | 1397 | 1975 | 2796 | 3662 | 4721 | 6113 |
| 机构护理费用 | 198 | 268 | 367 | 513 | 725 | 1026 | 1344 | 1733 | 2244 |
| 护理总费用 | 3541 | 4806 | 6576 | 9177 | 12933 | 18090 | 23523 | 30090 | 38497 |

由上表可知，2011 年我国老年长期护理总费用为 3541 亿元，到 2015 年快速增长至 4806 亿元。2030 年我国老年长期护理总费用已经突破 1 万亿元，达到 12933 亿元。2050 年，我国老年长期护理总费用更是达到 38497 亿元。面临如此高额的老年长期护理费用，理应引起我国政府的极大关注，尽早考虑未来我国如何解决这一重大问题。

# IV. 国外老年长期护理保险发展模式

## A.国外老年长期护理保险的经验

为应对老龄化严峻形势，美国、日本、德国等发达国家都先后实施了保障老年人口长期护理服务需求的政策措施，而我国现行社会福利和医保制度尚不能解决老年人长期护理服务，国家应在充分考量国力基础上，积极借鉴国际经验，建立起老年长期护理保障机制。具体经验借鉴包括：

**1）发展长期护理保险需要国家法律法规给予保证**

长期护理保险要想得到顺利发展，政府应出台相应的法律法规，明确长期护理保险的服务内容、运行机制和监管体制，严格规范长期护理服务市场。德国不仅颁布了《社会法典》，实施了社会保障法、社会福利法和社会保险法，还制定了与老年长期护理服务相关的《联邦照料法》、《负担平衡法》等。日本在 2000 年专门制定和实施了《长期护理服务保险法》，为 65 岁及以上生活需要照顾的老年人和 40 岁以上生活不能自理的人享受长期护理服务提供了经济上的保障。此外，各国还普遍重视护理资格审查制度、护理人员培训制度、受护理者申诉制度、服务质量检查制度等系列配套设施，对于提高护理服务水平和质量，保障长期护理保险的永续发展有显著作用。

**2）发展长期护理保险需要根据本国国情建立适当的运行机制**

由于老年长期护理费用数目巨大，一国应根据本国人口结构、文化背景、生活习惯和经济发展水平等因素，建立起适合本国国情的老年

长期护理服务筹资模式，坚持多方负担，多方支援，强调老年长期护理费用来源多元化。美国的医疗保健和医疗救助计划主要依靠国家税收进行实施，以此保障基本水平的老年人口护理服务需求。而其它更高水准的护理服务需求，由商业长期护理保险提供，其资金来源于被保险人缴纳的保险费。德国则发展社会性老年长期护理保险，以政府出资为主，企业、个人和非赢利组织相应分摊的运行机制，政府出资兴建公共护理院，以社会援助的方式救助最低生活保障线以下的贫困人群，并承担部分非赢利社区组织的服务成本；企业以纳税方式偿付老年人口长期护理服务的部分社会成本；个人则要按有关规定比例缴纳长期护理保险费，而非赢利组织积极从社会各界筹集支持资金。

**3）发展长期护理保险需要建立灵活的护理供给模式**

由于个人知识背景、思想认识和经济实力的差异，对养老方式的选择不尽相同。国外根据老年人对长期护理需求和服务的多样性，在大力发展护理院、养老院、老年康复中心等具有养老性机构的同时，积极倡导社区养老、居家养老，开展家庭病床、社区护理、日间护理、钟点工等服务项目，制定出有利于帮助和鼓励家庭成员承担对老年人照护责任的优惠政策，对接受不同护理服务类型的被保险人，护理保险经办者给予不同的费用补贴。我国作为老年人口大国，在发展长期护理保险的过程中，更应该提倡社区养老、居家养老等灵活多变的养老模式，实施鼓励社区养老、居家养老发展的长期护理保险费用补贴措施，充分利用旧有资源设施，避免额外的重复投资和成本消耗。

## B.国外老年长期护理保险的效果评价

长期护理保险制度构建和机制的良好运作能够有效应对护理风险事故的发生，协助国民减轻护理费用威胁，对护理需求者提供及时有效的护理处置和服务，预防贫穷的发生。在实施长期护理保险制度前，对抗长期护理风险是个体责任，必须依靠个人或家庭的力量，往往造成个人财产耗尽，家人身心疲惫。而对于特殊弱势群体，政府又不得不按照一定资格进行相应给付水平的资助，且随着人口老龄化形势加剧，护理需求者大量增加，依赖社会救助的群体也随之增多，社会救助制度中的大部分经费将沦为长期护理费用，给个人、家庭和国家带来日益沉重的经济精神负担。而长期护理保险制度建立后，利用保险原理筹集长期护理费用，实现个人、企业和政府对护理费用的合理分担，并引入市场竞争机制，给护理服务的供给和护理产业的发展提供制度化保障及良好的运作环境，以致护理需求者只需缴纳少量的保险费，以相对较低的负担，即可享领适足而及时的护理给付，保证护理需求者的人性尊严，达到应对个人护理风险的目的。

长期护理保险制度实施后，实现了长期护理风险的专业化管理，通过公共财源和私有资源的有效集结与运用，使国民面临护理需要风险时，能够根据自身偏好与客观支持能力选择最适宜的护理给付组合，而不会因护理等级的轻重、持续时间的长短而产生不确定性，甚至无力加以应对的困境。同时该制度明确规范了对护理需求者资格的申请、确认及核定等程序，强化护理计划的拟定和护理安全及品质的监查，避免因道德风险而有意延长护理时间，使真正的护理需求者不能够及时适当获得良好而有质量的护理服务，有效防止了长期护理的假性需求，确保长期护理供求在资讯透明及市场机制作用下有效运行，进而矫正市场失灵而引起的长期护理资源使用的不公平，带来整体社会民众对护理需要性风险事故预防的功效。

但是，我们必须看到，目前无论是采取社会保险模式还是商业保险模式，长期护理保障还都存在一定的缺性和不足。在以社保为主的国家，由于强调政府责任，国家需投入大量的资金来确保社会性长期护理保险制度的运行，在人口结构老化以及长寿化带来的护理时间的延长趋势下，原保险费率筹集而来的资金，难以适应这种护理费用的大幅增长，使国家背上沉重的财政负担。另外，给付水平的不断提高必然提高被保险人缴纳的保费，这可能造成代际之间的不公平。再者，社会性长期护理保险保障范围一般过于狭窄，且资格审查非常苛刻，这样可能造成一些长期护理需求者不能得到必要的适时护理服务。

美国鼓励通过商业化模式发展长期护理保险，运用市场机制来满足广大中产阶级的长期护理需求。但由于消费者存在短视行为，多数人不愿把护理问题作为优先考虑的风险。同时商业保险市场道德风险及逆向选择现象严重，保险公司难以控制第三方的医疗费用而可能造成护理费用的失控，进而导致长期护理保险产

品价格昂贵，只有少数老人能够买得起。如此一来，原本希望通过市场机制、由商业保险来解决部分老人的护理问题，但鉴于其保险市场维持在较低的比例，难以达到预期的效果。再加上被保险人的未来健康趋势难以预测，对护理持续时间、等级变动和利用模式等影响护理费用的因素无法得到合理估算，导致商业性长期护理保险处于市场失灵状态，难以应对与日俱增的长期护理社会风险。

## V.我国长期护理保险发展战略

在市场经济条件下，服务老人的人力、物力和医护服务在很大程度上都得从市场获取，其费用支出相当庞大，2011 年我国老年长期护理总费用最高估计分为 3541 亿元，2050 年竟达到 38497 亿元，所以发展长期护理服务的重要问题是要有经济保障。而我国还在很长一段时间内处于社会主义初级阶段，经济实力有限，如果发展老年长期护理服务过渡依赖于政府投入，会使我国财政负担加重，给经济和社会发展带来不利影响；如果仅靠家庭和老年人的退休收入来支撑，将给家庭带来沉重负担，可见应积极探索一种有效的长期护理服务融资策略。

由于我国经济欠发达，地区之间发展不平衡的现实，当前和今后一段时间内，我国无法实现养老的完全国家化，即国家没有足够的实力把老年人供养起来，而无需老人或其家庭出任何费用。国家应积极借助保险方式来筹集养老资金，采用社会保险和商业保险并行模式，由社会保险提供最基本的、必要的长期护理服务或其费用支出，例如提供各种医疗护理、临终关怀等，并对这种老年长期护理进行强制全民保险。同时，国家应采取鼓励商业性长期护理保险发展的各种政策，具体建议如下：

### A.尽快制定构建长期护理保障制度的法律法规，协调各有关部门的职能

中央政府应出台相应的法律法规，如在《社会保险法》中明确长期护理保险的服务内容、运行机制和监管体制，严格规范长期护理服务市场。国家各相关部委，如全国老龄工作委员会、民政部、中国保监会、卫生部等，应统一协调各自职能，具体规划长期护理保障体系的细节。考虑到职责继承性，对于社会性长期护理保险，可由中国保监会负责保费的筹集及资金的运营，民政部负责长期护理服务的供给，经办公共长期护理设施，卫生部负责护理服务的品质监管问题，老龄工作委员会可进行总体监管工作，其他部门应积极配合并负责相应工作，切实保障我国老年人得到适时适度护理。

各地方政府在中央法规政策目前缺失的情形下，应勇于大胆实践创新，根据各地人口老龄化的总体水平，结合各地经济发展状况，制定本地区的老年护理事业发展规划。

### B.构建灵活的资金筹集机制，实施多渠道、多主体筹资

长期护理费用支出规模庞大，单纯依赖个人力量会造成市场失灵，贫穷者不能得到必要的长期护理，护理风险难以有效应对。而靠政府的大量财政投入，会造成国家财政收支困难，给经济发展带来不利影响。因此，我国应建立长期护理费用的多渠道融资机制，实现政府、企业和个人的多主体分担。对于社会性长期性护理保险，可参照日本经验，公费负担 50%，其中国家、省（直辖市）、县市区按照 2：1：1 的比例分担，40 岁及以上的被保险人承担 50%。

由于商业性长期护理保险计划是公共长期护理保险计划的有力补充和配合，国家应通过相应的税收优惠政策促进其发展壮大。从表面上看，税收优惠政策会减少国家财政的即期收入，但实际上，随着商业性养老保险基金规模的不断扩大，对国家财政收支平衡应具有积极作用。发达国家的经验显示，基本社保普遍存在严重赤字，而这其中很大一部分是由国家财政来承担的，如果商业补充性养老金计划能够大力发展，那么它作为基本社保的替代品，能调节基本社保对的收入替代率，进而有效缓解国家财政压力。

对于商业性长期护理保险，政府应给予经营长期护理保险业务的保险公司所得税、营业税和印花税等税收政策优惠减免，以刺激长期护理保险市场的有效供求。而购买长期护理保险的个人可享有纳税抵扣，企业为员工购买长期护理保险的保险费可以作为经营费用在税前列支，在被保险人获得保险金时可以享有免税或者较低的税率，从而有效刺激长期护理保险市场的均衡供求。

### C.规范长期护理服务标准，培育长期护理产业发展的沃土

长期护理保险能否成功发展关键在于护理服务的专业水平和质量。如果长期护理服务的专业水平较高，服务的质量较好，能够让老年人及其家人感到满意，长期护理服务能够被社会所认同，那么对护理服务的需求会增加，整个护理服务市场会繁荣，进而长期护理保险市场会繁荣。但目前我国长期护理服务产业还没有发展起来，存在制度和管理缺位。因此，为避免像日本那样出现“有保险没有护理”情况的发生，政府应出台相应的政策，制定长期护理服务的具体管理办法，并鼓励各地充分发挥社区资源优势，建立起适应不同服务层次，满足不同经济水平护理需求的护理服务机构。同时要强化护理人员的培训力度，规范护理人员的护理行为，进行护理职业资格的认证和护理机构的专业等级认证，实施护理人员进修考试制度、受护理者申诉制度、服务质量检查制度，以提高护理水平和护理质量。

### D.吸取医疗保险的经验教训，加强各方合作，有效控制经营风险

长期护理保险涉及到保险人、被保险人、护理提供机构等多方主体，开展过程中极易产生道德风险和逆向选择。投保人会利用自己掌握的私有健康信息，以低于精算得出的合理保费价格来取得长期护理服务；医疗护理机构会追求利益最大化，利用其专业知识优势，诱导被保险人进行不必要的护理消费；而保险机构会意识到这些道德风险的存在，进而提高费率，费率的提高会导致部分身体素质好的投保人不愿或无力购买该产品而退出该市场，结果导致逆向选择的发生。因而，必须加强保险公司、医疗护理机构、社会保障部门等有关方面的合作，将保险人和护理提供者的功能紧密结合起来，严格控制道德风险和逆向选择。国家应借鉴美国管理式医疗的成功经验，允许健康保险机构投资于医疗护理领域，加速保险机构和医疗护理机构的一体化进程，最大限度地降低长期护理成本，进而推进长期护理保障的可持续发展。

## 参考文献

[1] Jiang Hong, Discussion of developing long term care in China, Insurance Studies, 2006.10.
蒋虹，论发展我国长期护理保险，保险研究 2006 年第 10 期。

[2] Yin Chengyuan, etc, Inspiration for China from LTC insurance of Japan, Japan Problem Studies,2006.2.
尹成远等，日本长期护理保险对我国的借鉴与启示，日本问题研究，2006 年第 2 期。

[3] Dai Weidong, Analysis the difference between Germany and Japan in LTC, Northeast Asia Forum, 2007.1.
戴卫东解析德国、日本长期护理保险制度的差异，东北亚论坛，2007 年第 1 期。

[4] Jing Tao, LTCI---A kind of insurance with high competitive advantage in the future in China, Beijing:University of International Business and Economics Press, 2006.
荆涛，长期护理保险---中国未来竞争力的险种，北京：对外经济贸易大学出版社，2006 年。

[5] Zhou Shen, Comparison between Germany and Japan in LTC and Inspiration for China’s LTCI, Legal System And Society, 2007.2.
周琛，德日两国的长期护理保险制度比较及我国 LTCI 建立构想，法制与社会 2007 年第 2 期。

[6] Brown and Finkelstein, 2009, “The Private Market for Long-term Care Insurance in the United States: A Review of the Evidence” Journal of Risk and Insurance, 76: 5-29.

[7] Brown and Finkelstein, 2007, “Why is the Market for Long-term Care Insurance so Small?” Journal of Public Economics, 91: 1967-1991.

[8] Campbell and Ikegami, 2003, “Japan’s Radical Reform of Long-term Care” Social Policy and Administration, 37: 21-34.

[9] Chen, 2001, “Funding Long-term Care in the United States: The Role of Private Insurance” Geneva Papers on Risk and Insurance, 26: 656-666.

[10] Congressional Budget Office (CBO), 2004, Financing Long term Care for the Elderly, Congressional Budget Office, Washington, D.C.
[11] Davey, 1998, "Exploring Shared Options in Funding Long-Term Care for Older People" Health and Social in the Community, 6: 151-157.
[12] Diacon et. al., 2002, "Size and Efficiency in European Long-term Insurance Companies: An International Comparison" Geneva Papers on Risk and Insurance, 27: 444-466.
[13] Finkelstein and McGarry, 2006, "Multiple Dimensions of Private Information: Evidence from the Long-Term Care Insurance Market" American Economic Review, 96: 938-958.
[14] Geraedts, Heller and Harrington, 2000, "Germany's Long-Term-Care Insurance: Putting a Social Insurance Model into Practice" Milbank Quarterly, 78: 375-401.
[15] McCall et.al., 1998, "Factors Important in the Purchase of Partnership Long-Term-Care Insurance" Health Services Research, 33: 187-203.
[16] Melnyk, 2005, Long-Term Care Insurance or Medicaid: Who will Pay for Baby Boomers' Long-Term Care? American Council of Life Insurers(ACLI), Washington, D.C.
[17] OECD, 2005, Long-term Care for Older People, OECD Health Project, OECD Publications, Paris, France.

# 我国长期护理保险需求测算与发展战略

宋占军，朱铭来

经济学院，南开大学，天津，中国，300071

**摘 要**：本文选取联合国经济与社会事务部人口司公布的《世界人口展望 2010》预测所得的人口数据和相关失能数据，测算出 2011 年到 2050 年我国老年长期护理需求者数量，进而测算长期护理保险总费用。在需求总量测算的基础上，本文通过比较研究的方法，在借鉴德国、日本、美国等主要发达国家长期护理保障制度的发展经验，系统提出构建我国长期护理保险制度的战略规划。

**关键词**：需求总量；护理总费用；发展战略

# Study on the Chinese Commercial Health Insurance Developing Routine

WANG zhijun[1], WANG qin[2]

[1] Strategy Development Dept., China Life P&C Insurance Company, Beijing, China, 100140
[2] Sales and Training Dept., China International Capital LTD., Beijing, China, 100004

**Abstract:** Health insurance is a special classification. It contains both insurance and medicine technology. The insurance object concerns health care risk and relative financial losses based on diseases, medical expenses, health services etc. Thus, it's difficult to identify and prevent. It is also influenced by government's policy and guide. Compared to life insurance and P&C insurance, it is different among such areas like data requirement, pricing progress, claim handling, and distribution channel. All of them limited the profit margin of health insurance and make it unstable. Due to above reasons market rules always inefficient. In western countries, it is found that government paid enough attention on the properties public goods of health insurance. In some special periods those governments want to be trusted by majority citizens in order to avoid riots. Some social welfare experts do not agree to use financial solution to cover health risk. However, they prefer use social security instead of health insurance. In America, commercial medicine system is the main solution to cover health care risk, but government also play important role in health insurance operating. In this circumstance, market rule can not be absolutely applied. The Chinese health insurance's developing routine and the future are not coherent answer both in theory and practice. This study firstly find some clues through overseas' experience. Secondly, it contrasts the political, economy, culture and social factors along the routine of industrialization, urbanization, and globalization and with the market mechanic reform in china. Meanwhile, it is referring the government's health care policy and analyzing the basic elements and potential ways to help health insurance developing well. This study shows public-private joint is the best way. In public point of view, third party administration (TPA) is the best choice. In private viewpoint, empowering operation is essential. To health insurance product design, company should develop product differently according to the properties public goods. In another words, if the properties public goods become dramatic, it will depend on the government. If the properties public goods become weaker, it could be operated by market rules. To succeed, insurer should integrate the resources in health care provider to develop product, cooperating with health care provider is a key factor, which can not be jumped away.

**Keywords:** health insurance; health care risk; insurer; insured; provider

## Ⅰ.对商业健康保险特性的分析

按照传统保险理论，保险风险是不确定的，客观存在的，具有一定的数量的，且能够被测量和评估的风险集合体。健康保险作为重要的保险类别，其风险特征应满足：一是损失发生的不确定性，二是损失存在的客观性，三是损失发生的普遍性，四是损失程度的可测定性。然而，随着医学技术和诊疗水平的提高，人类对健康风险事件的预测能力较以往显著改善，应对和干预健康风险事件的手段较以往不断丰富，人们对损失事件的处理方式更加多元，以财务方式界定的补偿标准和赔付范围很难做到统一，这对健康风险的不确定和可测定的理论基础产生了挑战。同时，健康风险受到气象、环境等外部因素，公共服务设施、医疗服务水平等社会因素，行为习惯、风险偏好等行为心理因素，以及年龄、性别、遗传基因等生理因素的综合影响，在客观性和普遍性特征上，也与传统的可保风险存在较大差异。另外，健康保险的道德风险和逆选择问题较为严重，以致于有学者[1]对商业保险理论在健康保险领域的适用性提出了质疑。以下从健康保险风险、管理模式、基础定义出发，综合分析商业健康保险的特性。

### A.健康保险风险的来源[1]

[1] Diane Archer, attorney and health care authority, the past president of the Medicare Rights Center (MRC), USA

保险与风险密切相关，一般来说，没有风险就没有保险，风险是保险存在的基础。健康保险是以人的身体健康为标的的保险，其风险主要来源于医疗风险、道德风险和逆选择风险。医疗风险是健康保险可保风险的核心内容，道德风险和逆选择风险虽然不在可保范畴，但实务操作很难清晰明确地将其排除在保险合同之外。

从医疗风险的定义看，国内较为普遍的描述是“在医疗服务过程中，可能导致损害或伤残事件的不确定性，以及可能发生的一切不安全事情”，美国杜克大学的描述是"遭受损害的可能性"。定义中的不确定性、不安全事件、可能性表述，侧重于医疗风险发生的概率，具体到医疗风险的来源，无外乎三种类别：一是患者本人，二是医疗服务提供过程中医院、医生等医疗服务提供者，三是其他诸如生态环境变化所导致的系统性因素。因此，研究医疗风险可以从患者、医疗服务提供者、外部环境三个角度分别切入。美国医学研究所（IOM）1999 年的研究表明，在人类早期的疾病谱中，鼠疫、伤寒、流感等传染性疾病是医疗风险产生的主要原因，20 世纪以来，大气污染、温室效应等生态环境变化所引起的疾病，以及医疗过程中的不确定性因素是导致医疗风险发生的主要原因，占据所有医疗风险的一半以上[2]。如果对医疗风险来源进行排序，外部环境第一，服务提供者其次，患者最次。这提示在职能制定医疗风险的防治措施中，是否应该按照这个顺序开展？研究健康保险制度出现以来的产品和服务提供，我们发现：来源于患者的部分是健康保险提供的主要内容，保险产品有医疗保险、疾病保险、失能收入损失保险、长期护理保险等；来源于医疗服务提供者的部分也有相应的健康保险产品，如院方责任险、医师责任险等；但来源于环境部分的风险，商业机构却很少提供保障。归纳起来，现代健康保险产品覆盖了健康风险来源中导致医疗风险的极小部分，是什么原因导致医疗风险的普遍存在与健康保险产品有限提供的矛盾？后面的研究将有所提及，但仍有待后期进行深入的专题论证。

道德风险是指“被保险人或受益人为谋取保险金而有意识地制造事故、致使保险标的受到损害或在保险标的受到损失时不采取减轻损失的有效措施，故意扩大保险标的损失度的危险”。主要表现为客户可将本不属于保险赔偿疾病的内容通过私人关系或利用医院管理漏洞，通过“开大处方、人情方”、“搭车开药“、“挂床治疗”等虚假欺诈行为来增大索赔金额，损害保险公司的利益，增加健康保险的风险管理难度。逆选择风险是指“投保人和被保险人为获得保险金而故意隐瞒某些具有高风险因素的情况来选择保险公司，而使公司遭受的风险”。在传统经营模式下，保险公司对客户的健康状况和医疗信息了解渠道不畅，对客户隐瞒病情和可能的带病投保信息，如职业、工作环境、年龄、身体健康状况等，很难准确识别和加以控制。

虽然医疗风险是健康保险的主要风险来源，但最终能被健康保险覆盖和服务的内容却极其有限，这主要是受医疗风险的社会属性影响。一方面，人类在自然界“生老病死”的规律中体现的是自然属性，并趋于稳定；但另一方面，随着社会进步的加速，医疗风险的社会属性则复杂多变，并趋于不稳定，尤其是工业革命以来的技术进步和制度创新，显著加剧了风险事件与风险结果间的复杂联系。医疗风险的社会属性，让人们在损害因果关系的判断上较为困难，同时，与经济高速发展对应的环境污染、资源枯竭、社会心理压力等问题对人类健康产生着直接或间接的严重影响，这些系统性因素导致了医疗风险的防治成本高昂。按照马克思关于社会性的学说，医疗风险的社会属性是由于不同国家或地区经济水平、人口状况、环境因素、民族风俗等意识领域的差异造成的，这些差异不仅体现在影响健康水平的因素上，还反映在不同风格的法律、法规等制度规范上，使得医疗风险不仅与医疗健康的个体要素相关，而且与医疗健康的配套制度相关。这就使得要对医疗风险进行准确界定存在困难，开展综合防治的成本费用较高，而且不同国家和地区制度规范的差异性较大，所以，单纯用保险机制来应对全面医疗风险不一定可行。

这样，我们研究健康保险风险来源的重点就放在患者和医疗服务提供者上，如患者自身的疾病、意外、器官功能退化带来的风险损

[2]卫生部医政司，中国医师协会，《我国医疗风险监测和预警机制课题》，2005 年国际医疗风险管理与病人安全研讨会

失，外界意外因素导致的风险损失，以及诊疗过程中风险事件的损失。现阶段，这些损失主要通过财务补偿的方式得到解决，由于技术手段和管理流程的限制，目前保险公司在处理健康险赔案时从损失发生到完成补偿的链条较长，其中可人为介入和操纵的环节较多，健康保险理赔环节的“跑冒滴漏”较为普遍。同时，在投保和理赔环节，受不良行为心理因素影响，可能伴随道德风险和逆选择，即投保时故意隐瞒对自己不利的事件，或出现疾病以后才买保险，一定程度上放大了医疗风险的危害，增加了经营管理难度。

## B.健康保险的管理模式

健康保险的经营管理虽然在不同的主办者、不同的国家和地区、不同的历史阶段有不同的模式，与之对应的运行方式和管理要点有较大差异，但运行环节归纳起来仍然是筹资、运营、给付三部分核心内容，管理环节归纳起来主要是谁主办，谁参与，如何进行利益分配，以及进入和退出标准等。以下，从主办者角度，分为政府主办、商业机构主办，以及混合模式三部分进行介绍。

**1）政府主办模式**

在此模式下，筹资一般采取强制征缴方式，运营模式有自营、委托外包、部分自营和部分外包相结合，给付则按互助共济原则追求“不赢不亏”。政府主办模式的理论基础来源于社会保险，不以盈利为目的。在极端情况下，健康保险的保费征缴通过税收形式实现，符合条件的公民自动成为被保险人，政府通过行政机构开展健康保险的运营管理，一般来说覆盖面广、保障程度较低，风险管理要求不高，亏损时可能采取财政兜底，盈利时可能面临行政干预。

**2）商业机构主办模式**

在此模式下，筹资主要通过自愿缴纳方式实现，运营中突出销售功能，强调保险机构的承保理赔能力，重视全流程风险管理，定价和给付遵循大数法则和共济原则，但以营利为宗旨。商业机构主办模式的理论基础来源于商业保险，是市场经济的产物，不论在自由竞争市场，还是垄断或寡头市场，保费收缴永远放在首要位置，消费者必须缴纳足额保费才能成为被保险人，对保险机构而言，产品开发、承保理赔、精算再保等技术要求较高，保险公司自负盈亏，经营成效取决于机构的整体经营能力和全面风险管理能力。

**3）混合模式**

属于以上两种模式的混合体。目前，大部分西方国家的健康保险模式均是两种模式的不同组合，相对而言，欧洲国家的政府成分多一些，美国的商业成分多一些。

回到医疗风险的普遍存在与商业保险有限保障的矛盾问题，这个问题的根源在就于模式选择，即主办者利益问题。对政府而言，社会稳定和得到老百姓拥护是提供服务的利益出发点，这就决定了服务的广覆盖是前提，虽然可能出现保障的低水平，但在“不赢不亏”的经营宗旨下，对医疗风险筛选不用很严格，可以做到可保健康风险以外的、针对传染病、环境危害等系统性风险的应对。而商业机构在医疗风险选择上之所以慎重，一方面受到主办者营利动机的驱使，一方面受到风险管理技术水平的限制。值得注意的是，政府主办模式不可避免会出现效率低下、资源浪费和成本高昂等问题，而商业机构主办则不可避免会出现公平问题。

从我国的实际情况看，健康保险的运营管理也是两种模式的组合[2]，其中，社会属性的内容由政府主办，称为医疗保险；商业属性的内容由保险公司主办，称为健康保险。为了保持概念的清晰以及与国外经验的比较，本文对商业机构主办模式下的健康保险运营管理统一叫做“商业健康保险”，对政府主办模式下的医疗保险运营管理统一叫做“社会医疗保险”。

## C.健康保险的定义

为进一步探讨运营管理模式，我们接下来分析不同国家商业健康保险的定义。美国的商业健康保险[3](Commercial Health Insurance)指覆盖医疗费用和失能收入损失的一类健康保险，可以根据续约规定和所提供的医疗责任予以分类，保单可以卖给个人或是作为团体计划中的一部分。英国的商业健康保险[4](Private Health Care)指由私人机构提供，由公民直接购买或通过医疗保险支付的，与政府公共健康体系相补充的一类健康保险产品和服务，包括与医疗

[3] The Health Insurance Primer Health Insurance Nuts and Bolts，HIAA, USA
[4] http://www.privatehealth.co.uk

费用相关的保险产品以及与医院护理、日间护理、护理中心护理、药物治疗相关的健康保障服务等。德国的商业健康保险[5]定义为“补偿因疾病和意外事故造成的经济损失保险，分为医疗费用保险，医疗保险和津贴的收入损失补偿保险（即伤残保险）三类”。由于医疗保障制度的构成，实质是对医疗服务融资模式的选择[3]，诱导需求和道德风险的普遍存在，要求商业健康保险必须借助政府力量进行筹资，筹资模式不应成为判断政府主办还是商业运作的标准。新加坡的商业健康保险[6]指（Private Health Insurance）应对昂贵的医疗费用支出以及预防重大灾害性疾病和潜在的失能损失的健康保险，由政府和私人机构合作，为“3M”方案（Medisave, 1984; Medishield, 1990; Medifund, 1993）通过更高质量的保障和服务形式，提供补充[4]。

我国学术界对商业健康保险的定义为“健康保险是以被保险人的身体为保险标的，使被保险人在疾病或意外事故所致伤害时发生的费用或损失获得补偿的一种保险。”中国保险监督管理委员会（简称“保监会”）2006 年颁布的《健康保险管理办法》给出的定义是“指保险公司通过疾病保险、医疗保险、失能收入损失保险和护理保险等方式对因健康原因导致的损失给付保险金的保险。”

以上定义反映了健康风险在制度框架内主体、客体和内容的关系。随着风险管理理论的发展，以贝克和吉登斯为代表的学者提出制度产生风险的风险社会理论，认为工业化社会发展在规避风险的同时，也制造了风险，而化解或缓解这些风险损害的责任理应由制度变革者，即政府部门或技术进步的主要受益者承担。对于健康保险风险社会性问题的研究本文难以深入进行，但基本看法是：医疗风险的防治应从主要矛盾和基础问题抓起，健康保险是应对医疗风险的有效手段，理应抓大放小，突出重点，从医疗费用、疾病负担、医疗纠纷等结果入手，提供风险管理产品和服务。同时，还应从医疗风险来源入手，尤其要重视系统性因素导致的医疗风险，以及在制度形成过程中，制度本身导致的风险。这也从侧面提示，要提供全面的健康保险服务，纯商业属性是不够的，因为社会责任不仅是政府的责任，也是社会进步受益者的责任。

对于健康保险的商业化运作，西方国家有不同的观点和做法，美国、英国将其归属人身保险范畴，澳洲、加拿大将其归属非寿险范畴，日本则称其为保险的第三领域，出台单独的法律和监管措施。相对于寿险和财产险的商业化运作，健康保险的商业模式并不成熟，不同国家和地区有不同作法。但有几点是共同的：一是主办者不是政府部门，大部分主办者是以营利为目的的商业机构，也有部分非赢利组织；二是健康风险局限于疾病、意外、功能衰竭等，环境因素等系统性医疗风险几乎不在保险范围；三是补偿方式以财务损失为主，很少涉及医疗服务项目的提供。这为我们分析商业健康保险的既往经验和经营现状提供了基础，但在探讨未来发展趋势的时候，却不应受此约束。

## D.商业健康保险的特征

为全面分析商业健康保险的经营管理特点，我们从健康风险特征、保险合同要素、产品类别、客户需求特征、运营管理特点几个方面入手。

**1）健康风险特征**

现阶段，商业健康保险的风险来源主要存在于两个环节：一是公司内部，即销售人员的理解能力，以及对客户的误导和欺诈，以及公司在精算、核保、理赔、客服、再保险等方面的专业能力。另一个是公司外部，包括经济发展、社会道德、法律法规、医学和卫生状况等社会环境，服务水平、管理制度、利益调整等医疗服务提供者的能力，以及来自于被保险人在年龄、性别、职业、健康状况、以往疾病方面的客观风险，和来自于无欺诈动机的自然主观风险，以及有欺诈动机的非自然主观风险。

通过前面分析，我们知道商业健康保险所保障的健康风险与传统的保险风险有较大差异。在风险的不确定性上，虽然大部分疾病发生的原因不明确，但随着科技的进步，尤其是遗传学和基因图谱的应用，越来越多的致病要素被发现，部分疾病发生与否的因果关系逐步被明确；在风险的客观性上，行为心理因素是主观的，但结果证明长期负面的情绪因素也能产生客观明确的病症；在风险的可测定性上，考虑到环境因素的影响，传染病、流行病的危

[5] http://www.dkv.com/
[6] Tan A. When ill health strikes, The Business Time, Nov. 8, 2006

害，风险事件的后果可能是巨大的、灾难性的，利用财务补偿的方式往往弥补不了。虽然英国、德国等西方大部分国家采取国家主导的健康保障模式，但健康保险商业化运作在美国、澳大利亚的成功，证实了其不可否认的生命力。但提示我们，支持商业健康保险发展的理论体系是什么？内在规律是什么？本文描述了该问题存在的表象和部分原因，具体分析将在后续研究中进行。

**2）保险合同要素**

在满足最大诚信、可保利益、补偿、近因等基本原则的基础上，保险合同关系成立，健康保险也不例外。但值得注意的是，商业健康保险合同虽然符合上述基本原则，在实际运营中也表现出一定的特性，或者叫不适应性。

关于最大诚信原则。指保险人和被保险人在签署合约之前，应对保险条款和被保险人的身体健康状况等影响合同生效的事件进行充分告知，本着诚实沟通、相互信任的原则缔结合约；在合同生效之后，应对导致双方利益受损但又不属于保险责任的事件进行充分沟通，不能欺骗对方。健康保险的合同当事人应该遵守这样的原则，但由于医疗风险的专业性强和复杂程度高，以及道德风险和逆选择问题，实际运行中，保险公司的“故意隐瞒”和被保险人的“恶意欺诈”同时存在，对健康保险的商业运作提出挑战。

关于可保利益原则。指投保标的在遭受事故时要对投保人带来经济损失，或对被保险人及其家属带来经济困难，投保人、被保险人、受益人之间应存在利益关系。由于健康风险损失程度的量化缺乏客观统一的标准，如同一疾病采取不同治疗方案、同一治疗方案选择不同医生或医院，所产生的医疗费用可能出现较大差异；另外，考虑到健康的多维属性，单纯通过经济损失来界定可保利益，也显得不够全面。

关于补偿原则。指被保险人发生损失时，通过现金赔付、治疗、手术、器官移植、护理等医疗服务给予的补偿不能对被保险人产生额外收益。从财务损失补偿的角度，不同保险公司间赔偿顺序的界定以及责任大小的分割，需要建立协调机制；更为关键的是，客户同时享受私人保险和社会保险的时候，需要跨越商业公司和政府机构间有顺畅的信息衔接和数据交换，这对补偿原则的适用性增加了难度。另外，考虑到健康保险的服务需求，补偿原则的量化标准成为问题，这也对健康保险的商业运作产生了挑战。

关于近因原则。指保险事件的发生是由于保险责任对应的直接最近原因导致的，保险人应对保险标的的损失承担责任。就疾病发生的原因而言，由于健康保险承保的疾病、医疗等保险事故部分是行为心理或社会环境因素导致的，而此类事件在常规的保险合同中属于除外责任，介于专业解释和朴素理解的差异，以及投保人与保险公司的信息不对称，法院在受理此类案件时一般会倾向弱者。而有的时候，被保险人的疾病状态并非故意行为所致，如产后抑郁、丧子后的精神异常等，虽近因是心理疾患，但可推导或证明是意外事件产生的直接影响。另外，个人的健康状态是生理、心理和社会适应性几方面的综合表现，简单照搬合同文本，以所谓的近因判断，容易出现理赔纠纷。

除此之外，传统的保险风险主要涉及保险人与被保险人，而健康风险的识别和应对还包括医生和医院这样的服务提供者，这极大地增加了健康保险运营管理的复杂程度。从商业健康保险的发展趋势看，在合同要素中，商业机构出于风险管理需要，逐步把医疗服务提供者纳入到合同主体，或医疗服务者主动提出用保险机制解决医疗过程中的风险，这对传统的保险合同也是一种尝试和挑战。

**3）产品类别**

健康保险产品实质上是对保险人与被保险人关于保险利益在权利义务关系上的规定，以合同方式存在。从以上分析可见，医疗风险作为健康保险合约的客体，由于来源广泛、因果关系较复杂、需要专业手段界定等原因，符合可保条件的不多，这就出现了合约主体（保险人与被保险人）之间对保险合同关系成立与否的博弈。博弈的结果可能是：保险人或提高价格，或对部分责任予以限制和除外，或夸大功能诱导消费；被保险人或在投保时隐瞒风险，欺骗保险公司，或拒绝加入。上述现象出现在强势保险人（卖方市场）和强势被保险人（卖方市场）两个极端情景，要实现博弈均衡，前提是保险人与被保险人对医疗风险的认识和判断趋于一致。对于以个体角色参与博弈的被保险人，要消除信息不对称，显然不太现实；如果增加保险人数量，是否信息不对称问题可以得到一定程度的缓解？这里提出一个命题，市

场机制能否应对医疗风险。在后期深入论证之前，作者的观点是市场机制可以处理来自患者和医疗服务提供者的部分医疗风险，但被保险人需要的保险保障远远超出当前健康保险合约中约定的责任，因此，政府的介入和计划的手段在解决医疗风险问题时仍是必须的。

笼统地看，健康保险的产品分类采用过以下方式：如按投保人数量分为个人健康保险和团体健康保险，按保障时间长短分为短期（可分为一年期以内的极短期和一年期），长期（一年期以上的定期及终身）两类，按合同能否单独购买可分为主险和附加险，按是否提供保证续保责任又可分为可保证续保和不保证续保两类，按风险承担责任还可分为基金管理型和风险保障型产品。为与保险机构提供的产品和服务对照，以下从三种常见分类进行介绍。

**（1）按保障范围分类**

一是医疗费用保险，指因疾病或意外事故所发生的医疗费用支出，一般包括门诊、住院期间发生的医疗费用，也有的国家包括疾病的预防费用，通常包含药费、床位费、检查检验费、治疗费、手术麻醉费、护理费等。二是收入损失保险，指因疾病或意外伤害所导致的收入损失，一般指失去工作能力所发生的收入损失，以 Disability（失能）为判定标准，住院日额津贴也具有类似特点，但不一定满足失能的标准。三是护理保险，指因疾病、意外或衰老而失去自我照顾能力，需要提供护理服务，一般以 ADLS（日常生活能力损失）的程度为判定标准。

**（2）按给付方式分类**

一是定额给付型，以保险事故发生为标的，按事先约定的固定金额给付，通常为一次或分期给付。二是津贴给付型，以保险事故发生后的持续时间为准，按事先约定的固定金额与持续时间作为给付条件，通常为日额津贴、月度津贴或年度津贴，也可一次性支付。三是费用补偿型，根据被保险人所发生的符合保险人合同规定内容的费用，按事先约定的比例给付，通常为住院期间发生的费用。四是服务提供型，由保险人的合作组织向被保险人提供医疗服务，保险人与合作组织间进行费用结算，通常也称为管理式医疗。

**（3）按风险承担方式分类**

一是风险保障型产品，按照疾病发生率、医疗费用、疾病持续时间等作为风险衡量标准的保险产品。二是基金管理型产品，指从投保人处汇集保费，按基金类型进行管理和运作，目前，有仅作基金委托管理，提供服务项目(理赔账单审核，健康咨询等)，不承担保险风险的产品；也有承担一定保险风险，并提供分红、投资连接服务的产品，也有完全不提供服务，也不承担保险和资金风险，仅通过诸如法律咨询等为投保人减少税费支出，而自身收取服务费用的产品。

**4）客户需求特征**

2009 年，美国商业健康保险实现保费收入 8012 亿美元，寿险（不含健康险）实现保费收入 5000 亿元，产险实现保费收入 6600 亿元，健康险业务占比约 40%，成为第一大险种。早在 1993 年，美国以费用报销型医疗保险为主的商业健康保险就已经占据了较大的市场份额，随着管理式医疗模式的建立，美国健康险市场迎来了巨大发展。2005 年，由美国 CLARITA 公司进行的全国客户调研发现：享有商业健康保险产品和服务的美国家庭占比 74%，是美国家庭保险需求的第一选择，其中，管理式医疗的家庭购买率就达到了 60%。从产品特征看，美国市场最受欢迎的管理式医疗保险，主要整合了医院和医生资源，客户在购买保险后可以实现医疗花费与保险金的直接赔付，不需垫付资金；医院和医生均是保险公司优选出来的，医疗水平高、服务质量好；同时，由于保险公司和医疗服务提供者建立了有效的利益机制，不合理的医疗费用得到了较好控制。从客户需求看，购买率由高到低的产品是 PPO/HMO 计划 60%，处方药保险 57%，牙科保险 50%，眼科保险 43%，意外和残疾保险 35%，失能保险 29%，重大疾病 23%。

零点公司 2006 年对我国五个主要城市的健康险市场调研[7]发现：现阶段，我国老百姓对健康保险的需求在所有被调查保险业务中位居第一，45%的人表现出明确的购买意愿，但同期健康保险的保费收入占总保费收入的比例仅为 6.68%，强烈的需求与实际购买之间存在较大的缺口。为了深入了解客户需求，零点公司组织了 10 场焦点小组座谈会，结果发现：在不考虑价格的基础上，客户最关心的是健康保险需求，如果要支付较高的保费，或保费不能部分返还，客户的购买意愿明显下降。总体

[7] 北京零点公司 2006 年为中国人民健康保险公司开展的健康保险产品调研

上，高收入人群看中的是差异化的医疗服务，中低收入人群倾向于不付费的基本医疗保障，中高收入人群是健康保险的主要需求群体。因此，我国中高收入群体不足，可能是解释上述健康保险需求与购买缺口的主要原因。从需求的产品顺位看，重大疾病第一，医疗费用报销第二，意外和残疾第三，对保险公司极力推荐的健康服务项目，客户由于没有经验、缺乏了解，而无法判断是否需要。

**5）运营管理特点**

商业健康保险由于受制度框架和政策法规的影响较大，保障责任的专业性较强，风险管理的复杂程度较高等因素影响，在运营管理上存在一定的特点。

一是产品突出保障功能，主要补偿因治疗疾病和意外伤害所引起的经济损失，或补偿因疾病和意外失能所致的收入损失；二是管理成本高，保单量大，金额小，运作成本高；三是理赔复杂，理赔金额事先不能确定，客户对理赔金额易产生争议，理赔频率高，合同期间可能多次理赔，保险事故发生频率高；四是风险评估要素不同，主要考察被保险人发生治疗的可能性大小（发病率）及治疗费用的多少；五是对医院的合作要求高，内容多，需要医疗机构提供快速、优质的医疗服务，控制不合理医疗费用，提供相关数据和资讯；六是精算基础不同，数据要求多，如发病率、住院率、门诊率、平均住院天数、人均住院费用、门诊费用等，且数据来源局限性大，数据质量不稳定。

商业机构为了有效管理健康保险，通常采取以下措施：一是加强基础数据的收集分析，保留费率调整的权利，加强定价的合理性和准确性；二是在保险合同中设置保护性条款，如免赔额、等待期、自付比例、既往症、入院通知、择期手术、分项限额、健康告知等，减少被保险人的逆选择；三是进行医疗费用审核，开展必要的理赔调查，注重理赔的数据统计分析，控制不合理的医疗费用支出；四是采用专门的核保技术和有经验的人员，如特殊情况问卷调查，关键指标抽查等，准确进行风险评估并确定适合的承保条件；五是加强医院管理，控制不合理的医疗费用；六是加强销售人员品质管理，建立客户黑名单库，防止业务员的误导和逆选择，防范客户欺诈。

# Ⅱ. 西方国家商业健康保险发展的常规历程

德国是医疗保健制度的创始人，早在 1685 年的普鲁士王朝，就建立了国家卫生管理制度，以立法形式推进健康保险经营管理模式的发展，随着 1911 年《联邦健康保险法规》的实施，私人机构逐步进入到健康保险领域，对疾病费用、住院费用、择医选院等费用和服务进行补偿。从这个意义上说，德国是商业健康保险的发源地，但商业健康保险取得突破性发展的国家是美国。作为两次世界大战的受益者，美国的经济和社会发展在 19 世纪末 20 世纪初取得了长足的进步，把英法德意澳等老牌资本主义国家甩在了身后，尤其是一战结束后，美国以自主意识、契约精神、全面竞争为核心的市场经济展现出蓬勃的生命力，即便是《社会保险法》颁布的 1936 年，政府承担的健康保险责任也极为有限，民众的医疗风险和健康保障需求主要通过商业健康保险模式来解决。回顾西方国家商业健康保险的发展历程，主要从政府职能、法律和政策法规、疾病谱和医疗技术发展三个方面来归纳。

## A.受政府职能发展变化的影响

研究政府职能对商业健康保险的影响，实质上是研究作为顶层设计的制度安排。健康保险作为一种制度安排，受政府职能的影响是毋庸置疑的，关键的问题是这种影响是否是决定性的。从德国政府职能与健康保险发展三个时期的关系看，健康保险的商业化发展主要取决于政府的决心和职能的转变。

**1）萌芽期**

在 1640-1688 年，普鲁士国王腓特烈·威廉在位期间，为了解决与周边列国的历史宿怨，扩大版图，政府极力推行军国主义政策，大力发展工商业，建立国家卫生管理制度，以征收“军事税”的方式促进和维护劳动者的基本健康，促进本国经济发展。与 1601 年英国政府颁布的《济贫法》相比，德国国家卫生制度不仅针对赤贫阶层提供福利救济，更重要的是确保了所有劳动者及其家属都能享受到基本的医疗健康服务[5]。同期，法国政府取消南特敕令后，胡格诺教徒纷纷逃往国外，为了解决当时在农奴制条件下劳动力短缺的问题，德国接纳和收容了来自法国的大量流亡者，从而快

速提高本国的军事实力。这一时期政府的职能目标非常明确，虽然当时普遍存在于普鲁士手工作坊和矿厂中的疾病保险协会，如共济会、矿工联合会，以及丧葬互助组等，也能为工人提供援助并减少疾病损失，但显然不能形成足够的势力。政府主办的健康保险成为政府笼络人心，稳定社会分工，促进经济发展的有力工具。因此，德国政府维持了较长时期的政府主导健康保险模式，但随着政府统治重心的转移和筹资能力的下降，来自低收入阶层对税收的不满、高收入阶层对高质量和灵活服务的需求，以及外来移民享受国家医疗的公民身份等问题，为健康保险的商业化运作提供了机会。

**2）压抑期**

到 1883-1889 年，俾斯麦政府建立了全世界最为完备的社会保障制度体系。如同俾斯麦的著名演讲词“当代的重大政治问题不是用说空话和多数派决议所能决定的，而必须用铁和血来解决。”德国政府在为农工立法的路上，正是德意志帝国建立初期，在封建主义，资本主义，社会主义和宗教主义各种因素并存，阶级关系极其复杂的特定时期，权衡各方利益，德国政府将社会保险立法看作是“一种消灭革命的投资”，在通过强权政治完成德国统一之后，不断出台保障工人阶级利益的措施，以笼络人心。这一时期，先后出台《工人医疗保险法》、《工伤事故保险法》、《伤残和养老保险法》，1911 年，俾斯麦继任者贝斯曼•霍尔威格通过《联邦健康保险法规》，德国政府将上述法律合并，颁布了统一的帝国保险法。直到一战和二战结束前的 50 多年里，由于军国主义思想在德国统治阶层中的盛行，政府职能的重心是通过高税收和高福利维持社会稳定、支持强权扩张，商业健康保险在这一时期几乎找不到踪影。

**3）发展期**

二战结束后，德国政府面临国内经济崩盘和巨额战争赔款的双重压力，政府职能转向经济建设，无暇顾及国民的医疗健康保健需求，商业健康保险以疾病基金和互助保险的形式在部分行业得到发展[6]。但出于天主教传统、普鲁士君主社会主义传统、普鲁士民间互助传统的影响，政府主导的社会保障体系虽然面临投入不足问题，但仍然是解决民众基本医疗健康保障的主要途径。这一时期，商业健康保险在联邦德国政府扶持下，得到快速发展，而在民主德国却没有形成气候。在东西德国分裂的 30 余年时间里，联邦德国政府于 1975 年增补《孤儿寡妇保险法》，汇总各类社会法规，出台《社会法典》，成为当代德国社会保险制度的法律基础。随着 1989 年柏林墙的倒塌，商业健康保险的发展迎来了春天，1995 年，重新统一后的德国政府设立长期护理保险并纳入法典，至此，德国社会保险的法律框架体系基本成型，但社会保险收费过高、保障不足的问题也日益突出。从科尔政府执政的 80 年代末期到 1996 年，政府每隔四年就会颁布一部新的《卫生保健改革法》，核心内容就是引入竞争、增强个人责任。2004 年，施罗德政府开始推行《法定医疗保险现代化法》，在鼓励投保人积极参与疾病的预防和早期诊治的同时，也要求他们承担部分医疗费用。

分析德国商业健康保险的发展历程，我们可以认为：政府职能在推动社会进步和人类文明发展上扮演了重要角色，对健康保险的社会性抑或商业性发展方向起到了决定性作用。当然，以上是基于政府职能重要调整的分析，虽然时间跨度长但论述较为简单，尤其是对发展期的概括显得过于笼统，为增加说服力，作者将在后续研究中增加篇幅，并借助 1927 年设立的德国健康保险公司（DKV）的成长历程，剖析政府职能对商业健康保险公司的影响。

## B.受法律法规变化的影响

如果说政府职能明确了政策的方向，法律法规则规定了政策的细节。对政府职能基本稳定的国家或地区，法律法规直接规定健康保险的经营模式和具体内容，从而对健康保险的商业化发展产生重要影响。

对应不同的筹资途径，现阶段，各国的商业健康保险大致有三种类型和四种模式[7]。一是政府筹资，以总税收、通货膨胀、特别税费等方式筹集资金，用于由中央政府管理的计划免疫、妇幼保健等，用于修健公立卫生服务机构，提供免费的基本卫生服务，卫生机构以国有为主，全民普遍享有免费的综合卫生服务。二是社会筹资，通过国家立法强制执行，雇主和雇员共同缴纳保险金，从而享有基本卫生服务。三是个人筹资，大多数公民通过自愿参加商业性医疗保险获得卫生服务，卫生服务机构

以私立为主，政府仅负担老人和穷人等特殊人群。

在这三种筹资模式的组合使用上。西方国家历经百余年的发展与演变，对应自身的法律环境，已基本定格为四种模式。一是商业保险模式，特点是参保自由，灵活多样，保障随保费增加而增长，能适应不同的需求层次，典型国家代表为美国。二是社会保险模式，特点是医疗保险基金由社会统筹，互助互济，保险费由雇主和雇员共同缴纳，政府酌情补贴，典型国家代表是德国。三是全民保险模式，特点是由政府直接创办医疗保险事业，老百姓纳税，政府收税后拔款给公立医院，医院直接向居民提供免费（或低价）服务，典型国家代表是加拿大。四是储蓄保险模式，特点是强调个人责任，通过立法迫使个人储蓄积累为医疗保险基金，典型国家代表是新加坡。

**1）美国**

在美国的商业健康保险发展历程中，法律法规对业务增长的促进作用非常明显。1936年，美国出台《社会保险法》，在此基础上，构建了以老年医疗保障制度、贫困人口医疗救助制度和少数民族免费医疗制度为核心的社会医疗保险体系，以及以非营利性组织和商业机构主导的私人健康保险体系。相应的政策法规包括：《老年健康保险法》、《美国安全法》、《健康维护组织法》、《需求证明书法案》，以及蓝盾（Blue Shied）保险计划和蓝十字（Blue Cross）保险计划等。由于社会医疗保险与私人健康保险的边界清晰，美国政府承担了弱势群体的基本健康保障需求，为健康保险的商业化发展奠定了基石。同时，部分政策法规的颁布，对商业健康保险的快速发展提供了机遇。如 1942 年，美国在《战时稳定法案》中规定“在战时物价和工资严格控制的情况下，允许雇主通过提供健康保障福利项目来留住工人”，通过商业保险方式，变相提高工人的薪酬待遇，受到工人阶级的普遍欢迎。1943 年，政府在行政税收法规中特别声明“雇主向商业保险公司交纳的团体医疗和住院保险保费可以作为员工收入而不用纳税”（《税收法》的前身），强化了健康保险和就业之间的联系，有效推动了企业团体健康保险的发展。美国是世界上商业健康保险发展最为成熟的市场，目前，随着管理式医疗（Management Care）和第三方管理（Third Party Adiministration）的兴起，美国的商业健康保险已经完成医疗费用报销模式向服务提供模式的转变，覆盖人群比例超过 75%，在医疗费用支出中的比重接近 30%[8]。

**2）德国**

德国现行的《社会保险法》规定，为公民提供医疗健康保障的方式有两种，一个是法定医疗保险，一个是商业健康保险，法定医疗保险机构是具有法人地位的，按公司法管理的、非营利性的机构，不隶属于政府，政府不直接参与法定医疗保险的实施和管理，德国公民一旦选择投保商业健康保险公司的保险，就不得随意退出而转入法定医疗保险机构，但参加了法定医疗保险的人可以自行决定是否变更为商业健康保险。数据显示[9]：2008 年，90%的德国人口选择了法定医疗保险，10%仅选择了商业健康保险，10%的人两者兼有，商业健康保险支付的医疗费用占全国医疗费用支出比例达到 12%，随着医改方案的逐步深入，商业健康保险覆盖的人群和费用占比表现出明显的增长势头。

**3）英国**

英国的医疗保障体系由公共医疗体系（英国国民保健服务 NHS）和私立医疗体系构成，商业健康保险可以覆盖更多公共体系不能涵盖的医疗服务，政策规定，拥有商业健康保险的癌症患者可以接受新型药品治疗，可以选择医疗机构，减少住院预约和等待的时间。2008 年英国保险行业者协会统计数据显示[10]：商业健康保险的参保比例约为 12%，在享受商保的人群中，73%由雇主为员工购买。由于健康保险的保障功能较为突出，在英国经济发展相对停滞的时期，业务发展仍然稳定，并表现出较强的抗经济下行能力，在 2003-2008 年的经济下行周期，健康保险却增长迅速，2008 年 GDP 增速 0.55%，而同期健康保险保费增长达到 7.3%。

**4）澳大利亚**

[8] 美国维朋（Wellpoint）公司北京代表处，美国医疗融资体系及商业健康保险，中国健康保险发展论坛，2010 年，北京

[9] 慕尼黑再保险公司，德国健康保险发展模式的经验借鉴，中国健康保险发展论坛，2010 年，北京

[10] 英国保柏（Bupa）集团北京代表处，英国医疗保障体系及商业健康保险市场概述，中国健康保险发展论坛，2010 年，北京

澳大利亚在立法和行政职能上延续了英联邦国家的传统，但对商业健康保险的扶持力度显然比英国更大，陆续出台《国民健康法》、《全民健康保险税收豁免法》、《商业健康保险法》等，其中，1996 年出台的《医疗税修正法案》，针对未购买商业健康保险的高收入人群惩罚性地征收医疗附加税；1998 年出台的《商业健康保险激励法》，增强了对商业健康保险的补贴力度；2000 年推出终身医疗保险制度，鼓励消费者尽早投保商业健康保险，允许商业健康保险基金推出全报销保障产品。从时间纬度看，澳洲每一项支持政策的出台，都极大地促进了商业健康保险业务的发展，仅 2000 年 6 月，由于终身医疗保险制度的出台，商业健康保险的持有率从 1999 年底的 31.3%快速提高到 43%，到了 9 月份，商保持有率跃升至 46.8%。目前，澳洲的商业健康保险覆盖人群比例稳定在 44%左右[11]。

由于各国的政治经济环境不同，东西方国家的法律体系差异较大，西方国家内部的政策法规也千差万别，为找出健康保险商业化运行发展的规律，需要更为完整的国别研究，这也是作者下阶段的重要工作。

## C.受疾病谱和医疗技术水平发展变化的影响

在研究健康保险制度的同时，不可避免地要研究健康保险制度的核心--医疗风险事件在各个不同时期的发展和演变，而决定人类所面临医疗风险事件的主要因素是疾病谱和医疗技术水平。以下，以商业健康保险最为发达的美国市场为例，分析疾病谱的变化与商业健康保险产业发展之间的关联。

1776 年，美国独立宣言提出“人人生而平等，任何人拥有生存权、自由权和追求幸福的权利，政府的正当权利，是经被统治者同意授予的”。在美国历史上，人权的重要性不言而喻，但建国后的 100 多年时间里，美国政府并不能对威胁公民健康生存的疾病风险承担全面的责任，倡导创新精神的商业机构也很少通过金融工具涉足医疗健康领域，这一方面是由美国当时急于摆脱英国统治，寻求政治经济独立的特殊历史阶段决定的，美国政府没有欧洲国家那样的财力和物力积累，在应对健康风险上难以有所作为。另一方面也是健康风险本身的特性决定的，因为这一时期，威胁人类健康的疾病风险主要是急性和慢性传染病，营养不良以及寄生虫病，生存尚且困难，治病就更加不易，人类通过医疗技术手段逆转或应对疾病风险的能力极为有限。

20 世纪初，医学技术在控制鼠疫、伤寒等流行病和传染病上取得了实质性突破，西方资本家最为担忧的劳工健康和生产力问题得到了保证，大部分疾病风险成为可保风险。美国政府作为世界战争的受益者，积累了一定的财力，在应对健康风险的手段选择上也更加自如。在这一时期，基于生物因素的疾病谱和医学模式引导了西方医学科学技术的发展，商业机构纷纷进入保险领域，开发了以费用报销为主要特征的医疗费用保险产品，得到雇主和雇员的普遍欢迎。

随着疾病谱的变化，健康和医疗风险的内涵发生了变化。20 世纪 30 年代，生物-心理健康成为人们对健康状态的共同理解，而衡量健康状态的标准也从单纯的医学指标扩展到生命质量指标，医学模式从一维发展到两维。这一时期，行为生活方式导致的心脑血管疾病，以及战争阴影下的心因性疾病成为危害健康的主要因素，但由于健康危险因素的测量在当时带有一定主观性，疾病风险事件的产生又存在一定滞后，商业机构提供的产品仍集中在生物因素导致的财务损失风险应对上，费用报销管理仍然是商业健康保险的主要特征。

70 年代末，关于生命质量的研究取得重大进展，医学领域研制出来的数以百计的测定量表对健康危险因素进行了全面客观的判断，逐渐形成以生物-心理-社会因素为核心的现代医学模式，这一时期的疾病谱，逐渐转变为高血脂、高血压、高血糖等营养过剩的富贵病，和心理、社会压力过大环境下的机体功能紊乱症。1997 年，美国精神病和心身医学教授恩格尔提出生物心理社会医学模式，再一次引领了健康风险理论的发展，但在保险实务界，由于对社会风险因素和损失程度进行评估的难度较大，商业机构的风险补偿模式受到了极大冲击，但部分眼光深远的公司，开始从末端的风险补偿功能绕到前端的风险预防功能，并尝试介入医疗服务过程，从而更为有效地应对医疗风险。这一时期，管理式医疗的观点逐渐在被保险人、保险公司和医疗服务提供者间得到普

[11] 范娟娟，澳大利亚私人健康保险监管现状及启示，中国保险，2010 年 02 期

及和推广。90 年代末期，美国完成了由传统的费用报销型到管理式医疗的转型，传统费用报销型业务的市场份额从 1993 年的 46%下降到 1999 年的 9%。

与许多国家不同，美国是一个医疗卫生资源极为丰富的国家，在和平年代中成长的美国公民均把医生和律师作为第一职业选择。到了 80 年代，美国医生数量迅速增加，病房、各种检查诊断、治疗及辅助设备出现大量闲置；同期，随着金融服务行业的快速发展，保险公司积累了大量客户，保险公司在与医疗机构的博弈中，掌握了一定的话语权，这为保险机构介入医疗服务提供了机会；更为重要的是，美国政府通过税收减免政策鼓励私人和雇主购买商业健康保险，极大地促进了保险公司的发展。但随着基因工程技术的发展，尤其是进入 21 世纪，人类对疾病风险的认识从完全陌生到相对确定，从可保风险角度，部分医疗风险经历了不可保到可保再到不可保的过程。这一时期，从保险中派生出的第三方管理机构，实质上已经不是风险管理机构，而是服务提供机构。2002 年，美国 60%以上的雇主使用了某种形式的第三方管理服务，包括基础行政管理，账单审核和报销，医疗管理，法律咨询等。

以上，从三个角度分析了商业健康保险的发展。在政府职能视角，由于健康是公民的基本权利，政府部门在力所能及的情况下，一般会通过社会保险方式提供健康保险服务，但政府承担所有健康风险的能力有限，保障程度通常不高，除非遇到战争或政权变更等临时性的重大事件。同时，在政局较为稳定时期，满足国民的健康保险需求成为政党争取选票的重要手段，政府部门委托商业机构进行健康保险的运营管理成为趋势。在法律法规视角，由于操作难度较大，不同国家都先后出台了支持商业健康保险发展的政策，相对而言，财政税收手段的效果最为直接。在医疗技术视角，由于健康风险与医疗技术息息相关，人类对健康风险的认识慢慢从局部到整体，应对手段逐渐从被动到主动，而覆盖疾病风险的健康保险产品，其商品属性在各个阶段都不明显。这些判断不是基于三个完全不同的视角得出的，因为，健康保险产品和服务所对应的基本人权、商业操作难度大、产品的非商品属性等特征，集合在一起，实际上对应了健康保险的“公共物品”视角[8]。

保罗.萨缪尔森认为“公共物品是增加一个人对该物品的消费，并不同时减少其他人对该物品消费的那类物品”，理查德.马斯格雷夫认为“公共物品是非竞争性消费的物品，通常还具有消费上的非排他性”，詹姆斯.布坎南认为“公共物品是通过政治制度实现需求与供给的那一类物品”[9]。从风险应对的角度，政府主导的免费预防接种、健康保险机构提供的健康教育等服务，具备公共物品特性，而在实际操作中，健康保险依赖财政税收政策扶持的特性，也表明按照公共物品属性运行健康保险是行之有效的方法。以上论述将在后续研究中深入探讨。

综合来看，商业健康保险的发展是众多因素共同作用和推进的结果，但出于健康保险的公共物品属性，从制度设计开始的，由政府推动的，自上而下的发展应该成为主要路径，而自发的，由市场推动的，自下而上的发展只能是有益的补充。

# III. 对我国商业健康保险发展历程的分析和具体建议

要论证健康保险的既往经验，不论是时间跨度，还是模式本身，国内的积累显然不够；因此，要结合国外、尤其是发达国家的经验教训，归纳出健康保险发展的内在规律和常规路径，作为参照并找出可供借鉴的内容。但是，中国从半封建、半殖民地社会进入到社会主义社会，经历的是帝王政治到民主政治的巨变，与西方国家在同一时间纬度上的经济基础和上层建筑差异巨大。这就需要在借鉴国外经验的时候，重新回到中国自身的发展历程上，结合我国经济社会发展所处的特定阶段，综合政治、经济、文化、社会等要素，分析我国健康保险发展进程中存在的主要问题，并对这些问题的性质、成因、潜在影响、解决措施等进行深入研究，才能得出我国商业健康保险发展的路径选择，以及与之配套的政策建议。

## A.我国商业健康保险发展历程

商业健康保险在中国出现的时间较短，只有三十余年。为方便研究，我们按时间序列把它划分为四段：一是 1982 年由中国人民保险公司经办的上海市合作社职工医疗保险，开创了国内商业健康险业务第一单；二是到 1995 年，保险公司推出重大疾病附加保险，充实和

完善寿险保单责任；三是城镇职工基本医疗保障制度改革前后，保险公司以寿险附加型的健康险经营模式快速拓展市场；四是到 2004 年，出现了人保健康等一批专业性的健康保险公司。这四段时间，反映了我国商业健康保险从一笔业务、一类产品、一种模式到一个主体的探索，取得了积极成效。但从经营结果看，我国商业健康保险的发展不够理想，主要表现在三个方面：

一是健康保险的供需不平衡。虽然健康保险是我国老百姓的第一保险需求，但实际购买的保险产品非常有限，健康险市场份额偏低，1999 年不到 3%，最高年份也不到 7%，与成熟市场 10%以上的市场份额有一定差距，2008 年，国家主导模式的英国为 10.7%，市场主导模式的美国为 39%。二是保险补偿和社会管理功能发挥有限。2007 年，我国健康险保费支付的医疗费用占医疗卫生总费用的比例不足 1%，市场主导模式的美国为 37%，国家保障为代表的英国为 11.9%，德国为 9%。三是政策引导效果不明显。《健康保险管理办法》出台以前，我国健康保险保费的复合增长率 49.55%，在财产、人寿、意外和健康险的四个分类中增长最快，业务占比从 1999 年的 2.62%提高到 2005 年的 6.34%；2005 年以后，健康保险保费的复合增长率 15.53%，业务增速在四类业务中最慢，保费占比从 2006 年的 6.68%下降到 2011 年的 4.82%。

我国商业健康保险发展历程虽然不长，但正值改革开放的关键时期，加上健康保障涉及政治、经济、文化等诸多方面，关系较为复杂，需要系统地加以论述。为保持连续性和表达作者的观点，以下从几个重要事件入手，提供简要的概览。

一是城镇职工基本医疗制度改革， 1996-1997 年，朱镕基总理对医疗保障制度改革的观点“我认为医疗保险筹资不能根据需要，只能根据可能。在这个低标准的基本医疗保障水平以上的医疗需求怎么办？我看，就要靠商业保险、企业补充保险和社会救济这三个渠道。医疗保险不要像养老保险以前那样搞部分行业统筹，基本医疗保险从一开始就要全面覆盖，各个行业都必须交纳基本医疗保障基金用于社会统筹。”基本医疗保险制度改革解决了商业健康保险的定位问题，提供了业务发展的广阔空间，即政府根据筹资可能办基本的事情，市场根据客户需要办补充的事情，1998-2005 年，健康险业务得以快速发展与此不无关系。

二是健康保险实行专业化经营，2006 年，保监会颁布实施《健康保险管理办法》，随着健康险专业化经营模式的确立，健康险经营的进入门坎提高，风险管控要求明显提升，但由于缺乏配套政策扶持（如税收政策），健康险的市场局面并没有如期打开。对比国外扶持健康险发展的税收政策，我国目前实施的国税发［2003］45 号（国家税务总局《关于执行＜企业会计制度＞需要明确的有关所得税问题的通知》）和财企［2003］61 号《财政部关于企业为职工购买保险有关财务处理问题的通知》，仍然是 2000 年和 2001 年政策的延续[11]。由于补偿力度有限，而且在提高健康保险经营资格的背景下，出现健康保险业务的相对下滑也是情理中的事。

三是医疗卫生体制改革[10]，2009 年，《中共中央、国务院关于深化医药卫生体制改革意见》明确提出要积极发展商业健康保险，在确保基金安全和有效监管的前提下，积极提倡以政府购买医疗保障服务的方式，探索委托具有资质的商业保险机构经办各类医疗保障管理服务。

## B.存在的主要问题

结合国外商业健康保险发展历程，我国健康保险发展不利的原因主要有四个：一是顶层设计不完善，政府职能在健康保险商业化运作中应该扮演的角色定位不够突出。二是政策配套不完善，如法律体系不健全，关键时期的财税支持力度不够等。三是医疗环境不健康，医疗服务环节存在严重的“诱致需求”，风险管理难度较大。四是健康保险的运营模式较粗放，虽然专业化经营提高了健康险的运营要求，但总体上我国商业健康保险机构仍然采用费用报销型管控思路，竞争焦点放在风险规避而不是降低成本、提高服务质量上，与客户需求存在较大差距。

人类在用市场手段应对健康风险自然属性的过程中取得了较多经验，但在应对健康风险诸如制度因素、环境因素、行为心理因素等社会属性的时候，市场手段会失灵，而计划手段往往产生一定效果[13]。由于健康保险具有一定的公共物品特性，我国短短三十年的商业健康保险运行实践，也经历和遇到了其他国家上百

年发展历程中出现的问题，这中间必然存在一定的规律。有关这部分的观点，作者将作专题深入研究。

## C.对商业机构的建议

结合以上分析，我国商业健康保险的发展路径应在计划经济和市场经济中间找到一个平衡，从制度设计来看，公私合营是必然的选择，配套法律法规应对经营主体给予差异化的扶持政策，而在商业机构自身的运行管理上，传统的费用报销模式、介入风险管控的管理式医疗模式和无风险的第三方管理模式均应成为当前的组织行为方式，以寻求适合我国商业健康保险发展路径的最佳组合。这需要保险人、被保险人和监管机构共同努力，限于篇幅，以下重点从商业保险机构的角度，提几点具体建议。

**1）产品设计**

**（1）明确市场定位**

2006 年以来，我国基本医疗保障体系初步建立，由劳社、卫生、民政部门主办的“全民医疗”保险框架，为商业机构提供了明确的市场机遇。按照现有政策[12]，我国商业健康保险可开展与城镇职工基本医疗保险、城镇居民基本医疗保险以及新型农村合作医疗相补充的中高端医疗保险，以及通过更加灵活高效的手段提供的替代性健康保险产品和服务。

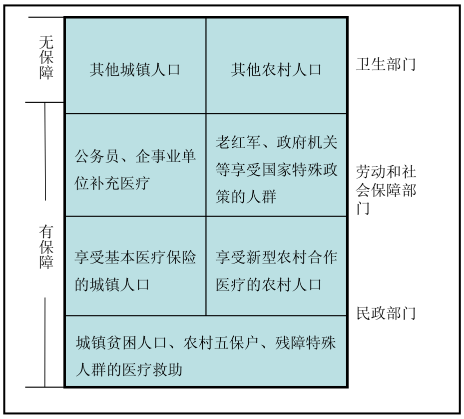



图 1.中国商业健康保险覆盖人群示意

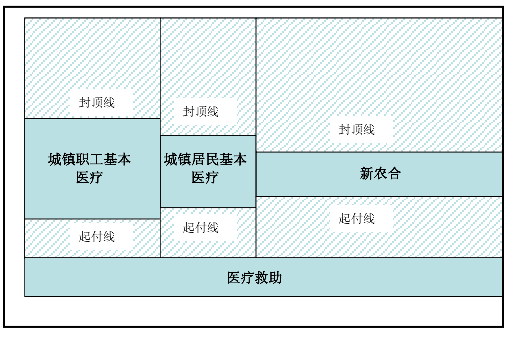



图 2.中国社会医疗保险与商业健康保险关系

**（2）做好客户分类**

客户分类是研究客户需求的基础，也是保险产品设计的前提。目前，常规分类方式有：按照按承保对象分为个人被保险人、团体被保险人，按交费对象分为个人投保人、雇主投保人、政府投保人（财政税收安排），按付费对象分为个人受益人、团体受益人、医疗机构，按服务对象分为投保人（个人、团体）、被保险人（个人、团体）、营销员，按人口特征如保障状况、收入水平、居住区域、就业状况等。

按照管理学优先要素理论，客户分析的核心是购买决策环节及产品适应性分析，即承保对象和交费对象分析，然后是后续服务提供及费用结算方式分析，即付费对象和服务对象分析；结合人口特征交叉分组后，可以找到不同客户分类后的健康保险关键需求点。

一是按承保对象特征分类，其健康保险需求点如下。

表 1. 按承保对象特征分类

| | 分类特征 | 健康保险需求点 |
|---|---|---|
| A 群体 | 有城镇职工基本医疗 | 便捷的医疗保健服务，各种类型的财务补偿计划 |
| B 群体 | 有城镇居民基本医疗 | 针对大额医疗费用的财务补偿计划 |
| C 群体 | 有新型农村合作医疗 | 针对常规医疗及大额医疗费用的财务补偿计划 |

二是按缴费对象特征分类，其健康保险需求点如下。

表 2.1. 按个人缴费对象特征分类

| 个人 | 分类特征 | 健康保险需求点 |
|---|---|---|
| A 群体 | 高收入 | 注重医疗服务质量和可及性的保障方案 |
| B 群体 | 中等收入 | 兼顾医疗服务质量、可及性和财务补偿内容的方案 |
| C 群体 | 低收入 | 注重交费水平和财务补偿额度的保障方案 |

表 2.2 按团体缴费对象特征分类

| 团体 | 分类特征 | 健康保险需求点 |
|---|---|---|
| A 群体 | 大型团体，效益好 | 委托管理或自保，完善基本保障之外的员工福利计划 |
| B 群体 | 大型团体，效益一般 | 委托管理，基本保障之外适度的补充计划 |
| C 群体 | 中型团体，效益好 | 委托管理或购买商业计划，完善基本保障外的员工福利计划 |

| | | |
|---|---|---|
| D 群体 | 中型团体，效益一般 | 委托管理或购买商业计划，基本保障之外适度的补充计划 |
| E 群体 | 小型团体，效益好 | 购买商业计划，完善基本保障之外的员工福利计划 |
| F 群体 | 小型团体，效益一般 | 购买商业计划，基本保障之外适度的补充计划 |

表 2.3 按政府缴费对象特征分类

| 政府 | 分类特征 | 健康保险需求点 |
|---|---|---|
| A 群体 | 财政筹资或政策要求，全部风险委托 | 承担风险的第三方管理内容 |
| B 群体 | 财政筹资或政策要求，部分风险委托 | 部分承担风险的第三方管理内容 |
| C 群体 | 财政筹资或政策要求，无风险委托 | 业务操作概念的第三方管理 |

三是按付费对象特征分类，其健康保险需求点如下：个人，针对个体受益人，健康保险需求点为根据保险大数法则确定的财务补偿计划。团体，针对企业受益人，健康保险需求点为根据预付制、后付制等方式确定的财务补偿计划。医疗机构，针对医疗服务提供组织，健康保险需求点为利用 DRG、总额包干、人头付费等方式确定的服务结算或补偿计划。

四是按服务对象特征分类，其健康保险需求点如下：投保人，关键点是如何让公司在众多竞争者中脱颖而出，成为投保人的最终选择。被保险人，关键点是如何让公司的产品成为适合被保险人实际需求的方案。营销队伍，关键点是如何吸引留存以及培育高产能的销售团队，围绕产品、薪酬福利方案等制定配套举措。

（3）进行产品开发

一是结合客户健康状况进行产品开发设计和改造。主要根据生物医学模式对应的健康定义，按照是否有明确疾病诊断或出现器质性改变的情形，分为健康状况良好、健康状况出现急性改变，以及健康状况发生慢性改变三类，差异化的设计现金补偿方案、致死性疾病保险、医疗保险、收入损失保险、长期护理保险，以及康复理疗类健康管理服务，做好现有健康保险产品的设计、改造和升级。

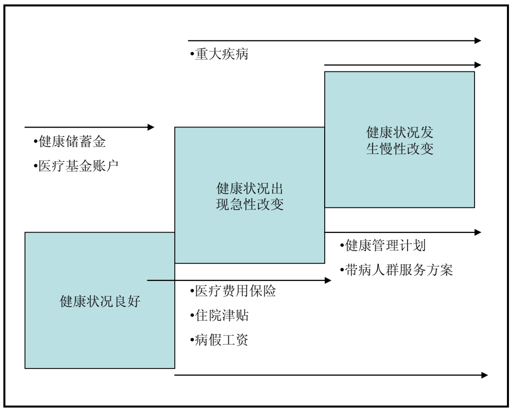



图 3. 按客户健康状况开发产品路线图

二是结合医疗服务提供水平进行产品开发研究和论证。结合客户预期的医疗服务要求，加强新产品的研究论证工作。如根据客户健康状态从好到外，服务需求水平从低到高设计产品，针对服务要求高的客户提供预防性医疗服务产品，对慢性病患者提供常规性医疗服务方案，对重症、急性病或致死性疾病患者提供高额医疗保障并提供医疗服务方案。

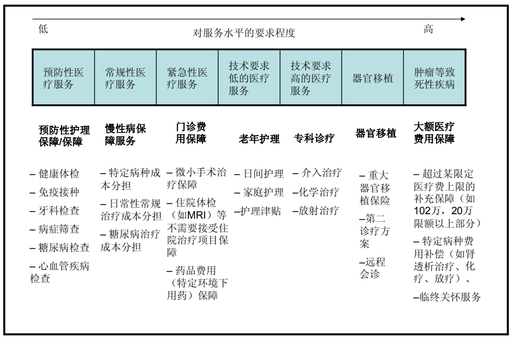



图 4. 按服务水平提供程度开发产品路线图

三是结合国外健康保险发展趋势进行产品开发学习和储备。结合美国传统费用报销型到管理式医疗的健康保险发展路径，加强健康保险发展趋势研究，做好国外新产品的学习、吸收和引进工作。

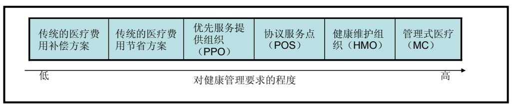



图 5. 国外健康保险产品演进路线图

同时，由于健康风险中占据主要位置的系统性医疗风险，一般的风险管理技术难以发挥效果，需要借助类似于巨灾风险管理的办法才能有效应对[14]。因此，商业健康保险机构应组织力量，研究论证巨灾风险管理思路融入健康保险的可行做法。

**2）渠道设计**

从保险公司的现有销售渠道看，可大致分为 3 类 12 个。第一类是中介/代理渠道，包括经纪公司、、专业、兼业代理公司、银行/邮政，以及媒体（广播、电视、报纸等）四个渠道；第二类是专属代理人渠道，包括健康咨询顾问、渠道销售专员，以及区域服务专员三个渠道；第三类是公司直销渠道，包括电话、信函、网站、保险超市，以及门店五个渠道。

由于健康险产品在保险责任、免责规定、医疗行为、给付方式等方面的描述比一般产寿险产品抽象，客户理解难度相对较大。因此，中国市场的健康险销售渠道发展方向是：传统销售渠道的个人产品，应通过类似于理财规划师的专属代理人操作，团体产品应通过属于公司雇员的团险专员实现；要逐步强化通过经纪或代理公司操作的非直销渠道；在当前阶段，电话、信函、网络等直接销售方式的操作难度较大，不宜开展。

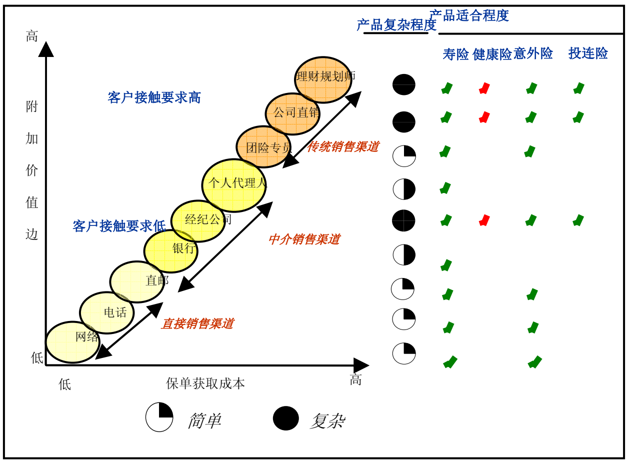



图 6. 不同险种的销售渠道适用性比较

鉴于中国当前法律环境和政策体系还不成熟[15]，商业健康保险的市场接受度、国民健康保健意识、健康险产品特点、政府相关政策举措、法律法规，以及社会保障体系等方面的特点，健康保险公司的渠道设计，可遵循以下原则：

一是低成本原则。要考虑对现有资源和网络的充分利用以降低建设成本、提高综合效益；另一个是对前期需要大额投入而后期产出并不明朗的渠道建设，必须进行充分的可行性论证和投产分析，限定在局部范围试点以获取充足的经验。在考虑建设成本的同时，新型销售渠道也需要有明确的任务目标，并提供战略性投入予以支持。低成本的核心是鼓励在现有资源上下工夫，对需要基础建设和创新性开展的要经过充分的试点论证，在试点成功的经验上再做大面积推广。同时，低成本的考虑还要注意渠道发展后期的扩展性和转换问题，因为健康保险核心优势会随着与医疗（保健）服务提供者合作关系的逐步深入而充分彰显，按照美国的发展模式，健康保险作为核心业务还将延伸到健康保健企业等多种产品领域；因此，销售渠道建设需考虑如何在医疗卫生领域下工夫的同时，保留转型或扩展的灵活性。

二是与产品配套原则。渠道永远是支持产品销售的，因此在考虑渠道建设的时候，保险公司拥有什么样的产品，未来将开发什么样的产品必须是清晰的。对于医疗费用、失能收入损失、长期护理、特定疾病、牙科/眼科等不同类别的健康险，对销售渠道的要求也不尽相同，在进行渠道建设的时候，一定要抓住产品特性。概括起来，中国目前健康险产品的特点是：产品多为短期险，每年单独投保；保险责任逆选择风险大，核保环节要求较高；理赔机会较大，客户与公司接触较为频繁，且赔款以 1000 元上下的小额赔付为主。针对这些特点，寿险公司主要通过个人代理人和公司直销两个渠道进行健康险销售，由于件均保费不高，采用以附加险搭配销售或组合销售模式，既节约成本又促进销售。但对专业公司而言，传统意义的个人代理人制不仅优势不明显，还可能因产品线的问题难以留存；同时，健康险服务需求较多的特性，也使得产品销售的同时应更多的考虑服务功能的实现。目前，由于涉及牙科/眼科、失能、护理等责任的新型健康险产品缺乏，在设计新型销售渠道的同时，也应提出合理的产品责任、销售模式、预计成本等信息，以协助产品设计的快速实现，确保产品更有市场针对性和竞争力。

三是效益原则。新渠道的设计必然涉及投入产出问题，对投入要坚持低成本原则外，对产出需要用效益原则进行评估。每个新渠道建设的提案，具体的保费计划和利润指标即是最直接的效益指标，是评估该渠道建设的主要依据；同时，对密切政府关系及增强潜在市场影响力，进行有效客户及经验数据积累等方面的因素也要综合考虑。

四是可操作性原则。要基于保险公司各阶段的能力现状，尤其是对新渠道的建设开发，要充分整合销售管理、产品开发、信息技术、

客户服务、健康管理等公司核心部门资源，详细加以设计和论证，通过细化各环节关键点、形成具体渠道建设方案，经过操作性评估后再开展建设。

**3）运营设计**

健康保险的运营设计主要基于运营模式的选择，结合国外商业健康保险经营管理模式，可划分为医疗费用报销模式、管理式医疗模式和第三方管理模式，这三种模式的特点各异，管控要点也有极大差别。

**（1）医疗费用报销模式**

该模式基于疾病、住院、护理、失能等的发生概率和损失程度，通过历史经验、精算技术和数学模型，确定不同损失情形下的医疗费用补偿标准，保险合同规定了保险公司与被保险人的权利义务，对医疗服务提供者没有直接约束力。我国的大部分商业健康保险机构采取该模式，对医疗风险进行事后补偿。

**（2）管理式医疗模式**

该模式在医疗费用报销管理之上，通过与医院及医生资本层面的深层次合作，增加了对医疗服务提供者的管理，介入到疾病、住院、护理、失能等医疗服务过程。我国的专业健康保险公司在尝试该模式，对医疗风险进行事前预防、事中干预、事后补偿。

**（3）第三方管理模式**

与前两种模式最大的差别在于，第三方管理只收取服务费，不承担保险风险。我国新农合经办业务就是典型的第三方管理模式。2011 年，全国共有 134 个县由保险公司参与经办服务，覆盖 3000 万人，委托管理资金 46 亿元。

运营模式的设计不仅要考虑当前业务的管控模式，还应结合未来业务的发展方向。目前，为满足新医改方案提出的“全民医保”目标，政府部门和私人机构需要携手合作，建立“公私合营”机制，提供品种丰富、种类齐全的健康保险产品和服务，在满足基本需求的同时，更好地提供个性化、多元化服务，不断改善人民物质文化生活水平。公私合营的实质是借助公立机构力量完成私人机构难以做到或难以做好的环节，如筹资环节、医疗服务提供环节，在确保公平的前提下提高效率。包括：公举私办，即政府负责筹资，将筹集到的资金委托私人机构管理；公私合办，即改革部分公立医院，允许民营资本进入医疗机构等。围绕新医改目标，我国商业健康保险机构除了传统的医疗费用报销管理模式外，在管理式医疗和第三方管理上将大有作为，这也对保险机构的资金运用和医疗卫生资源整合等提出了具体要求。

需要说明的是，文章立论之初，作者试图构造适合中国商业健康保险理论和实践发展需要的、体系较为完整的研究报告，论述中，尽力想跳出传统保险理论视野，希望通过对经济学、管理学、医学、社会学等学科知识的整合，从保险人、被保险人、监管者角度对制约我国商业健康保险发展的问题进行分析，并对现阶段健康保险实务操作中遇到的客户需求、业务性质、风险管理、监管政策等核心内容进行探讨。但由于时间、精力和学识的限制，很多观点仅在概念上提及，尚未深入下去和综合论证，部分观点在当前实务及学术界都还存在争议；部分内容是为了在逻辑上支持相关结论和政策建议，为后期研究所做的铺垫。因此，文章虽然涉及面较广，但更多地站在保险机构的立场，很多内容还留待后期进一步加以补充、修改和完善。

# References

[1] Chentao, Health Insurance, South West China Finacial University Press, 2002
陈滔，健康保险，西南财经大学出版社，2002 年
[2] Geyanfeng, Gongsen, The source and way about China Healthcare reform, China Development Press, 2007
葛延风，贡森，中国医改问题根源出路，中国发展出版社 2007 年
[3] Zhuminlai, Kuichao, Analysis on commercial health insurance position in the new healthcare reform, Comparative Economic & Social Systems, vol.1, 2007
朱铭来，奎潮，论商业健康保险在新医疗保障体系中的地位，《经济社会体制比较》，2009 年第 1 期
[4] Joshi V D, Lim J F Y, Health insurance in Singapore: Who is not included and why? Singapore Med J 2010; 515(5):399
[5] Fengyu, Analysis on the reason why first social security system happened in Germany, The News World, No.10, 2011
冯瑜，浅析德国率先建立社会保障制度的原因，新闻世界，2011 年第 10 期
[6] Sir Winston Leonard Spencer Churchill， Reminiscences on the second world war, Vol.1, South China Press, 2005
温斯顿·丘吉尔，第二次世界大战回忆录，第一卷，南方出版社，2005 年
[7] Wangzhijun, Commercial health insurance in different countries, Journal of China Insurance, No.8, 2008
王治军，各国商业健康保险，中国保险，2008 年第 8 期
[8] Mary E Northridge, John F Duane. Serving the Public Good. American Journal of Public Health. Mar 2009. Vol. 99, Iss. 3; pg. 393, 1 pgs

[9] Majun, Issue on the properties public goods, Journal of China Women's University, Vol.1, 2012
马珺，公共物品问题：文献述评，《中华女子学院学报》，2012 年第 1 期
[10] Guqin, The position of Commercial health insurance in national health care, Comparative Economic & Social Systems, vol.6, 2009
顾昕，商业健康保险在全民医保中的定位，《经济社会体制比较》，2009 年第 6 期
[11] Zhuminlai, Dingjihong, Study on the Tax policy on health insurance in different countries, Comparative Economic & Social Systems, vol.2, 2008
朱铭来，丁继红，健康保险税收优惠政策的国际比较研究，《经济社会体制比较》，2008 年第 2 期
[12] Liuyihui, Understanding the 'Economics Logic' of China, Journal of Finance, 16th, Jan, 2012
刘煜辉，理解中国"经济的逻辑"，《财经》，2012 年 1 月 16 日
[13] Guofeng, Sunlinyan, Study on moral hazard in health insurance, Economic Journal, No.6, 2003
国锋，孙林岩，健康保险中道德风险影响研究，《经济科学》，2003 年第 6 期
[14] Fengpengchen, Wangzhongsheng, Thinking about China commercial health insurance development, Finance Teaching and research, No.4, 2006
冯鹏程，王忠生，对我国发展商业健康保险的思考，《金融教学与研究》 2006 年 04 期
[15] Makai, Some issues on the government under the rule of law in china, Journal of China National School of Administration, No.5, 2011
马凯，关于建设中国特色社会主义法治政府的几个问题，《国家行政学院学报》，2011 年第 5 期

# 中国商业健康保险的发展路径研究

王治军[1]， 王 沁[2]
[1]战略发展部，中国人寿财产保险股份有限公司，北京，中国，100140
[2]销售交易部，中国国际金融公司，北京，中国，100004

**摘 要**：健康保险是保险中较为特殊的分类，由于保险标的是健康风险和与之相关的财务损失，跨越了保险与医学两个领域，涉及疾病、诊疗费用，医疗服务的方方面面，风险识别和防范的复杂程度高，对医疗卫生环境和政府干预的依赖性强，在精算定价、核保核赔、销售管理等环节不同于传统的财产和人寿保险，这些特性决定了健康保险在实际运营中承保利润边际偏小且不稳定，商业化运作的难度较大。考察西方发达国家的健康保险发展历程，在某些特定阶段，出于政权稳定及社会管理的需要，政府会强化健康保健的公共物品属性，部分推崇社会福利的学者，甚至否认健康风险可以通过财务筹融资方式得到解决，极力推动政府构建以社会保险为核心的医疗保障体系。在美国，虽然商业途径提供健康保险成为主流，但健康保险的运行中仍有较多的政府干预行为。中国商业健康保险的发展路径过去是什么样的，未来应该如何？在理论和实践上都缺乏总结。本研究通过对国外商业健康保险发展脉络的梳理，找出在不同层面制约和促进健康保险发展的关键因素，在借鉴国际经验的基础上，对照中国的政治、经济、文化和社会实际，循着我国社会的工业化、城市化、国际化发展路径，以及市场经济体制改革的进程和轨迹，结合历届政府在医疗健康保障问题上的政策主张，分析我国商业健康保险实现繁荣发展的基本要素和可能途径。研究表明：公私合营是现阶段健康保险发展的最佳路径，对公端，第三方管理是首选，对私端，授权经营是基础，在产品设计时，应充分考虑公共物品属性的强弱进行差异性开发。换句话说，对公共物品属性强的基本和低端医疗保障需求，要加强与政府的合作，通过强制保险、委托服务方式开展；对私人物品属性强的补充和高端医疗保障需求，政府应制定区别于寿险与财险的差异化政策，推进健康险的专营或授权经营。保险公司应加强整合医疗服务资源的产品设计和开发，这是健康险繁荣发展进程中不可逾越的环节。

**关键词**：健康保险；健康保障风险；保险公司；被保险人；医疗服务提供者

# The Medical Side Multi-Factors Analysis of Empirical Variables of Affecting Health Insurance Payment

WU Haibo
School of Economics and Management, JingXi University of TCM, Nanchang Jiangxi, China, 430003

**Abstract:** In early 2012, the State Council issued the "12th Five-Year" period deepen the medical and health system planning-cum-implementation of the program explicitly asked for "the positive development of commercial health insurance". The scheme and the increasingly serious problem of aging provides a rare opportunity for the development of commercial health insurance. Throughout the health insurance the last three decades the development trend of high loss ratio always become a "bottleneck" of further development of the insurance. There are many reasons, but mainly with doctors and patients is closely related to moral hazard. In this paper, field research and access the 1985-2010 years, the China Insurance Yearbook, China Health Statistics Yearbook and other relevant data based on the use of econometric methods, the health insurance the sum payable as an endogenous variable, in order to per thousand the number of doctors, hospital beds average utilization rate of outpatient health care costs per capita, per thousand, the number of beds, inpatient medical costs per capita, and discharged from hospital patient days per 100 acute and outpatient hospital admissions for the independent variable, the empirical analysis of health insurance paid the relevant data investigated; micro medicine, suffering from both sides of moral hazard in health insurance paid, and put forward relevant suggestions.
**Key words:** health insurance; moral hazard; induced demand; empirical analysis

## Ⅰ，引言

近年来，随着经济的快速发展和人们对健康关注度的逐步加深，国家加大了对医疗卫生事业的投入力度。然而，随之而来的医疗卫生费用虚高现象也层出不穷，并由此导致健康险赔付率的非正常膨胀现象日趋严重。这不仅造成医疗和保险资源的浪费，也影响了健康保险市场的可持续发展，形成了健康保险的博弈困境，即投入的增加与人们“看病难、看病贵、看病累”以及保险市场的低效率并存。这其中不乏有疾病谱的变化、医疗技术的进步、设备的更新、物价上涨、健康关注度增加等因素使然，但医疗卫生费用的增长远远偏离了这些正常因素的作用范围，那么，究竟是什么因素影响作用如此之大呢？如果我们把焦点转移到大家共同关注的医疗卫生道德风险和寻租行为，就不难找到答案。

针对健康险发展过程中面临的诸多困境，以及健康险和医疗机构的关系、医疗机构对健康险发展的作用等问题，国内诸多学者给予了广泛关注，如包文彬等（2001）[1]、钟胜等（2004）[2]、温小霓等（2006）[3]、邓乔健（2006）[4]，罗开平等（2007）[5]、王静（2007）[6]、方有恒（2008）[7]等，从博弈论视角分析了医院和保险公司的合作关系、健康险赔付与医院收入的关系（健康险赔付直接或间接转化为医院收入）以及合作医院对健康险风险管控的作用；李俊英（2005）[8]则考察了定点医院管理在健康保险理赔中的作用；王鸿勇等（2006）[9]、周洁卿（2005）[10]、柴云等（2007）[11]，则就医疗保险与医疗服务体系间良性互动关系以及充分发挥定点医疗机构在风险管控中的作用进行了探讨；张亚东(2003)[12]、赵肖等（2010）[13]对医疗机构管控道德风险的优势进行了研究，并分析了基于保险服务和医疗服务合并的未来发展趋势。

纵观现有研究成果，有关健康险赔付与

医院关系的探讨，可谓理论分析有余实证研究不足，大多数学者主要还是从定性或博弈论视角探讨了二者之间的关系，实证研究尚不多见。本文利用 1985-2010 年间中国保险年鉴、中国卫生统计年鉴的相关数据，从微观上考察了医患方的败德行为对健康险赔付的影响因子，并提出了相关的政策启示，以期能为我国商业健康险发展、医与险的合作重点、有效降低医患道德风险所致的高赔付率、提高医疗资源的使用效率、降低健康险成本和医疗卫生费用等提供借鉴。

## Ⅱ，变量选择

A. 因变量 **Y**：商业健康险赔付额（单位：亿元）

健康险赔付额高是医患道德风险导致不合理补偿和医疗费用"虚高"的直接体现，医、保行为因素共同作用于健康险赔付，所以我们从健康险赔付角度来研究医患道德风险的影响因素。当然，健康险赔付额占医疗机构收入、医疗费用的百分比亦可反映医疗服务方和投保人行为对赔付作用程度，但考虑到数据的合理性和便于计算，我们选择健康险的赔付额作为内生变量。

B. 自变量。考虑到数据的可得性和变量之间的相互关系，选取以下变量作为自变量。

$\mathbf{X_1}$：每千人医生数（单位：人）

用每千人医生数表示医方诱导医疗费用虚增对健康险赔付的影响。由于诱导需求很难用某一个确定的变量来恒量，国际上多采用人均医生数来表示，本文尝试借鉴这一方法，用每千人医生数间接表示医方的诱导需求。

$\mathbf{X_2}$：病床使用率（单位：%）

近年来，我国医院的床位数在不断增加，同时，病床使用率亦在大幅度提高，达到 80%以上。这有别于 80 年代我国医疗机构病床少、病床使用率高的情况，说明住院人数在剧增，在医院收入不合理和医务人员薪酬不科学的市场机制扭曲下，许多求诊病人"被住院"，本文用病床使用率衡量这一行为。

$\mathbf{X_3}$：门诊病人均医疗费用（单位：元）

医生素质对医疗费用和健康险公司赔付有重要影响作用。一方面是医生的业务素质高、经验丰富、技术好，有利于减少患者住院天数和避免"大检查、乱开药"等现象发生，从而减少医疗费用；另一方面，医生医德好，不收受"红包"，不伙同患者弄虚作假、不欺骗保险公司和诈骗保险费，有利于降低保险的赔付。医生素质很难用某一定量指标加以衡量，为使用数据便利和能较好反应这一变量对健康险赔付的影响，突出医生素质对健康险的影响程度，本文拟采用门诊病人人均医疗费用来表示。

$\mathbf{X_4}$：每千人床位数（单位：张）

随着医疗机构规模的扩张，医院的床位数也不断增加，为了使医院的床位不产生"空位床"，医方有诱使病人住院的可能，床位数的增加一般与医疗费用的上涨成正比。因此，在医保合作中，这一因素可以反映医方医疗行为对医疗费用及其健康险赔付的作用大小。

$\mathbf{X_5}$：住院病人人均医药费用（单位：千元）

疾病的持续时间和损失额度，这一因素对赔付影响很大。疾病严重，住院时间必延长，医疗费用也随之增加，保险基金损失额度变大。另外，延长住院时间、住院天数，对医疗费用支出的要求变得更大。排除疾病严重的客观因素，由医方道德风险所产生的住院天数增多，药费、检查治疗费、服务性收费随之增加，在保险部门不报销或报销部分门诊费用的情况下，导致次均医药费用支出变大，尤其是住院医药费用。针对这一现象，本文拟用住院病人人均医药费用作为衡量的指标，表示医疗服务的效率。

$\mathbf{X_6}$：出院者平均住院日（单位：天）

医疗机构和医生的服务质量高低与医疗费用的支出有紧密联系。一般而言，服务质量越高，患者住院天数减少，有助于降低不合理的医疗费用支出，降低赔健康险陪付率。表示医疗服务质量的方式很多，如总医疗费用、人均医疗费用、复诊率、治愈率、人均住院天数等，在此用出院者平均住院日表示医疗服务的质量。

**$X_7$:**每百急、门诊入院人数（单位：人）

每百急、门诊入院人数是衡量诊断人次中住院人数多少的重要指标。入院人数占急门诊的比例大，表明住院人数的相对数在增加；若急门诊人数亦在增加，则住院人数的绝对数也不断上升。当然，这既有疾病谱的变化和人们健康意识增强的结果，亦有在市场环境下，医疗机构的逐利动机使然，包括诊断升级、挂床住院等，本文试图用该指标表示后者。

**Dt:** $D_t$（$D_t$ =0 或 1）为虚拟变量，用来衡量专业健康险公司成立前后对健康险赔付是否有变化以及变化大小。当 t=0 时，$D_0$=0，表示专业健康险公司成立之前；当 t=1 时，$D_1$=1，表示专业健康险公司成立之后。

## Ⅲ, 样本选取与数据来源

在统计数据中，1985—1996 年的健康险数据包含在简易人身险中，其赔付额是根据平均降低率估算出来的。1997 年以后的数据则来源于历年中国保险年鉴和国家统计局 1996—2009 年年度“保险金融统计数据”和保监会 2000—2010 年“保险业年度经营数据”。

其中，每千人医生数（包括职业医师和助理医师）（人）、病床使用率（%）、门诊病人人均医疗费用（元）、每千人床位数（张）、住院病人人均医药费用（千元）、出院者平均住院日、每百急、门诊入院人数（人）、平均每所医院收入（千万元）等数据取自国家统计局“体育卫生和社会福利”年度数据（1996—2010 年）、卫生部“卫生统计提要”（2001—2010 年）、“中国卫生统计年鉴”（2003—2010 年）、“卫生事业统计简报、公报”（1996—2010 年），经整理而成；健康险赔付数据取自保险金融统计数据、中国保险年鉴、保监会“保险业年度经营数据”，经整理而成；1997 年以前平均每所医院收入、健康险赔付额、1990 年前的门诊病人和住院病人均医疗费用数据是根据平均降低率估算而得到；其中，平均每所医院收入不包括财政补助收入。

附表：各变量数据调整后一览表

| 年份 | 健康险赔付额(Y,亿元) | 每千人口医生数($X_1$,人) | 医院病床使用率($X_2$,%) | 门诊病人人均医药费用($X_3$,元) | 每千人床位数($X_4$,张) | 住院病人人均医疗费用($X_5$,千元) | 出院者平均住院日($X_6$,天) | 每百急、门诊入院人数($X_7$,人) | $D_t$ |
|---|---|---|---|---|---|---|---|---|---|
| 1985 | 0.2383 | 1.36 | 82.7 | 5.4 | 2.11 | 0.4376 | 15.8 | 2.3 | 0 |
| 1986 | 0.3216 | 1.37 | 82.8 | 6.3 | 2.14 | 0.4873 | 15.9 | 2.2 | 0 |
| 1987 | 0.4342 | 1.39 | 84.3 | 7.2 | 2.2 | 0.5425 | 16 | 2.1 | 0 |
| 1988 | 0.5862 | 1.49 | 84.4 | 8.2 | 2.25 | 0.6041 | 15.8 | 2.3 | 0 |
| 1989 | 0.7914 | 1.56 | 81.5 | 9.5 | 2.28 | 0.6725 | 15.8 | 2.3 | 0 |
| 1990 | 1.0683 | 1.54 | 80.7 | 10.9 | 2.3 | 0.7494 | 19.9 | 2.3 | 0 |
| 1991 | 1.4423 | 1.54 | 81.5 | 15.8 | 2.32 | 0.8344 | 16 | 2.3 | 0 |
| 1992 | 1.9471 | 1.54 | 78.6 | 19.9 | 2.34 | 1.0346 | 16.2 | 2.3 | 0 |
| 1993 | 2.6285 | 1.55 | 71.1 | 25.1 | 2.36 | 1.283 | 15.5 | 2.5 | 0 |
| 1994 | 3.5484 | 1.57 | 69 | 31.7 | 2.36 | 1.5908 | 15 | 2.6 | 0 |
| 1995 | 4.7904 | 1.58 | 72.7 | 39.9 | 2.39 | 1.9726 | 13.3 | 2.6 | 0 |
| 1996 | 6.4671 | 1.59 | 70.9 | 52.5 | 2.4 | 2.1896 | 12.8 | 2.7 | 0 |
| 1997 | 8.7306 | 1.61 | 61.7 | 56.4 | 2.35 | 2.3279 | 13.8 | 2.7 | 0 |
| 1998 | 13.545 | 1.6 | 60.2 | 64.9 | 2.33 | 2.584 | 13.1 | 2.8 | 0 |
| 1999 | 11.003 | 1.67 | 59.8 | 74.6 | 2.39 | 2.8682 | 12.6 | 2.9 | 0 |
| 2000 | 12.917 | 1.68 | 67.3 | 85.8 | 2.38 | 3.1837 | 11.6 | 3 | 0 |
| 2001 | 33.519 | 1.69 | 61.1 | 93.6 | 2.39 | 3.2455 | 11.8 | 3.2 | 0 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2002 | 49.937 | 1.47 | 64.6 | 99.6 | 2.32 | 3.5977 | 10.9 | 3.5 | 0 |
| 2003 | 69.902 | 1.48 | 65.3 | 108.2 | 2.34 | 3.9107 | 11 | 3.6 | 0 |
| 2004 | 89.903 | 1.5 | 68.4 | 118 | 2.51 | 4.2848 | 10.8 | 3.8 | 0 |
| 2005 | 107.92 | 1.52 | 70.3 | 126.9 | 2.59 | 4.6615 | 10.9 | 3.8 | 1 |
| 2006 | 125.1 | 1.54 | 72.4 | 128.7 | 2.7 | 4.6689 | 10.9 | 3.9 | 1 |
| 2007 | 116.86 | 1.54 | 78.3 | 135.8 | 2.85 | 4.9644 | 10.8 | 4.1 | 1 |
| 2008 | 175.28 | 1.66 | 81.5 | 138.3 | 3.05 | 5.2341 | 10.7 | 4.3 | 1 |
| 2009 | 217.03 | 1.75 | 84.8 | 152 | 3.31 | 5.6841 | 10.5 | 4.5 | 1 |
| 2010 | 264.02 | 1.79 | 86.7 | 166.8 | 3.56 | 6.1939 | 10.5 | 4.7 | 1 |

## Ⅳ, 模型设定

为了减小数据波动的异方差影响，我们在模型中使用的上述数据均为取自然对数的形式。根据上述相关理论分析和变量选取，构建如下线性回归模型：

$$\ln Y_t=C+\beta_1\ln X_{1t}+\beta_2\ln X_{2t}+\beta_3\ln X_{3t}+\beta_4\ln X_{4t}+\beta_5\ln X_{5t}+\beta_6\ln X_{6t}+\beta_7\ln X_{7t}+\beta_8 D_t+\mu_t$$

其中，$\mu_t$ 表示随机扰动项，且 $\mu_t \sim n(0, \alpha^2)$。

模型的估计与修正

利用 Eviews5.0 计量经济学分析软件，运用最小二乘法对模型中的参数进行估计，得到如下计量回归模型：

$$\ln Y_t=-17.3041-1.4060\ln X_1+0.9406\ln X_2+1.8637\ln X_3-0.6542\ln X_4-0.6509\ln X_5+1.95281\ln X_6+4.7447\ln X_7+0.0738D_t \quad (1)$$

$\hat{SE}$=(6.2771) (1.6538) (1.2350) (0.8609) (2.0666) (1.2707) (0.8269) (1.0517) (0.2434)

t=(-2.7566) (-0.8501) (0.7616) (2.1646) (-0.3165) (-0.5122) (2.3614) (4.5113) (0.3034)

$R^2=0.9936$ $\overline{R}^2=0.9907$ F=333.9025 DW=1.7981

A. 多重共线检验。

从模型分析的结果来看，$R^2$、修正的 $R^2$、F 值都较大，表明模型对数据的拟合度较好，各解释变量联合对被解释变量的影响显著。但是，除了 $\ln X_3$、$\ln X_6$、$\ln X_7$ 的系数 t 检验通过以外，其他各项系数的 t 检验结果均不理想，而且，部分的系数为负，与经济理论假设不相符，说明该模型存在多重共线，有的变量纳入模型不合理。

表 1. 相关系数矩阵

| | LNX1 | LNX2 | LNX3 | LNX4 | LNX5 | LNX6 | LNX7 |
|---|---|---|---|---|---|---|---|
| LNX1 | 1.000000 | -0.202672 | 0.637816 | 0.683855 | 0.636128 | -0.453151 | 0.523169 |
| LNX2 | -0.202672 | 1.000000 | -0.452702 | 0.250551 | -0.405679 | 0.313170 | -0.116227 |
| LNX3 | 0.637816 | -0.452702 | 1.000000 | 0.702438 | 0.997443 | -0.921107 | 0.909217 |
| LNX4 | 0.683855 | 0.250551 | 0.702438 | 1.000000 | 0.737117 | -0.672039 | 0.847237 |
| LNX5 | 0.636128 | -0.405679 | 0.997443 | 0.737117 | 1.000000 | -0.928464 | 0.930602 |
| LNX6 | -0.453151 | 0.313170 | -0.921107 | -0.672039 | -0.928464 | 1.000000 | -0.924418 |
| LNX7 | 0.523169 | -0.116227 | 0.909217 | 0.847237 | 0.930602 | -0.924418 | 1.000000 |

由相关系数矩阵也可以看出，各解释变量之间的相关系数较高，证明确实存在严重多重共线。为消除多重共线现象，采用逐步回归法消除，见表 2、表 3、表 4。

步骤一，将被解释变量 lnY 对每个解释变量分别进行回归，得到 6 个回归方程(见表 2)

表 2. 各变量回归后统计量和参数一览表

| 变量 | $\ln X_1$ | $\ln X_2$ | $\ln X_3$ | $\ln X_4$ | $\ln X_5$ | $\ln X_6$ | $\mathrm{Ln} X_7$ | $D_t$ |
|---|---|---|---|---|---|---|---|---|
| 参数估计值 | 19.1584 | -5.5260 | 1.8958 | 13.8618 | 2.5381 | -11.1227 | 8.6206 | 3.6411 |
| t 计量 | 3.5145 | -1.4705 | 20.9660 | 6.2818 | 25.9592 | -12.1558 | 19.9513 | 4.8201 |
| $R^2$ | 0.3397 | 0.0826 | 0.9482 | 0.6218 | 0.9656 | 0.8602 | 0.9431 | 0.4918 |
| $\overline{R}^2$ | 0.3122 | 0.0443 | 0.9460 | 0.6060 | 0.9641 | 0.544 | 0.9407 | 0.4707 |

步骤二，以 $\ln X_5$ 为基础，顺次加入 $\ln X_1$、$\ln X_2$、$\ln X_3$、$\ln X_4$、$\ln X_6$、$\ln X_7$、$D_t$ 变量逐步回归，结果如表 3 所示。

表 3. 加入新的变量回归结果(一)

| 变量 \ 变量 | $\ln X_1$ | $\ln X_2$ | $\ln X_3$ | $\ln X_4$ | $\ln X_5$ | $\ln X_6$ | $\ln X_7$ | $D_t$ | $\overline{R}^2$ |
|---|---|---|---|---|---|---|---|---|---|
| $\ln X_5$ $\ln X_1$ | -2.3287 (-1.4796) | | | | 2.6545 (21.4612) | | | | 0.9658 |
| $\ln X_5$ $\ln X_2$ | | 2.4634 (4.1646) | | | 2.6775 (32.4527) | | | | 0.9786 |
| $\ln X_5$ $\ln X_3$ | | | -2.4293 (-2.6300) | | 5.7527 (4.6944) | | | | 0.9712 |
| $\ln X_5$ $\ln X_4$ | | | | 2.4722 (2.8622) | 2.2703 (17.8892) | | | | 0.9724 |
| $\ln X_5$ $\ln X_6$ | | | | | 2.2747 (8.6718) | 3.7560 (7.2829) | | | 0.9644 |
| $\ln X_5$ $\ln X_7$ | | | | | 1.5210 (10.1359) | | 3.7560 (7.2829) | | 0.9886 |
| $\ln X_5$ $D_t$ | | | | | 2.3031 (21.9188) | | | 0.7586 (3.7561) | 0.9768 |

步骤三，经比较，新加入 $\ln X_7$ 的修正 $R^2$ 改进最大，而且各项的 t 检验都显著，保留 $\ln X_5$，再加入其他新的变量逐步回归，结果如表 4 所示。

表 4. 加入新的变量回归结果(二)

| 变量 \ 变量 | $\ln X_1$ | $\ln X_2$ | $\ln X_3$ | $\ln X_4$ | $\ln X_5$ | $\ln X_6$ | $\ln X_7$ | $D_t$ | $\overline{R}^2$ |
|---|---|---|---|---|---|---|---|---|---|
| $\ln X_5$ $\ln X_7$ $\ln X_1$ | -0.7668 (-0.8150) | | | | 1.5881 (9.2249) | | 3.6496 (6.8131) | | 0.9885 |
| $\ln X_5$ $\ln X_7$ $\ln X_2$ | | 0.0325 (0.0461) | | | 1.5311 (5.7351) | | 3.7255 (4.4124) | | 0.9881 |
| $\ln X_5$ $\ln X_7$ $\ln X_3$ | | | 1.3483 (1.6587) | | -0.4992 (-0.4071) | | 4.6281 (6.3962) | | 0.9894 |
| $\ln X_5$ $\ln X_7$ $\ln X_4$ | | | | -0.6289 (-0.3615) | 1.5059 (9.4944) | | 3.9194 (5.6524) | | 0.9882 |
| $\ln X_5$ $\ln X_7$ $\ln X_6$ | | | | | 1.6445 (9.8247) | 1.1264 (1.5102) | 4.1318 (7.3751) | | 0.9892 |
| $\ln X_5$ $\ln X_7$ $D_t$ | | | | | 1.5438 (8.9137) | | 3.6054 (4.8214) | 0.0579 (0.2835) | 0.9882 |

注：如以 10%作为临界值，则 $1nX_6$ 也是满足条件的，本文以 5 %临界值为判断标准。

在 $\ln X_5$、$\ln X_7$ 基础上加入 $\ln X_1$、$\ln X_2$、$\ln X_3$、$\ln X_4$、$\ln X_6$、Dt 后，除了新加入 $\ln X_1$、$\ln X_2$ 、$\ln X_4$、$D_t$ 的 $\overline{R}^2$ 下降外，其他各项的 $\overline{R}^2$ 都有提高。但是，加入其他变量以后，都存在参数的 t 检验不显著，这说明在 lnX5、lnX7 变量中加入 $\ln X_1$、$\ln X_2$、$\ln X_3$、$\ln X_4$、$\ln X_6$、$D_t$ 后，都引起严重多重共线性，应予剔除。最后修正严重多重共线性影响的回归结果为：

$$\ln Y = -2.8517 + 1.521 \ln X_5 + 3.756 \ln X_7 \qquad (2)$$

$$\hat{SE} = (0.4669) \quad (0.1501) \quad (0.5157)$$

$$t = (-6.1072) \quad (10.1359) \quad (7.2829)$$

$$R^2 = 0.9896 \quad \overline{R}^2 = 0.9887 \quad F = 1094.078 \quad DW = 1.0976$$

B.自相关检验。

从检验结果来看，各解释变量的系数符号与经济学意义相符，而且不存在多重共线性；由回归分析结果 DW=1.0976，根据 D－W 检验，给定显著性水平 $\alpha=0.05$，n=26，$k'=2$，得上临界值 dU=1.553 下临界值 dL=1.224，$0 < DW=1.0976 < dL=1.224$，说明模型存在正自相关，需要对自相关进行补救。为解决正自相关问题，在此采用科克伦-奥克特迭代法，即通过逐次迭代寻求更满意的 $\rho$ 值，然后再运用广义差分法。

对残差序列 e 进行滞后一期的自回归，得

$e=0.3691(-1)$ (3)

对原模型进行广义差分，得到广义差分方程

$\ln Y-0.3691\ln Y(-1)=C(1-0.3691)+\beta 5(\ln X_{5t}-0.3697\ln x_{5t}(-1))+\beta_7(\ln X_{7t}-0.3697\ln x_{7t}(-1))+u_t$ (4)

对(4)式得广义差分方程进行回归，得

$\ln Y_t^*=-1.985+1.2993\ln X_{5t}^*+4.2054\ln X_{7t}^*$ (5)

t=(-5.2375) (5.8975) (6.1348)

$R^2=0.9806$ $\overline{R}^2=0.9788$ F= 555.1789 DW=1.934

给定显著性水平 α=0.05，n=25，k' =2，得上临界值 dU=1.550 下临界值 dL=1.206，dU＜DW＜4- dU，说明已不存在序列自相关，无需再进行迭代；决定系数 $R^2=0.9806$，认为逐步拟合的多元线性回归模型中的因变量（健康险赔付额）可以被自变量 $\ln X_5$(住院病人人均医药费用)、$\ln X_7$(每百门、急诊入院人数)解释，且拟合度较高；F=555.1789，大于临界值 $F_{0.05}(2,26)=3.37$，通过 F 检验，认为这两个因素对健康险赔付影响具有统计学意义，方程总体已通过检验, 在5%水平上显著。

C.异方差检验。

下面对方程是否存在异方差进行检验，采用针对时间序列的 ARCH 异方差检验方法，分别得到辅助回归结果(表 5)

表5. 辅助回归结果的ARCH异方差检验

| 方程变量 / 滞后期数 | $(n-p)R^2$ | $\chi^2_{0.05}(p)$ |
|---|---|---|
| 滞后一期(p=1) | 0.0976<br>2.3424 | 3.841 |
| 滞后二期(p=2) | 0.1246<br>2.8658 | 5.991 |
| 滞后三期(p=3) | 0.2917<br>6.4174 | 7.815 |

从 ARCH 检验结果来看，三个辅助回归方程都得到$(n-p)R^2<\chi^2_{0.05}(p)$，则接受原假设，表明模型中的随机误差项不存在异方差。

由差分方程(4)式有

$$C=\frac{-1.958}{1-0.3691}=-3.1035 \quad (6)$$

由此，得到最终的健康险赔付影响因素模型为

$\ln Y_t=-3.1035+1.2993\ln X_{5t}+4.2054\ln X_{7t}$ (7)

## V，结论及启示

根据以上实证分析结果，作如下分析：

A. 住院病人人均医疗费用每增加 1 个百分点，健康险赔付额平均增长 1.3 百分点，其刺激作用不是很强。因此，住院病人的医疗费用是健康险风险管控的一个重点，但作用不易夸大。保险公司采取规定报销范围内的药品和检查项目、设施器材、报销比例等办法，能够较好地防范医患方道德风险。相

反，值得重视的是加强与医方的合作，努力防范诸如“挂床住院”、“假住院证明”等伪住院现象。另外，理论上，住院者医疗费用是健康险支付和补偿患者医疗费用最主要部分，但对健康险赔付的影响不是很突出，可能是保险公司对这一大类的报销采取了严格的管理、监督、审查措施和健康险赔付只占住院者医疗费用的部分费用所致。

B. 每百急、门诊入院人数上升 1 个百分点，健康险赔付额增加 4.2 百分点，急门诊的入院人数对健康险赔付的影响显著。这一现象与疾病谱的变化、人们健康意识的增强、人们可支配收入增加等因素密切相关，但根据人们就诊情况、医疗卫生现状来看，这些因素在当前的影响应该不是很强。这可能是在我国医疗市场化的现状下，医疗机构面临生存的压力和竞争的需要，加之床位数和医生数的逐年增加，医生激励性劳务收入不突出的情况下，确实存在“诊断升级”、“患者被住院”、“分解住院”、“造病人”等行为，致使急、门诊入院人数上升，从而大幅度提高了健康险赔付额。因此，综合考虑医、保、患三方利益，强化与医院合作，防范上述等道德风险行为，是健康险发展过程中的一个重点。

C. 反映专业健康险公司成立是否对健康险赔付产生重要影响作用的 $D_t$ 变量引入后，发现回归结果系数较小，且明显增加了系数的误差，t 统计量值减小，显著性减弱。这说明我国专业健康险公司的成立对健康险赔付影响作用并不大，专业健康险公司对健康险赔付因子的管控能力依然薄弱。其可能因素有二：一方面，专业健康险公司成立时间短，经营健康险的经验、策略及其风险管理能力欠缺；另一方面，目前包括财险公司在内的所有保险公司都可以经营健康险，专业健康险经营的份额少，且那些以健康险作为附加险经营的保险公司以低费率销售，甚至在购买其他险种后，把健康险予以赠送使然。若从与健康险联系紧密的医方寻找原因，可能是当前专业健康险公司与医方的合作方式欠佳、合作内容不够、合作过程不畅、合作决策执行不力等导致的结果。因此，专业健康险公司的专业化程度亟待加强，与医方合作需要创新，经营健康险公司的标准应规范化。

政策启示：

其一、对健康险赔付产生影响的医方因子中，住院病人均医疗费用和每百人急门诊入院人数对其都有影响，但前者没有后者影响显著，后者中诸如“诊断升级”、“分解住院“等行为，应重点防范。

其二、保险公司当前实行的对住院病人医疗费用审查和管理制度，以及对住院医疗费用的报销范围、药品使用、服务项目的管理是比较有效的，其管理的重点应是防患“挂床住院”、“假住院证明”等败德风险行为。

其三、医方道德风险对健康险赔付产生重要影响表明，健康险的发展需重视医院和医生的作用，加强与其合作具有紧迫性和必要性；同时，双方合作管理的重点是防范诊断升级、分解住院、挂床住院等医方和患方的道德风险行为。

第四、专业健康险公司的成立对健康险赔付影响不显著表明，保险监管部门应作出对经营健康险公司权限的严格规定和进行严格监督；对非专业健康险公司经营健康险做出严格限制，以杜绝行业间销售健康险低费率、甚至赠送的不正当竞争。此外，专业健康险公司还应该强化专业化建设，汲取发达国家健康险发展的经验，提高自身风险管控能力。

参考文献：

[1] Bao Wenbin and Gu Haibin, The game equilibrium analysis of medical insurance system, china and foreign scientific information, 2001.12.
包文彬、顾海斌，医疗保险体系中的博弈均衡分析，中外科技信息,2001 年第 12 期。
[2] Zhong Sheng and Rou Ling, Game Analysis of insurance companies and hospitals cooperation, Operations Research and Management, 2004.3.
钟胜、罗琳，保险公司与医院合作的博弈分析，运筹与管理,2004 年第 3 期。
[3] Wen Ni and Song Guoxiang, Game and

incentives of medical insurance, Journal of Xi'an University of Electronic Science and Technology, 2006 1.
温小霓、宋国乡，医疗保险博奕与激励，西安电子科技大学学报,2006 年第 1 期。
[4] Deng Qiaojian, Rule of game of the insurance companies and hospitals, health industry of China, 2006.3.
邓乔健，保险公司与医院的搏弈规则，中国卫生产业,2006 年第 3 期。
[5] Luo Kaiping, Commercial health insurance monopoly fixed-point hospital's dynamic incentive mechanism design, contemporary economic science, 2007.3.
罗开平，商业医疗保险中垄断型定点医院的动态激励机制设计，当代经济科学,2007 年第 3 期。
[6] Wang Jing, The game co-operation analysis of insurance companies and hospitals in health insurance,education statistics, 2007.12.
王静，健康保险中保险公司与医院的博弈合作分析，统计教育,2007 年第 12 期。
[7] Fang Youheng ,On the mode of cooperation of insurance companies and medical institutions, industrial economy, 2008.4.
方有恒，论保险公司与医疗机构合作模式，工业技术经济,2008 年第 4 期。
[8] Jun-Ying Li, The effect of sentinel hospital management in the health insurance, financial of Xinjiang, 2005. 11.
李俊英，定点医院管理在健康保险理赔中的作用，新疆金融,2005 年第 11 期。
[9] Wang Hongyong, medical insurance and the positive interaction between the health care system to build, Chinese Health Economics, 2006. 9.
王鸿勇，医疗保险与医疗服务体系间良性互动关系的构建，中国卫生经济,2006 年第 9 期。
[10] Zhou Jieqing, Explore the mode of cooperation on insurance companies and medical institutions, the Shanghai Insurance, 2005 11.
周洁卿，关于保险公司与医疗机构合作模式探讨，上海保险,2005 年第 11 期。
[11] Cai cloud, etc., Establish the concept of risk-sharing mechanisms for cooperation of health insurance companies and medical institutions,, the Group of Economic Research, 2007,1.
柴云等，建立健康保险公司与医疗机构风险共担合作机制的构想，集团经济研究,2007 年第 1 期。
[12] Zhang Yadong, the vertical integration of the development of commercial health insurance - Also on the agency costs and transaction costs of regulatory options, Financial Research, 2003.7.
张亚东，发展商业医疗保险的纵向一体化研究—兼论代理成本与交易成本的规制选择，金融研究,2003 年第 7 期。
[13] Zhao Xiao and Chen Tao, China's commercial health insurance business model development direction , The Health Economics Research, 2010 7.
赵肖、陈滔，论我国商业健康保险经营模式发展方向，卫生经济研究, 2010 年第 7 期。

# 影响健康险赔付的医方多因素变量实证分析

吴 海 波

经济与管理学院，江西中医学院，南昌，中国，330004

**摘 要：**2012 年初，国务院印发的《“十二五”期间深化医药卫生体制改革规划暨实施方案》明确提出要“积极发展商业健康保险”。该方案及日益严重的老龄化问题为我国商业健康险的发展提供难得机遇。但纵观健康险近三十年来的发展态势，居高不下的高赔付率始终成为该险种进一步发展的“瓶颈”。其原因是多方面的，主要与医患道德风险密切相关。本文在实地调研并查阅 1985-2010 年间中国保险年鉴、中国卫生统计年鉴等相关数据的基础上，运用计量经济学方法，以健康险的赔付额作为内生变量，以每千人医生数、病床使用率、门诊病人人均医疗费用、每千人床位数、住院病人人均医药费用、出院者平均住院日、每百急、门诊入院人数为自变量，对影响健康险赔付的相关数据进行了实证分析；从微观上考察了医、患两方的败德行为对健康险赔付的影响，并提出了相关对策建议。

**关键词：**健康险；道德风险；诱导需求；实证分析

作者简介：吴海波（1972-），男，博士、江西中医学院经济与管理学院副教授，中国保险学会理事。通讯地址：江西省南昌市湾里区江西中医学院经济与管理学院(330004),Email:whb4127@163.com;联系电话：13684815767;15079075989

# Performance of the Life Insurance Market in China[1]

Xu Xu

Insurance Department, Beijing Technology and Business University, Beijing, China, 100048

**Abstract**: Market Performance reflects the markets efficiency and resource allocation effect. The real situation and existing problems is an important issue for sustainable development of China's life insurance market after its rapid development in thirty years. This paper gives the the connotation of life insurance market performance and its evaluation standard, analyses the public and micro performance of China's life insurance market, and finally puts forward several suggestion to enhance its market performance.

**Keywords:** Life Insurance; Performance; SCP; DEA

## Ⅰ.引言

产业组织理论通常所指的市场绩效，是指在一定的市场结构下，通过一定的市场行为使某一产业产生的价格、产量、成本、利润、产品质量和品种以及技术进步等方面的最终经济成果，它是市场结构和市场行为共同作用的结果，反映了市场运行的效率和资源配置的效果。本文通过界定人身保险市场绩效的内涵及其评价标准，从人身保险市场的公共绩效和微观绩效两个层面对中国的人身保险市场进行实证分析，并对提升中国人身保险市场绩效的途径提出建议。

## Ⅱ. 人身保险市场绩效内涵

虽然贝恩早在 1968 年就对产业绩效从 6 个方面进行了描述，但迄今对“绩效”含义仍无统一的界定标准。

### A. 绩效的内涵

**1. 产业绩效的内涵**

产业经济学中的绩效（Performance）是一个比较宽泛的概念。贝恩（1968）认为对绩效的考察主要涉及以下六个方面：受产量、企业规模和过剩生产能力所影响的相对技术效率；相对于长期边际成本和平均成本的价格水平以及价格——成本差额；长期边际成本和价格相等条件下最大可能产出规模与实际产出水平的比较；生产成本与促销费用的比较；生产或产品的特点，如设计、质量和多样性等；产业在产品和生产工艺等方面的进步状况，及其与可达到最优水平的比较。Scherer 和 D. Ross（1990）将绩效界定为包括“生产和分配效率、技术进步、产品品质、公平和利润”等内容。

但在实际研究过程中，由于相关变量难以数量化或者相关数据难以搜集到，大量研究通常是以“利润率、毛利率”等简单的财务指标对产业绩效加以衡量。

**2. 人身保险市场绩效的内涵**

考虑到保险业行业的特征，我们认为简单地以盈利性指标作为保险业绩效的衡量指标是不全面的。由于保险业是经营风险的特殊产业，具有较高的社会性和公众性，保险市场的经营绩效关系到众多社会公众的人身保障和利益。因此，本节对人身保险市场绩效的界定是一个综合绩效的概念，包括市场宏观的公共绩效（对经济增长和安全保障的促进程度）和微观的厂商绩效（寿险公司经营意义上的微观绩效）两个方面。

### B. 人身保险市场绩效的评价标准

**1. 人身保险市场公共绩效的评价**

对人身保险市场公共绩效的评价指标主要采用保险深度和保险密度两个指标。

（1）保险深度。保险深度是指保费收入占国内生产总值（GDP）的比例，反映一个国家保险业在其国民经济中的地位。

（2）保险密度。保险密度就是人均保费收入，即按一个国家全国人口计算的人均保费收入，反映一个国家保险的普及程度和

Supported by the Research Foundation of Humanities and Social Sciences of Beijing Board of Education.

保险业的发展水平。

**2. 人身保险市场微观绩效的评价**

人身保险市场的微观绩效主要是指市场的微观主体，即寿险公司自身经营意义上的微观绩效，或者说是厂商绩效。在产业组织理论的产业效率研究中，往往以企业效率来衡量厂商绩效。

（1）效率的内涵

效率的本义是指生产一定的产品所使用的投入品最少，分为技术效率、经济效率和工程效率三种。技术效率是用实物单位计量的效率；经济效率是用成本（价值）单位计量的效率；工程效率是计量某一特定要素的效率（如能量与燃料消费量之比）。资源应用中的效率通常是指帕累托效率或帕累托最优，即资源的不同使用已经不可能在不使其他人处境变坏的同时使任何一个人的处境变好（Richard G. Lipsey, 1987；Paul A. Samuelson, 1989）。也就是说，对于作为参与稀缺资源配置的企业来说，对其效率的衡量就是根据预期目的对资源配置和利用的最终结果进行评价，本质上反映了企业对其资源的有效配置，反映了企业所具有的市场竞争能力、投入产出能力和可持续发展能力。企业有效率意味着该企业在投入一定生产资源的条件下是否能使产出达到最大，或者说生产一定产量时企业是否实现了“成本最小”。

（2）企业效率的测量方法

Farrell（1957）的技术效率定义带来对企业技术效率的测量的发展，“所谓技术效率，就是在生产技术不变、市场价格不变的条件下，按照既定的要素投入比例，生产一定量产品所需的最小成本 CL，占实际生产升本 CS（投入水平）的百分比。”即：TEF=CL/CS。虽然技术效率只是全部经济效率的组成部分之一，但一个企业必须首先在技术上是有效率的，才能最终达到经济上的有效率。因此，在实际测量企业技术效率的时候，最主要的是确定研究对象的生产边界函数（生产可能性边界）。经济学估计生产边界函数有两类方法，一类是以计量经济学方法为主的参数方法，另一类则是以数学规划为主的非参数方法。

1）参数法。最早使用参数方法测量企业效率的是 Benston（1965）的研究。参数法主要以生产函数或者成本函数为测量效率的依据，首先确定生产函数或者成本函数，然后估计出函数中的参数。早期的研究大多采用柯布一道格拉斯生产函数作为被测量的函数，并忽略企业中各类产出间的相关性以及产出的弹性，以此对生产函数中的参数项进行估计。后来的相关研究逐渐采纳了更富有弹性的二次项形式和超越对数（translog）成本函数形式，特别是超越对数成本函数具有易估计性和包容性等方面的优点，逐渐成为企业效率研究的主要函数设定形式（Beston 等，1982）。然而人为设定函数和随机干扰项，使得参数法具有较强的主观性，所以说服力也比较差。

目前主要的参数法有三种形式：随机前沿方法（stochastic frontier approach，SFA）；自由分布法（distribution free approach，DFA；厚前沿方法（thick frontier approach，TFA）。其中在效率测量中应用较为广泛的是随机前沿方法，其他两种方法实际上是它变形后的形式。

2）非参数法。与参数法不同的是，非参数法在测量企业技术效率时不要求对其基本的生产函数或者成本函数做出明确的定义。主要有数据包络分析法（data envelopment analysis，DEA）和自由可置壳（free disposal hull，FDH）。FDH 方法是 DEA 方法的一个特例（Berger & Humphrey，1997）。数据包络方法（DEA）是目前产业组织理论领域研究企业效率用的较多地研究方法，本章也将采用 DEA 方法研究中国人身保险市场的微观绩效。

DEA 方法以测量具有多项投入和多项产出的决策单元（Decision Making Unit，DMU）相对效率为基础发展起来的一种效率测量方法。DEA 方法是利用线性规划方法，将决策单元的多项投入与多项产出指标数据投射在一个坐标空间上，求出最大产出或最小投入为效率边界即生产可能性边界。在没有随机性误差的假设下，如果决策单元落在此效率边界上，则表示该决策单元是有效率的；如果不在此效率边界上，则表示该决策单元无效率，其与效率边界之间的差距即代表决策单元的无效率程度。通过对决策单元各项输入输出（投入和产出）数据的综合分析，DEA 方法可以得出每个决策单元的综合效率指标，并据此将各个决策单元进行排序，确定有效率的（相对效率最高的）决策单元。

# III. 人身保险市场公共绩效分析

## A. 人身保险市场的成长性

保险市场发展的终极目标是提高保险资源配置效率。所谓资源配置效率，其考察的是生产者的生产效率和消费者的效用满足程度两方面，反映了保险市场各要素资源（劳动力、资本等）在产业市场内如何被利用及其利用成效。因为不能对我国人身保险市场的资源配置绩效进行直接分析，所以只能从资源配置的结果即人身保险市场的发展状况来侧面印证。

### 1. 人身保险市场绝对规模的比较分析

市场的绝对规模考察的是生产者利用有限保险资源获得的产出大小程度。从国内恢复人身保险业务至今逾 30 年的时间里，中国人身保险产业得到了突飞猛进的发展，表现出极高的市场增长性。1982 年，中国人身保险业的保费收入仅有 159 万元人民币，到 2009 年实现保费收入 8144.18 亿元，远远高于同期 GDP 增速；人身险保费收入的年增长率除少数几年外，一直保持在 20%以上，最高曾经在 1993 年达到 86.8%的增长率。（见图 1）。

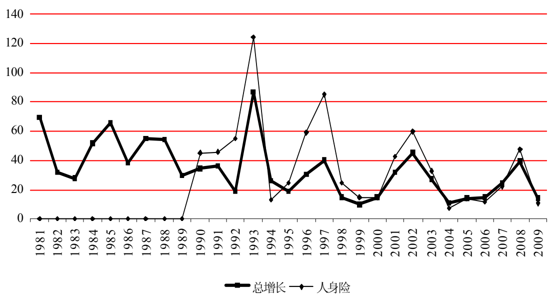



**图 1 中国保费总收入和人身保险保费收入增幅变动图（1981-2009）**

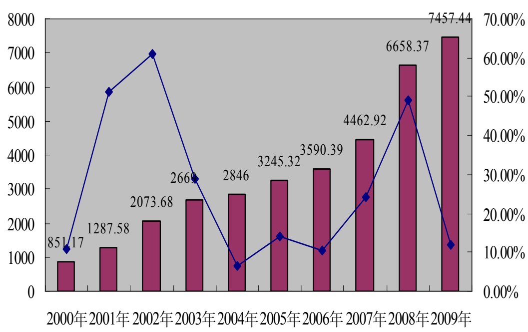



**图 2 中国寿险保费收入和增幅变动图（2000-2009）**

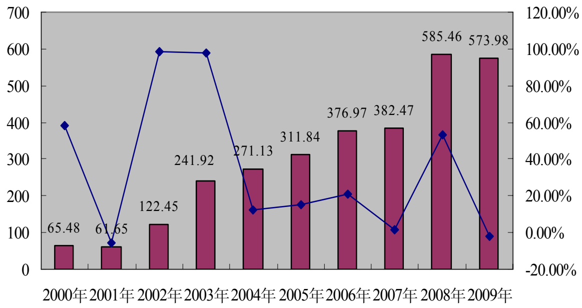



**图 3 中国健康险保费收入和增幅变动图（2000-2009）**

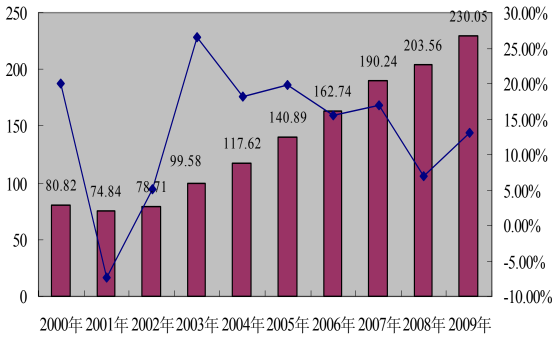



**图 4 中国意外险保费收入和增幅变动图（2000-2009）**

在业务总规模上，中国人身保险市场自 1980 年恢复业务以来表现出了强劲的增长速度。从保费收入状况看，2010 年中国寿险保费收入世界排名第 5 位，在新兴市场国家中处于领先地位。但从市场绝对规模的比较就可以看出与其他国家的差距。2010 年中国人身保险市场实现保费收入 1429.99 亿美元，在世界市场上的份额为 5.67%，仅为同期美国寿险保费收入的 28.25%，日本的 32.45%。因此，中国人身保险市场的总规模与发达国家还存在一定差距。

### 2. 人身保险密度的比较分析

保险密度一般被用来衡量一国保险业发达程度，此处利用该指标来考察有限的人身保险消费品在消费者中的分配。人均人身保费收入越高，也从另外一个角度说明人身保险产品提供者的产出越高，人身保险市场越发达，人身保险资源的配置效率相对也越高。

从图 5 可以看出，我国人均保费收入在过去 10 多年间有了根本性的增长，从 1996 年人均不到 30 元人民币保费提升到了 2009 年的 618.84 元。而我国人口在过去 10 多年

间也净增了 1 亿 1 千多万人1，分母加大了，人均保额的大幅度提升在很大程度上说明了我国在人身保险资源开发及其配置效率方面的显著提升。

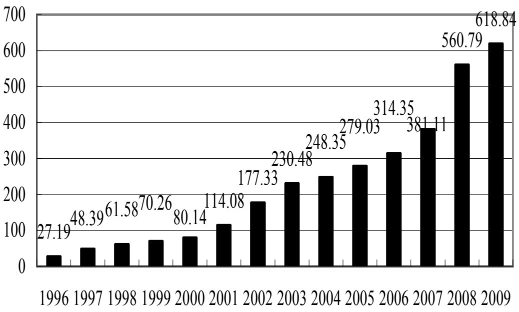



**图 5 中国历年人身保险密度（1996-2009）**

但从国际比较看，2010 年中国寿险密度只有 105.5 美元，在世界排名为 61 位，中国的保险密度远低于 364.3 美元的世界平均水平，仅为世界平均保险密度的 28.96%，最高的瑞士达到了 3666.8 美元。

**3. 地区分布均衡性分析**

根据资料显示，我国保险市场地区分布不平衡问题一直没有大的改变，东部沿海、经济发达地区一直占据我国保险市场业务量的最大份额。在这些地区，人身保险市场的公共绩效发挥得较好。从图 6 可以看出，近年我国人身保险的保费收入主要集中来源于广东、北京、上海、山东、江苏等几个省市，均远远超过中西部广大地区的保费收入。2009 年，中国人身保险市场上，东部十六省市2保费收入 4784.9 亿元，占全国 57.96%；中部八省市3保费收入为 2046.586 亿元，占全国的 24.79%；西部十二省市4保费收入为 1424.186 亿元，占全国 17.25%。有 8 个省的人身险保费收入超过 400 亿元（计划单列市单独计算），从高到低依次为广东、江苏、北京、上海、山东、河北、河南、四川，这 8 个省市的保费占全国人身险保费总额的 52.34%。随着东部和沿海地区保险业务增幅的下降，各公司集中于少数几个地区争抢保险业务，势必造成资源的竞争性浪费。

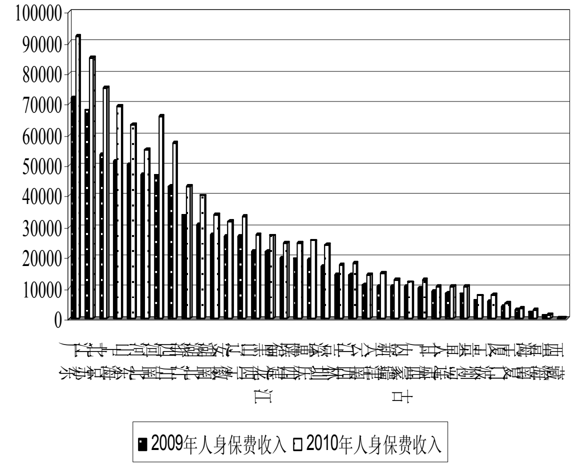



**图 6 2009-2010 年中国省（直辖市、自治区）保费收入分布图**

造成东西部地区经济发展不平衡的状况，主要原因在于我国改革开放以来经济建设的重心一直集中于东部地区，作为新兴产业的保险业自然会与此相适应，保费收入从而远远超过中西部欠发达地区。这种现状不是一朝一夕形成的，因而改变这种状况也不可能一蹴而就。近年，国家开始重视西部的开发建设与东北工业基地的复兴，从十五大制定西部大开发战略到十六大提出振兴东北工业大基地战略，国家从政策、人力、财力、物力上重点扶植西部和东北的建设，人身保险业作为社会风险保障系统中的重要机制，国家更是加大扶植力度。保险资源在空间上逐步往广大中西部和东北地区的转移应成为提高人身保险市场资源配置效率、避免资源浪费，进而提高人身保险在各省市地区公共绩效的途径之一。

## B. 人身保险对国民经济增长的推动

判断人身保险市场发展对国民经济增长的促进作用，一方面可以通过人身保险深度衡量人身保险业在国民经济中的地位。一般，保险深度越大，说明该保险市场越发达，其对国民经济的作用也相对越大。从图 7 中，可以清楚地发现我国人身保险深度一直呈上升趋势，在国民经济中的地位和重要性正在逐年上升。

1 1996 年我国人口统计数为 12.2389 亿人；根据国家统计局 2010 年 5 月 26 日发布的《2009 年全国人口和计划生育事业发展公报》，2009 年末我国总人口数为 13.35 亿人，净增 1.11 亿人。

2 包括北京、天津、河北、辽宁、大连、上海、江苏、浙江、宁波、福建、厦门、山东、青岛、广东、深圳、海南。

3 包括山西、吉林、黑龙江、安徽、江西、河南、湖北、湖南。

4 包括重庆、四川、贵州、云南、西藏、陕西、甘肃、青海、宁夏、新疆、内蒙古、广西。

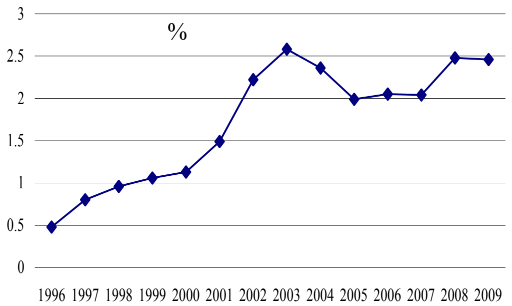



**图 7 中国历年人身保险深度（1996-2009）**

但仅从历史发展分析还是不够的，还需从比较角度来衡量。2010 年，中国寿险业务的保险深度为 2.5%，整体处于世界的第 30 位；同期，世界平均的寿险保险深度为 4%。而英国、法国、芬兰、爱尔兰等一些欧洲国家的寿险保险深度在 7%左右。因此从保险深度的国际比较来看，中国人身保险市场的发展水平与发达市场相比还有较大的市场发展潜力。

另一方面，衡量保险市场对国民经济的作用还可通过保险市场的服务水平进行，即以平均百万人口享受保险公司服务家数为指标衡量。以我国 2010 年的数据与国外 2001 年相比（如表 1），也存在较大的差距。

**表 1 中国与其他主要国家平均百万人口享受保险公司服务家数**

| 国家或地区 | 保险企业数(家) | GDP（10 亿美元） | 人口（百万人） | 平均百万人口享受保险公司服务家数 |
|---|---|---|---|---|
| 美国 | 5438 | 10 082 | 276.8 | 19.65 |
| 英国 | 777 | 1 424 | 59.5 | 13.05 |
| 德国 | 650 | 1 854 | 82.3 | 7.9 |
| 法国 | 466 | 1 310 | 59.2 | 7.87 |
| 日本 | 102 | 4 029 | 127.1 | 0.8 |
| 新加坡 | 103 | 86 | 4.1 | 25.12 |
| 中国(2010) | 121 | 5648 | 1335.2 | 0.09 |

数据来源：OECD，Insurance Statistics Yearbook，2003；瑞士再，Sigma，2011 年第 2 期；中国保险年鉴 2010。

此外，我国人身保险市场在危险保障和经济补偿方面的宏观作用也在逐年上升（见图 8）。2009 年，中国人身保险共支付赔款和给付 1549.69 亿元。其中，寿险业务给付金额为 1268.74 亿元，同比下降 3.52%；健康险业务赔款和给付支出为 217.03 亿元，同比增长 23.82%；意外险业务赔款支出为 63.92 亿元，同比增长 2.16%。

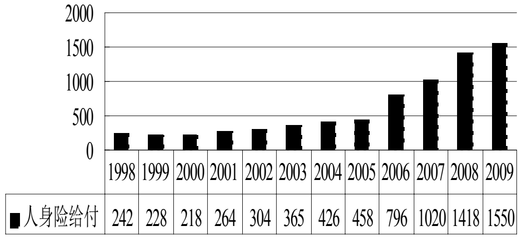



**图 8 中国人身保险业的赔款和给付（1998-2009）**

## B. 人身保险市场微观绩效分析

1．输入输出变量设置和样本单位数据选择

（1）寿险公司的投入项

本部分选择资本金、劳动成本和营业费用 3 项作为投入指标。

1）资本金。资本金是公司设立和运营的基础，寿险公司作为经营风险的特殊企业，具备与其经营范围相适应的注册资本具有更为重要的意义。足够的资本是保障保险公司正常运营的重要条件，它不仅是保险公司开业之后 3-5 年盈利期间保证偿付能力的基础，也是保证其偿付能力的最后一道防线。因此，本部分以“实收资本”作为寿险公司的一项重要投入项。

2）劳动成本。对寿险公司来说，劳动因素是重要的投入项目。本部分以保单直接获得成本为劳动成本[5]。因为就寿险公司来说，从业人员大多为个人代理人，而个人代理的固定薪资较低甚至没有，寿险公司的劳动成本主要体现在对个人代理人的佣金和手续费支出上，因此本文将佣金支出和手续费支出的总和作为劳动成本投入项。

（2）营业费用。在寿险公司经营过程中，办公费用、产品开发费用、宣传广告费用等营业费用也是一项重要的投入项。

[5] 此处没有直接选择劳动力人数作为投入项的原因在于，统计年鉴上公布的各寿险公司人员数中，对于个人代理人人数中存在大量的空挂现象，虽然有其名但并未实际在岗。

2．寿险公司的产出项

对于寿险公司的产出项，一些针对保险企业效率研究的文献多采用保费收入、利润总额、投资收益等三项或两项作为产出项。承保和投资是现代寿险企业维持生存和发展的两大业务体系，保费收入是寿险企业考核中最重要的一个绩效指标，能直接体现寿险企业的经营成果，因此本部分采用保费收入作为寿险公司的产出项之一；同时，投资在当今中国寿险公司的经营过程中得到日益重视，因此本部分采用投资收益作为寿险公司产出项之二。

3．样本期间和样本单位的选择

DEA 模型要求样本容量大于投入产出指标总个数。根据模型要求结合我国人身保险市场的实际发展情况，本部分将 2004-2009 年样本期间所有年份数据齐全的寿险公司全部纳入样本期间；在样本处理上，将属于同一实际控制人的企业合并计算，比如将美国友邦在上海、北京、深圳、江苏等地的分（支）公司数据合并计算，将平安人寿、平安健康和平安养老合并计算；共 27 家寿险公司，全部样本数量共 135 个。这 27 家寿险公司在样本期间各年的市场份额之和均占到了整个人身险市场份额的 90%以上，因此具有足够的代表性。[6]

## B. 微观厂商绩效的 DEA 结果及结论与分析

1．DEA 测算结果

本部分针对 27 家寿险公司 2004-2009 年 6 期投入产出面板数据，选择规模效率可变的 C2R 模型，采用 DEAP2.1 软件求解相关 DEA 模型线性规划问题，得到各保险公司的技术效率及其分解后的纯技术效率和规模效率。所有样本数据计算效率值结果见表 5、表 6、表 7。

2．结论与分析

（1）综合分析

表 2、表 3、表 4 可以看到，在当前技术和管理水平下，2004-2009 年间中国人身保险市场技术效率平均值为 0.507，这和中国人身保险市场效率较低的直观结论相符。同时也说明，在给定产出水平的前提下，寿险公司可以大幅度减少成本费用以便缩减投入。样本期间，技术效率均值最高的年份是 2009 年，为 0.63；最低的年份是 2005 年，为 0.313；各寿险公司技术效率水平在 0.02-1 之间波动，均值最高的泰康人寿为 1，最低的海尔纽约人寿为 0.155，差距较大。样本期间始终处在技术效率前沿面上的寿险公司仅有泰康，其他如太保人寿、平安人寿、新华、中国人寿、中意、瑞泰、恒安标准、太平人寿、生命、中保康联和友邦等都在均值以上，其他公司技术效率损失较大。

纯技术效率平均值为 0.68，意味着如果人身保险市场上的公司都采用了最优生产技术的话，投入的 32%可以节约下来。处在纯技术效率前沿面上的寿险公司有中国人寿、平安人寿、太保人寿、泰康、中保康联、天安人寿和瑞泰，中意人寿的绝大部分年份为纯技术有效，其余公司纯技术效率损失较大。

[6] 样本期间有个别公司的名称发生变化，文中统一使用 2009 年的名称。

**表 2 2004-2009 年历年中国各寿险公司技术效率值**

| 公 司 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 均值 | 排名 |
|---|---|---|---|---|---|---|---|---|
| 泰康 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **1** |
| 太保人寿 | 1 | 0.953 | 0.991 | 1 | 1 | 1 | 0.991 | **2** |
| 平安人寿 | 1 | 1 | 1 | 1 | 0.82 | 1 | 0.97 | **3** |
| 新华 | 1 | 0.911 | 1 | 0.855 | 0.99 | 0.772 | 0.921 | **4** |
| 中国人寿 | 1 | 0.639 | 0.947 | 0.841 | 1 | 1 | 0.905 | **5** |
| 中意 | 0.46 | 1 | 1 | 1 | 0.46 | 1 | 0.82 | **6** |
| 瑞泰 | 0.757 | 0.071 | 0.773 | 1 | 1 | 1 | 0.767 | **7** |
| 恒安标准 | 1 | 0.408 | 0.434 | 0.98 | 1 | 0.402 | 0.704 | **8** |
| 太平人寿 | 0.96 | 0.347 | 0.623 | 0.548 | 0.374 | 0.567 | 0.57 | **9** |
| 生命 | 1 | 0.151 | 0.424 | 0.753 | 0.185 | 0.698 | 0.535 | **10** |
| 中保康联 | 0.39 | 0.074 | 0.448 | 0.742 | 0.505 | 1 | 0.527 | **11** |
| 友邦 | 0.541 | 0.455 | 0.577 | 0.52 | 0.244 | 0.727 | 0.511 | **12** |
| 招商信诺 | 1 | 0.031 | 0.507 | 0.999 | 0.144 | 0.278 | 0.493 | **13** |
| 中德安联 | 0.951 | 0.112 | 0.428 | 0.55 | 0.105 | 0.296 | 0.407 | **14** |
| 天安人寿（原恒康天安） | 0.323 | 0.053 | 0.309 | 0.45 | 0.25 | 1 | 0.398 | **15** |
| 中英 | 0.208 | 0.114 | 0.245 | 0.412 | 0.381 | 0.656 | 0.336 | **16** |
| 金盛 | 0.246 | 0.046 | 0.268 | 0.645 | 0.215 | 0.595 | 0.336 | **17** |
| 光大永明 | 0.353 | 0.065 | 0.191 | 0.458 | 0.224 | 0.567 | 0.31 | **18** |
| 首创安泰 | 0.203 | 0.159 | 0.233 | 0.546 | 0.268 | 0.431 | 0.307 | **19** |
| 中宏 | 0.566 | 0.272 | 0.24 | 0.245 | 0.15 | 0.316 | 0.299 | **20** |
| 民生 | 0.499 | 0.173 | 0.208 | 0.27 | 0.214 | 0.368 | 0.289 | **21** |
| 太平洋安泰 | 0.271 | 0.189 | 0.27 | 0.258 | 0.314 | 0.429 | 0.289 | **22** |
| 中美大都会 | 0.08 | 0.02 | 0.14 | 0.479 | 0.082 | 0.675 | 0.246 | **23** |
| 信诚 | 0.217 | 0.093 | 0.228 | 0.283 | 0.103 | 0.438 | 0.227 | **24** |
| 海康 | 0.227 | 0.034 | 0.192 | 0.428 | 0.093 | 0.282 | 0.209 | **25** |
| 长生人寿（原广电日生） | 0.425 | 0.032 | 0.13 | 0.186 | 0.112 | 0.204 | 0.182 | **26** |
| 海尔纽约 | 0.263 | 0.05 | 0.128 | 0.138 | 0.051 | 0.301 | 0.155 | **27** |
| 均 值 | 0.59 | 0.313 | 0.479 | 0.614 | 0.418 | 0.63 | 0.507 | |

**表 3 2004—2009 年历年中国各寿险公司纯技术效率值**

| 公 司 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 均值 | 排名 |
|---|---|---|---|---|---|---|---|---|
| 中国人寿 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 平安人寿 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| 太保人寿 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 |
| 泰康 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 |
| 中保康联 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 5 |
| 天安人寿（原恒康天安） | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 6 |
| 瑞泰 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| 新华 | 1 | 0.938 | 1 | 0.872 | 0.993 | 0.772 | 0.929 | 8 |
| 中意 | 0.614 | 1 | 1 | 1 | 0.712 | 1 | 0.888 | 9 |
| 恒安标准 | 1 | 0.718 | 0.822 | 1 | 1 | 0.409 | 0.825 | 10 |
| 招商信诺 | 1 | 0.802 | 0.843 | 1 | 0.689 | 0.573 | 0.819 | 11 |
| 长生人寿（原广电日生） | 0.92 | 0.803 | 1 | 0.704 | 0.841 | 0.464 | 0.789 | 12 |
| 生命 | 1 | 0.264 | 0.454 | 1 | 0.282 | 0.706 | 0.618 | 13 |
| 太平人寿 | 0.961 | 0.367 | 0.676 | 0.644 | 0.375 | 0.57 | 0.599 | 14 |
| 中德安联 | 1 | 0.692 | 0.567 | 0.682 | 0.184 | 0.297 | 0.570 | 15 |
| 友邦 | 0.582 | 0.587 | 0.598 | 0.586 | 0.273 | 0.734 | 0.56 | 16 |
| 金盛 | 0.426 | 0.439 | 0.491 | 0.7 | 0.37 | 0.595 | 0.504 | 17 |
| 海尔纽约 | 0.838 | 0.672 | 0.476 | 0.347 | 0.252 | 0.359 | 0.491 | 18 |
| 中英 | 0.411 | 0.468 | 0.343 | 0.56 | 0.472 | 0.657 | 0.485 | 19 |
| 首创安泰 | 0.455 | 0.523 | 0.476 | 0.567 | 0.398 | 0.463 | 0.480 | 20 |
| 中美大都会 | 0.4 | 0.4 | 0.407 | 0.542 | 0.283 | 0.708 | 0.457 | 21 |
| 中宏 | 0.614 | 0.568 | 0.366 | 0.36 | 0.354 | 0.347 | 0.435 | 22 |
| 光大永明 | 0.489 | 0.439 | 0.363 | 0.462 | 0.267 | 0.567 | 0.431 | 23 |
| 太平洋安泰 | 0.427 | 0.454 | 0.398 | 0.323 | 0.386 | 0.466 | 0.409 | 24 |
| 海康 | 0.671 | 0.379 | 0.369 | 0.444 | 0.194 | 0.321 | 0.396 | 25 |
| 民生 | 0.587 | 0.315 | 0.287 | 0.372 | 0.214 | 0.377 | 0.359 | 26 |
| 信诚 | 0.427 | 0.331 | 0.286 | 0.314 | 0.147 | 0.441 | 0.324 | 27 |
| **均值** | **0.771** | **0.672** | **0.675** | **0.721** | **0.581** | **0.66** | **0.68** | |

规模效率平均值为 0.716，绝大部分寿险公司规模效率都较高，但处在规模效率前沿面上的寿险公司仅有泰康一家，其他如新华、太保人寿、平安人寿、太平人寿等虽然都特别接近前沿面，但都有不同程度的规模效率损失。根据样本公司样本期间规模状态表（见表 4），大多数中资寿险公司在整个样本期间多处于规模报酬递增或不变的状态，说明中资公司有进一步发展的巨大潜力；而大部分外资公司则多处于规模报酬递减状态运营。规模报酬综合情况进一步显示出，2004-2009 年以规模报仇递增和递减状态运营的寿险公司数量和比重均波动递增，说明我国寿险公司同时存在扩大规模和提高质量双重压力，重规模轻质量的粗放式经营方式确实存在较严重的问题。样本期间各年度对技术效率、纯技术效率和规模效率均值有提升和下拉作用的最优和最差公司情况见表 5。从该表还可以看到，样本期间位于技术效率前沿面上的公司家数分别为 8、3、4、5、5、8；位于纯技术效率前沿面上的公司家数分别为 12、8、10、11、8、8；位于规模效率前沿面上的公司家数分别为 8、3、4、5、5、10。随着时间的推移，无效率保险公司的数目在逐渐减少，特别是近年来人身险市场上资源浪费的问题已得到高度重

视，并初见成效。

**表 4 2004—2009 年历年中国各寿险公司规模技术效率值及规模报酬状态**

| 公 司 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 均值 | 排名 |
|---|---|---|---|---|---|---|---|---|
| 中国人寿 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 平安人寿 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| 太保人寿 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 |
| 泰康 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 |
| 中保康联 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 5 |
| 天安人寿（原恒康天安） | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 6 |
| 瑞泰 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 7 |
| 新华 | 1 | 0.938 | 1 | 0.872 | 0.993 | 0.772 | 0.929 | 8 |
| 中意 | 0.614 | 1 | 1 | 1 | 0.712 | 1 | 0.888 | 9 |
| 恒安标准 | 1 | 0.718 | 0.822 | 1 | 1 | 0.409 | 0.825 | 10 |
| 招商信诺 | 1 | 0.802 | 0.843 | 1 | 0.689 | 0.573 | 0.819 | 11 |
| 长生人寿（原广电日生） | 0.92 | 0.803 | 1 | 0.704 | 0.841 | 0.464 | 0.789 | 12 |
| 生命 | 1 | 0.264 | 0.454 | 1 | 0.282 | 0.706 | 0.618 | 13 |
| 太平人寿 | 0.961 | 0.367 | 0.676 | 0.644 | 0.375 | 0.57 | 0.599 | 14 |
| 中德安联 | 1 | 0.692 | 0.567 | 0.682 | 0.184 | 0.297 | 0.570 | 15 |
| 友邦 | 0.582 | 0.587 | 0.598 | 0.586 | 0.273 | 0.734 | 0.56 | 16 |
| 金盛 | 0.426 | 0.439 | 0.491 | 0.7 | 0.37 | 0.595 | 0.504 | 17 |
| 海尔纽约 | 0.838 | 0.672 | 0.476 | 0.347 | 0.252 | 0.359 | 0.491 | 18 |
| 中英 | 0.411 | 0.468 | 0.343 | 0.56 | 0.472 | 0.657 | 0.485 | 19 |
| 首创安泰 | 0.455 | 0.523 | 0.476 | 0.567 | 0.398 | 0.463 | 0.480 | 20 |
| 中美大都会 | 0.4 | 0.4 | 0.407 | 0.542 | 0.283 | 0.708 | 0.457 | 21 |
| 中宏 | 0.614 | 0.568 | 0.366 | 0.36 | 0.354 | 0.347 | 0.435 | 22 |
| 光大永明 | 0.489 | 0.439 | 0.363 | 0.462 | 0.267 | 0.567 | 0.431 | 23 |
| 太平洋安泰 | 0.427 | 0.454 | 0.398 | 0.323 | 0.386 | 0.466 | 0.409 | 24 |
| 海康 | 0.671 | 0.379 | 0.369 | 0.444 | 0.194 | 0.321 | 0.396 | 25 |
| 民生 | 0.587 | 0.315 | 0.287 | 0.372 | 0.214 | 0.377 | 0.359 | 26 |
| 信诚 | 0.427 | 0.331 | 0.286 | 0.314 | 0.147 | 0.441 | 0.324 | 27 |
| **均值** | **0.771** | **0.672** | **0.675** | **0.721** | **0.581** | **0.66** | **0.68** | |

注：i 表示规模报酬递减，d 表示规模报酬递增，- 表示规模报酬不变。

**表 5 2004-2009 各年 TE、PTE 及 SE 最佳及最差公司统计表**

| 年份 | | 最佳公司（效率值=1） | 最差公司 | 变动区间 |
|---|---|---|---|---|
| 2004 | TE | 泰康、太保人寿、平安人寿、新华、中国人寿、恒安标准、生命、招商信诺 | 中美大都会 | 0.08-1 |
| | PTE | 中国人寿、平安人寿、太保人寿、泰康、中保康联、恒康天安、瑞泰、新华、恒安标准、招商信诺、生命、中德安联 | 中美大都会 | 0.4-1 |
| | SE | 泰康、新华、太保人寿、平安人寿、中国人寿、恒安标准、生命、招商信诺 | 中美大都会 | 0.201-1 |
| 2005 | TE | 泰康、平安、中意 | 中美大都会 | 0.02-1 |
| | PTE | 中国人寿、平安人寿、太保人寿、泰康、中保康联、恒康天安、瑞泰、中意 | 生命 | 0.264-1 |

| | | | | |
|---|---|---|---|---|
| | SE | 泰康、平安人寿、中意 | 招商信诺 | 0.038-1 |
| 2006 | TE | 泰康、平安人寿、新华、中意 | 海尔纽约 | 0.128-1 |
| | PTE | 中国人寿、平安人寿、太保人寿、泰康、中保康联、恒康天安、瑞泰、中意、新华、广电日生 | 信诚 | 0.286-1 |
| | SE | 泰康、新华、平安人寿、中意 | 广电日生 | 0.13-1 |
| 2007 | TE | 泰康、太保人寿、平安人寿、中意、瑞泰 | 海尔纽约 | 0.138-1 |
| | PTE | 中国人寿、平安人寿、太保人寿、泰康、中保康联、恒康天安、瑞泰、中意、恒安标准、招商信诺、生命 | 信诚 | 0.314-1 |
| | SE | 泰康、太保人寿、平安人寿、中意、瑞泰 | 广电日生 | 0.265-1 |
| 2008 | TE | 泰康、太保人寿、中国人寿、瑞泰、恒安标准、 | 海尔纽约 | 0.015-1 |
| | PTE | 中国人寿、平安人寿、太保人寿、泰康、中保康联、恒康天安、瑞泰、恒安标准 | 信诚 | 0.147-1 |
| | SE | 泰康、太保人寿、中国人寿、瑞泰、恒安标准 | 广电日生 | 0.133-1 |
| 2009 | TE | 泰康、太保人寿、平安人寿、中国人寿、中意、瑞泰、中保康联、天安人寿 | 海尔纽约 | 0.301-1 |
| | PTE | 中国人寿、平安人寿、太保人寿、泰康、中保康联、恒康天安、瑞泰、中意 | 中德安联 | 0.297-1 |
| | SE | 泰康、新华、太保人寿、平安人寿、中国人寿、中意、瑞泰、光大永明、中保康联、天安人寿 | 长生人寿 | 0.439-1 |

（2）趋势分析

通过趋势分析，我们可以更直观地看出中国人身保险市场微观效率的变动轨迹。通过图 9 可以看到，样本期间中国人身保险业的技术效率、纯技术效率和规模效率在总趋势上呈现出上升态势，技术效率在 2009 年最高为 0.63。总体的微观绩效是在逐步提高的。

（3）投入冗余分析

从 DEA 的测算结果可以得出在给定产出水平下，中国人身保险业的投入过多，资本金、劳动力和费用等的实际投入分别需要减少 15.63%、6.98%和 11.93%（见表 6）。这些数据说明，中国人身保险市场上资源浪费较严重，现有的技术、管理水平还有较大的提升和改善空间。

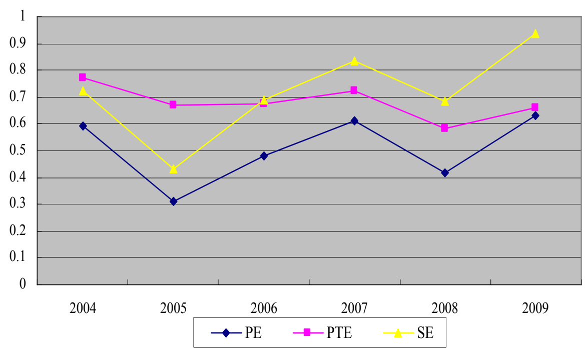



**图 9 2004-2009 年中国人身保险市场效率趋势图**

表 6 2004—2009 年中国人身保险市场历年投入冗余值

| 投入项 | | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 均值 |
|---|---|---|---|---|---|---|---|---|
| 资本金（亿） | 实际投入 | 467.10 | 491.98 | 534.94 | 589.83 | 859.69 | 926.70 | 645.04 |
| | 投入冗余 | 33.17 | 74.14 | 82.98 | 109.14 | 164.24 | 141.04 | 100.79 |
| | 可减少 | 7.10% | 15.07% | 15.51% | 18.50% | 19.10% | 15.22% | 15.63% |
| 佣金和手续费（亿） | 实际投入 | 191.15 | 256.97 | 308.44 | 389.72 | 477.05 | 525.15 | 358.08 |
| | 投入冗余 | 6.32 | 15.93 | 19.14 | 25.21 | 39.93 | 43.37 | 24.98 |
| | 可减少 | 3.31% | 6.20% | 6.21% | 6.47% | 8.37% | 8.26% | 6.98% |
| 营业费用(亿) | 实际投入 | 223.02 | 256.32 | 334.31 | 417.42 | 510.02 | 605.47 | 391.09 |
| | 投入冗余 | 11.87 | 30.00 | 31.11 | 37.61 | 84.75 | 84.64 | 46.66 |
| | 可减少 | 5.32% | 11.7% | 9.3% | 9.01% | 16.62% | 13.98% | 11.93% |

综上所述，我们简要做出如下结论：

第一，中国人身保险市场的总体效率较低。2004-2009 年间中国人身保险市场技术效率均值为 0.5073，纯技术效率均值为 0.66，规模效率均值为 0.936。技术非效率主要源于纯技术效率过低，规模效率的损失相对不大。但技术效率总体趋势呈现逐步提高态势。

第二，在现有的技术和产出水平下，中国人身保险市场存在较严重的资源浪费问题，资本金、劳动力和费用等实际投入分别需要减少 15.63%、6.98%和 11.93%。

## Ⅳ. 人身保险市场绩效改善建议

就中国人身保险市场而言，无论是宏观公共绩效，还是微观厂商绩效，从根本上都取决于微观层面单个寿险公司经营行为和经营绩效的改进。因此，从这一层面上，甚至可以认为微观寿险公司主体行为和绩效的提高更为重要。

### A. 转变粗放式经营模式

保险业的经营方式一般分为三种：粗放式经营、集约型经营和创新型经营。保险市场的发展水平决定其经营方式。一般在市场发展初期，由于供需状况、企业技术水平、经营管理经验等方面相对薄弱，保险公司多采取粗放型经营方式。发展到一定程度后，经营方式也会逐步改进。与中国经济转轨的大背景相一致，人身保险业长期实施的是粗放式经营模式。但随着市场经济制度的成熟，中国人身保险市场也亟需向集约型模式发展，强调经济和社会效益，实现最小投入的最大回报，并不断培育创新能力，最终转向创新型经营方式。

### B. 由单一重规模向效益优先、兼顾规模转变

由于我国人身保险市场发展时间相对较短，因此长期以来“以保费论英雄”、“以规模丁效益”的 思想普遍存在，其结果就是保险公司自身经营风险的增大。而不顾业务质量地粗放经营，也为保险市场的未来健康发展买下了很多风险隐患。因此，在做大市场的同时，寿险公司更多地应该注重经营效益的提升。

一是要调整结构，大力发展内含价值高、保障水平高的长期期交和保障型产品。大力发展保障程度高、创佣创费能力强的产品，增加此类产品的销售力度，不仅可以给寿险公司带来较高的利润，而且还可以真正有效提高人身保险的覆盖面，满足大多数人民群众真正的风险保障需求。而期交业务的发展也可以减少人身保险市场依赖趸交方式带来的周期性波动，实现寿险公司的可持续发展。二是提高投资收益，完善投资管理机制，在保证资金安全的前提下，提高投资收益水平。三是提高管理效益，加强承保理赔管理，提高业务质量；强化预算管理，加强成本管控。

### C. 推广信息化建设

根据国际经验，跟踪先进信息技术发展，建立强大的信息系统，提升技术效率是保险公司改进经营管理决策水平、不断提高保险业经营效率的一项基本手段。国外保险公司已完全将其经营管理模式承载在信息技术系统之上。包括营销管理、销售管理、承保、理赔等各经营环节都广泛运用上了信息技术。依托现代网络信息技术，建立决策支持、市场监测、风险控制、产品开发、内部管理、客户服务等系统，可以使得各经营环节的决策紧密连接，高效运转，具有明显的成本优势。在信息化水平方面，我国保险业

的建设水平比较之后，因此应大力推动电子化工程建设，通过技术进步提高寿险公司的技术效率。

首先，保险欺诈成本开支是整个保险业界共同面对的难题，所以有必要联合保险业界集体反欺诈。欧洲及北美一些国家都早已认识到集体保险反欺诈的重要性（如美国的反保险欺诈联盟）。所以保险行业协会等组织有必要组织引导各家保险公司，联手建立中国的反保险欺诈体系。

其次，保险公司作为市场主体，一方面必须建立起公司自身的保险反欺诈系统，优化成本效益机制，强化公司保险反欺诈人员的培训，更新技术，切实提高承保和核保质量；另一方面，需要加强和其他保险公司的信息沟通，减少信息不对称造成的损失。

## References

[1] Jean Tirole, The Theory of Industrial Organization[M]. Shanghai Joint Publishing, China's People’s Publishing House.
[2] Dennis W. Carlton, Jeffrey M. Perloff, Modern industrial organization[M], Shanghai's People's Publishing House, 1998.
[3] Jiang Shengzhong, The study of Chinese insurance industrial organization optimization[M], China Social Sciences Press, 2003.1.
[4] Wang Xujing, Insurance(5th)[M], Higher Education Press, 2011.8.
[5]Xu Xu, Study on the Effective Insurance Regulation Institutions[M], Economics and Science Press, 2009.5.
[6] Yao Shujie, Feng Genfu, Han Zhongwei, The empirical analysis of efficiency of Chinese insurance industry[J], Economic Study, 2005.7.
[7]Abreu, D., Infinitely Repeated Games with Discounting: A General Theory, Mimeo, Harvard
[8] http://www.circ.org.cn/
[9] http://www.repec.org/
[10] http:/fic.wharton.upenn.edu/fic/

# 中国人身保险市场绩效分析

徐徐

北京工商大学保险学系，北京，中国，100048。

**摘要**：市场绩效反映的是市场运行效率和资源配置的效果。中国人身保险市场自 20 世纪 80 年代复业以来在经历了高速发展的同时，其市场绩效的真实情况及其存在的问题，是人身保险业维持可持续发展过程中必须探讨的一个重要问题。本文通过界定人身保险市场绩效的内涵及其评价标准，从人身保险市场的公共绩效和微观绩效两个层面对中国的人身保险市场进行实证分析，并对提升中国人身保险市场绩效的途径提出建议。
**关键词**：人身保险；绩效；SCP 范式；数据包络（DEA）

# Empirical Analysis of Portfolio Insurance Applying in Life Insurance Fund

ZHENG Qinghuan, LI Ziyou
School of Business, East China University of Science and Technology, Shanghai, China, 200237

**Abstract:** Portfolio insurance is a kind of strategy that can guarantee both the minimum level of profit in a specific time interval and the potential profit with such a target combination. Since life insurance fund has the characteristics of return on a regular basis and long-term liability, it is suggested that the portfolio insurance be chosen to achieve the target profit with the guarantee of the investment safety. This paper is based on the historical data of CSI 300 index in Chinese stock market and combines the portfolio insurance strategies with the life insurance investment. The analysis focuses on the effects of Constant Proportion Portfolio Insurance (CPPI), Time Invariant Portfolio Protection (TIPP) and Constant Mix Strategy (CM) on the investment performance. The results indicate that: In downside stock market, CM strategy is preferred with the small income of premium; TIPP with a higher cushion should be chosen with the large income of premium. In upside stock market, CPPI is preferred regardless the income of premium. If the judgment of whether it is in bull or bear is unclear, CPPI is preferred.
**Keywords:** portfolio insurance; life insurance fund; Constant Proportion Portfolio Insurance; Time Invariant Portfolio Protection

## Ⅰ.引言

保险资金运用是寿险公司生存与发展的重要支柱。根据保监会发布的数据显示，2011 年寿险保费收入同比下降 10.16%，降幅较大。与此同时，随着国内人均预期寿命不断提高，利差损风险的加大，以及人员费用、佣金费用等成本的增加，寿险行业竞争日趋激烈，保费利润下降，寿险投资的重要性愈加凸显，投资利润已经成为寿险业的主要利润来源。如何控制风险与收益的平衡，在确保安全性的前提下尽可能提高收益率，是摆在寿险公司投资策略组合面前的一个难题。而投资组合保险策略可以通过静态或动态的资产配置策略的使用，使寿险公司既可以参与到积极的股票市场运作中，保留潜在收益上升趋势，又可以根据预先指定的水平和最低要保金额减少潜在损失，使损失控制在一定的范围之内。

投资组合保险策略在安全性和盈利性两方面都非常适合寿险公司的投资要求。首先，寿险产品流动性要求高、利率敏感性强，且必须保证具有充分的到期给付和退保给付能力，所以寿险投资以安全性为首要前提。而投资组合保险策略能够在保留最低财富水平的同时，提供应对损失的保护，因此符合寿险公司对其负债管理的安全性要求。其次，尽管近些年我国寿险投资总量保持高速增长态势，投资渠道也从安全性较高的银行存款、国债拓宽到收益性较强的企业债、基金、股票等方面，但我国 A 股市场波动率较大。以沪深 300 指数为例，从 2006 年的 1033 到 2007 年 2 月份的 2230，再涨到 2008 年 1 月份的 5731，不到两年内涨了 5 倍之多，2008 年金融危机之后，沪深 300 指数跌至 1817。在这样的股票市场中，保险资金运用的安全性受到威胁，证券投资难以实现预期盈利目标。而投资组合保险策略的目的正是保证投资者在继续拥有资产增值潜力的同时，回避或锁定资产价格下跌的风险，与寿险资金投资于股市的要求相适应。

本文研究投资组合保险中 CPPI 策略、TIPP 策略和固定投资组合策略对寿险公司投资绩效的影响，实证分析在空头阶段、多头阶段和震荡阶段寿险公司的最优策略安排，为寿险投资提供对策建议。.

## Ⅱ.投资组合保险策略的对比分析

1973 年，Black 和 Scholes（1973）提出了期权定价公式，给投资策略的创新提供了一个新的方向。在经过了几年的试验之后，Rubinstein 和 Leland(1981)通过在投资组合保险策略中引入复制性卖权策略，正式提出了组合保险策略。在此之后，投资组合保险策略得到

了迅速发展，该类策略已经成为实用投资策略中的重要分支。在实务操作中，通过设定简单参数所形成的组合保险策略由于其简便性和易操作性而受到更多青睐，主要包括 CPPI 策略、TIPP 策略和固定组合保险策略。

## A.固定比例投资组合保险策略（CPPI）

由于复制性卖权策略需要估计的参数较多，计算复杂且容易受到风险资产价格波动的影响，Black 和 Jones（1987）提出了一个简单的投资公式，发展出固定比例投资组合保险策略 CPPI 技术用于股票投资。

固定比例投资组合保险策略的开始点是投资者在 t 时刻的风险资本，叫做缓冲额度。当期缓冲额度（$C_t$）代表 t 时刻价值（$W_t$）和最低要保额度（$F_T$）的净现值（NPV）之差；t 时刻价值（$W_t$）由无风险资产价值（$r_t$）和风险资产价值构成（$e_t$）；其中$e_t$的计算方式是在缓冲额度上乘以乘数 m，因此有：

$$W_t = r_t + e_t \quad (1)$$
$$C_t = W_t - NPV(F_T) \quad (2)$$
$$e_t = m * C_t \quad (3)$$

投资者的剩余财富被投资于无风险资产。原则上，乘数 m 可以被设定是任意价值，但它的选择有很强的经济意义。其倒数 1/m 代表风险资产发生的最大突然损失，缓冲额度并未完全损失，投资组合的价值也未降到最低要保金额的净现值以下。例如，乘数 m=4 时，风险资产损失的最大为 25%（1/4=0.25），没有违反最低要保金额。但超过 25%的损失突然发生时，其价值就下降到最小值以下（投机破产）。

## B.时间不变性投资组合保险策略（TIPP）

TIPP 策略是比 CPPI 策略更为保守的一种投资组合保险策略。在操作上两者大致相同，唯一不同的是价值底线的设定与调整。CPPI 策略的运作有一个固定的最低要保金额（最初的财富乘以最低要保率），TIPP 策略会将资产总价值乘以最低要保率和原价值底线进行比较，取较大者为最新的价值底线。因此 TIPP 策略的价值底线随投资组合的价值上升而上升。

也就是，在选取最初要保额和乘数后，该策略如下实施：

（1）计算投资组合实际的价值（股票加现金）

（2）该价值乘以最低要保率

（3）若步骤 2 的结果大于最低要保额，则选取新的最低要保额，否则最低要保额不变，即：

$$F_T = Max(f * W_t,\ F_{T-1}),\quad t=0，1，2 \quad (4)$$
$$e_t = m * (W_t - F_T) \quad (5)$$

和传统的 CPPI 策略相比，TIPP 策略中保险额度是随行情变化不断调整的，具有只能向上而不能向下调整的“棘轮效应”，一旦达到最低要保额，风险资产变成无风险资产是不可逆的。因此 TIPP 策略不能参与到接下来上升的市场活动中。但是由于达到最高的投资组合价值的最低要保额的持续变化，投资组合的价值有可能会达到或低于当前最低要保额的增加，因此 TIPP 策略更容易终止于完全投入在无风险资产时。

## C. 固定组合保险策略（CM）

固定组合保险策略也是一种动态的组合保险策略，其运作原理是：在操作过程中将投资组合中的风险资产与无风险（或低风险）资产保持一定比例不变，投资组合的价值因风险资产价值的变化而变化。即，

$$e_t / r_t = c \quad (6)$$

其中，$e_t$为 t 时刻风险资产的价值；$r_t$为 t 时刻无风险资产的价值；c 为固定比例常数。如果随着时间的推移，风险资产或无风险资产市值发生变化，导致比例变化时，则进行仓位的调整，使其一直保持比例不变。从原理上看，其是一种低买高卖策略，即在股票市场上涨时卖出股票，在股市下跌时，买进股票。

# III.研究设计

由于寿险资金不同于基金公司或证券公司，坚持以长期价值投资为理念，主要以投资沪、深大盘蓝筹股票为主。因此选择沪深 300 指数从 2008 年开始至 2011 年第一季度的收盘价作为研究的数据段，具体走势如图 1 所示：

从股票市场涨跌走势看，基本可分为三个

资助信息：本项目受 2011 年度教育部人文社会科学研究青年项目（11YJC790303）、2012 年国家社科基金青年项目（12CJY106）资助。

阶段：

第一阶段，从 2008 年初到 2008 年 11 月，股票市场处于单边下跌阶段；

第二阶段，从 2008 年 11 月到 2009 年 8 月，股票市场处于单边上涨阶段；

第三阶段，从 2009 年 8 月到 2011 年 3 月，股票市场处于震荡阶段。


**图 1 2008 年至 2011 年第一季度沪深 300 历史走势**

## A.特定公司场景假设

假设某寿险公司投资品种以固定收益类、权益类为主。期初时点投资组合市场价值为 300 亿元，该公司根据自身的偿付能力状况和市场判断，权益类投资的战略目标为 15%，内部规定权益类资产按市值计算可达到 20%的上限。对于保底资产价值希望不低于总资产的 90%。对于固定收益产品，假设每年收益率为 4%。

由于保险公司的差异比较大，有些保险公司业务增长比较快，有些处于停滞状态，因此本方案将分为两种情况，一种情况是极端情形下假设保险公司业务增长规模较慢，无保费净流入，将投资组合看成是一个纯粹的封闭式基金：另一种情况则假设某公司在全国寿险公司中处于第二梯队，参照太平人寿等保险公司近几年保费收入数据，扣除各项费用和保证金后，假设第一年可流入投资组合的资金为 108 亿元，每月流入投资组合的资金量相等，并假设在第二年现金净流入比前一年增长 20%。

## B. 参数设定

本研究包括两个参数设定，风险乘数和最低要保额所占比例。根据以往研究结果，风险乘数一般设定为 2，4 和 6；价值底线的设定一般在 90%——100%之间。考虑到本研究专门针对寿险公司，寿险投资的权益类投资比例不得超过 20%，因此风险乘数的选取要适当保守一些，同时考虑到 CPPI 和 TIPP 策略的相似性，将风险乘数设定为 2 和 3 两种情况进行分析。同时假定寿险公司保底资产价值不低于总资产的 90%，因此对 CPPI 策略和 TIPP 策略均选取最低要保率为 95%和 90%两种情况进行分析。

固定比例投资组合保险策略的参数只有一个，即权益类资产与固定收益类资产的比例。这里主要设定两种情景：因保险公司的权益类（股票、基金）可投资上限为 20%，因此一种情景设定按中位数 10%作为长期投资的战略目标，即权益类资产与固定收益类资产的比例为 10/90；另一种情景下按保险公司在该阶段的战术目标权益类占比目标为 15%进行配置，约定权益类资产与固定收益类资产的比例为 15/85。

## C.调整原则

动态投资组合保险策略需要在市场交易价格变动过程中，对资产配置比例进行动态调整，使实际值不会过于偏离理论值。考虑到连续调整造成巨额交易成本问题，本研究采取定期调整法原则，每月检查一次，在固定资产和权益类资产间进行动态调整。

## D. 绩效评估指标

选取最直观的收益率评价指标来衡量各投资组合保险下的业绩。即在期初投资组合的数值和每月流入的保费净现金流相同时，以收益率最高者为绩效最好。具体计算公式为：投资收益率=期末市值/（期初市值+期间保费流入）-1。

# Ⅳ. 实证分析模拟结果

## A. 投资组合策略的绩效表现

利用沪深指数数据对 CPPI 策略、TIPP 策略和固定组合保险策略在不同参数情境下的投资绩效进行了分析，主要比较股票市场的空头阶段和多头阶段，具体分析结果如下：

### 1） 固定比例投资组合保险策略（CPPI）

从有无保费流入两种情况下 CPPI 策略的投资绩效来看，测算发现不管有无保费流入，最低要保率和风险乘数对投资收益的影响趋势均相同，即：在空头阶段，最低要保率越高，风险乘数越低，亏损越少，反之亦然；而多头阶段，最低要保率越低，风险乘数越高，收益越

高，反之亦然，这与 CPPI 理论相符。但是在有保费流入的情况下，最低要保率和风险乘数对投资收益的影响有所下降。与此同时，在空头阶段最低要保率对收益率的影响远大于风险乘数对收益率的影响，而在多头阶段这一现象不是特别突出。这是由于多头阶段处于本文分析的第二阶段，空头阶段收益的变化对其产生了中和效应影响。（见表 1，表 2）

表 1. CPPI 方法无保费流入下不同参数的收益比较

| 收益率 | | 2，0.9 | 2，0.95 | 3，0.9 | 3，0.95 |
|---|---|---|---|---|---|
| 空头 | 08.01-08.11 | -8.32% | -3.59% | -9.26% | -4.30% |
| 多头 | 08.11-09.08 | 12.47% | 11.33% | 13.28% | 13.00% |
| 震荡 | 09.08-11.03 | 3.80% | 3.47% | 4.09% | 4.09% |

表 2 CPPI 方法有保费流入下不同参数的收益比较

| 收益率 | | 2, 0.9 | 2, 0.95 | 3, 0.9 | 3, 0.95 |
|---|---|---|---|---|---|
| 空头 | 08.01-08.11 | -7.78% | -3.37% | -8.84% | -4.11% |
| 多头 | 08.11-09.08 | 13.29% | 11.25% | 13.96% | 12.89% |
| 震荡 | 09.08-11.03 | 4.07% | 3.60% | 4.07% | 4.06% |

2） 时间不变性投资组合保险策略（TIPP）

从有无保费流入两种情况下 TIPP 策略的投资绩效来看，不管有无保费流入，最低要保率和风险乘数对投资收益的影响趋势均相同，而且与 CPPI 策略模拟出的结果基本一致。（见表 3，表 4）

表 3 TIPP 方法无保费流入下不同参数的收益比较

| 收益率 | | 2, 0.9 | 2, 0.95 | 3，0.9 | 3, 0.95 |
|---|---|---|---|---|---|
| 空头 | 08.01-08.11 | -8.32% | -3.59% | -9.26% | -4.30% |
| 多头 | 08.11-09.08 | 12.47% | 9.40% | 13.28% | 11.49% |
| 震荡 | 09.08-11.03 | 2.65% | 4.97% | 3.55% | 3.50% |

表 4 TIPP 方法有保费流入下不同参数的收益比较

| 收益率 | | 2，0.9 | 2, 0.95 | 3，0.9 | 3，0.95 |
|---|---|---|---|---|---|
| 空头 | 08.01-08.11 | -7.78% | -3.37% | -8.84% | -4.11% |
| 多头 | 08.11-09.08 | 13.29% | 8.83% | 13.96% | 11.10% |
| 震荡 | 09.08-11.03 | 4.07% | 4.77% | 4.07% | 4.43% |

3） 固定组合保险策略（CM）

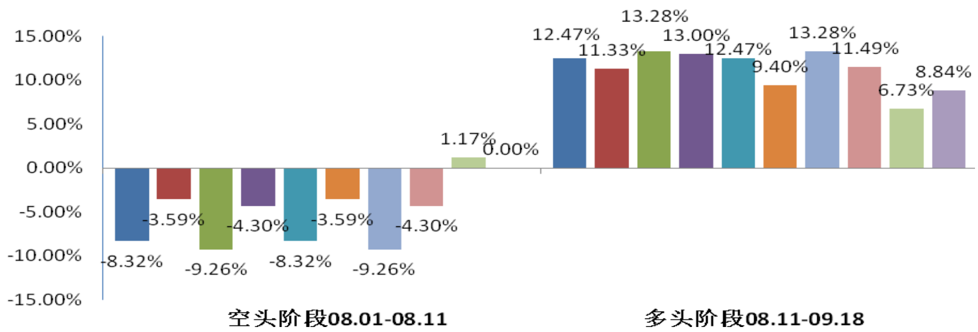
从有无保费流入两种情况下 CM 策略的投资绩效可以看出，无论是否有保费流入，在空头情况下，权益类资产的比例越高，收益越低，反之亦然；而在多头情况下，权益类资产的比例越高，收益越高，反之亦然。(见表 5)

表 5 固定组合保险策略方法下不同参数的收益比较

| 收益率 | | 无保费流入 | | 有保费流入 | |
|---|---|---|---|---|---|
| | | 10/90 | 15/85 | 10/90 | 15/85 |
| 空头 | 08.01-08.11 | 1.17% | 0.00% | -6.47% | -10.90% |
| 多头 | 08.11-09.08 | 6.73% | 8.84% | 10.43% | 14.42% |
| 震荡 | 09.08-11.03 | 6.02% | 5.60% | 4.77% | 4.43% |

## B. 不同情境下组合策略的比较及选择

1）无保费流入下市场各阶段的策略选择




注：从左至右依次为 CP（2，0.9）、CP（2，0.95）、CP（3，0.9）、CP（3，0.95）；TI（2，0.9）、TI（2，0.95）、TI（3，0.9）、TI（3，0.95）；CM（10/90）和 CM（15/85）策略下的投资绩效。

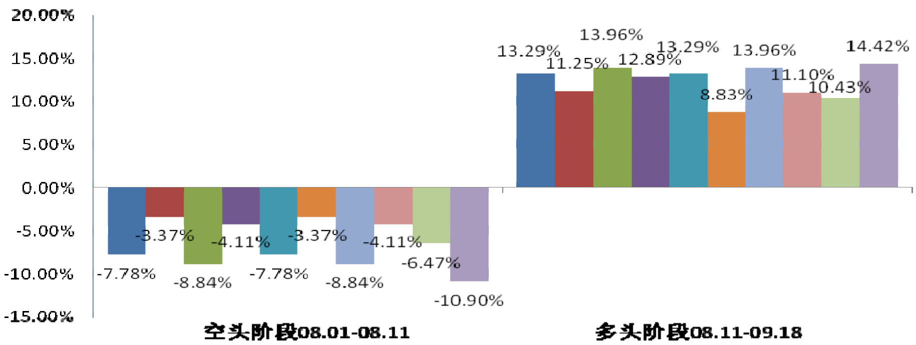
图 2. 无保费流入情况下各情况收益率

（1）空头阶段 CM 策略优于 CPPI 策略和 TIPP 策略。理论上空头阶段 TIPP 策略的损失

应小于 CPPI 策略。但从图 2 中可以看出，在空头阶段，二者有着同样的投资绩效，这是因为空头阶段是本文研究的第一阶段。在空头阶段且无保费流入的情况下，投资收益率始终为负，即无风险资产和风险资产的总和一直处于下降阶段。因此对于 TIPP 来说，其最低要保额始终不变，导致该情形下 TIPP 策略与 CPPI 策略完全一样，投资收益率相同。空头阶段 CM 策略显示出正值，反映出该策略对资产的保障较好，由于该阶段偶有风险资产价值上升的情况，CPPI 和 TIPP 价值底线的设定导致其不能迅速积极地应对该市场的变化，而 CM 策略的风险资产比例始终高于前者，使资产价格下跌的损失由无风险资产收益和风险资产价值上升时产生的收益所抵消。因此 CM 策略在空头阶段的损失要远远小于 CPPI 策略和 TIPP 策略。

（2）多头阶段 CPPI 策略优于 TIPP 策略和 CM 策略。在（2，0.95）和（3，0.95）这两种同样的参数情况下，CPPI 策略的收益要高于 TIPP 策略下的收益，这与理论相符。理论上，TIPP 策略的价值底线随总资产的增加而改变，且处于上升状态，因此在同样的参数条件下，TIPP 策略投资于风险资产的比例小于 CPPI 策略，不能积极参与到上升的权益类市场中，造成 TIPP 的投资绩效效低。但从图 2 中可以看出，在（2，0.9）和（3，0.9）这两种同样的参数情况下，CPPI 策略和 TIPP 策略的绩效再一次相同，这实际上与我们设定的投资风险资产的最高比例有关。如果没有限制，得出的结论应该与（2，0.95）和（3，0.95）这两种情况下的结论相同，但是在快速上涨的股市下，无论是 CIPP 策略还是 TIPP 策略，都已触发了公司内部的权益的比例不超过总资产的 20%这一限制，故而限制了 CPPI 在上升的权益类市场中的参与度，反而导致该情形下 TIPP 策略与 CPPI 策略在权益类市场中的投资完全一样，进一步导致二者投资收益率相同。同时空头阶段 CM 策略的投资收益率始终低于 CPPI 策略和 TIPP 策略，这也体现出风险和收益的对称关系，CM 策略在空头阶段的损失小，在多头阶段的收益也较低。

### 2）有保费流入下市场各阶段的策略选择




注：从左至右依次为 CP（2，0.9）、CP（2，0.95）、CP（3，0.9）、CP（3，0.95）；TI（2，0.9）、TI（2，0.95）、TI（3，0.9）、TI（3，0.95）；CM（10/90）和 CM（15/85）策略下的投资绩效。

图 3. 有保费流入情况下各情况收益率

（1）空头阶段 CPPI 策略和 TIPP 策略的收益率相同。从图 3 中可以看出，在空头阶段，CPPI 策略和 TIPP 策略二者具有相同的收益率。而 CM 策略在有保费流入的情况下的损失并不比 CPPI 策略和 TIPP 策略小，甚至在 CM（15/85）的情况下要高于其他两种策略。这是因为空头阶段的测定是研究的第一阶段，CPPI 策略和 TIPP 策略的价值底线起到了很好的缓冲作用，二者均为高买低卖型策略，而 CM 策略却是低买高卖型策略，这使得该阶段二者在权益类市场的投资一直低于 CM 策略在权益类市场的投资，所以权益市场的下降趋势使得 CPPI 策略和 TIPP 策略的损失较小。随着保费的流入，资产价值渐渐增加，这一差距便随之凸显出来，也就是 CM 策略中投资于权益类市场的资产越来越大于 CPPI 策略和 TIPP 策略中投资于权益类市场的资产，因此表现出 CM 策略在无保费流入和有保费流入下投资绩效的显著差异。

（2）多头阶段 CPPI 策略优于 TIPP 策略和 CM 策略。在（2，0.95）和（3，0.95）这两种同样的参数情况下，CPPI 策略的收益要高

于 TIPP 策略，而在（2，0.9）和（3，0.9）这两种同样的参数情况下，CPPI 策略和 TIPP 策略的绩效仍然相同。其原因和无保费流入的情况相同，一是因为空头阶段处于研究的第一阶段导致该阶段 TIPP 策略的最低要保额始终不变；二是因为在快速上升的股市下，无论是 CIPP 策略还是 TIPP 策略，都已触发了公司内部的权益比例限制，导致二者风险资产投资比例相同。

## C. 空头阶段的重新验证

由于本研究开始于空头阶段，CPPI 策略和 TIPP 策略的收益率表现大体形同，无法比较二者的区别。所以选取震荡阶段中的一段下降部分对空头阶段进行重新验证。具体选取从 2010 年 4 月 6 日到 2010 年 7 月 5 日的数据，并把这一阶段称为第二空头阶段。各情境下的投资收益率如表 6-8 和图 4 所示：

表 6 第二空头阶段 CPPI 方法下不同参数的收益比较

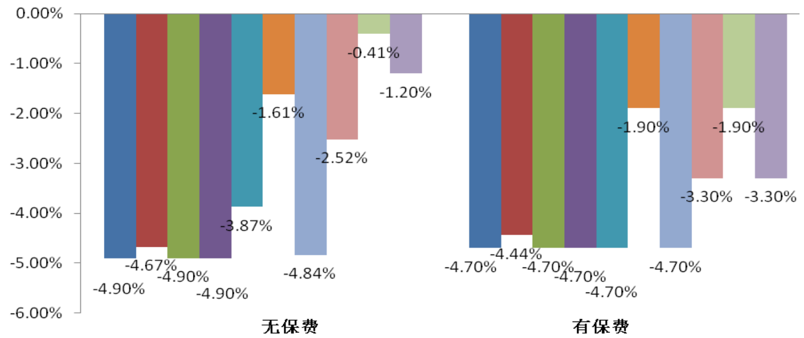
| 收益率 | 2，0.9 | 2，0.95 | 3，0.9 | 3，0.95 |
|---|---|---|---|---|
| 无保费 | -4.90% | -4.67% | -4.90% | -4.90% |
| 有保费 | -4.70% | -4.44% | -4.70% | -4.70% |

表 7 第二空头阶段 TIPP 方法下不同参数的收益比较

| 收益率 | 2，0.9 | 2，0.95 | 3，0.9 | 3，0.95 |
|---|---|---|---|---|
| 无保费 | **-3.87%** | **-1.61%** | **-4.84%** | **-2.52%** |
| 有保费 | **-4.70%** | **-1.90%** | **-4.70%** | **-3.30%** |

表 8 第二空头阶段 CM 方法下不同参数的收益比较

| 收益率 | 10/90 | 15/85 |
|---|---|---|
| 无保费 | -0.41% | -1.20% |
| 有保费 | -1.90% | -3.30% |




**注：从左至右依次为 CP（2，0.9）、CP（2，0.95）、CP（3，0.9）、CP（3，0.95）；TI（2，0.9）、TI（2，0.95）、TI（3，0.9）、TI（3，0.95）；CM（10/90）和 CM（15/85）策略下的投资绩效。**

**图 4 第二空头阶段各情况收益率**

研究表明，无保费流入的情况下，TIPP 策略优于相同参数下 CPPI 策略，而且 CM 策略的投资绩效损失始终最小；有保费流入的情况下，除了由于公司内部的权益比例限制使得 CIPP 策略和 TIPP 策略收益率相同之外，其他两种情况下 TIPP 策略的投资绩效仍然优于 CIPP 策略，尤其是在（2，0.9）这一参数情况下，很好地体现了 TIPP 策略在空头阶段对资产的保护。这与理论预期相一致，在经过一段时间权益市场的上升和下降之后，TIPP 策略确实是比 CPPI 策略更为保守的一种投资组合保险策略，而且二者均可以将最初的财富保护在预先指定的水平上。

有保费流入的情况下，CM 策略始终优于 CPPI 策略，尽管在价值底线较低时 TIPP 策略和 CM 策略起到了同样的保护效果，但仍可以认为空头阶段无论是否有保费流入，CM 策略基本比其他两种策略起到了更好的保护资产效果。

# V 结论与政策建议

从整体上看，固定比例投资组合保险策略（CPPI）、时间不变性投资组合保险策略（TIPP）、固定组合策略（CM）都能起到组合保险的作用，可以将财富保护在一定预先指定的保护水平上，具有较好的锁定风险和向上获利能力，适用于我国寿险公司投资。三种策略并无绝对优势，符合风险与预期收益相匹配的规律，为获取适当的收益和保障，寿险公司

可根据自身公司的风险承受能力和风险偏好选取适当的价值底线和风险乘数，而且一般来说，无论是 CPPI 还是 TIPP 方法，价值底线对收益率的影响要高于风险乘数，因此对价值底线的设定要比对风险乘数的设定更为重要

从不同市场行情来看，在空头阶段，若保费收入较少，建议采用 CM 方法，这样可将投资损失降低至最小；而在保费增长速度较快时，除了 CM 方法外，还可以采用价值底线较高的 TIPP 方法。在多头阶段，不管寿险公司的保费如何，都建议选择 CPPI 策略，因为 CPPI 策略比 TIPP 策略能更好的能分享股市上涨的收益，其中当价值底线较低时，TIPP 策略和 CPPI 策略已近乎相似，对二者的选择相对来说不是特别重要，而寿险公司的权益类投资限制政策更为重要，应着重研究权益类投资按市值计价的可投资上限， 。在震荡时期，无法得出最优的投资组合保险策略，因为这与震荡时期长短及最初时点和最后时点选取有关。但震荡时期的收益率普遍为正，而从长期来看股票市场是一个盘旋向上的过程，所以可以看作长期多头的市场。鉴于寿险公司股票投资的长期性特征，在无法判断是处于多头还是空头阶段时，可以采用 CPPI 策略。

## References

[1] Black, F., Scholes, M. The pricing of options and corporate liabilities. The Journal of Political Economy，1973，81，637~654.
[2] Leland, H.，Rubinstein. The Evolution of Potfolio Insurance . In: D.L. Luskin ed．Portfolio Insurance: A guide to Dynamic Hedging．New York：Wiley，1976
[3] Rubinstein, M., Leland, H.E.. Replicating options with positions in stock and cash . Financial Analysts Journal，1981，37，63~72.

# 投资组合保险策略应用于寿险投资的实证分析

郑庆寰，李姊优
商学院，华东理工大学，上海，中国，200237

**摘　要：**投资组合保险是一种能在特定时间内，既保证达到最低收益水平，但也能使标的组合获得潜在盈利的保护性投资策略。由于寿险资金具有长期负债性和定期返还性的特点，寿险资金在保证投资安全性的前提下要实现既定收益，所以特别适合采用投资组合保险策略。本文利用中国股票市场沪深 300 指数的历史数据，根据保险公司的假设场景，分析了投资组合保险中 CPPI 策略、TIPP 策略和固定投资组合策略对寿险公司投资绩效的影响。分析表明：在空头阶段，若保费收入较少，可采用固定投资组合策略，而在保费增长较快时，还可以采用价值底线较高的 TIPP 方法；多头阶段，不管寿险公司的保费如何，都建议选择 CPPI 策略；在无法判断是处于多头还是空头阶段时，建议采用 CPPI 策略。
**关键词：**投资组合保险策略；寿险投资；固定比例投资组合保险策略（CPPI）；时间不变性投资组合保险策略（TIPP）

# Control of Moral Hazard in Long-Term Care Insurance

ZHOU Haizhen, ZHAN Junfeng

School of Finance; Zhejiang University Of Finance & Economics , Hangzhou, China, 310018

**Abstract:** Long-term care insurance is an insurance for the possibility of demand for long term care. As the development of aging society in China, long-term care insurance, especially for elderly, will become more and more popular. Moral hazard is the main risk that insurance companies face in the market. In long term care insurance market, excessive consumption of nursing resources due to asymmetry of information is the main moral hazard. In the methods of controlling moral hazard, coinsurance rate is an effective way to reduce moral hazard. In this paper, we set a model which including insurer, insured and nursing home to analyses the way to make a appropriate coinsurance percentage.

**Keywords:** long-term care insurance; moral hazard; coinsurance rate.

## Ⅰ.引言

长期护理保险是适用于因为年老或者疾病、意外事故等导致失去部分或全部生活自理能力，需要在家中或者入住护理机构接受长期护理的被保险人的一种健康保险。

道德风险是保险市场中的主要风险之一，对于如何控制道德风险中外学者有比较深入的研究。道德风险分为事前道德风险和事后道德风险。事前道德风险指由于保险的保护而改变了个体预防事故发生的动机，Steven Shavell（1979）通过模型分析了保险人能够和不能观察到被保险人的行为时道德风险的不同[1]，Kangoh Lee（1992）认为由公共部门来提供一些防损的产品可以为保险公司观察被保险人的防损措施提供有利的信息从而帮助保险公司确定合理的保费和保险金额[2]。而在长期护理保险市场及普通医疗保险市场中存在最多的则是事后道德风险，即由于保险的存在而造成的被保险人对医疗资源的过度消费。同时因为在健康保险市场上还存在第三方利益主体——医疗机构或护理机构，使得道德风险更加严重，因此也是各国学者研究的热点方向。如Aviva Aron-Dine（2012）, Liran Einav（2012）等研究了被保险人在购买医疗保险时对医疗价格的理性预期的重要性，认为被保险人在购买医疗保险时并不是短视的，他们会根据未来医疗服务的价格来决定现在所要求的医疗服务的数量[3]，Liran Einav, Amy Finkelstein（2012）等通过实证分析，阐明了人们会根据自己对未来的预期（如医疗服务的价格）来选择保险而产生道德风险[4];David C. Grabowski 和 Jonathan Gruber（2007）对美国家庭护理费用的大幅上升进行了分析，认为支出的大幅上涨与美国的公共医疗体系政策对家庭护理的关注无关[5]。

针对保险人所面临的道德风险，很多学者从保单条款设计等方面提出了控制措施，如Ching-To Albert Ma 和 Thomas G McGuire（1997）通过建立模型引入保险人、被保险人、医疗机构三方，证明了医疗机构可以通过设定一个恰当的共保率来使被保险人和医疗机构在服务数量和质量上达到均衡[6]；Ralph Winter（2001）在“Optimal Insurance Under Moral Hazard”一文中论证了通过免赔额来促进人们进行事前防预以减少道德风险的可行性[7]。国内学者对医疗保险中的道德风险的控制也有较多的研究，如史文璧和黄丞（2005）认为保险机构对于道德风险的控制应该分别针对被保险人和医疗机构展开，重点应该控制医疗机构的诱导需求[8]；国锋（2010）在《医疗保险中的道德风险》一书中对医疗保险中道德风险产生的原因、造成的危害及降低道德风险的方法进行了详细的阐述[9]。可见，目前对于道德风险尤其是医疗保险中道德风险的控制问题的研究已经较为成熟。但是对于专门对长期护理保险的道德风险进行讨论的文章却很少，Yasuyuki Kusuda（2011）结合日本的长期护理保险，论证了通过第三方的护理计划制定者（Care Manager）来控制被保险人对护理资源的过度消费的可行性,并针对这种模型可能产生的道德风险进行了分析[10]。但是总的来说，

在研究道德风险时并没有将长期护理保险的道德风险与普通医疗保险区分开，对长期护理保险的道德风险还缺少系统的研究。而国内由于长期护理保险并未开展起来，所以鲜有人对长期护理保险的道德风险进行分析研究。本文拟通过建立模型分析共保率与被保险人要求的护理服务量之间的关系来探讨用制定共保率的方法来控制道德风险的可行性，并对其他控制长期护理保险中道德风险的方法进行初步探讨。

本文后续结构安排如下，第二部分介绍了长期护理保险中道德风险产生的原因及控制方法的简介，第三部分对采用共保率进行道德风险的控制进行具体分析，并对采用保险机构和护理机构联合控制道德风险的可能性进行讨论，第四部分对研究结果及研究中的不足进行总结，并对后续的研究进行展望。

# II. 长期护理保险中的道德风险

道德风险分为事前道德风险和事后道德风险，在这里我们主要研究的是长期护理保险中的事后道德风险。长期护理保险中的道德风险与医疗保险中的道德风险相似，都是指由于保险的存在而导致的患者对医疗服务的过度消费，保险公司的损失即为被保险人过度消费的那部分医疗服务。产生过度消费的原因有两方面，一是由于被保险人不需要或只需要承担很少一部分的医疗服务的边际成本而使其有过度消费的动机，另一方面是由于医疗机构出于自身利益最大化的考虑与被保险人合谋或者引诱被保险人增加医疗成本。在普通的医疗保险中，医疗机构对患者的诱导需求非常严重，是国内医疗保险产生道德风险的主要原因。而在长期护理保险中，护理服务的提供是以患者的健康状态为基础来进行分级提供的，每一级的护理时间及服务内容等各不相同，在决定需要哪级护理服务时患者往往有更大的主动权。患者可以根据自己的身体状态要求相当的或者是超过其需求的护理服务，当其要求的护理等级超过及实际需要的护理等级时便产生了道德风险，因此在长期护理保险中道德风险的产生主要是由于被保险人的过度消费产生的。

道德风险的存在会带给保险公司带来福利上的损失，包括因为保险的存在而造成的购买服务的价格上升，购买服务的数量过度，购买服务的质量超过正常需要的水平等，这些损失都要由保险公司来承担，因此，在长期护理保险市场上，如何采取相应的措施控制事后道德风险，对于保险公司来说意义重大。

# III.长期护理保险中的道德风险控制措施

在道德风险的控制方面，普遍采用的方法有免赔额、共保率和最高限额等方法。在一些发达国家，如日本，长期护理保险属于社会保险，其支付手段采用实物支付的方式，即直接提供护理服务，这种方法可以有效的防止对护理服务的过度消费。但在我国由于相关产业及政策不完善，采取实物给付的方法并不可行。通过免赔额的方法来控制道德风险在车险当中应用较多，医疗保险中也有应用，其可以提高人们的风险防范意识，也可以使保险公司免于应付一些琐碎的小额赔款。但在长期护理保险中单纯应用免赔额的方法来进行道德风险的防范却并不可行，一是在规定免赔范围方面存在技术问题，二是在免赔额之上的部分若全由保险公司来承担则无法降低道德风险。因此比较可行的方法主要还是通过规定共保率来进行，而免赔额和最高限额的方法可以当作辅助手段来使用。通过规定共保率来使被保险人承担一部分护理成本，可以有限降低被保险人对护理服务的过度消费。

共保率指的是被保险人所要承担的医疗或护理服务费用的比例，即被保险人消费医疗服务的成本。共保率越高意味着对被保险人来说医疗或护理服务价格越高。共保率过高会限制被保险人对合理医疗或服务量的要求，而共保率过低则不利于控制被保险人的过度消费，制定一个合理的共保率对于保险人和被保险人都有重要意义。因此，我们希望能确定一个较合理的共保率范围。

## A. 最优共保率范围的分析

在对最优共保率的分析中，我们引入三个利益主体，即保险公司，被保险人和护理机构。我们的整个过程分为 5 个步骤。步骤 1，保险公司制定一份共保率为 $\beta$ 的保单；步骤 2，被

保险人根据自身的喜好决定是否购买这份保单；步骤 3，被保险人以 P 的概率发生风险事故，即发生需要长期护理的情况；步骤 4，被保险人根据自身的效用函数和共保率 $\beta$ 选择护理服务的级别和数量；步骤 5，被保险人到

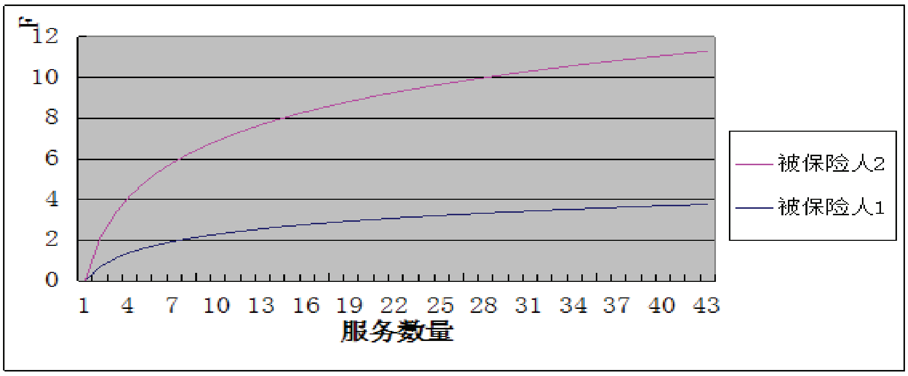



**图 1 被保险人的收益函数**

保险公司进行报销，保险公司按合同约定进行赔付。

在整个过程中，三个利益主体的效用函数可以如下表述：

被保险人的效用函数可以写成

$$EU = pU(\omega - \alpha - \beta(c+\delta)\tau - s + F(\tau)) + (1-p)U(\omega - \alpha)$$

（1）

其中 $U(\square)$ 为被保险人的效用函数，$U'(\square) > 0$ ，$p$ 被保险人为发生长期护理风险的概率，$\omega$ 为被保险人的初始财富，$\alpha$ 为缴纳的保费，$\beta$ 为保单规定的共保率，$c$ 是护理服务的成本，$\delta$ 是护理机构的利润，$\tau$ 为被保险人所得到的护理服务的数量，$s$ 为失能为被保险人带来的财富损失，$F(\tau)$ 是被保险人得到的护理服务折算成的收益，我们假设它是一个边际收益率递减的函数。

护理机构的收益可以写成

$$V = p\delta\tau \qquad (2)$$

其中 $\delta$ 为每单位服务中护理机构所得到的利润，在这里 V 是一个单调递增的函数，即护理机构从自身利益最大化的角度出发，认为被保险人购买越多的服务对自己越有利。护理机构虽然能够掌握被保险人的真实身体状况，但由于其不需要承担护理的成本，也不会因为监督被保险人适当消费而从保险机构处得到补偿，因此其不会对被保险人对护理服务的消费产生监督约束的作用，而是会诱导其过度消费。结合前面的论述，被保险人在护理服务数量方面有较大的主动权。

我们假设保险市场是完全竞争的，即利润为 0，则：$\alpha = p(\delta + c - \beta)\tau$ （3）

综合上述分析，在我们的模型中护理机构追求自身利益最大化，被保险人要求越多的护理服务对其越有利，对被保险人的约束作用很小，所以我们主要从保险人和被保险人两方面进行来找出确定共保率的方法。

当被保险人以概率 P 发生了保险事故时，其效用函数为

$$U = U(\omega - \alpha - \beta(c+\delta)\tau - s + F(\tau))$$

（4）

被保险人为了满足自身效用最大化，其选择的护理服务的数量应满足以下条件

$$U'(\square)(-\beta(c+\delta) + F'(\tau)) = 0$$

（5）

即式子（4）关于 $\tau$ 的一阶导数为 0，在这里 $\omega$ 、$\alpha$ 、$s$ 为常数。

式（5）等同于下式

$$\beta = \frac{F'(\tau)}{c+\delta} \tag{6}$$

为了便于比较共保率对不同被保险人的影响，我们假设市场上存在有两个类型的被保险人，他们产生道德风险的可能性不同。其中一个产生道德风险的可能性较小，相应的收益函数为 $F_1(\tau)$；另一个产生道德风险的可能性则相对较大，其相应的收益函数形式为 $F_2(\tau)$，并且假设收益函数有如下形式：

$$F_1(\tau) = \ln(\tau)$$

$$F_2(\tau) = 2\ln(\tau)$$

则被保险人 1 和 2 的收益函数如图 1 所示。

在图 1 中，横轴代表护理服务的数量，纵轴代表服务给被保险人带来的财富价值，被保险人 2 的斜率大于被保险人 1，其服务数量的边际价值比被保险人 1 的大，2 和 1 比起来产生道德风险的可能性更大。

被保险人要求的护理服务的数量和保险合同的共保率之间的关系可通过式（6）求出。选定一个共保率即可由式（6）求出被保险人要求的相应的护理服务数量。如图 2 所示。

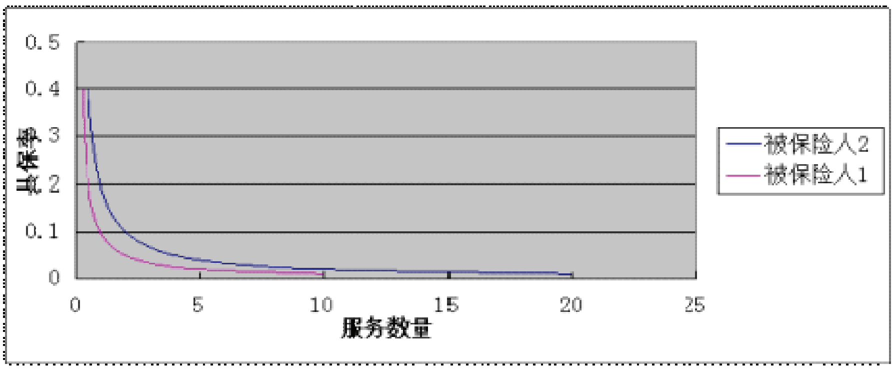



**图 2 共保率与服务数量关系趋势图**

由图 2 可以看出，无论是哪种被保险人，共保率和其所要求的护理服务数量之间关系的趋势是相同的。当共保率很小时，要求的护理服务数量会很大，这时对抑制道德风险的作用不大，而当共保率很大时，要求的护理服务数量则会变得很小，又会限制被保险人对正常服务的要求。因此我们希望能找到一个比较合理的共保率区域，既能有效控制保险公司所面临的道德风险，又能让被保险人得到基本的保险保障。如图 2 所示，在共保率为 5%－20% 之间服务数量的变化相对较平缓，可以认为当共保率在这个区域之内时，能比较有效地控制被保险人对过多护理数量的要求，即保险人不会面临过大的道德风险，对被保险人的基本护理需求又有较强的保证能力。在图 2 中，不论是产生道德风险概率较大的个体（被保险人 2）或者产生道德风险概率相对较小的个体（被保险人 1），其共保率与服务数量的相对趋势是相同的，即其对护理需要相对稳定的共保率的范围是相同的。在这里的论述中我们给予了效用函数 F 多种具体的形式，所得到的最优共保率的范围也大体是一致的，即对于不同的对象其共保率可以设定为一样，保险公司不必根据被保险人的个人特点设定不同的共保率。

由上面的分析可知，通过共保率来控制长期护理保险中的道德风险是可行的，存在一个共保率的最优范围，在这个范围里既能有效的控制被保险人所需要的护理服务的总量，又对被保险人的基本需求有较强的保证能力。

## B.其他控制道德风险的方法讨论

在长期护理保险市场中，护理机构从自身利益最大化的角度出发，有可能诱导被保险人过度消费而产生道德风险。对于这种原因导致的道德风险，理论上可以通过将保险公司和护理服务机构结成共同利益体来控制。但我国目前要由保险公司直接建立自己的护理机构，还

面临着一些如政策上的障碍，因此当前通常的做法是当被保险人发生长期护理需要时，由保险公司指定的鉴定机构对被保险人需要的护理水平做出鉴定，然后由保险公司指定的护理服务机构或者由被保险人按照保险公司指定的护理水平自行寻找护理服务机构来提供护理服务。为了更好地控制道德风险，因此，保险公司可以采取一些相应的预防手段，例如设定服务总量的约束线，在合约中设定一些对护理机构的监督及奖罚条款等。如果能够由中立的权威部门来设定一个护理等级评估机构，由其对被保险人的护理等级进行鉴定，然后由护理机构根据该评估机构的鉴定结果来提供护理服务，最后由保险公司对被保险人进行赔偿，亦可以有效的控制由护理机构带来的道德风险。

## IV. 结论与展望

长期护理保险在我国的发展势在必行，而基于社会的现实条件只能先发展以商业保险为主的长期护理险，为了使长期护理保险能满足消费者的实际需求，将长期护理险向实报实销的方向推动是十分必要的。在本文中，我们讨论了在实报实销模式下利用共保率来控制道德风险的可行性，得出存在一个共保率的最优范围，可以将道德风险控制在保险人和被保险人都可以接受的范围内。但在我们的分析中也存在一个很大的缺陷，我们对被保险人的效用函数给出了具体的形式，这些具体的形式是不是具有普遍代表性还有待研究。对于产生道德风险概率不同的人群，其最优共保率范围是否相同，我们只是从几个特定函数中统计出了一个范围，是否具有普遍性也有待研究。

将保险机构与护理机构结为利益共同体或通过独立的第三方作为被保险人护理等级的鉴定机构来控制道德风险也是可行的，其中的具体问题，像如何控制护理机构对被保险人的诱导消费或者第三方评级机构的具体建立和运作的可行性和实施方法等，还可以做更进一步的探讨。

## References

[1]Steven Shavell; "On moral hazard and insurance"; The Quarterly Journal of Economics, November 1979;

[2]Kangoh Lee; "Moral hazard, Insurance and Public Loss Prevention"; The Journal of Risk and Insurance,1992;

[3]Aviva Aron-Dine, Liran Einav, Amy Finkelstein and Mark Cullen; "Moral hazard in health insurance: How important is forward looking behavior?"; January 2012;

[4]Liran Einav, Amy Finkelstein, Stephen Ryan; "Selection on moral hazard in health insurance"; March 2012;

[5]David C.Grabowski, Jonathan Gruber; "Moral hazard in nursing home use"; Journal of Health Economics 2007;

[6] Albert Ma & McGuire. "Optimal Health Insurance and Provider Payment", The American Economic Review; Sep 1997;87,4;

[7]Ralph A.Winter; "Optimal insurance under Moral Hazard"; University of Toronto;

[8]Shi Wenbi, Huang Cheng; "Moral hazard and control of risks in medical insurance"; Inquiry into Economic Issues, 2005;

史黄璧，黄丞“道德风险与医疗保险风险控制”，经济问题探索，2005 年第 2 期；

[9]Guo Feng; "Moral hazard in medical insurance", Shanghai Academy of Social Sciences Press, 2010;

国锋，“医疗保险中的道德风险”，上海社会科学院出版社，2010；

[10]Yasuyuki Kusuda."Care Manger and Moral Hazard In Long-Term Care Insurance System". Okuda, Mihama-cho, Chita, Aichi 470-3295, Japan; June 2011;

[11]Frank A.Sloan, Edward C. Norton; "Adverse Selection, Bequests, Crowding Out, and Private Demand for Insurance: Evidence from the Long-term Care Insurance Market";Journal of Risk and Uncertainty, 15:201-219 (1997);

[12]Christophe Courbage; "Long-Term Care Insurance and Basis Risk"; The Geneva Association,53 Route de Malagnou, 1208 Geneva, Switzerlan
[13]Jaap H. Abbring &Pierre-Andre Chiappori; "Adverse Selection And Moral Hazard In insurance: Can Dynamic Data Help To Distinguish?"; Journal of European Economic Association; April-May 2003;
[14]Jeffrey R.Brown & Amy Finkelstein; "The private market for long-term care insurance in the United States: A review of the evidence"; The Journal of Risk and insurance,2009, Vol. 76, No. 1, 5-29
[15] Heinz Rothgang; "Social Insurance for Long-term Care: An Evaluation of the German Model";Social Policy & Administration ISSN 0144-5596; Vol 44,No,4, August 2010, pp, 436-460;
[16]Henri de Castries; "Ageing and Long-Term Care: Key Challenges in Long-Term Care Coverage for Public and Private Systems" The Geneva Papers, 2009,34,(24-34);
[17]Jing Tao ;"Long_Term Care Insurance– A very competitive insurance in the future of China"; University of International Business and Economics Press; 2006;
荆涛；“长期护理保险－中国未来极富竞争力的险种”；对外经济贸易大学出版社；2006年；
[18]Jing Tao, Wang Jing-tao & Li Sha; "Empirical Analysis on Influencing Factors of Demand for Long-term Care Insurance"; School of Insurance, University of International Business and Economics, 2011；
荆涛，王靖韬，李莎；“影响我国长期护理保险需求的实证分析”；对外经济贸易大学保险学院，北京工商大学学报（社会科学版），Vol 26 No. 6 Nov 2011。

# 长期护理保险中道德风险的控制

周海珍，战峻峰
浙江财经学院金融学院，杭州，中国，310018

**摘要：**长期护理保险是被保险人为了应对未来可能需要长期护理的风险而购买的保险。随着我国人口老龄化的不断加剧，长期护理保险尤其是老年长期护理保险有着越来越广阔的市场前景。道德风险是保险公司在销售长期护理保险中所面临的主要风险。在长期护理保险中，由于信息不对称所引发的被保险人对护理资源的过度消费是引起道德风险的主要原因之一。在控制道德风险的方法中，设定共保率是降低道德风险的有效方法。本文引入保险人、被保险人和护理机构三个利益相关主体，通过模型分析来对设定共保率的策略进行探讨，对最优共保率的制定提出合理化的建议。

**关键词：**长期护理保险；道德风险；共保率

# Migrant Workers Social Endowment Insurance Fund Raise the Establishment of New Channels

ZHANG Liying, LI Cuixia

School of Economics and Management, Northeast Agricultural University ,

Heilongjiang, China, 150030

**Abstract**: Migrant workers is our social and economic construction of major powers, but the group has been a social endowment insurance system on the edge of the state, not only violated the peasant-workers basic rights and interests, but also to maintain the stability of the countryside. Because farmers and citizens migrant workers have double identity, so the government for migrant workers endowment insurance field bears special responsibility and duty. The existing rural migrant workers of social insurance fund financing channels, mainly with the employing unit and leads to their burden is given priority to, already can not adapt to the new situation of the need, the government should actively explore new channels to raise funds and solve the trouble back at home of migrant workers.

**Keywords**: Migrant workers; Social endowment insurance; Financing channel

**Introduction:**

For the establishment of new rural social pension insurance system, the party and the government since 2009to carry out the new rural social pension insurance. Premier Wen Jiabao in 2010 government work report pointed out:" accelerate the improvement of the social security system covering both urban and rural residents. Solid advance new rural social pension insurance pilot, pilot to expand the scope of the county of 23%." Rural social endowment insurance system is the important part of the social insurance, mainly serving the rural non town staff, through the payment of certain labor income, in the old age cannot be engaged in the production of labor, can obtain the national and social economic assistance in order to maintain the basic living needs of a social insurance system.

## I . China's Migrant Workers Social Endowment Insurance Status

First of all, the low rate of migrant workers insurance. According to the Chinese Ministry of agriculture in 2010 statistical data shows, at present countrywide range of migrant workers in the total amount of up to250000000, of which more than 120000000belongs to the flow state, a total of more than60000000provinces and employment of migrant workers. Although local governments to actively expand the coverage of basic social security system, adhere to the migrant workers in the social security system in the dominant position, but overall, migrant workers insurance rate is low. The migrant workers overall endowment insurance rate is only 16%, which has the migrant workers endowment insurance total population does not exceed 35000000.

Secondly, the increasing rate for migrant workers. According to the State Department of labor and social security of the survey data, the present stage our country rural migrant workers the average refund rate reaches as high as 42%, such as the 2010 Guangzhou city to participate in the basic old-age insurance for enterprise employees in the total number of 1500000, but a year up to 600000people applying for refund, demand surrender people is the basic of migrant workers in cities; in Jiangsu Kun Shan to participate in the social pension insurance of migrant workers of about 600000 people, and the annual demand surrender the number close to 100000. In the choice to surrender insurance decision process, migrant workers groups in the social endowment insurance system in the struggle and the contradictory state of mind.

Finally, migrant workers on the social endowment insurance of the necessity to know inadequacy. In China for thousands of years the farmer has relied on family old-age social function, to a certain extent, affected the process of workers to participate in the social pension to the enthusiasm and initiative, only the government guide correctly and migrant workers voluntary insurance combination, to improve farmers' insurance awareness, gradual advancing rural endowment insurance system reform and complete.

## II . China's Migrant Workers Social Endowment Insurance System Existence Question and Reason Analysis

### A. Endowment insurance system itself in the design defects

The present stage our country countryside society old-age insurance system and the relevant provisions in the insurance responsibility main body, financing and treatment and other aspects of the standard has some deficiencies, and the development of rural economy and the affordability of mismatch, a certain extent affected the migrant workers social endowment insurance system for in-depth implementation.

First of all, the state of agricultural insurance financing of the relevant provisions, take individual contribution, collective allowance and government subsidies combination mode,but in the implementation process, in some places, the one-sided emphasis on" personal pay" link, especially in the development of collective economy is not optimistic about the prospects of the regional, social endowment insurance premiums or even by farmer individual is fully committed, this greatly increases the difficulty of premium.Faced with the dilemma, where individual take compulsory way to the migrant workers financing, cause farmer emotional conflict, bring the factor of social instability.

Secondly, the endowment insurance financing ratio, each district carry out in different ways, the social endowment insurance system is lack of consistency, continuity problems directly hindered the development of social insurance system process. In third, the existing social employment policy and rural social endowment insurance system lack of continuity between, this makes rural migrant workers nationwide labor mobility difficulties. For example, the migrant workers working in the city has been involved in the social endowment insurance, but once back in the countryside, because the country does not establish a nationally unified social insurance system, finally had to be in a certain period of interruption of personal insurance. This not only on their own social endowment insurance brings adverse effect, but also reduces the national social insurance coverage. Social insurance coverage is decided by social security fund collection, adjust the abilities of the decisive factor, finally restricted the improvement of the social security system process. Finally, the current social endowment insurance system for migrant workers groups in terms of some provisions of the standard is difficult to achieve. For example, if the realization of migrant workers pay15 years can according to the relevant provisions of receiving social pension, but the majority of migrant workers groups mainly engaged in labor intensive work, especially focus on the physical work field, the actual payment period of over 15 years is difficult.

### B. Local regulations lack of consistency, to favourable policy guidance

In 2009 the national implementation of the new rural social pension insurance policy, designed to make the Chinese rural farmers enjoy the social benefit of the old-age service, national labor and social security department issued on migrant workers endowment insurance system principles. The central work of the pension insurance system of migrant workers of the total policy on the local social insurance system with the development of supervision and guidance, but local in combination with regional economic development characteristics at the same time, into the local policy tendency, led the national social insurance system shows regional difference. Therefore, at this stage of the social endowment insurance system of the regional policy and process workers inter-provincial flow between the current situation of serious unbalance, migrant workers once the inter-provincial transfer case is difficult to maintain the original established social endowment insurance relation.

According to the State Department of labor and Social Security2010investigation data shows, countrywide each year 25% of migrant workers to change the work location of the provinces. Due to the lack of a unified social endowment insurance to plan as a whole, the local social system of endowment insurance regulations exist difference, migrant workers insured account cannot switch, not with migrant workers moved to the new working Province, led directly to the endowment insurance relationship termination. Therefore inevitable situation is even in the process of migrant workers during working time to pay premiums, later but still unable to enjoy national endowment insurance. Process workers work strong liquidity, by unit assume endowment function probability is very low, so the maintenance and protection of migrant workers in later life the basic rights and interests of social need to solve the problem.

### C. China's household registration system led to the towns of rural social security to uneven distribution of resources

Our country urban and rural segmentation on opposite sides of the household registration system has seriously hindered the development of migrant workers in city. Long term since government by two yuan in urban and rural areas household registration system, always put the city residents as a social resource service center, in the policy orientation of emphasis on the construction of social security system of city residents. In the town the residents of the popularity of social insurance and welfare in the process there are many difficulties under the premise of rural social insurance system, development and perfect process more slowly, causing process workers unable to share and urban residents equal social security, work in the town, rural household registration in the wandering state for the insured to increase heavy instability factors, refused to surrender insurance or in severe cases, damage to the vital interests of migrant workers groups

### D. Characteristics of migrant workers groups increasing difficulty of management

Migrant workers groups and individual differences between large, difficult to carry out unified, targeted management. Migrant workers working cycle is different, some migrant workers choose seasonal processes work, some are agelong and outer work, there are a number of migrant workers in the town of stability and long working life, so the migrant workers individual differences in specific circumstances, it is difficult to follow a unified model to establish social security system for the aged. Coupled with the income of migrant workers at a low level, life constraints, to bear the insurance premium. According to the current social endowment insurance premium payment provisions, migrant workers should be paid more than 100 yuan monthly premium, while most of the migrant workers, to get rid of the basic living expenses, monthly pay almost no earnings, higher social endowment insurance is difficult to achieve, so a surrender phenomenon

### E. The employer reasons

Many employers refuse to handle insurance for migrant workers, migrant workers endowment insurance enterprises take a negative attitude, can hide away. The main reason is that some employers think, for migrant workers to participate in the social pension insurance will increase the burden of enterprises, thus often violate the provisions do not insured. In recent years, integrated / 219migrant workers rates continue to rise, enterprise managers generally believe that, if the migrant workers choose to surrender, can get personal account in 11% as a one-time payment, while the remaining 15% are not returned to the enterprise, but become social pooling fund. Therefore, enterprises simply refuse to migrant workers social endowment insurance relation, this is the low rate of guaranteeing migrant workers as a cause of

## III. Perfecting China's Migrant Workers Social Endowment Insurance System and the Countermeasures

### A . In the present financial system adjustment fund raising way, solve the migrant workers endowment insurance funds

Migrant workers with farmer and citizen identity, therefore the government of migrant workers endowment insurance field has a special responsibility and obligation. The migrant workers social insurance fund financing channels, mainly to the employing units and the migrant workers ' burden, the government should actively explore new financing way, mainly through the following ways

One is the rural land acquisition costs in the part of the funds for the rural pension insurance. According to the rural endowment insurance of China 's actual situation as well as the local government 's actual financial, assure a farmer in off the land, from agricultural production to become migrant workers from the rural land is the basic guarantee of acquiring part migrant workers social insurance funds, it is rural pension insurance fund is the main source of. First of all, the expropriation of agricultural land should be in accordance with the provisions of a certain amount of land compensation and labor placement of gold, and in which a portion of the funds for migrant workers of social insurance fund, and corresponding conversion for personal accounts for a total of. This is not only beneficial to the increase of migrant workers social insurance amount of funds, but also promote the rural agricultural scale of production. Secondly, establish a sound government fiscal transfer payment system, in rural labor input and output effectively fiscal transfer payment, it accounts for the proportion of the total income depends on the input to the ratio of the number of migrant workers labor. This lateral transfer payment funds should be in accordance with the regulations in the reasonable proportion to agricultural labor seat of the rural social insurance funds

**B . Rational extension of rural social insurance premium payment period, adjust the payment rate**

From the migrant workers personal income characteristics, migrant workers, labor income was significantly lower than the urban labor. Labor and social security ministry and combination of national statistic bureau released the 2011 Annual labor and progress of social security career statistical bulletin shows, migrant workers and urban workers' annual salary level difference is bigger, so the migrant workers individual payment rate should be lower than current provisions of the 8% standards for urban workers, adjustment in the4 -5% is appropriate. From the migrant workers employment geographical mobility and income fluctuation characteristics, local government can be set according to the different conditions of payment rate, migrant workers choose according to their actual situation reasonable payment way, higher income migrant workers can be higher than case payment standard, and vice versa can choose a lower payment rate.

**C. Strengthen government inspection supervision, the implementation of preferential tax policies**

Local governments can according to the different characteristics of migrant workers work to determine the corresponding payment rate, in order to avoid the enterprises for the purpose of saving the cost to pay insurance premiums, and fully mobilize enterprise encourage migrant workers to participate in the social pension insurance initiative. In general, migrant workers labor mobility smaller contribution ratio on the high side, fluidity is greater contribution rate is low.

On the other hand, the government should actively implement preferential tax policy and social welfare policy, can also according to pay insurance for migrant workers employing units relief certain period or proportion of tax revenue. The power of the government through mobilization of migrant workers and employers participating in rural social endowment insurance actively, perfect social insurance system for migrant workers incentive mechanism is actually indirect economic support and subsidies. Strengthen government inspection supervision, the implementation of preferential tax policy and other measures not only ensure the government revenue and expenditure rationality, also increase the competition of enterprise vitality and employment potential, to the use of units and migrant workers to enjoy the achievements in social economic development.

**D. The realization of social endowment insurance the inter-provincial transfer, the establishment of a national coordinating mechanism**

The existing old-age insurance fund regional policy has been unable to adapt to the objective requirement of the inter-provincial flow of migrant workers, migrant workers to participate in social endowment insurance actively by many social factors, which is the main reason why migrant workers for the participants can guarantee the late years of life security concerns. The most effective way is to achieve social endowment insurance the inter-provincial transfer, the establishment of a national coordinating mechanism. First, perfecting the unified national social pension insurance mechanism, establishment of migrant workers social endowment insurance accounts, realize the unified management. At the same time to encourage public security registration, financial institutions, tax authorities and other related functions of mechanism to realize information sharing, create social insurance basic information database, timely, accurate processing of social endowment insurance relationship transfer across regions, provinces and continuity. Secondly, further reasonable regulations in social insurance program, perfect service, so that migrant workers insured registration, payment, transfer and continuation of social insurance relations more simple and convenient. Finally, promote flexible and diverse ways of payment. Migrant workers endowment insurance payment in monthly, quarterly, annual payment, such as interrupt enable and then back.

### E． To further advance the rural household registration system and rural land transfer system reform

On the reform of the household registration system, the phasing out of medium and small city rural area registered permanent residence and non rural area registered permanent residence restriction, ensure the farmer to account for the location of the county area reasonable flow feasibility, where migrant workers in the city have a fixed residence, stable work economic source of income, belong to the social insurance category, and then for the set up social endowment insurance accounts, make social endowment insurance relation with regional flow and metastasis. Rural land transfer system reform should be based on the collective ownership of rural land under the premise of migrant workers, allowing transfer of land management right independently, through the line of rent a bale instead, illegal transfer, leasing, auction, land right of person, company or large hosting and other forms, the effective realization of the rural economic development, so that migrant workers through the end of government finance establishing compensation mechanism of social endowment insurance individual account, enhance rural old-age social function, so that migrant workers eventually equal and reasonable treatment of endowment insurance.

**References:**


[1] Cui Xiurong. Constructing "People-Oriented" Migrant Workers Endowment Insurance System [J]. Henan Social Science, 2010, (5).

[2] Qi Xingfa. The Current Peasant Workers Endowment Insurance Policy Evaluation [J]. Shandong Social Science, 2009. (8)

[3] Hou Mingxi. Urban and Rural Migrant Workers under the Background of Endowment Insurance System Consummation [J], Journal of Chongqing Industry and Commerce University, 2011, (4)

[4] Zheng Gongcheng. China's Social Security System Vicissitude and the Evaluation [M]. Beijing: Chinese People's University Press , 2002.

[5] Ii Qiang. Migrant Rural Workers Unemployment and Social Security Problem [J]. New field of vision, 2010 (5) :46-48

**Author Introduction**: Zhang Liying, Female, Harbin in Heilongjiang Province, Northeast Agricultural University, Associate Professor, Doctor, Northeast Agricultural University and Forestry Economy Management Flow Stands Postdoctoral Research Direction: Agricultural Economic Management

Address: Heilongjiang province Harbin city Xiangfang District timber Street No. 59 gardeners new E building 4 unit 401 room

The telephone number: 15945188189

E-mail: 768446985 @qq.com

In this paper, Heilongjiang Province is the philosophy and social science research in planning the annual project of "migrant workers in Heilongjiang Province town dweller mechanism research" (project number: results of a phase 11D099) and post-doctoral fund project "in Heilongjiang Province Based on psychological contract for the new generation of migrant workers citizenization mechanism and management strategies of" stage results (project number: LBH-Z11240).

# The Establishment of Private Pension Plans(PPP) and the Evolution of Financial Structure: From the Perspective of Risk Management

ZHU Yanxia[1], HUANG Bin[2]
[1] School of Economics and Management, China University of Geoscience, Wuhan, China, 430074
[2] Strategy Plannning Division, the People's Insurance Company(Group) of China, Beijing, China, 100084

**Abstract:** In this paper we explore the role of financial factors on the evolvement of pension structure to PPP-based mode. So as to seek the interrelationship between PPP and financial system, we make risk management as a linkage and illustrate our conclusions using data from selected OECD countries. We find that the capacity of risk management of a state's financial system constraints the design or selection of its private pension plans. Furthermore, the evolvement of pension structure to PPP-based rests on the evolutive process of its financial structure. In the following analysis of case, we show the deficiency of financial capability in pension risk management is an important reason explaining for the "renationalization" of Argentina's individual accounts in 2008. Based on the theoretical and empirical analysis, we finally discuss the process of pension reforms in China mainland in the past decade as well as the present situation of China's financial structure.
**Keywords:** pension structure; private pension plans; financial structure; risk management

## Ⅰ. 引言

人口结构的演化对各国公共养老金系统长期的财政生存能力提出了严峻的挑战，特别是对于那些拥有庞大规模的现收现付制（Pay-As-You-Go，PAYG）公共养老金系统的国家，因此为了保证养老金系统的稳定性、充足性、持续性和可负担性，世界各国都在积极改革本国的养老金系统，总体上以缴费确定型（Defined Contribution，DC）的私人养老金计划来补充公共养老金计划收益率的减少或不足，以此来缓解人口老龄化对公共养老金系统的巨大压力。例如，在英国，20 世纪 70 年代强制实施的、与收入相联系的国家补充性养老金计划在 80 年代进行了改革，允许个人退出该计划而选择私人养老金计划；瑞士、澳大利亚分别在 1985 年、1992 年实行了强制积累型的职业养老金计划等。养老金制度的改革导致了养老金结构由公共计划向私人计划的转变，也导致了现收现付制向积累制以及 DB 型（Defined Benefit，收益确定型）向 DC 型的转变。伴随而生的是，养老风险整体上由国家和企业向个人进行转移。

那么如何评价这些结构改革的效果呢？2007 年爆发的国际金融危机可以被看作是对全球养老金结构向私人养老金计划和 DC 型计划改革的一次重要检验。总体上来说，它在很大程度上动摇了人们对积累型的私人养老金系统，特别是 DC 型养老金计划的信心，也向参与者揭示了他们实际上已成为养老风险的主要承担者。危机后的养老金系统正在面临一次新的调整，众多的学者已对新一轮的养老金改革列出了一系列的清单，包括：对私人计划中临近退休者进行风险保护，政策主张为实行基于生命周期的默认投资策略[15]；对个人积累的养老资产的价值保护，即保证机制的设计[1][6][14]；强化退休者的金融知识教育和相关意识[13]；在积累计划中构建风险共享机制[7]；我国的个人账户制转变为名义账户制的再提议[12][24]，等等。

在一国养老金制度改革中，金融要素是重要的影响因素之一。然而，在对一国金融系统与养老金系统的相关性研究上，现有的文献大多探讨的是养老基金的交易行为对金融市场的影响[21][17]，即私人养老金计划发展所导致的养老基金的快速积累对金融市场规模和股价波动性的影响。研究也往往集中在经验研究领域，主要检验了养老基金等机构投资者的交易行为对资本市场的潜在影响以及金融机构之间存在的羊群效应。在国内，郑秉文和孙守纪研究了

强制型企业年金制度[1]下，澳大利亚、冰岛和瑞士三国企业年金资产对金融发展的影响，并对企业年金资产的发展和金融发展之间进行了格兰杰因果关系检验，结果证明企业年金的发展与金融发展关系密切[26]。

为了更好地了解金融要素在一国养老金制度改革中所发挥的作用，本文以风险管理作为养老金结构和金融结构之间内在联系的连结点，研究私人养老金计划发展与金融系统演化之间的规律。余下的内容安排如下：第二部分主要结合风险管理的相关理论，提出养老金结构与金融结构内在联系的理论依据；第三部分则集中对该理论进行实证分析，鉴于 OECD 私人养老资产在世界总体规模中占据的绝对份额（超过 96%[2]），这里将选取 OECD 国家的有关数据，对金融市场发展与私人养老金计划发展的相关性和因果关系进行检验，建立二者固定效应的面板数据模型，并进行压力测试；2008 年阿根廷个人账户计划的“再国家化”是近几年来养老金结构改革中最引人关注的事件之一，这是世界养老金结构向私人养老金计划发展趋势的一次“回潮”，本文第四部分将讨论阿根廷私人养老金计划改革失败的原因，我们认为，金融市场条件的缺失是其中最重要的原因之一；最后是结论，并联系我国的金融结构现状对我国养老金结构改革的进程与得失进行了相关讨论。.

## Ⅱ. 养老金整体结构与金融结构相关性的理论依据

1）不同金融结构中的风险管理需求与方式

金融结构是指金融系统中金融工具和金融机构的形式、性质和相对规模。按照不同组织在资源配置中所发挥作用的不同，一般金融结构可以分为“市场主导型”（market-based）和“银行主导型（bank-based）”等两种类型。金融结构与经济发展一直是金融学研究的重要议题之一，而二者相互联系的纽带就包括风险分配机制[4]。

风险管理是金融中介的重要职能，不同的金融结构下，金融机构管理风险的方式和能力也会不同[5][19]。总体上来说，在金融系统以银行主导型的国家，金融机构主要通过跨期平滑的方式来帮助客户管理风险。金融机构在市场回报率高、收益有剩余时建立短期的资产储备，而当回报率低时动用此储备来弥补收益的不足。在这个过程中，金融机构通过充当“缓冲器”的角色来平滑不同时期的收入，从而保证客户具有稳定的收益，免受风险的冲击，因此投资者自身对风险管理的需求并不强烈。而在市场主导型的国家，由于金融市场中的激烈竞争，传统的跨期平滑的风险管理方式不再可行，金融中介往往通过横截面的风险分散来管理风险，即在某个时点上通过个体间的风险交换，使投资者对任何一种风险都持有较小的比例来实现风险的分散，同时这种风险交换也可以使风险厌恶程度更高的人比风险厌恶程度低的人持有较少的风险头寸。由于横截面上的风险分散不能消除不可分散的风险，因此投资者风险管理的需求更加强烈。此时，风险管理成为金融中介的主要功能，金融机构使用金融衍生工具的探索也被看作是金融机构在资本市场上风险管理功能改进的指标。

2）不同养老金结构下养老风险管理的需求与方式

我们将养老金整体结构界定为公共养老金计划与私人养老金计划在养老金体系中的相对地位，进一步将养老金结构区分为“公共养老金计划主导型”与“私人养老金计划主导型”。

作为“送给第一代人的礼物”，公共的、现收现付制的养老金计划用当期工作者的缴费来支付当期养老者的退休收入，且由于个体间长寿风险的关联性所导致的市场失灵，公共养老金计划能够通过缴费或收益的变化在不同代际间进行财富和风险再分配，或者通过税收融资在所有代际间进行风险分配。因此，一个现收现付制的公共计划能够实现代际间的风险共享，即政府通过充当“缓冲器”的角色来平滑不同时期的养老金缴费和收入，跨期平滑是公共计划管理养老风险的主要方式[20][22][12]。

在主要由公共计划提供养老收入的国家，养老风险的管理方式整体表现为风险的跨期平滑，且家庭的养老风险管理需求也并不强烈。而在私人养老金计划主导型的国家，养

[1] 这里的企业年金并非真正意义上的年金，而是积累型的职业养老金计划，例如澳大利亚的“超级年金计划”。
[2] 2006 年的数值。

老金的收益与缴费具有一对一的关系[3]，退休人员领取的养老金收益主要来源于自身在工作期间的缴费以及积累资产的投资收益，养老资产在资本市场上的投资表现在很大程度上影响退休人员所能领取的养老金大小。因此，代际间的风险共享难以发生，而养老资产在金融市场投资中所进行的风险分散就成为私人养老金计划主要的风险管理方式。这也就意味着，当养老收入主要依赖于私人计划时，横截面个体间的风险共享成为养老风险的主要管理方式，且对于可分散的金融风险和不能分散的长寿风险的管理需求更加强烈。此时，金融中介正是执行这一重要职能的主体。

综上所述，不同金融结构下金融机构管理风险方式的不同对应了不同的养老金结构下养老风险管理方式和需求的差异。鉴于金融机构在私人养老金计划中所发挥的主要作用，我们初步认为金融系统的风险管理方式在某种程度上决定了养老风险的管理方式，或者说，私人养老金计划的发展受一国金融系统风险管理方式和能力的制约，一国养老金结构向私人养老金计划发展的演化取决于该国的金融结构及其演化进程。正如 Merton & Bodie 所说："退休系统的变化很多时候往往被看作是外生的事情，或者被认为是对过去错误政策的纠正。事实上，我们认为这些变化应被系统地看作是机构（金融）改变的动态进程中的一部分，……退休系统的演化和金融系统事实上作为一个整体，能够被看成是创新的螺旋变化。"[18]

## III. 养老金结构与金融结构相关性的实证分析

1）公共养老金计划与私人养老金计划的替代性

在养老收入充足性的界定上，部分学者认为：50％的实际收入替代率水平能够满足退休者基本的需求，而 70％的实际收入替代率则能够保证退休者维持退休前的生活水平[8][10]。但实际上，不同国家正式的养老金系统提供的收入替代率往往具有较大的差异。一般而言，相对于发达国家，新兴国家养老金系统所提供的养老收入水平较低。对于养老金结构的界定取决于公共计划与私人计划在养老金系统中的相对地位。在衡量公共养老金计划地位的指标上，我们选取公共养老金替代率和公共养老金支出作为替代；而在衡量私人养老金计划重要程度的指标上，我们则选取了私人养老基金资产与 GDP 的比重。

表 1 和表 2 显示了经合组织（OECD）28 个国家公共养老金替代率、公共养老金支出和私人养老基金资产的规模及描述性统计。这些国家私人养老金计划和公共养老金计划的相关系数分别为－0.55（以公共养老金替代率衡量公共养老金计划）和－0.52（以公共养老金支出规模衡量公共养老金计划），考虑到不同国家总体替代水平上的差异，我们认为这些数值反映出公共养老金计划与私人养老金计划之间存在明显的替代关系。这一替代关系在高收入国家和低收入国家同样明显，但在低收入国家组中，公共养老支出与私人养老基金资产/GDP 的相关系数较低，这可能来源于低收入国家中公共计划的覆盖率较低等原因。如果仅仅计算英国、美国、荷兰、日本、德国、法国和意大利等工业化七国私人养老金规模和公共养老金计划的相关系数，发现其相关程度为－0.61，这进一步加强了我们的推论。

2）私人养老金计划与金融市场的相关性

比较表 1 中 OECD 国家公共养老金计划、私人养老基金资产规模以及市场资本化程度等指标，我们发现：（1）在金融系统以银行为主导的国家（即市场资本化程度[4]较低的国家），养老金系统主要表现为公共养老金计划主导型，即公共计划提供主要的养老金收入，私人养老资产发展程度较低，如葡萄牙、西班牙、奥地利、意大利、比利时和新西兰等；（2）对于市场资本化程度较高（即金融系统为市场主导型）的国家，包括瑞士、荷兰、澳大利亚、加拿大、爱尔兰、丹麦、冰岛等，私人养老资产规模庞大，公共计划主要提供全民享有的基础养老金。与此同时，为了弥补公共计划提供收入的不足，这类国家与收入相关联的职业养老金计划的参与往往具有强制性或半

[3] 主要指具有缴费和收益一一对应的 DC 型的养老金计划。事实上，养老金结构改革中所建立的新计划大多属于这种类型。

[4] 一般将市场资本化程度作为衡量金融市场发展程度的指标。

强制性，因此强制的职业养老金计划在养老金系统中具有重要的地位，例如冰岛、澳大利亚和瑞士等，它们的强制型私人养老金替代率分别达到 68.3％、25.7％和 22.6％[26]；（3）还有一些市场资本化程度居中的国家，伴随着养老金结构的改革，它们的私人养老金计划正在迅速的发展，例如瑞典和法国等；

表 1 2007 年部分 OECD 国家公共养老金替代率和私人养老资产规模 （单位：％）

| 国家 | 公共养老金总替代率 | 私人养老资产/GDP | 市场资本化程度 | 公共养老金支出/GDP | 国家 | 公共养老金总替代率 | 私人养老资产/GDP | 市场资本化程度 | 公共养老金支出/GDP |
|---|---|---|---|---|---|---|---|---|---|
| 冰岛 | 9.2 | 134 | 198.5 | 1.9 | 匈牙利 | 50.7 | 10.9 | 34.6 | 9.1 |
| 荷兰 | 31.3 | 132.2 | 122.2 | 4.7 | 瑞典 | 37.8 | 8.7 | 132.4 | 7.2 |
| 瑞士 | 35.8 | 119.4 | 293.6 | 6.4 | 西班牙 | 81.2 | 7.5 | 124.8 | 8 |
| 澳大利亚 | 17.4 | 105.4 | 151.5 | 3.3 | 挪威 | 59.3 | 7 | 92.2 | 4.7 |
| 英国 | 30.8 | 86.1 | 137.3 | 5.4 | 奥地利 | 80.1 | 4.7 | 61.4 | 12.3 |
| 美国 | 41.2 | 74.3 | 142.5 | 6 | 捷克 | 49.1 | 4.7 | 42.1 | 7.4 |
| 芬兰 | 63.4 | 71 | 150.1 | 8.3 | 斯洛伐克 | 24.4 | 4.2 | 8.3 | 5.8 |
| 智利 | 3.2 | 64.4 | 129.6 | 5.2 | 德国 | 39.9 | 4.1 | 63.2 | 11.4 |
| 爱尔兰 | 32.5 | 46.6 | 55.6 | 3.6 | 比利时 | 40.4 | 4 | 84.2 | 8.9 |
| 丹麦 | 25 | 32.4 | 89.2 | 5.6 | 意大利 | 67.9 | 3.3 | 50.7 | 14.1 |
| 日本 | 34.4 | 20 | 101.7 | 9.8 | 韩国 | 66.8 | 3.1 | 107.1 | 1.7 |
| 葡萄牙 | 54.1 | 13.7 | 57.1 | 10.8 | 土耳其 | 72.5 | 1.2 | 44.3 | 6.1 |
| 波兰 | 27.1 | 12.2 | 48.7 | 10.6 | 法国 | 51.2 | 1.1 | 107.3 | 12.5 |
| 新西兰 | 39.7 | 11.1 | 34.3 | 4.3 | 希腊 | 95.7 | 0 | 85.2 | 11.9 |

注：公共养老金计划总替代率是 2004 年的值，定义为个人或某个特定人群从公共计划所获取的养老金平均收入占他（们）某个特定时期平均收入（相当于退休前的最后工资水平）的比重；公共养老金支出/GDP 为 2008 年数据。

资料来源： OECD，Pension Market in Focus，2008；WEF，2007 年度报告；OECD，Pensions at a Glance，2011。

表 2 描述性统计 （单位：％）

| | | 均值（私人养老资产/GDP） | 标准误（私人养老资产/GDP） | 公共养老金替代率与养老基金/GDP | 公共养老支出/GDP 与私人养老基金/GDP | 私人养老基金/GDP 与市场资本化 |
|---|---|---|---|---|---|---|
| 总体 | | 35.3 | 44.1 | －0.55 | －0.52 | 0.74 |
| 按收入划分 | 高于 OECD 平均 | 53.2 | 49.8 | －0.55 | －0.69 | 0.71 |
| | 低于 OECD 平均 | 11.4 | 17.3 | －0.69 | －0.21 | 0.47 |
| 按基金规模 | 高值组（10％上） | | | －0.38 | －0.63 | 0.81 |
| | 低值组（10％下） | | | －0.31 | －0.30 | 0.35 |

（4）一些欧盟新成员国，如波兰、斯洛伐克共和国等，养老金系统相对落后，不仅公共养老金计划提供的退休收入较低，且私人养老金计划的发展程度也较低[5]。

进一步按人均收入水平对上述国家进行划分，我们可以看到：高收入国家私人养老基金的资产规模占 GDP 的比重均值为 53.2％，低收入组仅为 11.4％，收入水平越高，私人养老金计划所积累的资产规模越大，相反，收入水平越低，私人养老金计划普遍不发达。这一结论与 Allen 等人对股票市场的分析一样，他们发现股票市场的规模也会随收入的增加而越大[3]。计算样本国家私人养老基金资产与市场资本化程度的相关系数（见表 2），可以发现，对于高收入组，这一系数为 0.71，低收入组则仅为 0.47。

再按养老资产规模的程度将样本国家分为两组（养老资产与 GDP 的比值大于 10％为高

[5] 上述国家中，希腊是一个例外，虽然金融市场发展程度较高，但希腊退休者的养老金收入几乎完全来自公共计划，其替代率接近 100％，养老金结构的不合理以及人口老龄化的双重压力导致金融危机后希腊的养老金体系面临崩溃的边缘. 希腊由养老金危机所导致的债务危机必然要求希腊进行养老金结构的改革，且金融市场的发展也为其私人养老金计划的发展提供了较好的条件。

收入组），我们可以进一步发现，在私人养老金计划发展程度较高的国家，这一系数值达到0.81，而在私人计划发展程度较低的国家，这一系数为 0.35。由此，我们可以进一步推断私人养老金计划发展必然依赖于金融市场所提供的条件。

为了更好地界定金融市场和私人养老金计划相互作用的方向，这里我们选取了 OECD25 个国家[6]2001－2010 年私人养老基金资产相对于 GDP 的比重和市场资本化程度[7]的数据，并按照人均收入水平和私人养老金计划发展程度将上述国家划分为高收入组和低收入组以及私人养老金计划发展成熟组和新兴组，对金融市场发展和私人养老金计划发展进行了格兰杰因果关系检验。可以看到，除了低收入组中金融市场发展不是私人养老金计划的格兰杰原因，在其它组和样本总体上，金融市场发展都是促进私人养老金计划发展的格兰杰原因。

表 3 私人养老金计划发展与金融市场发展的格兰杰因果关系检验

| | 滞后时期 | 结论 |
|---|---|---|
| 总体 | 1，2 | MC 是 PFG 的原因 |
| | | PFG 不是 MC 的原因 |
| 高收入组 | 1，2 | MC 是 PFG 的原因 [1] |
| | | PFG 不是 MC 的原因 |
| 低收入组 | 1 | MC 不是 PFG 的原因 [2] |
| | | PFG 是 MC 的原因 |
| 私人养老金计划成熟组 | 1 | MC 是 PFG 的原因 |
| | | PFG 不是 MC 的原因 |
| 私人养老金计划新兴组 | 1，2 | MC 是 PFG 的原因 |
| | | PFG 不是 MC 的原因 |

注：PFG 指私人养老资产规模/GDP，MC 为市场资本化程度，显著性水平默认为 5%；[1]滞后 2 期时，该结论在 7%的显著性水平下成立；[2]在 10%的显著性水平下该结论成立；在其它的滞后时期 MC 和 PFG 都不是相互的格兰杰原因。

3）计量模型

为了进一步量化金融市场推动私人养老金计划发展的效应，继续利用上述面板数据，并考虑到一国人均收入水平对金融市场和私人养老金计划发展的意义，我们建立以下模型：

$$PFG_{i,t} = \beta_1 * \ln GDPpercapita_{i,t} + \beta_2 * MC_{i,t} + \eta_i + \mu_{i,t}$$

$PFG$ 和 $MC$ 含义如上；$GDPpercapita$ 代表人均 GDP 水平；$\eta_i$ 代表不同国家的其它方面特征，包括人口老龄化程度、职业养老金计划是否强制等。经武－豪斯曼检验发现用固定效应模型解释效果更好，模型回归结果为：

表 4 模型估计结果

| | 共同截距项 | $\beta_1$ | $\beta_2$ | $\overline{R}^2$ |
|---|---|---|---|---|
| 总体 | －208.75（0.00） | 23.46（0.00） | 0.07（0.00） | 0.97 |
| 高收入组 | －334.64（0.00） | 36.31（0.00） | 0.08（0.00） | 0.97 |
| 低收入组 | －93.68（0.00） | 10.47（0.00） | 0.05（0.00） | 0.99 |

注：括号内为 t 统计量对应的概率值。

总体而言，无论从样本总体、高收入组或低收入组，所有的回归系数均在 1%的显著性水平上通过了检验，$\overline{R}^2$ 都接近为 1，模型回归的效果较好。$\beta_2$ 衡量了金融市场发展对私人养老金计划的影响：在样本总体上，市场资本化程度每增加一个百分点，私人养老基金资产与 GDP 的比值就平均增加 0.07 个百分点；在高收入组，金融市场发展对私人养老金计划发展的促进作用更大，分别高出样本总体和低收入组 0.01 和 0.03 个百分点。

4）压力测试——金融危机对养老金结构和金融结构相关性的影响

考虑到 2001 美国发生了金融市场危机以及对世界金融市场的传染机制，且 2004 年所有国家的金融市场重新恢复到 2001 年的水平，这里我们剔除样本国家 2001－2003 年的数据，以更好地分析 2007 年金融危机前后养老金结构和金融结构关系的稳定性。我们将样本国家的考察时间段分为两组，包括危机前（2004－2007 年）和危机后（2009－2010 年），分别对上述模型进行回归，结果如表 5。

表 5 模型估计结果

| | 共同截距项 | $\beta_1$ | $\beta_2$ | $\overline{R}^2$ |
|---|---|---|---|---|
| 危机前（2004－2007） | － 79.91（0.36） | 10.05（0.25） | 0.17（0.00） | 0.99 |
| 危机后（2009－2010） | －147.46（0.57） | 17.04（0.51） | 0.16（0.05） | 0.99 |

注：括号内为 t 统计量对应的概率值。

可以看到，危机前后人均 GDP 的对数对养老资产的影响不再显著，市场资本化程度对养老资产的影响效应增强，超过了总样本影响程度的两倍；但在危机前后，$\beta_2$ 的值并没有多大变化，因此可以认为金融市场对私人养老

6 由于比利时、斯洛伐克、法国养老基金资产数据不全，因此减少了 3 个样本。

7 养老基金资产/GDP 和市场资本化程度的数据均来自于 OECD 统计。

金计划发展的影响是比较稳定，当金融市场遭受大的损失时，私人养老资产也会遭受较大的损失。据 OECD 估计，2007 年的金融危机导致私人养老资产的损失达到 20%[16]。

综合上述分析，我们认为，虽然人口老龄化是推动世界养老金结构转变的直接原因，且在很大程度上与该国的文化传统和历史背景相关，体现了一国公共养老金系统选择的独立性，但从养老金制度改革的动态发展历程来看，养老金改革也反映了一国对养老风险管理方式的不同选择，且这种风险管理方式的选择取决于该国金融市场的发展，以及由金融结构演变所伴随的风险管理功能和能力的变化。

从现实情况来看，当前世界金融系统发展更倾向于市场主导型的金融系统。例如自 20 世纪 80 年代中期以来，法国一直在刻意选择增加金融市场重要性的政策；日本也在实施其金融系统的“大爆炸”改革，以使东京金融市场能够与纽约和伦敦的金融市场相竞争；巴西及其他拉丁美洲国家也在为创造美国类型的金融系统而改革。另一方面，养老金系统的多支柱、私有化发展也成为养老金改革的主旋律，并在 20 世纪 90 年代达到了一个高潮。进一步而言，我们认为金融结构发展的趋势为养老金结构的私有化改革提供了金融条件，一国金融结构的演化以及随之而来的风险管理功能的变化通过改变养老风险管理方式的选择持续推动着该国养老金系统的演化。也就是说，养老金整体安排的差异反映了国与国之间金融结构的差异，一国的金融结构及其演化决定了该国的养老金结构的选择和变化。

## Ⅳ. 案例分析：2008 年阿根廷个人账户的“国有化”再改革

1）“国有化”前阿根廷的养老金体系及结构改革历史

拉美国家是世界养老金制度由现收现付制向积累制、DB 型向 DC 型以及公共养老金计划主导向私人养老金计划主导改革的先锋。自 1981 年智利社保制度完全私有化开始，包括阿根廷、玻利维亚、墨西哥等大约有十几个拉美国家也都相继进行了社保制度的全部或部分私有化。如今很多国家的改革都达到 15－20 年，而阿根廷成为第一个正式宣布社保制度私有化失败的国家。

1994 年阿根廷对其传统的现收现付型社会保障制度进行了私有化改革，建立了一个多支柱的混合养老金系统。第一支柱由基础养老金组成，缴费率 16％，拟实现 28％的替代率。第二支柱包括两个组成部分，包括现收现付制计划和个人账户计划，缴费率为 11％，参与者可以在这两个计划之间进行选择，改革初加入个人账户计划为默认选择，且允许现收现付制计划向个人账户的转换，但不允许后者向前者的转换。个人账户计划完全为 DC 型，由私人的养老基金管理公司（AFJP）管理，退休时领取的收益取决于个人账户的资产的积累水平。

由于阿根廷 20 世纪 90 年代经济的不稳定以及 2001 年爆发的金融危机，养老金体系特别是私人养老金计划遭受了重大损失，2002 年私有化的社保基金投资收益率达到历史最低点，损失超过 45％。基于此，2005 年以来阿根廷政府对养老金制度又进行了多次调整，总体的趋势是不断缩小私人养老金计划的覆盖面以及减少私人养老金计划的规模。具体表现在：允许加入个人计划的成员退回到现收现付制计划；加入现收现付制计划成为默认选择；投资策略上也有较大变动，投资资产主要集中于政府债券等。另一方面也着力于不断扩大现收现付制的覆盖面和作用，提高现收现付制的待遇水平。

2）阿根廷私人养老金计划运营的失败

2008 年 10 月阿根廷总统向国会递交了取消私人养老金制度的法案，将第二支柱的个人账户实行国有化，第二支柱变为完全的现收现付制的、与收入有关的 DB 型制度，这一法案的实施也宣布了阿根廷持续了 14 年的社保制度私有化的失败。

设置强制性个人账户的目的在于保证个人获得充足的退休收入，具体改革成效主要体现在投资收益水平、管理成本和缴费密度等指标上。首先，高的投资收益率是个人账户发展的重要理论依据之一，因此个人账户投资收益率的大小及波动性是评价私有化改革功效的重要指标。阿根廷从 1995 年到 2008 年，养老基金平均投资收益率仅为 0.6%，波动率为 17.68％[8]，收益率低且波动性大。其次，从基金的管

[8] 收益率为几何平均值，算术平均值为 2.4%，波动性的计算基于算术平均值。2008 年的投资收益率采用 2007 年 10 月到 2008 年 10 月的收益率，即－19%。数据来源于郑秉文和房连泉（2009）。

理上看，阿根廷个人账户耗费高额的管理费用，14 年来 AFJP 的手续费大约占实缴股本的 20－30％，手续费占工资的 21.2％，远远高于改革前传统社保体制的运用成本，严重侵蚀了参与者的养老资产。第三，在覆盖率上，由于新增劳动者加入社保制度的意愿普遍下降，阿根廷 2002 年社保制度的覆盖率由 1994 年改革前的 50％下降到 24％。此外，金融危机的导火索使个人账户的问题更加突出。在私有化期间，阿根廷经历了 2001 年和 2007 年两次重大的金融危机，2001 年的危机导致阿根廷养老资产的投资收益率在 2001 年和 2002 年分别下降到－10.36％和－45.23％，2007 年 10 月到 2008 年 10 月间，养老基金的投资净回报率下降到－19％，金融危机造成了养老资产的重大损失。最终私人养老金计划难以为退休者提供充足的养老金收入，直接导致国家为保证最低养老金收入的财政支出不断增加。

3）社保制度“再国有化”的金融解释——金融机构管理养老风险的能力不足

虽然阿根廷的此次社保制度“再国有化”受到养老基金管理公司、国内反对党等的反对、否定和怀疑，却受到了参保人的极大欢迎并顺利通过，毫无疑问，广大民众是此次国有化改革得以成功的社会基础。正如 Barr & Diamond 在讨论养老金制度改革的原则时反复强调的，“公共养老金制度由现收现付制向积累制的转移可能会也可能不会带来福利的改善，当政策的设计超出一个国家的执行能力，那么它就是一个坏的政策设计”[12]。除制度设计和政策执行等方面的原因外，我们认为，阿根廷 1994 年所进行的社保制度的部分私有化改革超出了其金融系统的能力是导致其失败的重要原因之一。

表 6 阿根廷和智利金融结构的比较（1994－2010） 单位：%

| | | 均值 | 中值 | 最大值 | 最小值 | 标准误 |
|---|---|---|---|---|---|---|
| 阿根廷 | 市场资本化程度 | 26.15 | 17.33 | 101.37 | 1.6 | 23.45 |
| | 银行信贷/GDP | 35.51 | 30.81 | 80.06 | 22.48 | 13.56 |
| 智利 | 市场资本化程度 | 91.89 | 87.03 | 167.90 | 27.80 | 33.72 |
| | 银行信贷/GDP | 77.25 | 82.40 | 100.29 | 55.09 | 13.78 |

数据来源：OECD Statistics.

通过比较阿根廷和智利 1994 年到 2010 年间的金融结构（表 6）可以发现，总体上看阿根廷的金融系统的发展要远远落后于智利。具体来看，阿根廷的市场资本化程度不到智利的 1/3，银行信贷相对规模不到智利的 1/2。从结构上看，阿根廷金融市场发展程度较低，且银行在金融系统中的作用也不明显，市场资本化和银行信贷规模/GDP 均值分别为 26％和 35％。

阿根廷和智利私有化改革的金融基础上是不同的。通过对二者的相对规模的比较，我们可以将阿根廷的金融结构界定为银行主导型；智利的金融结构在 1990 年前为银行主导型，且 1991 年以后除了在 2001、2002 和 2008 年金融危机时出现短期的反弹，市场资本化的程度一直高于银行信贷/GDP，因此智利的金融结构可以归纳为市场主导型。阿根廷金融市场的落后直接体现为金融工具的缺乏和股票市场的波动。如前所述，金融机构使用衍生工具的探索往往被看作是金融机构在资本市场上风险管理功能改进的一个指标，且由于股票市场的波动性较大和其它原因，政府限制养老基金主要投资于债券，2004 年阿根廷养老基金投资于债券的比例达到 72％[23]。而金融工具的缺失以及金融市场的落后必然体现为金融机构风险管理能力的不足，这一点从 AFJP 投资效率和高额管理成本的分析中已经得到了证实。且私有化改革后由于 AFJP 之间的恶性竞争导致银行和工会退出了 AFJP 领域，国外资本进入并形成了垄断，市场竞争格局呈现出较强的集中趋势，AFJP 由最初的 25 家到 2008 年缩减为 10 家。这样的格局也导致 AFJP 和参与人之间形成了不正常的利润和风险分配关系：前者享有丰厚的利润和较小的投资风险，后者养老资产损失较大且承担较大的投资风险。金融机构未能发挥风险管理的职能反而将风险转移给了参与者。因此，在社保制度再国有化问题上出现了 AFJP 强烈反对而参与者极力支持的对立。应该说广大民众成为此次社保制度私有化的最终掘墓人[25]。

## Ⅴ. 结论以及对我国养老金制度改革的意义

本文从风险管理的角度解释了养老金结构

与金融结构的相似性，认为金融结构下金融机构风险管理方式和能力在很大程度上通过影响养老风险管理方式的选择而限制一国的养老金结构私有化的功效，并以此建议养老金结构的改革需要与一国的金融机构风险管理能力相匹配，这样才能形成金融系统与养老金系统作为一个整体的良性发展。虽然学术界并不支持阿根廷的社保制度的“再国有化”，但我们认为，即使存在人口结构老龄化的压力，也不能说明所有的私有化改革都是最优的，养老金制度私有化的改革应取决于公共部门和金融机构风险管理效率的比较。

我国于 1997 年也启动了社保制度部分私有化的改革，建立了个人账户，到现在将近 15 年。从个人账户的实施情况来看，改革效果尚未完全实现。首先是存在个人账户的“空账”问题。虽然从 2001 年开始，我国个人账户在 13 个省市逐步做实，但真正做实的省份并不多，2011 年的整体“空账”规模仍达到了 1.3 万亿。其次看个人账户的投资收益，除了极少数个人账户资产由全国社保基金代为投资，绝大部分个人账户资产尚未进入资本市场，其投资收益率按银行一年存款利率计算，低于我国的通胀水平和工资增长水平。2010 年，我国居民消费价格指数为 3.3%，城镇居民人均可支配收入实际增长 7.8%，可见在低收益率下，我国个人账户资产正在逐渐缩水。再次，我国个人账户资产的规模也在缩减。改革初个人账户的缴费为工资的 11%，做实的过程中这一比例在不断下降。根据《国务院关于完善企业职工基本养老保险制度的决定》（国发［2005］38 号）的规定，从 2006 年开始这一比例下调到 8%。自 2008 年以来，个别省份甚至用本已做实的个人账户来补充统筹部分的不足，养老金结构的改革进程出现了一定程度的“反转”。

表 7 1991－2010 年我国银行信贷/GDP 与市场资本化程度的比较

| | 均值 | 最大值 | 最小值 | 标准误 | 2010 年 |
|---|---|---|---|---|---|
| 银行信贷/GDP | 118.70 | 151.88 | 87.70 | 21.55 | 146.39 |
| 市场资本化 | 42.79 | 178.20 | 0.53 | 42.81 | 81.02 |

表 8 2004－2010 年间以 CR4 衡量的我国银行集中度

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|
| 国有银行集中度（%） | 53.6 | 52.4 | 51.3 | 53.2 | 51 | 50.9 | 48.7 |

注：国有银行集中度以四大国有银行总资产占银行业金融机构总资产的比重来衡量。

资料来源：中国银监会统计。

下面从我国的金融结构来分析我国个人账户现状形成的原因。总体上，我国的金融结构可以概括为银行主导型且银行集中度高。表 7 比较了我国的银行和股票市场在资金融资中的作用，可以看到我国银行信贷规模要远远高于市场资本化程度，2010 年高出 65 个百分点，且银行信贷规模的波动性要远远小于市场资本化程度。表 8 则说明了我国银行的集中度。四大国有银行总资产在银行业金融机构总资产中的占比从 1997 年的 91%下降到 2010 年的 48.7%，虽然总体上呈现不断下降的趋势，但与其它国家相比，市场集中化程度仍然较高。与高集中度相伴随的是银行系统的较低效率以及其它金融部门发展的严重滞后。

可见，我国银行主导型的金融结构为金融机构进行跨期平滑的风险管理提供了广阔的空间，也限制了我国养老风险管理模式的选择。金融市场的不发达体现为金融市场的高波动性、金融工具的缺乏以及金融监管能力的落后等，因此在养老风险管理上，金融机构难以通过金融市场提供有效率的横截面个体之间的风险共享，即市场难以保证个人账户资产市场化投资和管理的效率。相比较而言，政府提供的跨期平滑的养老风险管理模式更能适应我国金融机构风险管理能力的现状，在当前养老风险的管理上也相对更具可操作性。基于前文的分析，我们认为我国现有的金融结构尚未为我国“积累制”的养老金制度改革提供充足的金融条件。事实上，我国个人账户的不断缩减也代表了养老结构向公共计划的一种“被动性”回归。

鉴于我国个人账户的现状，学术界也为我国个人账户的改革寻找了新的模式，那就是“名义账户制”[11][27]。与积累制相比，名义账户制保留了精算中性的特征，同时不需要账户的积累。参与者每人拥有一个名义账户，账户资产以事先确定的利率（通常为工资增长率）保持增长。由于由公共部门管理该计划，因此它不需要金融部门具备很严格的风险管理能力，也能避免金融市场短期的波动对养老资产的冲击，特别适合像我国这种金融市场不发达

而经济处于快速增长的国家。当然，随着我国金融市场的发展以及金融机构风险管理能力的增强，积极促进自愿型私人养老金计划的发展（例如企业年金）将会对我国养老金系统的均衡发展具有重要的意义。

References

[1] A. H. Munnell, A. Golub-Sass, R.A. Kopcke , and A. Webb, “What does it cost to guarantee returns?”, Center for Retirement Research, No. 9-4, February 2009.

[2] C. Pugh, and J. Yermo, “Funding regulations and risk sharing”, OECD Working Papers on Insurance and Private Pensions, No.17, 2008.

[3] F. Allen, X. Gu and O. Kowalewski, “Financial crisis, structure and reform”, Wharton Financial Institutions Center Working Paper, No.37, 2011.

[4] F. Allen, and H. Oura, “Sustained economic growth and the financial system,” IMES Discussion Paper Series, No. E-17, August 2004.

[5] F. Allen, and A. M. Santomero, “The theory of financial intermediation”, Journal of Banking and Finance, 1998, 21: 1461-1485.

[6] G. Grande, and I. Visco, “A public guarantee of a minimum return to defined contribution pension scheme members”, Temi di discussion, No. 762, June, 2010, Banca d’Italia.

[7] H. Blommestein, P. Janssen, N. Kortleve, and J. Yermo, “Evaluating risk sharing in private pension plans”, OECD Financial Market Trend No.96, 2009.

[8] J. Brown, and T. Nijman, “Opportunities for improving pension wealth decumulation in the Netherland”, Tilburg: Netspar Discussion Papers, 2011.

[9] L. Bovenberg, and Theo Nijman, “Collective pensions and the global financial crisis: The case of the Netherlands”, Pension Research Council Working Paper, WP2011-17, 2011.

[10] L. Einav, A. Finkelstein, and P. Schrimpf, “Optimal mandates and the welfare cost of asymmetric information: Evidence form the U.K. annuity market”, Econometric, 2010, 78(3):1031 – 1092.

[11] M. Asher, N. Barr, P. Diamond, E. Lim, and J. Mirrlees, “Social security reform in China: Issues and options”. Policy Study of the China Economic Research and Advisory Programme (Jan.), 2005, http://www.oup.com/us/pdf/social_security_study_2005.

[12] N. Barr, P. Diamond, “Reforming pensions”, Center for Retirement Research at Boston College, Working Papers, No. 26, 2008.

[13] O. S. Mitchell, and A. Lusardi, “Financial literacy: implications for retirement security and the financial marketplace”, Oxford: Oxford University Press, 2011.

[14] P. Antolin, S. Payet, E. R. Whitehouse, and J. Yermo, “The role of guarantees in defined contribution pensions”, OECD Working Papers on Financial, Insurance and Private Pensions, No.11, OECD Publishing, 2011.

[15] P. Antolin, S. Payet, and J. Yermo, “Assessing default investment strategies in defined contribution pension plans”, OECD Journal: Financial Trends, 2010.

[16] P. Antolin, and Fiona Stewart, “Private pensions and policy responses to the financial and economic crisis.” OECD Working Paper on Insurance and Private Pensions no. 36, 2009.

[17] P. J. Dennis, and D. Strickland, “Who blinks in volatile markets, individuals or institutions?”, Journal of Finance, 2002, 57: 1923-1950.

[18] R. C. Merton, and Z. Bodie, “The design of financial system: Toward a synthesis of function and structure”, NBER Working Paper, No. 10620, 2004.

[19] R. C. Merton, “A functional perspective of financial intermediation”, Financial Management, 24(2): 23-41, 1995.

[20] R. C. Merton, “On the role of social security as a means for efficient risk sharing in an economy where human capital is not tradable”, in Z. Bodie and J. B. Shoven(eds), Financial Aspects of the United States Pension System, Chicago, 1983.

[21] R. Cohen, P. Gompers, and T. Vuolteenaho, “Who underreacts to cash-flow news? Evidence from trading between individuals and institutions”, Journal of Financial Economics, 2002, 66: 409-462.

[22] R. J. Shiller, “Social security and institutions for intergenerational, intragenerational and international risk sharing”, NBER Working Papers, No.6641, 1998.

[23] R. Rofman, E. Fajnzylber, and G. Herrera, “Reforming the pension reforms: The recent initiatives and actions on pensions in Argentina and Chile”, The World Bank Working Paper, No.0831, 2008.

[24] Zheng Binwen, The revelation from European debt crisis to Chinese pension

reform-the reform lists, in Zheng Binwen(eds), The China Pension Report 2011, Beijing, 2011.

郑秉文.欧债危机对中国养老金改革的启示——对中国养老金制度提出的改革清单，载于郑秉文主编《中国养老金发展报告2011》，北京：经济管理出版社。

[25] Zheng Binwen and Fang Lianquan, The Nationalization o f the Privatized Social Security System in Argentina, Journal of Latin American,

郑秉文，房连泉. 阿根廷私有化社保制度“国有化再改革”的过程、内容与动因[J].拉丁美洲研究，2009, 31(2):7－24。

[26]Zheng Binwen and Sun Shouji, Mandatory Occupational Pension System and its Impact on Financial Development——Case Study of Australia, Iceland and Switzerland, Journal of Public Management,2008.2.

郑秉文，孙守纪. 强制性企业年金制度及其对金融发展的影响－澳大利亚、冰岛和瑞士三国案例分析[J]. 公共管理学报，2008，5（2）：1－13。

[27]Zheng Binwen, The Evolution of NDC Approach in the Social Security’s History of Thoughts and Private Plans, Economic Research Journal, 2003.4.

郑秉文.养老保险“名义账户”制的制度渊源与理论基础[J].经济研究，2003（4）：63－71.

# 基于风险管理视角的私人养老金计划发展与金融结构的演变

诸艳霞[1]，黄 斌[2]
[1]经济管理学院，中国地质大学，武汉，中国，430074
[2]战略规划部，中国人民保险集团股份有限公司，北京，中国，100084

摘 要：本文的目的在于探求金融因素在一国养老金结构向私人养老金计划主导型演变过程中所起的作用。本文以风险管理作为一国养老金结构与其金融结构之间内在联系的连结点，探讨了私人养老金计划发展与金融系统演化之间的规律，并选取了 OECD 国家的数据进行了检验。本文认为，一国私人养老金计划的选择和设计受该国金融系统风险管理方式和能力的制约，一国养老金结构向私人养老金计划主导型的演化取决于该国金融结构的发展进程。2008年阿根廷个人账户“再国有化”的改革，金融条件的不足就是导致这种结果出现的重要原因之一。基于前面的理论分析和对国别经验的总结，最后联系我国金融结构的现状探讨了我国养老保险制度改革的进程及其得失。
关键词：养老金结构；私人养老金计划；金融结构；风险管理

# Population Ageing and the Financial Sustainability of Social Pension System in China

WANG Xiaojun[1], REN Wendong[2,3]
[1] Center for Applied Statistics, Renmin University of China, Beijing, China, 100872
[2] School of Statistics, Renmin University of China, Beijing, China, 100872
[3] School of Statistics, Shandong University of Finance and Economics, Jinan, China, 250014

**Abstract**：As a result of globe population ageing and economic growth slowing, the public pension system worldwide is facing significant financial unsustainable challenge and has to be reformed. In China, *Social Insurance Act* implemented in 2011 has the requirement of financial sustainability for social pension system, but there are no financial risk management system in practice and relative theoretical study on it. In this paper, we discuss the concept of financial sustainability of social pension system and the method to measure it, and then build a long term actuarial model to evaluate the financial income, outgo and balance. The result is that, current system has serious financial solvency problem in the long term. Increase retirement age and cut the benefit will help to recover financial balance but need to develop multi-pillar system to provide adequate pension benefit.

**Keywords:** population ageing; financial sustainability; social pension system

## I. 引言

在全球经济增速放缓和日趋严重的人口老龄化压力下，世界各国的公共养老金体系正在面临可持续发展的巨大挑战，近年来愈演愈烈的欧债危机也引发人们对老龄化下高福利制度可持续性的深刻思考。关于公共养老金体系的财务可持续发展问题，世界银行（World Bank, 1994）[1]对人口老龄化趋势及其对养老金体系收入和支出的测算分析，应该是最具代表性和指引性的研究报告。Roseveare（1996）[2]对OECD20个国家的老龄化趋势、公共养老金的政府预算缺口等进行了模拟测算分析，展示了欧洲公共养老金体系潜伏着巨大的危机。欧盟委员会（2010）[3]在其发布的《建立充足、可持续和安全的养老金系统》绿皮书中，再次提醒欧盟成员国面临的老龄化和经济与金融危机挑战，提出了为实现养老金系统长期财务可持续发展必须要实施的改革。

在我国，从2011年7月开始实施的《社会保险法》对社会保险制度提出财务可持续发展的要求，但实践中并没有建立起相应的风险管理系统，相关理论研究也比较缺乏，已有的研究大多集中在对可持续发展中的问题与对策的讨论，很少有相关的定量分析。本文将在讨论公共养老金体系财务可持续发展内涵和度量方法的基础上，通过建立精算评估模型，对我国基本养老保险的财务可持续性进行测算分析，以期得出相关的定量分析结论。

## II. 养老保险可持续性的内涵与度量

关于养老金体系可持续发展的内涵和度量，世界银行的报告（Holzman, 2005）[4]指出，养老金制度的基本目标是能够提供充足、可负担、可持续和稳健的退休收入。其中，“可持续”指的是持续的财务支付能力。Aaron(2010)[5]总结了已有的相关研究，认为一个可持续的养老金体系应该是在提供充足养老金待遇的前提下具有长期的财务偿付能力，同时不要将支付负担转嫁给下一代。基于已有研究，本文认为，一个可持续发展的养老金体系，应该能够提供充足的养老金水平，应该有充足的经济资源支付养老金，应该能保证人们公平享有养老保障（包括代际公平和代内公平），应该能应对老龄化和长寿等风险。其中，充足的养老金水平的最低要求是避免老年贫困，如果一个养老金体系不能为人们提

本文获教育部人文社会科学重点研究基地项目基金“我国养老金体系政府担保风险研究”（项目批准号：10JJD790037）和自然科学基金社会保障预算管理研究（项目批准号：71173230）的资助。

供最基本的养老金待遇，这一制度就失去了存在的必要性。如果没有充足的资金支付到期养老金，或者为了满足对养老金的支付，需要付出超出人们支付能力的高成本，或者需要将支付责任转嫁给下一代或下几代，或者因不可避免的老龄化和人口长寿趋势而导致偿付能力问题等，这样的养老金体系都是不可持续的。因此，本文认为，度量养老金体系可持续性的指标应包括：待遇充足性、成本可负担性、代际和代内分配公平性、应对老龄化和长寿趋势的结余资金充足性、资金长期收支平衡性等几个方面。

待遇充足性可以用养老金替代率衡量，替代率=养老金/工资，依据分子和分母的不同口径，可以分为个人总替代率和净替代率，社会平均替代率等，分别用于衡量个人养老金收入占个人总工资的比例、个人养老金净收入占净工资的比例，社会平均的养老金水平占社会平均工资的比例等。

成本可负担性可以用养老金支出占GDP的比例、养老金支出占缴费工资的比例、个人和单位养老金缴费率等来衡量。通过观察这些指标随时间的变动，可以看出养老金支出对经济的压力和对单位或个人的压力。

代际和代内分配的公平性可以用不同人群养老金内涵回报率以及养老金财富与养老金缴费的比例来衡量，前者是实现参保缴费与待遇领取平衡时内涵的回报率，后者是待遇现值与缴费现值的比例。通过这两个指标的代际和代内对比，可以衡量分配的公平性。

结余资金的充足性一般用基金率衡量，基金率=年末累计结余/下年支出。基金率等于1，表明结余资金至少能用于下一年的支付，养老基金在下一年内是充足的，如果在未来长期内的基金率维持稳定并大于1，表明制度在长期内是可持续的。

养老基金的长期收支平衡，一般用长期精算余额来度量。长期精算余额是未来长期内养老金系统期初结余基金和收入现值之和与支出现值的差额，表示在长期内收入与支出的差距。如果长期精算余额为正数，表明长期内系统具备财务偿付能力，反之，表明长期内系统存在偿付能力不足。有时，长期精算平衡也用精算余额占缴费工资的比例表示。长期精算平衡等于长期综合收入率与长期综合成本率之差。长期综合收入率是期初结余基金和收入现值之和与缴费工资现值的比例，长期综合成本率是支出现值与缴费工资现值的比例。

本文将采用替代率、养老基金年度赤字、养老金赤字和累计赤字占GDP的比例、长期精算平衡等指标来度量和分析我国基本养老保险的财务可持续性。

## III.中国人口老龄化趋势

联合国人口司依据各国的基础数据，在不同的假设水平下，定期测算未来的人口变动，定期更新对不同国家的人口预测结果，该数据普遍用于国际比较研究，考虑到我国已发表的人口预测结果建立在不同的测算目标下，并没有公认的权威预测结果。这里采用联合国2010年居中假设下的人口预测数据，见表1和图1。

从表1和图1可见，中国人口总数在2020年将增长到14亿，以后逐年下降，到2060年降低到12.1亿人。但人口老龄化速度较快，人口中位年龄从2010年的34.5岁上升到2060年的49.5岁。60岁以上人口比例从2010年的13.1%上升到2060年的36.6%，届时有超过1/3的人口是60岁以上的人口。人口抚养比从2010年的18.9%上升到2060年的73.5%，每10个年轻人要负担约7.4个老年人。劳动年龄人口比例从2010年的70.1%下降到2060年的49.8%，这一水平低于国际平均水平，甚至低于发达国家的水平。

**表 1. 2010-2060 年中国人口预测数据**[①]

| 年份 | TP | MA | LP | RP | LR | RR | DR |
|---|---|---|---|---|---|---|---|
| **2010** | 13.4 | 34.5 | 9.4 | 1.8 | 70.1 | 13.3 | 18.9 |
| **2015** | 13.7 | 36.2 | 9.2 | 2.1 | 67.1 | 15.1 | 22.5 |
| **2020** | 13.9 | 38.1 | 9.1 | 2.4 | 65.9 | 17.4 | 26.4 |
| **2025** | 14.0 | 40.1 | 9.0 | 2.8 | 64.2 | 20.2 | 31.5 |
| **2030** | 13.9 | 42.5 | 8.5 | 3.4 | 61.0 | 24.4 | 40.0 |
| **2035** | 13.8 | 44.7 | 8.0 | 3.8 | 58.1 | 28.0 | 48.2 |
| **2040** | 13.6 | 46.4 | 7.8 | 4.0 | 57.0 | 29.4 | 51.6 |
| **2045** | 13.3 | 47.7 | 7.4 | 4.1 | 55.4 | 31.1 | 56.1 |
| **2050** | 13.0 | 48.7 | 6.8 | 4.3 | 52.6 | 33.9 | 64.4 |
| **2055** | 12.5 | 49.1 | 6.4 | 4.5 | 50.9 | 35.6 | 69.9 |
| **2060** | 12.1 | 49.4 | 6.0 | 4.4 | 49.8 | 36.6 | 73.5 |

注：TP 表示总人口数（亿），MA 表示年龄中位数，LP 表示 15-59 岁人口数（亿），RP 表示 60 岁以上人口数（亿），LR 表示 15-59 岁人口比

[①]资源来源：2010 年数据除年龄中位数外均来自中国第六次全国人口普查数据，其他数据来自 Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2010 Revision, http://esa.un.org/unpd/wpp/index.htm

例（%），RR 表示 60 岁以上人口系数（%），DR 表示 60 岁以上人口抚养比（%）

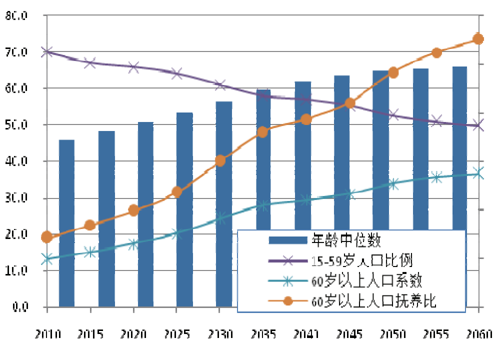
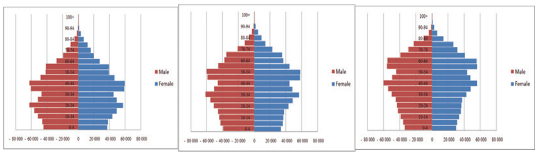
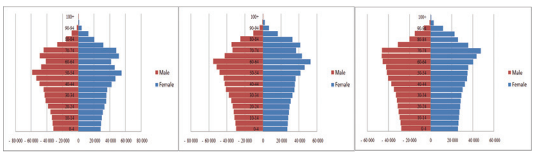



**图 1. 2010-2060 年中国人口预测数据**

人口年龄金字塔的变动反映了人口老化的趋势。图 2 为依据联合国居中假设下的预测结果画出的人口金字塔。由图中看出，2010 年劳动年龄人口占绝大比例，老年人口和少儿人口比例相对较低，到 2030 年，60 岁以下人口的年龄结构基本呈矩形，人口老化明显，到 2060 年，60 岁以下年龄人口呈倒梯形，人口老化非常严重。



**2010 年　　2020 年　　2030 年**



**2040 年　　2050 年　　2060 年**

**图 2. 人口年龄金字塔变动**

# IV.养老保险长期财务可持续性分析

预测养老金系统的未来财务收支状况，需要对未来参保人口、缴费人口、领取人口及其性别年龄结构做出预测，需要对未来工资和养老金调整指数等做出假设。

## A. 模型与方法

### 1）、缴费人口预测

考虑到我国当前的基本养老保险只覆盖城镇就业人口，未来缴费人数可依据人口、城镇人口比例、城镇人口就业率、养老保险平均覆盖率等来估计。假设男性 60 岁退休，女性 55 岁退休，有，

缴费人口数=(15-59岁男性人口数+15-54岁女性人口数)×相同年龄段的城镇人口比例×相同年龄段的城镇就业比率[2]×平均覆盖率[3]　　（1）

### 2）、领取人口预测

t 年的待遇领取人数可以分为 t-1 年已取得领取资格并在 t 年继续领取养老金的人数和 t 年新增领取人数两部分，假设新增领取人数是每年正常退休的人数。

t 年待遇领取人数=t-1 年待遇领取人数×生存概率+t 年新增的待遇领取人数　　（2）

t 年新增的待遇领取人数=t-1 年 55-59 岁的男性缴费人数×对应年龄的生存概率+t-1 年 50-54 岁女性缴费人数×对应年龄的生存概率　　（3）

依据《中国统计年鉴 2011》提供的数据，2010 年参保缴费人数为 19402.3 万人，参保离退人数为 6305.0 万人[4]。为了获得新增离退休人口数，需要估计出分年龄参保人口数，这里假设参保缴费人口的年龄结构与城镇就业者年龄结构相同，参保离退休人口的年龄结构与城镇老年人口年龄结构相同。

### 3）、养老保险未来收支预测

年度缴费收入＝缴费人数×社会平均工资×缴费工资占社会平均工资的比例×缴费率　　（4）

年度支出=待遇领取人数×人均平均待遇水平　　（5）

年度收入=年度缴费收入+利息收入　　（6）

年度结余=年度收入-年度支出　　（7）

t 年累计结余=t-1 年累计结余×（1+利息率）+（t 年缴费收入-t 年支出）　　（8）

### 4）、综合精算平衡

以SIR表示综合收入率，SCR表示综合成本率，AB表示精算平衡，PV为现值，I为收入，C为支出，S为征税工资，上述符号的下脚标表示计算时点，其中，下脚标0表示长期评估期的起点，下脚标n为长期评估期的末年，评估时期长度为n+1年，$F_0$为评估期初的结余基金，$F_n$为评估期末的目标基金额，则，

$$SIR_0 = \frac{F_0 + PV_0 I}{PV_0 S} \times 100\% \qquad (9)$$

---

[2] 这里的城镇就业比率不是城镇就业率。城镇就业比率=城镇就业人口/（城镇 15-59 岁男性人口数+城镇 15-54 岁女性人口数）

[3] 平均覆盖率=城镇缴费人口/城镇就业人口

[4] 中国统计年鉴 2011，表 21-38

$$SCR_0 = \frac{PV_0C + PV_0F_n}{PV_0S} \times 100\% \qquad (10)$$

$$AB_0 = SIR_0 - SCR_0 \qquad (11)$$

如果以平均征税工资、平均待遇以及他们的增长率来计算未来的缴费收入、未来支出和未来征税工资的现值，有，

$$PV_0I = \bar{S}_0 \sum_{t=0}^{n-1} c_t L_t^a \cdot \prod_{h=1}^{t} \frac{1+g_h}{1+i_h} \qquad (12)$$

$$PV_0C = B_0 \sum_{t=0}^{n-1} L_t^o \cdot \prod_{h=1}^{t} \frac{1+j_h}{1+i_h} \qquad (13)$$

$$PV_0S = \bar{S}_0 \sum_{t=0}^{n-1} L_t^a \prod_{h=1}^{t} \frac{(1+g_h)}{(1+i_h)} \qquad (14)$$

其中，$c_t$ 为第 $t$ 年的征税率，$\bar{S}_0$ 为期初的平均缴费工资，$L_t^a$ 为第 $t$ 年缴费的人数，$g_t$ 为 $t$ 年工资增长率，$i_t$ 为 $t$ 年的利息率，$B_0$ 为期初人均待遇水平，$L_t^o$ 为第 $t$ 年领取待遇的人数，$j_t$ 是 $t$ 年待遇的增长率。

## B. 精算假设

### 1)、城镇人口比例

改革开放以来，我国的城镇化进程加速，城镇人口比例从 1978 年的 17.92%上升到 2011 年的 51.27%。在未来的几十年里，人口城镇化率将进一步提高，这里采用国务院发展研究中心（2010）[7]的预测方法，假定中国城镇化率的峰值为 80%，采用 logistic 回归方法，可得出未来 50 年的城镇化水平，见图 3。

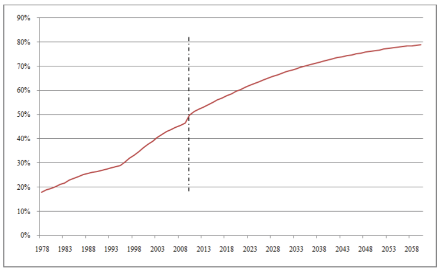


图 3. 中国城镇化率的历史数据与预测数据

### 2）、城镇就业比率

按照中国统计年鉴计算的城镇就业比率在过去 20 年里大体保持在 80%左右，我们假设未来的城镇就业比率仍然保持在 80%的水平上。

### 3）、养老保险平均覆盖率

2010 年我国养老保险的平均覆盖率为 55.9%，按照 2020 年养老保险全覆盖的目标，养老保险的覆盖率应该达到 100%，但依据国际经验，即使是养老保险制度非常健全的发达国家，养老保险的覆盖率也只有 90%左右[6]。这里，我们假设 2020 年后平均覆盖率达到 90%，2010-2020 年的覆盖率线性增加。

### 4）、GDP 增长率

未来 GDP 的增长采用 2012 年世界银行《中国 2030》[8]报告中的预测，2011-2015 年为 8.6%，2016-2020 年为 7.0%，2021-2025 年为 5.9%，2026-2030 年为 5%。以后各年保持 5%不变。

### 5）、工资增长率

一般来说，工资增长快于 GDP 增长才能使劳动者报酬在 GDP 中的占比逐步提高。我国在过去 20 里，除个别调整年份，工资增长率一直快于 GDP 的增长，我们假定未来工资增长率仍保持高出 GDP 增长的 1%。

### 6）、养老金待遇增长率

在过去的 20 年里，养老金待遇的增长率总体上慢于工资的增长率，使养老金平均替代率逐步下降，2010 年养老金平均替代率降低到 45%。近年来，为提高养老金待遇，养老金待遇保持了与工资的同步增长。我们假定未来养老金的待遇增长率与工资保持一致。

### 7）、缴费工资占社会平均工资的比例

依据人力资源和社会保障事业发展统计公报的数据计算，近 10 年来，缴费工资占社会平均工资的比例有下降趋势，2002 年的这一比例为 66%，2010 年下降到 55%。在预测中我们假设未来的这一比例保持在 60%的水平上。

### 8）、利息率

考虑到当前养老保险的结余基金主要以存入银行为主，假设未来结余基金的长期平均利息率为 3%。

## C. 测算结果

依据前面给出的基础数据、模型和假设，通过 Excel VBA 编程，可以测算出未来制度覆盖人口及制度内抚养比、未来养老保险基金收支和结余、未来年度累计结余以及长期精算平衡等。

### 1）、未来制度覆盖人口和抚养比

未来制度覆盖人口及制度内抚养比如图 4 所示。从图中可见，未来年份制度内缴费人口和领取人数均呈增长趋势。在 2020 年全覆盖目标下，养老保险的覆盖面迅速扩大，总缴费人数从 2010 年的 1.94 亿迅速上升到 2025 年的 3.84 亿，随后十几年内保持在 3.8 亿左右。在 2040 年后，由于人口总数降低、人口年龄结构老化，使缴费人口呈逐年减少趋势，到 2060 年减少到 3.23 亿人。养老金领取人口从 2010 年的 0.63 亿人上升到 2060 年的 2.51 亿人。由于缴费和领取人口增长比例的差异，使制度内人口抚养比呈现先降后升的趋势，2010 年制度内抚养比为 32.5%，到 2020 年降低到 22.0%的最低水平，以后年份

里，抚养比迅速上升，到 2060 年达到 77.6%，表明存在严重的制度覆盖人口老化。

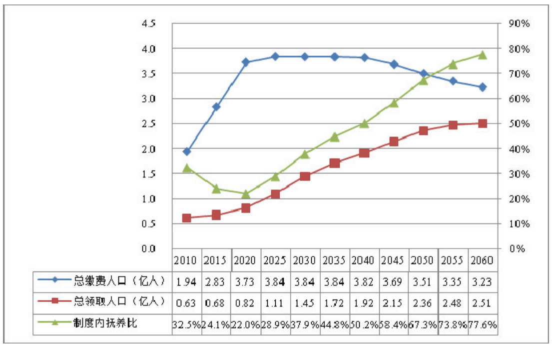



**图 4. 2010-2060 年缴费、领取和制度内抚养比**

### 2）、未来养老保险年度收支状况

未来 50 年我国基本养老保险收支状况如图 5 所示。

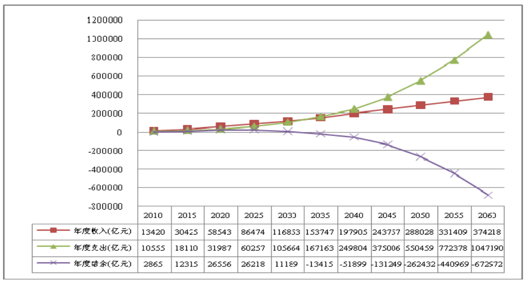



**图 5. 2010-2060 年基本养老保险年度收入、支出和结余**

由图 5 可见，在上述假设下，随着时间的推移，年度收入和年度支出都在增加，年度收入从 2010 年的 1.34 万亿元上升到 2060 年的 37.4 万亿元；年度支出从 2010 年的 1.06 万亿元上升到 2060 年的 104.7 万亿元。2030 年前，年度收入略大于年度支出，2035 年后，年度支出迅速增长，使年度赤字达到 1.3 万亿元。随着时间的推移，2060 年的年度赤字达到 67.3 万亿元，相当于 2060 年 GDP 数值的 10.86%。

### 3）、长期精算平衡分析

未来 50 年的长期综合收入率、长期综合成本率、长期精算平衡值的结果列入表 2 中。

**表 2. 未来 50 年长期精算平衡**

| | |
|---|---:|
| 综合收入率 | 28.60% |
| 综合成本率 | 41.67% |
| 综合精算平衡 | -13.67% |
| 未来缴费现值（亿元） | 722344 |
| 未来支付现值（亿元） | 1075048 |
| 缴费与支付现值差（亿元） | -352704 |

由上表可见，未来 50 年的综合精算平衡为-13.67%，表明如果制度按假设的情形运行，未来将会出现严重的偿付能力问题。为了维持现有制度的收支平衡，或者需要提高 47.8%（13.67%/28.60%）的缴费，或者需要降低 32.8%（13.67%/41.67%）待遇支出。从绝对额来看，未来的收入现值为 72.2 万亿元，支出现值达到了 107.5 万亿元，从而未来赤字现值为 35.3 万亿元。而 2010 年中国 GDP 总量为 39.8 万亿元，这样，未来 50 年基本养老保险赤字现值相当于 2010 年 GDP 总量的 88.7%。

### 4）、累计结余

2010 年的累计结余为 1.5 万亿元，以后结余逐年缓慢增加，到 2030 年增加到 9.16 万亿元，以后结余基金逐年消耗，到 2045 年结余基金消耗殆尽，并有 10.49 万亿元的赤字，到 2060 年累计赤字达到 148 万亿元。如图 6 所示。

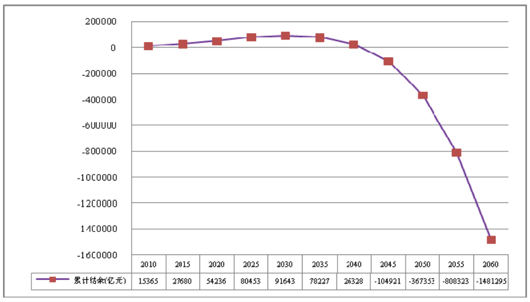



**图 6. 2010-2060 年累计结余**

## D. 敏感性分析

前面的测算分析建立在对人口、经济和制度等因素一定假设的基础上，如果这些因素的水平发生变化，将对未来收入产生影响。为了方便分析，我们将影响未来收支的因素进行归类后分解。

### 1）、影响因素分解

为了简化分析，我们以 $I_t$ 表示 t 年收入，$O_t$ 表示 t 年支出，$L_{t,a}$ 表示 t 年参保的缴费人数，$L_{t,r}$ 表示 t 年待遇领取人数，$\overline{S}_t$ 表示 t 年的社会缴费工资，$\overline{B}_t$ 表示 t 年人均待遇，$C_t$ 表示 t 年的缴费率，有，

$$I_t = L_{t,a} \cdot \overline{S}_t \cdot C_t \,, \qquad I_{t+1} = L_{t+1,a} \cdot \overline{S}_{t+1} \cdot C_{t+1}$$

$$O_t = L_{t,r} \cdot \overline{B}_t \,, \qquad O_{t+1} = L_{t+1,r} \cdot \overline{B}_{t+1}$$

$$I_{t+1} = I_t \times \frac{L_{t+1,a}}{L_{t,a}} \times \frac{\overline{S}_{t+1}}{\overline{S}_t} \times \frac{C_{t+1}}{C_t} \,, \quad O_{t+1} = O_t \times \frac{L_{t+1,r}}{L_{t,r}} \times \frac{\overline{B}_{t+1}}{\overline{B}_t}$$

如果忽略年末结余基金的利息，并且假设缴费率不变，那么，t+1 年缴费收入与支出的对比关系可以表示为：

$$\frac{I_{t+1}}{O_{t+1}} = \frac{I_t}{O_t} \times (1 \Big/ \frac{\overline{B}_{t+1}}{\overline{B}_t} \Big/ \frac{\overline{S}_{t+1}}{\overline{S}_t}) \times (1 \Big/ \frac{L_{t+1,r}}{L_{t+1,a}} \Big/ \frac{L_{t,r}}{L_{t,a}}) \qquad (15)$$

其中，$\frac{I_t}{O_t}$是 t 年的收支比，$\frac{\bar{B}_{t+1}}{\bar{B}_t}\Big/\frac{\bar{S}_{t+1}}{\bar{S}_t}$反映待遇增长与工资增长的对比关系，$\frac{L_{t+1,r}}{L_{t+1,a}}\Big/\frac{L_{t,r}}{L_{t,a}}$反映 t+1 年制度内抚养比与 t 年抚养比的对比关系，这两个值对 t+1 年收支比的影响都呈反向变动。因此，如果待遇增长在工资增长中的比例越高，制度内人口越老化，缴费收入相比待遇支出的增长越慢，制度出现收支缺口的可能性越大。

在下面的分析中，我们将影响缴费收入与支出对比关系的因素归纳为两个，一个是待遇增长占工资增长的比例，一个是制度内人口抚养比的变动。另外，如果养老基金有累积结余，利息收入也是年度养老保险基金收入的重要组成部分，在一定的结余基金下，利息率的水平直接影响利息收入的高低。在影响因素分析中也将利息率的影响列出。

2）、养老金相对工资的增长变动对收支的影响

为了表示上的方便，设 t 年的工资增长率为$g_t$，养老金增长率为$k_t$，则，

$$\frac{\bar{B}_{t+1}}{\bar{B}_t}\Big/\frac{\bar{S}_{t+1}}{\bar{S}_t}=\frac{1+k_{t+1}}{1+g_{t+1}}$$

当$\frac{1+k_{t+1}}{1+g_{t+1}}$等于 1 时，养老金增长与工资增长的对比关系对预测年的收支比不产生影响，当$\frac{1+k_{t+1}}{1+g_{t+1}}$的值小于 1 时，将使预测年的收支比提高，提高幅度为$\frac{g_{t+1}-k_{t+1}}{1+k_{t+1}}$。

图 7 和图 8 分别是当养老金增长率是工资增长率的 50%、80%和 100%时，年度结余基金的变动和养老金替代率的水平。

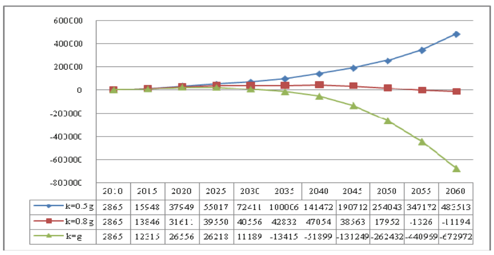



**图 7. 2010-2060 年不同待遇调整指数下年度基金结余** 单位：亿元

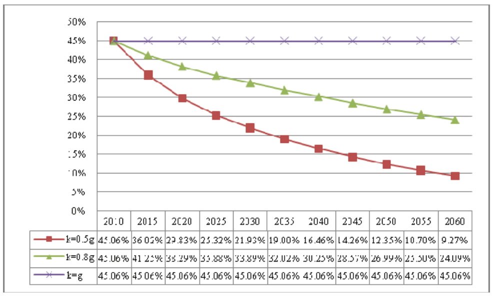



**图 8. 2010-2060 年不同待遇调整指数下的平均替代率**

可见，在养老金增长率为工资增长率的 50%时，基本养老保险在未来 50 年是可持续的，但是这种可持续是以养老保险待遇显著降低为前提的，平均替代率将由 2010 年的 45%迅速降低到 2060 年的 9.27%，在没有其他收入来源时，这一水平的养老金将使老年人陷入极度贫困。当养老金增长率为工资增长率的 80%时，在 2050 年前基金不存在支付赤字，但养老金的平均替代率在 2050 年会降低到 26.99%，在 2060 年降低到 24.09%。

3）、退休年龄变动对未来收支的影响

退休年龄是影响未来制度覆盖人口抚养比的重要因素，退休年龄推迟将使缴费人数增加，待遇领取的人数减少，从而降低养老基金的支付压力。我们将上节给出的假设称为基础假设，在基础假设下对退休年龄再给出两种假设：（1）从 2015 年起男女退休年龄提高到 60 岁，之前年份保持基础假设水平；（2）从 2020 年起男性退休年龄提高到 65 岁，女性退休年龄提高到 60 岁，之前年份保持基础假设不变；

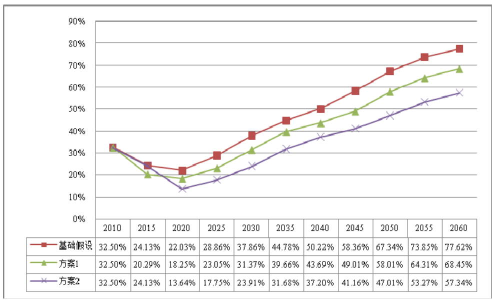



**图 9. 不同退休年龄假设下的制度内抚养比**

在不同退休年龄假设方案下的制度抚养比变动如图 9 所示。在方案 1 下，2015 年的制度内抚养比低于基本假设条件的 3.84%，随着时间的推移这一比例逐渐提高，到 2060 年达到了 9.17%。在方案 2 下，制度内抚养比在 2020 年后低于基本假设下的抚养比，制度内抚养比由 2020 年的 13.64%上升到 2060 年的 57.34%。

图 10 是在不同退休年龄方案下的基金结余情况，可见，在方案 1 下，年度结余在 2035-2040 年间出现赤字，到 2060 年赤字达到 51 万亿；在方案 2 下，年度结余在 2045-2050 年间出现赤字，到 2060 年赤字达到 29 万亿。

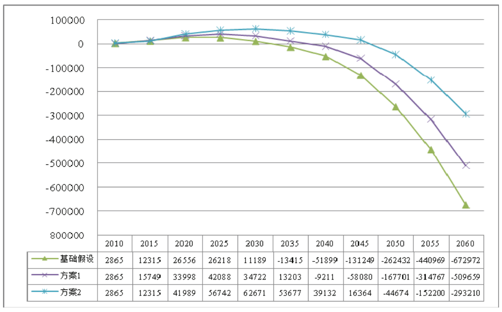
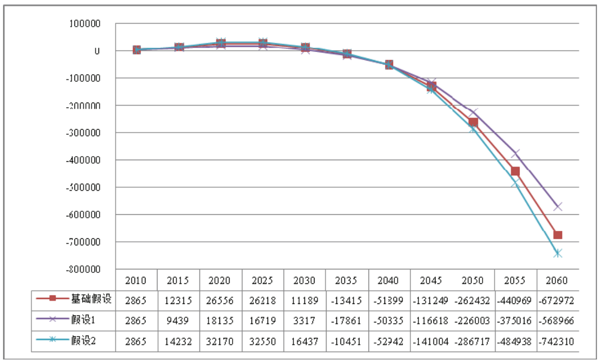


**图 10. 不同退休年龄假设下的年度基金结余 单位： 亿元**

**4）、制度覆盖率变动的影响**

制度覆盖率假设直接影响未来制度覆盖的人口数和人口结构，在前面的假设中，我们设定制度的覆盖面限于城镇就业人口，城镇就业人口的养老保险覆盖率从 2010 年的 55.9%增加到 2020 年的 90%，中间年份的覆盖面线性变化。为了分析覆盖率变动对未来收支的影响，我们对未来覆盖率增加下面两种假设：（1）覆盖率从 2010 年的 55.9%增加到 2020 年的 75%，之后保持不变；（2）覆盖率从 2010 年的 55.9%扩大到 2020 年的 100%，之后保持不变。测算结果如图 11 所示。




| | 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 | 2045 | 2050 | 2055 | 2060 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 基础假设 | 2865 | 12315 | 26556 | 26218 | 11189 | -13415 | -51399 | -131249 | -262432 | -440969 | -672972 |
| 假设1 | 2865 | 9439 | 18135 | 16719 | 3317 | -17861 | -50335 | -116618 | -226003 | -375016 | -568966 |
| 假设2 | 2865 | 14232 | 32170 | 32550 | 16437 | -10451 | -52942 | -141004 | -286717 | -484938 | -742310 |

**图 11. 不同制度覆盖率假设下的年度基金结余 单位： 亿元**

由图 11 可见，在方案 1 下，年度赤字首次出现在 2031 年，到 2060 年赤字达到 57 万亿；在方案 3 下，年度赤字首次出现在 2034 年，到 2060 年赤字达到 74 万亿。表明养老保险覆盖面的扩大在近期内有助于减轻支付压力，但长期内由于更多的人领取养老金而会使支付压力增大。

# V. 结论

1、在未来的 50 年内，中国人口老龄化程度日益严重。劳动年龄人口总量持续减少，老年人口总量持续增加，到 2060 年，劳动年龄人口只占总人口的 50%左右，超过 1/3 的人口是 60 岁以上的老年人，每 10 个年轻人要抚养超过 7 个老人。这样的老龄化程度远远高于世界平均水平，甚至超出很多发达国家的水平。

2、人口老龄化给养老保险基金收支带来沉重的压力，尽管预期在未来 10 年的迅速扩面可以缓解养老基金的支付压力，但 2035 年后，仍然会出现越来越严重的支付赤字，到 2060 年年度赤字水平超过当年 GDP 的 10%，如果以现值计算，2010 年未来 50 年的累计赤字将超过当年 GDP 的 88%。这样的制度无法保证长期财务的可持续性。

3、降低养老金待遇调整指数可以有效缓解养老保险的支付压力。但降低养老金待遇的调整指数是以养老金替代率的显著下降为代价的。当养老金的调整指数为工资增长率的 50%时，2060 年的养老金平均替代率只有 9%左右，如果按工资增长率的 80%调整养老金，2060 年的平均养老金替代率也只有 24%左右。如果没有其他养老金来源，这一水平的养老金是不充足的，从而不能保证制度的可持续性。要保证制度的待遇充足性，需要大力发展多支柱养老金体系，使人们能够通过多种途径获得老年收入保障。

4、提高退休年龄可以有效缓解养老金的支付压力，但人口寿命延长的趋势必然会抵消提高退休年龄的影响。需要说明的是，限于篇幅，本文没有测算分析死亡率降低和寿命延长对养老保险基金收支的影响，在进一步的深入研究中，需要通过更细致的测算分析得出相关结论。

# VI. 参考文献：

[1] World Bank, Averting the Old Age Crisis: Policies to Protect the Old and Promote Growth, World Bank: Washington. 1994.

[2] Deborah Roseveare, Willi Leibfritz, Douglas Fore, Eckhard Wurzel, Ageing Populations, Pension Systems and Government Budgets, Simulations for 20 OECD Countries, Economics Department, Working Papers No. 168, OECD, Paris 1996.

[3] European Commission, Green Paper, towards adequate, sustainable and safe European pension systems, Brussels, COM(2010) 365/3, SEC(2010)830.

[4] Holzman, Robert and Richard Hinz, Old-age income support in the 21st century: an international perspective on pension systems and reform, 2005, World Bank. Washington, D.C. 20433, USA

[5] Aaron George Grech, Assessing the sustainability of pension reforms in Europe, Centre for Analysis of Social Exclusion，London School of Economics, 2010.

[6] Robert Holzmann, David A. Robalino, and Noriyuki Takayama, Closing the Coverage Gap: the role of social pensions and other retirement income transfers,2009,World Bank. Washington, D.C. pp.99-110.

[7] Development Research Center of the State Council, China's Urbanization:Prospects,Strategies and Policies, China Development Press. 2010. pp.103-120

国务院发展研究中心课题组，中国城镇化：前景，战略和政策，中国发展出版社，2010. 103-120

[8] Development Research Center of the State Council, the People's Republic of China, China 2030: Building a Modern, Harmonious, and Creative High-Income Society,2012,World Bank. Washington,

# 中国人口老龄化与社会养老保险的财务可持续发展

王晓军[1]，任文东[2,3]
[1]应用统计科学研究中心，中国人民大学，北京，中国，100872
[2] 统计学院，中国人民大学，北京，中国，100872
[3]统计学院，山东财经大学，济南，中国，250014

**摘　要：**在全球经济增速放缓和日趋严重的人口老龄化压力下，世界各国的公共养老金体系正在面临可持续发展的巨大挑战，各国纷纷对其养老金体系实施结构性或参数式改革，以帮助恢复养老金体系的偿付能力。在我国，从2011年7月开始实施的《社会保险法》对社会保险制度提出财务可持续发展的要求，但实践中并没有建立起相应的风险管理系统，相关的理论研究也比较缺乏，已有的研究大多集中在对可持续发展中的问题与对策的讨论，很少有相关的定量分析。本文在讨论社会养老保险财务可持续发展的内涵和度量方法的基础上，通过建立精算模型，对我国社会养老保险的未来收支、支付赤字和长期精算平衡进行了测算分析。结果表明，现行制度在未来长期内存在较严重的支付赤字，缺乏长期偿付能力，如果采取提高退休年龄和降低待遇的改革，将会有效缓解制度的财务压力，但需要大力发展多层次养老金体系，以弥补社会养老保险对待遇的削减，满足养老金待遇充足性的要求。
**关键词**：人口老龄化；社会养老保险；财务可持续性

# Discussion on the Rational Choice of the National Pension System in the Post-Crisis Era

ZHAO Qing
School of Public Administration and Policy, Renmin University of China, Beijing, China, 100872

**Abstract:** Under the background of economic stagnation and population ageing in 1970s, many countries have reformed their traditional pension system. Chile has substituted a funding system for the Defined-Benefit Pay As You Go (PAYG) pension system completely, and become the typical example of "the privatization of social security". The United Kingdom has transformed the State Earnings Related Pension schemes into a part-funding system through the "Contract-out" policy. Continuing with the conventional route, Australia has become one of the few countries which have formed a unique pension system that mainly contains the zero & the second pillar. Sweden has reformed the PAYG system to a Non-Financial Defined Contribution (NDC) system. This paper makes an evaluation of the real effect of the current pension system of the four countries. From the perspective of profit, the real rate of return of the funding is often higher than the internal rate of return of PAYG. But if we take the total operating cost & transforming fees into consideration, the advantage of the Financial Defined Contribution (FDC) may not be that obvious. The market risk of funding system will be much higher than the PAYG as we use the coefficient of variation and VAR model to test. The NDC system in Sweden doesn't perform as well as the old PAYG in both the aspects of profit and risk aversion. Based on the essence of pension, which aims at poverty alleviation and providing a secure and stable income expectation for the elderly, and the feasibility of financial sustainability, we propose that we establish a pension system with PAYG as the main body, and other tier (such as FDC) as a supplement to the basic part. That can be a rational choice for the construction of the national pension system in the post-crisis era.
**Keywords:** Pay As You Go(PAYG); Funding system; Non-Financial Defined Contribution; risks; essence of pension

## Ⅰ.引言

随着 20 世纪 70 年代爆发的石油危机引发经济滞涨，加上日益严峻的人口老龄化问题，各国纷纷对传统的养老保险德国模式进行改革。以降低现收现付养老金权重、增加积累制比例、减少待遇确定型计划（DB）、增加缴费确定型计划（DC）为主要特征的养老保险私有化改革的浪潮在世界范围内掀起。至今，已有二十多个国家引入了完全或部分基金积累型（Financial Defined Contribution, FDC），以及名义积累的个人账户制度（Non-Financial Defined Contribution, NDC），将实际的或名义的基金积累制替换了过去以现收现付制为主的养老金制度体系。那么，基金积累制度在各国的实际运行效果究竟如何？它果真比现收现付制更有效吗？还是会在新的经济环境中产生新的问题？2008-2009 年的全球性经济危机作为一个时间窗口，对改革国家的养老金制度进行了检阅。

## Ⅱ. 改革国家的养老金制度安排

20 世纪 70 年代以来，改革传统现收现付制养老金制度的国家可以分为两大类。第一类是将待遇既定型（Defined Benefit, DB）现收现付制（Pay As You Go, PAYG）改为完全或部分的基金积累制（FDC），以智利、英国、澳大利亚为代表。智利是将完全积累制替代了过去的现收现付制，而英国通过"合同退出"，在保留了少部分现收现付制养老金制度的基础上推出了职业和个人养老金计划。相比于前两个国家，澳大利亚以超级年金为主体的养老金体系更多是依赖历史路径发展的产物。第二类则是将 DB 型 PAYG 转变为名义账户制（NDC），财务机制仍是 PAYG，但待遇与缴费挂钩，瑞典及东欧的转型国家是这类模式的践行者。

### A.智利

20 世纪 70 年代石油危机过后，智利在新自由主义奉行的"自由化""私有化""市场化"思潮影响下，成为拉美最早进行经济改革的国家。社会保障私有化的改革是其经济改革的重要组成部分。1980 年 11 月 4 日，在皮诺

切特军政府的强力推动下，最终的养老金制度改革法案以 3500 号法令（1981 年正式实施）的形式予以公布。智利新养老金制度的基本内容是：放弃以前的现收现付制，实行以个人资本为基础的完全的个人账户制，由私人养老基金管理公司负责经营管理，费用完全由个人缴纳，雇主不承担供款义务。由此看来，智利模式的最大特点是劳动者的养老问题由个人负责，政府在养老保障中的责任被缩至最小——仅限于为加入养老金计划者提供最低养老金保障，以及为无法参加者提供基于家计调查的社会养老救助金。因此，智利模式是养老保险私有化的典型代表，它是对传统现收现付型社会保险制度的根本性变革。

## B. 英国

英国的养老金计划私有化改革始于撒切尔政府上台的 70 年代末，是英国宏观经济改革的一个重要组成部分。英国从 1978 年开始立法，允许雇主和雇员选择从国家收入关联计划（SERPs）中“协议退出”（contract-out），并给予税收优惠，鼓励建立雇主支持的职业养老金计划或个人账户养老金计划。1986 年的法案（Pension Act 1986）规定，降低国家收入关联养老金计划的待遇水平，设立缴费确定型职业养老金计划，并允许由保险公司和其他金融中介机构提供“个人养老金计划”（Personal Pension Schemes, PPSs）。1997 年布莱尔领导的新工党上台后，大体上延续了撒切尔政府力图减少国家公共养老金给付成本的改革思路，于 2002 年建立起国家第二养老金（S2P），取代了国家收入关联养老金[1]。30 多年的私有化改革，形成了当前英国较为复杂的“多支柱”养老金制度体系。

## C.澳大利亚

早在 19 世纪初，澳大利亚就出现了由雇主提供的职业年金计划。20 世纪 80 年代以前，澳大利亚人退休后领取的养老金主要有两种：一种是联邦政府提供的、基于家计调查的非缴费型养老金，满足一定条件的公民才能享有这种福利；另一种是自愿的职业养老金，是由雇主提供给某些特殊雇员（主要是白领阶层和政府雇员）的额外福利[2]。20 世纪 80 年代中期以来，在人口老龄化影响及政府财政赤字的困扰下，政府提供的养老保障不充分且不甚令人满意。1992 年，澳大利亚通过了《退休金保障法》，要求所有雇主都必须支付工资的一定比例作为注册强制年金基金的缴费，以雇员的名义存入一个账户，在雇员退休后为其提供养老金[3]。这一制度逐渐成为澳大利亚养老金制度的主体，其规模和作用不断得到加强。目前，澳大利亚形成了以“零支柱”、“二支柱”、“三支柱”为支撑的比较独特的养老金制度体系（如表 1 所示）。

## D.瑞典

过去，瑞典社会保障基金几乎全部来源于国家提供的财政补贴和雇主缴纳的社会保障费，个人只须缴纳工资收入的 1%。1991 年，由四党组成的自由保守联合政府代替社会民主党上台执政，对瑞典养老金制度进行结构性改革。1998 年以名义账户制度（NDC）为核心的新养老保险制度代替了原有的国民养老金和收入关联养老金计划。新制度包括两个部分：（1）现收现付的名义既定供款计划，又称名义账户制度；（2）强制性、私人管理的个人账户计划。前者作为基本养老保险制度，成为新制度的第一支柱；后者是积累制度，构成第二支柱。新社会养老保险制度总缴费费率是收入的 18.5%，雇员和雇主各缴纳一半（9.25%）。再加上雇主和雇员在自愿基础上协商建立的职业养老金计划（费率为 2%-4.5%），就构成了瑞典当前养老保障制度的三个支柱。

**表 1. 智利、英国、澳大利亚、瑞典养老金体系比较**

| 国　家 | 零支柱 | 一支柱 | 二支柱 | 三支柱 |
|---|---|---|---|---|
| 智 利 | 养老救济金<br>（家计调查/法定） | 无（保留改革前参加 PAYG 的部分雇员和军人） | 个人账户养老金计划<br>（FDC/强制性） | 个人自愿<br>储蓄计划 |
| 英 国 | 最低养老金保障计划<br>（家计调查/法定/非缴费型） | 国家基本养老金（缴费型/PAYG/均等化水平） | 国家收入关联养老金<br>（PAYG/DB/强制）<br>S2P | 职业养老金计划<br>个人账户计划<br>（FDC 或 FDB/自愿） |
| 澳大利亚 | 国家养老金制度<br>（收入审查/法定/非缴费型） | 无 | 超级年金制度<br>（FDC/强制） | 个人储蓄<br>（自愿） |
| 瑞 典 | 最低保障养老金<br>（针对低收入老人/法定） | 名义账户制（缴费型/收入关联/PAYG/DC） | 个人账户计划<br>（FDC/强制） | 职业养老金计划<br>（FDC/自愿） |

资料来源：作者整理.

### E. 小结

虽然各国的养老金体系存在制度安排上的差异，但“五支柱”方案（世界银行，2005）为比较各国养老金制度的结构特色，提供了参考依据。第一支柱是一个强制性、非积累的、公共管理的待遇既定型体系，第二支柱是一个强制性、积累型的、私人管理的缴费既定型计划，第三支柱是一个自愿性的退休储蓄计划；以防止老年贫困为确切目标的零支柱，以及非融资的第四支柱——包括家庭支持、对医疗保健和住房的享有在内的一系列社会政策[4]。如表 1 所示，在四国养老金制度中，作为一支柱的现收现付制或者欠缺（如澳大利亚），或者发挥的功能有限（如英国），或者已经完全转变为其他制度安排（如智利、瑞典）。

## III. 收益评价

一般而言，给参加者带来最高收益率的养老金计划是优化个人福利并进而优化社会福利的养老金计划[5]。Samuelson （1958）的理论研究表明，当生物回报率（即工资增长率和劳动力增长率的综合）大于利率时，现收现付制在长期运作中能够实现代际间的帕累托最优[6]。因此，评价改革后的养老金制度是否有效的一个重要标准就是比较基金积累制的回报率与现收现付制的内含回报率。根据 Samuelson（1958）和 Aaron（1966）的证明结论，我们可以用养老金的投资收益率衡量基金积累制的回报率，用生物回报率——即工资增长率与劳动力增长率（一般用人口增长率表示）之和——衡量现收现付制的内含回报率。

### A.智利

从回报率的均值来看（如表 2 所示），智利养老金近 15 年的运行状况表明，基金积累制比现收现付制更有效——投资收益率均值 5.26%高于生物回报率 3.1%。如果我们采取年末累积收益的方式计算：假设期初（1994 年）拥有 100 比索养老资产，经基金积累，年末（2008 年）将获得 201.87①比索；若采取现收现付制，年末资产为 157.27②比索。

无论从均值还是年末收益的指标来看，似乎都能说明智利养老金采取基金积累制的收益要大于现收现付制，但是如果考虑管理成本，实际收益率可能要打折扣。1982 年新制度启动时，行业佣金平均占缴费工资的比重为 4.8%，至 2004 年逐步下降到 2.4%，2010 年维持在 2.67%，占养老金缴费总额的 21%③。一项研究表明，到 2004 年年底，智利账户管理费用累计占养老金资产的比重大约为 23.82%，这就意味着将近 1/5 的养老基金资产会被管理佣金消耗掉[7]。

### B.英国

近 20 年来，历经数次经济波动，英国养老基金的投资收益率均值（7.38%）高于同时段生物回报率的均值（4.21%）。假设某人在期初（1991 年）拥有 100 英镑的养老资产，经积累，期末（2010 年）将拥有 358.76④英镑的资产。如若仍采取现收现付制，则期末拥有 227.66⑤英镑，小于基金制积累的资产。

**表 3 1991-2010 年英国养老金实际投资收益率与生物回报率比较**

| 年　份 | 实际投资收益率 (r) | 生物回报率 (n+g) |
|---|---|---|
| 1991-1995 | 12.69% | 4.85% |
| 1996-2000 | 9.84% | 4.77% |
| 2001-2005 | 2.97% | 3.66% |
| 2006-2010 | 4.02% | 3.55% |
| 1991-2010 | 7.38% | 4.21% |

资料来源：养老基金的实际投资收益率来自 TOWERS WATSON, Long-term statistics, UK 2011:p26. 生物回报率根据人口增长率（来自 http://stats.oecd.org）和实际工资增长率（来自 http://stats.oecd.org）加总求得。

有统计显示，英国只有不到 5%的人能够做到一生都不换工作，而大多数人平均在一生中要更换 6 次工作。对于参加 DB 计划的雇员而言，如果在其一生中更换了 6 次工作，那么他将承受比不更换工作获得的养老金大约 25%-30%的损失，即使只是在职业生涯中更换一次工作，那么养老金损失也会达到 16%[8]。自 DC 计划建立以来，平均 19%的基金价值被用于缴纳管理费用，最差的计划甚至达到 28%[9]。另外，成员在不同 DC 计划提供者之间转换，同样会产生 25%到 33%的转换费用，而从 DB 计划转到 DC 计划则要花费更多。因此，考虑到运营成本和转换费用，英国养老基金的

① 按基金积累制的投资收益率计算：100×(1+19.48%)×(1-2.49%)×……×(1-21.97%)=201.87 比索

② 按现收现付制的内含回报率计算：100×(1-4.66%)×(1+6.12%)×……×(1+0.74%)=157.27 比索

③ Contribution structure, 智利养老基金管理局（http://www.fiap.cl）

④ 按基金积累制的投资收益率计算：100×(1+10.34%)×(1+17.61%)×……×(1+9.32%)=358.76 英镑

⑤ 按现收现付制的内含回报率计算：100×(1+8.67%)×(1+5.54%)×……×(1+2.58%)=227.66 英镑

投资回报率将不再像表 3 的数据那样可观。

**表 2. 1994-2008 年智利基金积累与现收现付制相关指标**

| 年份 | 实际投资收益率(r) | 实际工资增长率(g) | 人口增长率(n) | 生物回报率(n+g) |
|---|---|---|---|---|
| **1994** | 19.48% | -6.41% | 1.75% | -4.66% |
| **1995** | -2.49% | 4.48% | 1.64% | 6.12% |
| **1996** | 3.31% | 7.06% | 1.52% | 8.58% |
| **1997** | 4.51% | 2.75% | 1.42% | 4.17% |
| **1998** | -1.09% | 2.90% | 1.33% | 4.23% |
| **1999** | 14.53% | 2.43% | 1.27% | 3.70% |
| **2000** | 3.98% | 1.48% | 1.23% | 2.71% |
| **2001** | 5.72% | 1.61% | 1.19% | 2.80% |
| **2002** | 2.68% | 2.08% | 1.15% | 3.23% |
| **2003** | 11.90% | 1.00% | 1.11% | 2.11% |
| **2004** | 9.10% | 1.86% | 1.07% | 2.94% |
| **2005** | 5.70% | 1.88% | 1.05% | 2.92% |
| **2006** | 17.04% | 2.01% | 1.02% | 3.03% |
| **2007** | 6.50% | 2.90% | 0.99% | 3.89% |
| **2008** | -21.97% | -0.23% | 0.97% | 0.74% |
| **均值(u)** | 5.26% | 1.85% | 1.25% | 3.10% |
| **年末收益** | 201.87 | 130.99 | 120.43 | 157.27 |

数据来源：实际投资收益率（Real rate of return）来自 FIAP（http://www.fiap.cl）；
实际工资增长率根据联合国数据库（http://data.un.org）指数化工资计算得出；
人口增长率来自 OECD library (http://stats.oecd.org).

## C.澳大利亚

澳大利亚的养老金制度在国际上享有很高评价，作为其主体性制度安排的超级年金制度因其高收益率、便携性、透明性等突出优点而受到广泛称赞。但是，从一个长期投资过程来看，由于受经济周期的影响（尤其是 2000-2002 年与 2008-2009 年的经济下滑），超级年金近十多年的净投资收益情况并不太理想，其收益均值（2.39%）仅略高于现收现付制情况下的内含回报率（2.23%）。如果计算年末收益的话，期初（1997 年）的 100 澳元养老金资产经积累，至期末（2010 年）仅为 132.45 澳元[①]，小于现收现付制下的积累额 136.02 澳元[②]。由此看来，基金积累的超级年金并不比现收现付制为老年人提供的收入保障更充足。

**表 4 澳大利亚超级年金投资收益率与生物回报率比较**

| 年 份 | 实际净投资收益率(r) | 生物回报率(n+g) |
|---|---|---|
| 1997-2001 | 5.47% | 2.16% |
| 2001-2005 | 0.69% | 1.92% |
| 2006-2010 | 0.26% | 2.10% |
| 1997-2010 | 2.39% | 2.23% |

数据来源：净投资收益率来自 APRA, Celebrating 10 years of superannuation data collection 1996－2006 Insight, Issue 2,2007，p37; Annual Superannuation Bulletin June 2011 ( issued 29 February 2012), p39. 生物回报率根据人口增长率（来自 http://stats.oecd.org）和实际工资增长率（来自 http://stats.oecd.org）加总求得。

## D. 瑞典

瑞典改革后的新制度由名义账户（inkomstpension）和积累账户（premium pension）两部分组成[③]。前者是 DC 型 PAYG 制，工作一代的缴费用于当期的养老金支付，账户无实际资产；后者是 FDC 制，由个人缴费进行投资运营以实现保值增值。名义账户的名义利息率以盯住社会平均工资增长率为目标，但当长期内制度的资产与负债不平衡时，“自动平衡机制”将启动，降低或提高名义账户计息率，以实现制度长期内的资产负债平衡。制度设计了平衡率[④]来表示平衡状态，当平衡率小于 1 时，表示长期内负债大于资产，自动平衡机制将启动，名义账户计息率将相应降低，直到平衡率恢复到 1[10]。2008-2009 年，受经济危机的影响，制度的平衡率均小于 1，分别降至 0.9826 和 0.9549[11]，即负债大于资产将近 2% 和 5%。虽然制度的长期财务状况会在自动平衡机制的调整下得以平衡，但对于个人账户拥有者来说，这就意味着退休权益将受损，因为其名义账户资产将在 2009-2010 年间计负的利息（表 5）。

① 按基金积累制的投资收益率计算：100×(1+12.25 %)×(1+5.95%)×……×(1+6.05%)=132.45 澳元
② 按现收现付制的内含回报率计算：100×(1+4.23%)×(1+3.31%)×……×(1+2.32%)=136.02 澳元

③雇主、雇员分别缴纳雇员实际收入的 10.21%和 7%的费用，其中 16%进入名义账户，2.5%进入积累账户
④ 平衡率=（缴费资产价值+缓冲基金）/养老金负债

**表 5 瑞典名义账户计息与名义工资增长率、积累账户收益率与生物回报率之比较**

| 年份 | 名义记账利率(%) | 名义工资增长率(%) | 积累账户收益率(%) | 生物回报率(%) |
|---|---|---|---|---|
| 1995 | 1.8 | 3.23 | 4.6 | 3.75 |
| 1996 | 1.8 | 6.12 | 4.6 | 6.28 |
| 1997 | 2.8 | 5.06 | 4.6 | 5.12 |
| 1998 | 3.4 | 3.3 | 5% | 3.35 |
| 1999 | 1.7 | 4.07 | 3.7 | 4.14 |
| 2000 | 1.4 | 3.61 | 0.7 | 3.77 |
| 2001 | 2.9 | 2.8 | -8.6 | 3.06 |
| 2002 | 5.3 | 2.41 | -31.1 | 2.74 |
| 2003 | 3.4 | 2.78 | 17.7 | 3.15 |
| 2004 | 2.4 | 3.78 | 7.9 | 4.18 |
| 2005 | 2.7 | 3.06 | 30.5 | 3.46 |
| 2006 | 3.2 | 3.53 | 12.2 | 4.09 |
| 2007 | 4.5 | 4.64 | 5.6 | 5.39 |
| 2008 | 6.2 | 4.2 | -34.3 | 4.98 |
| 2009 | -1.4 | 2.44 | 34.9 | 3.3 |
| 2010 | -2.7 | 1.46 | 12.3 | 2.32 |
| 均值 | 2.46 | 3.53 | 4.39 | 3.94 |

资料来源：根据 Annual Report of the Swedish Pension System 2007-2010 数据整理

如表 5 所示，自名义账户制试运行以来，名义记账率在大多数时候都没能盯住名义工资增长率，其均值（2.46%）低于名义工资增长率（3.53%）。对于积累账户而言，其投资收益率 4.39%虽大于 3.94%，但按照年末累积收益的算法，积累账户的收益仍不如现收现付制①。因此，从收益的角度来看，瑞典改革至今新形成的 NDC 与 FDC 相结合的养老金制度，并不比旧的 PAYG 制更有效。

## Ⅳ. 风险评估

收益性只是评价养老金制度有效性的一个方面，另外一个重要方面就是对制度风险的衡量。下面将从一般的风险波动衡量指标与一个更精确的 VAR（Value at Risk）模型对两种类型的养老金制度进行风险评估。

### A.标准差与变异系数

**表 6 四国养老金制度风险的一般性评价标准**

| 国家 \ 风险测量 | | 均值(u) | 标准差(σ) | 变异系数(σ/u) |
|---|---|---|---|---|
| 智利 | r | 5.26% | 0.098 | 1.863 |
| | n+g | 3.10% | 0.028 | 0.903 |
| 英国 | r | 7.38% | 0.128 | 1.728 |
| | n+g | 4.21% | 0.017 | 0.392 |
| 澳大利亚 | r | 2.39% | 0.088 | 3.675 |
| | n+g | 2.23% | 0.016 | 0.737 |
| 瑞典 | r’ | 2.46% | 0.022 | 0.813 |
| | g’ | 3.53% | 0.011 | 0.283 |

注：r 表示各国养老基金的实际投资收益率，n+g 表示各国现收现付制情况下的内含回报率；r’表示瑞典的名义记账利率，g’表示名义工资增长率。

对于以 FDC 制代替 PAYG 制成为一国主体性养老金制度安排的智利、英国和澳大利亚，虽然基金的平均投资收益率要高于平均生物回报率，但简单平均数的背后忽略了经济波动的风险——这种风险涵盖了一国的宏观经济状况、养老金投资组合策略、基金的监管环境与管理效率等一系列与养老金制度设计息息相关的因素。因此，我们还有必要考察收益背后的风险。一般而言，标准差和变异系数是衡量风险的简化指标。从表 6 中的数据可以看出，智利、英国、澳大利亚的投资收益率的标准差与变异系数均大于生物回报率的相应数值，说明 FDC 制的风险均明显高于 PAYG。对于实行 NDC 制的瑞典，名义记账利率不仅没能盯上名义工资的增长率，而且制度风险也相对较大（变异系数 0.813>0.283）。

### B. VAR 技术测量

VAR（Value at Risk），表示受险价值，VAR 值指在一定的持有期与一定的置信度范围内，某金融工具或投资组合所面临的潜在的最大损失。下面将用 VAR 模型对各国养老金制度的风险进行更为精确的测量。VAR 模型定义如下[12]：

$$P(\mathrm{L}>\mathrm{VAR})\leqslant 1-c \qquad (1)$$

其中，L 表示损失，$c$ 为置信水平，取 $c$=0.99。模型表示养老金资产损失超过某一固定值(VAR)的概率为 1%，或者是养老金损失不超过固定值(VAR)的概率为 99%。

假设养老金的资产损失是服从正态分布的分位数函数，即 $\mathrm{L}\sim N(\mathrm{u},\sigma^2)$，FDC/NDC 制与 PAYG 制下的养老金损失分别取各自回报率的负值表示。根据均值及标准差，用 Excel 软件中的统计函数，各国养老金不同财务机制下“损失”的下分位数值（VAR）计算如表 7 所示。

**表 7 三国养老金损失的 VAR 评估**

| 国家 \ 风险测量 | | 均值(u) | 标准差(σ) | VAR 值(下分位数) |
|---|---|---|---|---|
| 智利 | r | 5.26% | 0.098 | -0.281 |
| | n+g | 3.10% | 0.028 | -0.096 |
| 英国 | r | 7.38% | 0.128 | -0.37 |
| | n+g | 4.21% | 0.017 | -0.08 |
| 澳大利亚 | r | 2.39% | 0.088 | -0.228 |
| | n+g | 2.23% | 0.016 | -0.061 |
| 瑞典 | r’ | 2.46% | 0.022 | -0.071 |
| | g’ | 3.53% | 0.011 | -0.059 |

VAR 评估结果如下：以智利为例，有 99%的概率能够保证基金积累制下的养老金损失不超过 28.1%，有 99%的概率保证现收现付制下的养老金损失不超过 9.6%，因而智利的基金积

① 假设期初（1995 年）拥有养老金资产 100 克朗，至期末（2010 年）将拥有养老金资产：
按基金积累制的投资收益率计算：100×(1+4.6%)×(1+4.6%)×……×(1+12.3%)=154.45 克朗
按现收现付制的内含回报率计算：100×(1+3.75%)×(1+6.28%)×……×(1+2.32%)=185.5 克朗

累制风险更大。对于英国、澳大利亚和瑞典，同样的概率（置信水平）下，PAYG 的养老金损失也明显小于 FDC/NDC（即 37%、22.8%、7.1%的损失分别小于 8%、6.1%、5.9%的损失），故而 PAYG 的风险总体较小。

# V. 结论

智利、英国、澳大利亚、瑞典的养老金体系虽有差异，但共同点在于完全或部分的 FDC 和 NDC 成为了该国的主体性养老金制度安排——而制度形成的历史原因，有的是基于制度发展的路径惯性，如澳大利亚，有的是受“社会保障私有化”改革浪潮的影响，将原有的现收现付制彻底或部分放弃，智利尤为突出。各国近 10-20 年的数据表明，基金积累制的回报率均值一般高于现收现付制下的内含回报率，但若从年末累积收益的角度看，澳大利亚超级年金近 14 年通过投资运营积累的养老金资产并不如现收现付制下盯住生物回报率积累的资产可观；即使对于 FDC 制下均值、年末积累收益值均较大的智利和英国，若考虑基金的运营成本和转换费用，其实际的净投资收益率恐怕要大打折扣。如果说在包含了大的经济波动的经济周期中，积累制养老金相对于现收现付制的收益优势并不是十分明显，那么，基金积累制与现收现付制相比所潜藏的风险，则是比较大的。无论是从风险的一般性指标（标准差与变异系数），还是从更加精确与定量化的 VAR 模型来评估，基金积累制的风险均明显高于现收现付制。瑞典的 NDC 制在收益性与抵抗风险的能力方面均不如旧有的现收现付制。总之，FDC 和 NDC 的养老金制度的优点并不十分明显，但缺点却比较突出。

## A. 理念性反思

FDC 和 NDC 制的运行效果之所以如此不尽人意，一个最主要的原因就是它们在抵御市场风险方面的脆弱性，尤其是在经历 2008-2009 年波及全球的经济大萧条的过程中。因此，危机过后，我们有必要反思目前的制度安排。各国实践已表明，以增加积累比重与个人责任、减少现收现付制比重与政府责任为主要特征的社会保障改革并不能有效应对此次经济危机的冲击：风险的放大必将导致收益的不确定，进而带来替代率的不确定，最后将给在职者未来的退休生活带来相当大的不确定性——这就与养老金制度的本质相违背。在英国，通过“合同退出”加入 DC 计划的中等收入者可能达不到期望替代率，并且高收入者的 DC 计划比 DB 计划更难达到期望替代率[13]。在瑞典，退休金替代率已从 90 年代早期的 70%下降到 2009 年的 64%，预期到 2050 年仅为 53%[14]，而与此同时，个人的缴费负担并未减轻。

相比之下，现收现付制则体现了代际之间的责任分担、互助共济，有益于社会的公平，符合人类的天性、本能与自然法则。待遇既定型的养老金又为在职者提供退休时确定的待遇给付承诺，进而使人们拥有对未来的安全、稳定预期。没有后顾之忧，老年人才能拥有从容、幸福的生活。由此看来，DB 型 PAYG 制度是体现养老金本质的良性制度安排。

## B. 技术性改进

人口老龄化下养老金制度的支付危机成为现收现付制备受诟病的主要原因，但是，我们应当知道，老年人真正感兴趣的不是现金，而是对食物、医疗服务、取暖、活动设施等的消费需求。学者已从理论上证明，只要在职者劳动生产率增长率大于或等于赡养率的增长率，现收现付制不必然发生支付危机[15]。所以，问题的关键在于一国的国民产出水平，而不是通过哪些特别的方式为养老金融资。随着生产率水平的提高、财富的积累，未来老年人对实物（而不仅是现金）的需求能够得到有效解决。另外，老龄化是一个动态化过程，它意味着赡养者（照顾者）与被赡养者（被照顾者）寿命的同时延长，政策的参量调整（如延长退休年龄）能够使现收现付制的可持续性得以实现。

因此，对一国主体性养老金制度的选择，重返 DB 型 PAYG 制既必要亦可行；当然，我们也需要把握好度，不能像希腊等国走向了另一个极端①，应根据各国实际情况，在主体性制度安排之外建立起有兜底、有基金积累的多层次养老金体系——这可谓后危机时代，国家养老金制度的一个理性选择。

# 致谢

感谢中国人民大学李珍老师、王晓军老师、程永宏老师带给本论文的创作灵感，感谢米海杰博士对论文的技术指导。

**References**

[1] Chen Xing, Development of UK Pension System and Its Enlightenment, Journal of China University of Geosciences (Social Sciences Edition), 2007.4.
陈星，英国养老金制度发展演变及其启示，中国地质大学学报（社会科学版），2007 年第 4 期.
[2] Study on Endowment Insurance across Countries and Its Enlightenment to China, edited by China Insurance Regulatory

① 希腊养老金制度层次单一，现收现付制高达 95%的养老金替代率是导致支付危机，进而衍生债务危机的重要原因。

Commission, Beijing: Chinese Financial and Economic Publishing House, 2007.1.
养老保险国别研究及对中国的启示[M]. 中国保监会编著，北京：中国财政经济出版社, 2007.1.
[3] LiZhen, Sun Yongyong, Zhang Zhaohua. The choice of Chinese fund management system of social endowment insurance: based on the international comparison. Beijing: Remin Publishing House, 2005.p167
李珍 孙永勇 张昭华. 中国社会养老保险基金管理体制选择——以国际比较为基础[M]. 北京：人民出版社，2005. P167
[4] Robert Holzmann, Richard Hinz, Income Support in the 21st Century：An International Perspective on Pension Systems and Reform. The World Bank. pp2.
[5] Lindbeck, Assar & Mats Persson 2003. “The Gains from Pension Reform.” The Journal of Economic Literature XLI (March):74-112.
[6] Paul A. Samuelson, “An Exact Consumption—Loan Model of Interest With or Without Social Contrivance of Money”, Journal of Political Economy, Vol. 66, No. 6 (Dec., 1958), pp. 467-482.
[7] Mauricio Soto, Chilean Pension Reform: the Good, the Bad, and the in Between, Boston College Retirement Research Center, June 2005.
[8] Blake.D, Orszag J.M.(1997) “Portability and Preservation of Pension Rights in the UK, Report of the Director-General’s Inquiry into Pensions”,pp74.
[9] David Blake. The UK Pension System: Key issues, Pensions, July 2003,p353.
[10] LiZhen, Zhou Yimeng, The Sweden Model of Social Security for the Elderly——What problem dose the NDC in Sweden solve? Economic Perspectives. 2010.8.
李珍、周艺梦. 社会养老保障制度的“瑞典模式”——瑞典名义账户制度解决了什么？[J]. 经济学动态. 2010 年第 8 期.
[11] Social Insurance Agency(Stockholm), Annual Report of the Swedish Pension System 2010, pp39.
[12] Philippe Jorion. VALUE AT RISK: The New Benchmark for Managing Financial Risk. USA, The McGraw-Hill Companies. pp106.
[13] PPI, Retirement income and assets: outlook for the future,2010. pp16.
[14] Social Insurance Agency(Stockholm), Annual Report of the Swedish Pension System 2008，pp34.
[15]Cheng Yonghong, Quantifying analysis on the relationship between PAYG system and population ageing. Economic Study. 2005.5.

# 浅议后危机时代国家养老金制度的选择

赵 青
公共管理学院，中国人民大学，北京，中国，100872

**摘 要：** 20 世纪 70 年代以来，在经济滞涨与人口老龄化的背景下，各国纷纷对传统养老保险制度进行了改革。智利用基金积累制完全取代了现收现付制的国家养老金制度，成为社会保障私有化的典型。英国通过“合同退出”实现了国家收入关联养老金制度向部分积累制的转变。澳大利亚在历史路径的沿革下，形成了只有零支柱与二支柱养老金制度的少数几个国家之一。瑞典将原有的现收现付制改革为名义账户制。本文对改革国家在整个经济周期中养老金制度的运行效果进行了评价。从收益性角度来看，基金积累制的投资收益率一般要高于现收现付制的内含回报率，但若考虑个人账户基金管理的运营成本和转换费用，则这种优势将大打折扣。从风险的角度看，基金积累制的市场波动风险（用变异系数与 VAR 模型衡量）要明显高于现收现付制。而名义账户制在收益性与抵御风险的能力方面均不如现收现付制。基于养老金在缓解贫困、提供稳定而安全的收入预期方面的本质特征，以及现收现付制在财务可持续性上的可行性，本文认为，建立以待遇确定型现收现付制为主体、多层次为补充的养老金体系是后危机时代国家养老金制度的理性选择。

**关键词：**现收现付制；基金积累制；名义账户制；风险；养老金本质

# Stochastic Claims Reserving in General Insurance: Models and Methodoledgies

Jinlong HUANG and Xianyi WU*
Department of Statistics and Actuarial Science
East China Normal University

June 10, 2012

**Abstract**

In this article we review the main approaches extensively investigated for claims reserving in general insurance. We first introduce the models underlying the most-known Chain Ladder method and Bornhuetter-Ferguson method. Then we discuss their Bayesian versions, Generalized limear models for claims reserving and the bootstrap approaches to evaluating the variabilty of predicted/estimated reserves are reviewed also. In addition, we conclude the paper by introducing the multivariate version for claims reserving methods.

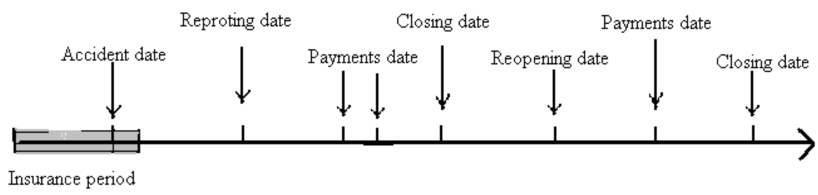
## 1 Introduction

### 1.1 General insurance and claims reserving

Insurance industries can be put in two categories: life insurance and non-life insurance. There are rather different characteristics between Non-life and life insurance products, such as terms of contracts, type of claims, risk drivers, etc., and in many countries there is a strict legal separation between these two insurance products such that any company dealing with one type of insurance products is not allowed to operate that other type of insurance products. While the term non-life insurance is known in continental Europe, it is known as General Insurance in UK and Property and Casualty Insurance in USA. A life company develops and sells such insurance products motor/car insurance (e.g., motor third party liability and motor hull), property insurance (e.g., property against fire, flooding, business interruption, etc.), liability insurance (e.g., director and officers (D&O) liability insurance) accident

*Supported by Shanghai Philosiphy and Social Science foundation under grant No. 2010BJB004.

Figure 1: Claim process.




insurance (personal and collective accident, including compulsory accident insurance and workers' compensation), health insurance, marine insurance, etc. The history of a typical non-life insurance claim can be illustrated in the following Figure 1, in which an accident occurred at a time between the insurance period and then reported some time later at the reporting date with the claim being settled at a further later time point indicated by closing date. For certain cases, due to certain reasons, e.g., new evidence is discovered for a liability insurance such that the account of the closed claim has to be reopen to handle newly raised claims.

We are here concentrated in the claims in terms of money but set aside the details in insurance operation and accounting, e.g. inflation effect that has been observed in the literature. At the evaluation date, usually the end of an accounting year, the insurer need to make down the figure of the money to be kept to cover the future payments for claims. This total amount of money is referred to as claims reserve (or loss reserve). As shown in the above figure, we will distinct incurred but not reported and reported but not settled (RBNS) claims; the meanings of which are clear from the figure. And the future payments include two part: one for the IBNR claims and one for RBNS claims.

Classically, a majority of actuaries make their loss reserving based on the data sets that are known as development triangles or aggregate data. The data sets are mostly in the form

$$\mathcal{D} = \{X_{ij}, i = 0, 1, \ldots, I, j = 0, 1, \ldots (I - i) \wedge J\}, \tag{1.1}$$

where $i$ indicates accident years, $j$ the development years, $X_{ij}$ the claims amount caused by the accidents occurred in accident year $i$ and is generally referred to as development year/period, and $I$ the number of years in which partial or the entire claims history are observed and $J$ is the maximum development years. Note that the calendar evaluation year is $I$ and $I \geq J$ is generally required. The unknown $X_{ij}$ for $j \in (I - i, J]$ is referred to as outstanding loss liabilities for $i > I - J$.

For all $i \in \{0, \cdots, I\}$, $j \in \{0, \cdots, J\}$, let $C_{i,j}$ denote the cumulative payments for accident year $i$ of the first $j+1$ development years, i.e., $C_{ij} = \sum_{k=0}^{j} X_{ik}$.Therefore the outstanding loss liability for accident year $i$ is

$$R_i = C_{i,J} - C_{i,I-i} = \sum_{k=I-i+1}^{J} X_{i,k}. \tag{1.2}$$

Classically, the data set $\mathcal{D}$ is taken as a set of deterministic numbers and the objective is to predict $\sum_{i=0}^{I} R_i$ or equivalently $\sum_{i=0}^{I} C_{iJ}$. In the later of last century, researchers started to model $X_{ij}$ by random variables and hence changed the objective to estimating the mean of $\sum_{i=0}^{I} C_{iJ}$. Actually, we can generally consider the objective of claims reserving as estimating the distribution or certain functionals of the random claims $\sum_{i=0}^{I} C_{iJ}$. based on the observed data $\mathcal{D}$.

Moreover, denote the set of observations at time $I$ for the first $j$th development years by

$$\mathcal{D}_j = \{X_{i,k}; i+k \leq I, 0 \leq k \leq j\}, \quad j = 0, 1, \cdots, J \tag{1.3}$$

then $\mathcal{D}_I = \mathcal{D}_J$ is all the available observations at time $I$. Finally, we let

$$\mathcal{F}_{i,j} = \sigma(C_{i,0}, \ldots, C_{i,j}) \quad j = 0, 1, \cdots, J-1 \tag{1.4}$$

be the filtration generated by the loss claims history of accident year $i$ and development year $j$.

The existing claims reserving methods for data sets of form (1.1) include the most popular chain ladder (CL) and Bornhuetter-Ferguson (BF) methods. The stochastic methods developed after the later of last century were mainly concerned with the construction of as general as possible models that justify CL and BF methods. In all these models, the following is the fundamental assumption and is respected by all stochastic models.

**Model Assumption 1.1** *1.* $\{C_{i,j}, j = 0, 1, \ldots, J\}$ *are mutually independent over* $i = 0, 1, \ldots, I$.

# 2 Stochastic Models for Chain Ladder Method

## 2.1 Distribution-free Chain-Ladder model

The chain ladder method may be the most popular technique for reserving because of its simplicity and distribution-free assumption. The following chain ladder model assumptions are given Mack (1993) [16].

**Model Assumption 2.1** *1. There exist a set of development factors* $f_0, f_1, \cdots, f_{J-1} > 0$*, referred to as development factors, such that for all* $0 \leq i \leq I$ *and all* $1 \leq j \leq J$ *we have*

$$E[C_{i,j}|\mathcal{F}_{i,j-1}] = E[C_{i,j}|C_{i,j-1}] = f_{j-1}C_{i,j-1}.$$

*2. There exist a set of positive numbers* $\sigma_0^2, \cdots, \sigma_{J-1}^2 \geq 0$*, such that for all* $0 \leq i \leq I$ *and all* $1 \leq j \leq J$ *we have*

$$Var(C_{i,j}|\mathcal{F}_{i,j-1}) = Var(C_{i,j}|C_{i,j-1}) = \sigma_{j-1}^2 C_{i,j-1}. \tag{2.1}$$

### 2.1.1 Feature of the model

Under this basic assumption, it can be easily seen that

$$E[C_{i,J}|\mathcal{D}_I] = C_{i,I-i} f_{I-i} \cdots f_{J-1} \text{ and } \mathrm{Var}(C_{iJ}|\mathcal{D}_I) = C_{i,I-i} \sum_{j=I-i}^{J-1} \prod_{m=I-i}^{j-1} f_m \sigma_j^2 \prod_{n=j+1}^{J-1} f_n^2, \tag{2.2}$$

where the second equality can be verified by first noting that $\mathrm{Var}(C_{iJ}|\mathcal{D}_I) = \mathrm{Var}(C_{iJ}|\mathcal{F}_{i,I-i})$ and thus

$$\begin{aligned}
\mathrm{Var}(C_{iJ}|\mathcal{D}_I) &= \mathrm{E}[\mathrm{Var}(C_{iJ}|\mathcal{F}_{i,J-1})|\mathcal{F}_{i,I-i}] + \mathrm{Var}[\mathrm{E}(C_{iJ}|\mathcal{F}_{i,J-1})|\mathcal{F}_{i,I-i}] \\
&= \sigma_{J-1}^2 \mathrm{E}[C_{i,J-1}|\mathcal{F}_{i,I-i}] + f_{J-1}^2 \mathrm{Var}(C_{iJ}|\mathcal{F}_{i,J-1}) \\
&= \sigma_{J-1}^2 C_{i,I-i} \prod_{m=I-i}^{J-2} f_m + f_{J-1}^2 \mathrm{Var}(C_{i,J-1}|\mathcal{F}_{i,I-i}),
\end{aligned}$$

and then recursively applying this equality.

### 2.1.2 Estimation

For every $j = 1, 2, \ldots, J$, denote $\mathcal{F}_{j-1} = \bigvee_{i=0}^{I} \mathcal{F}_{i,(j-1)\wedge(I-i)}$. The effective data to estimate $f_{j-1}$ are $C_{i,j-1}, C_{i,j}, i = 0, 2, \ldots, J-j$, satisfying a linear model

$$\begin{pmatrix} C_{0,j} \\ \vdots \\ C_{J-j,j} \end{pmatrix} = \begin{pmatrix} C_{0,j-1} \\ \vdots \\ C_{J-j,j-1} \end{pmatrix} f_j + \varepsilon,$$

where $\varepsilon = \begin{pmatrix} \varepsilon_0 & \ldots & \varepsilon_{J-j} \end{pmatrix}^T$ satisfying $\mathrm{E}\left(\varepsilon|\mathcal{F}_{j-1}\right) = 0$ and $\mathrm{Var}\left(\varepsilon|\mathcal{F}_{j-1}\right) = diag(C_{0,j-1}, \cdots, C_{J-j,j-1})$. Thus the conditional BLUE (best linear unbiased estimator) of $f_{j-1}$ given $\mathcal{F}_{j-1}$ are

$$\widehat{f}_{j-1} = \frac{\sum_{i=0}^{I-j} C_{i,j}}{\sum_{i=0}^{I-j} C_{i,j-1}}. \tag{2.3}$$

Meanwhile, $\sigma_j^2$ can be estimated by

$$\widehat{\sigma_j}^2 = \frac{1}{I-j-1} \sum_{i=0}^{I-j-1} C_{i,j} \left(\frac{C_{i,j+1}}{C_{i,j}} - \widehat{f}_j\right)^2. \tag{2.4}$$

It is also not difficult to examine that $E\left[\widehat{f}_{I-i}\cdots\widehat{f}_{J-1}|\mathcal{F}_{i,I-i}\right] = f_{I-i}\cdots f_{J-1}$. Then an unbiased estimator of $E[C_{i,J}|\mathcal{D}_I]$ is given by

$$\widehat{C}_{i,J}^{CL} = \widehat{E}[C_{i,J}|\mathcal{D}_I] = C_{i,I-i}\widehat{f}_{I-i}\cdots\widehat{f}_{J-1} \tag{2.5}$$

Here we note that the unbiasedness does not depends on the second item of Assumption 2.1.

**Remark 2.1** *From formula (2.5), it is very apparent that the estimator $\widehat{C}_{i,J}^{CL}$ might not be robust with respect to the outlier of $C_{i,I-i}$. A robustification of the chain-ladder method can be found in a recent work by Verdonck, Van Wouwe and Dhaene (2009).*

### 2.1.3 Estimation of the MSEP

Since the claims in different accident years are independent, it holds that

$$\mathrm{Var}\Big(\sum_{i=1}^{I} C_{iJ}|\mathcal{D}_I\Big) = \sum_{i=1}^{I}\mathrm{Var}(C_{ij}|\mathcal{D}_I)$$

The mean squared error of the prediction $C_{i,J}^{CL}$ (MSEP) is given by

$$MSEP^{CL} = \mathrm{E}\left[(\widehat{C}_{i,J}^{CL} - E[C_{i,J}|\mathcal{D}_I])^2\Big|\,\mathcal{F}_{j-1}\right] = C_{i,I-i}^2\mathrm{E}\left[(\widehat{f}_{I-i}\cdots\widehat{f}_{J-1} - f_{I-i}\cdots f_{J-1})^2\Big|\,\mathcal{F}_{j-1}\right]. \tag{2.6}$$

The following discusses the estimation of $MSEP^{CL}$

**Mack's method.**

Mack (1993)[16] gave the following approach for estimating the parameter estimation error. Introduce for $j \in \{I-i,\cdots,J-1\}$,

$$T_j = \widehat{f}_{I-i}\cdots\widehat{f}_{j-1}(f_j - \widehat{f}_j)f_{j+1}\cdots f_{J-1}.$$

This implies that

$$(\widehat{C}_{i,j}^{CL} - E[C_{i,j}|\mathcal{D}_I])^2 = C_{i,I-i}^2\Big(\sum_{j=I-i}^{J-1} T_j^2 + 2\sum_{I-i\le j<k\le J-1} T_jT_k\Big).$$

Note that $E[T_k|\mathcal{D}_k] = 0$ and that $T_j$ is $\mathcal{D}_k$-measurable for $j < k$. Moreover, under the assumption on the variance of $C_{ij}$, see equation (2.1), We see that

$$E[T_jT_k|\mathcal{D}_k] = \begin{cases} 0, & \text{if } j < k \\ \widehat{f}_{I-i}^2\cdots\widehat{f}_{j-1}^2\frac{\sigma_j^2}{S_j^{[I-j-1]}}f_{j+1}^2\cdots f_{J-1}^2, & \text{if } j = k \end{cases} \tag{2.7}$$

where $S_j^{[k]} = \sum_{i=0}^{k} C_{ij}$. Hence we further have

$$MSEP^{CL} = \mathrm{E}\left[C_{i,I-i}^2 \sum_{j=I-i}^{J-1} \widehat{f}_{I-i}^2 \cdots \widehat{f}_{j-1}^2 \frac{\sigma_j^2}{S_j^{[I-j-1]}} f_{j+1}^2 \cdots f_{J-1}^2\right] \tag{2.8}$$

Replace the unknown parameters $f_j$ by $\widehat{f_j}$ given in (2.3) and $\sigma_j^2$ by $\widehat{\sigma_j}^2$ given in (2.4) in (2.2) and (2.8), we get the following estimator for msep$(\widehat{C_{iJ}}^{CL}|\mathcal{D}_I)$,

$$\widehat{\mathrm{msep}}_{C_{iJ}|\mathcal{D}_I}\big(\widehat{C_{iJ}}^{CL}\big) = \big(\widehat{C_{iJ}}^{CL}\big)^2 \sum_{j=I-i}^{J-1} \frac{\widehat{\sigma}_j^2}{\widehat{f}_j^2}\Big(\frac{1}{\widehat{C_{iJ}}^{CL}} + \frac{1}{S_j^{[I-j-1]}}\Big). \tag{2.9}$$

**Time Series and Enhanced Time Series Model.**

The Time Series Model has been investigated by several authors, such as [2] and [21]. [6] discussed different approaches for the estimation of MSEP in the Time Series framework. Moreover, [36] proposed the Enhanced Time Series Model to describe the uncertainty whether the deterministic chain ladder factors $f_j$ are still valid for future claims development behavior.

**Model Assumption 2.2 (Time Series model)** *The cumulative payments $C_{i,j}$ satisfy*

$$C_{i,j} = f_{j-1}C_{i,j-1} + \sigma_{j-1}\sqrt{C_{i,j-1}}\varepsilon_{i,j} \tag{2.10}$$

*where conditional on $\mathcal{D}_0$, $\varepsilon_{i,j}$ are mutually independent with $E[\varepsilon_{i,j}|\mathcal{D}_0] = 0$, $E[\varepsilon_{i,j}^2|\mathcal{D}_0] = 1$ and $P[C_{i,j} > 0|\mathcal{D}_0] = 1$.*

Define the individual development factor for accident year $i$ and development year $j$ by

$$F_{i,j} = \frac{C_{i,j}}{C_{i,j-1}} \tag{2.11}$$

It is easy to check that under Model Assumption 2.2, equality (2.2) also holds and further we have

$$E[F_{i,j}|C_{i,j-1}] = f_{j-1} \quad \text{and} \quad Var(F_{i,j}|C_{i,j-1}) = \frac{\sigma_{j-1}^2}{C_{i,j-1}}. \tag{2.12}$$

then the BLUE for $f_j$, conditional on $\mathcal{D}_j$, coincides with (2.3) and therefore (2.5) is also an unbiased estimator of $E[C_{i,J}|\mathcal{D}_I]$ in the Time Series model. Therefore the estimation error are given by

$$(\widehat{C}_{i,j}^{TS} - E[C_{i,j}|\mathcal{D}_I])^2 = C_{i,I-i}^2(\widehat{f}_{I-i}\cdots\widehat{f}_{J-1} - f_{I-i}\cdots f_{J-1})^2 \tag{2.13}$$

which coincides with (2.6).

In order to determine the (conditional) estimation error, we need to determine the volatilities $\widehat{f}_j$ around its true values $f_j$. [6] measures these volatilities with a conditional resampling method. That is, we estimate (2.13) by

$$C_{i,I-i}^2\Big(\prod_{k=I-i}^{J-1} E[\widehat{f}_k^2|\mathcal{D}_k] - \prod_{k=I-i}^{J-1} f_k^2\Big). \tag{2.14}$$

We therefore resample the observations $\widehat{f}_{I-i}, \cdots, \widehat{f}_{J-1}$, given $\mathcal{D}_I$. This means that for the determination of an estimator for the (conditional) estimation error we have to take into account that, given $\mathcal{D}_I$, the observations for $\widehat{f}_j$ could have been different form the observed values $\widehat{f}_j$. To regard this source of uncertainty, we degenerate a set of 'new' observation by the formula

$$C_{i,j}^* = f_{j-1}C_{i,j-1} + \sigma_{j-1}\sqrt{C_{i,j-1}}\widetilde{\varepsilon}_{i,j} \tag{2.15}$$

in the upper triangle, where $\varepsilon_{i,j}$ and $\widetilde{\varepsilon}_{i,j}$ are $i.i.d$ random variables. Therefore given $\mathcal{D}_I$, $C_{i,j}^*$ and $C_{i,j}$ have the same distribution.

From (2.3) and (2.15), we get the following representation for the resampled estimates of the development factors

$$\widehat{f}_{j-1}^* = \frac{\sum_{k=0}^{I-j} C_{k,j}^*}{\sum_{k=0}^{I-j} C_{k,j-1}} = f_{j-1} + \frac{\sigma_{j-1}}{S^{j-1}}\sum_{k=0}^{I-j}\sqrt{C_{k,j-1}}\widetilde{\varepsilon}_{i,j} \tag{2.16}$$

further given $\mathcal{D}_j$, $\widehat{f}_j^*$ and $\widehat{f}_j$ have the same distribution.

From (2.16) and the fact that the observations $C_{i,j}$ and $\widetilde{\varepsilon}_{i,j}$ are unconditionally independent, we conclude that:

1) the estimators $f_0^*, \cdots, f_{J-1}^*$ are conditionally independent w.r.t $\mathcal{D}_I$.

2) $E[\widehat{f}_{j-1}^*|\mathcal{D}_I] = f_{j-1}$ and $E[(\widehat{f}_{j-1}^*)^2|\mathcal{D}_I] = f_{j-1}^2 + \frac{\sigma_{j-1}^2}{S^{j-1}}$ for $1 \le j \le J$.

Hence (2.14) is estimated by

$$C_{i,I-i}^2\Big(\prod_{k=I-i}^{J-1}(f_k^2 + \frac{\sigma_k^2}{S^k}) - \prod_{k=I-i}^{J-1} f_k^2\Big) \tag{2.17}$$

Next, replace $f_j$ and $\sigma_j$ in (**??**) and (2.17) by their estimators, we get an estimator for the conditional MSEP.

According to (2.12), the conditional variational coefficients of $F_{i,j}$ are given by

$$V_{CO}(F_{ij}|C_{i,j-1}) = \frac{\sigma_{j-1}}{f_{j-1}}C_{i,j-1}^{-\frac{1}{2}} \to 0, \quad \text{as} \quad C_{i,j-1} \to \infty$$

which means that the risk completely disappears for very large portfolios. However, this is not the case in practice for there are always some external factors that influences a portfolio and are not diversifiable. To take this risk class into account, we refer to [36].

**Model Assumption 2.3 (Enhanced Time Series model)** *There exist positive constants* $f_{j-1}, \sigma^2_{j-1}, a^2_{j-1}$ *and random variables* $\varepsilon_{i,j}$ *such that for all* $i \in \{0, \cdots, I\}$ *and* $j \in \{1, \cdots, J\}$ *we have*

$$C_{i,j} = f_{j-1} C_{i,j-1} + (\sigma^2_{j-1} + a^2_j f^2_{j-1} C_{i,j-1})^{\frac{1}{2}} \sqrt{C_{i,j-1}} \varepsilon_{i,j} \tag{2.18}$$

*where* $\varepsilon_{i,j}$ *has the same assumption as in Model Assumption 2.2.* ***(Enhanced CL model or Enhanced Time Series model?)***

**Theorem 2.1** *Under Model Assumption 1.1 and 2.3, we have,*

*1. the conditional variational coefficients of* $F_{i,j}$ *is bounded from below by* $a^2_{j-1}$, i.e.

$$V_{CO}(F_{ij}|C_{i,j-1}) \geq \lim_{C_{i,j-1} \to \infty} V_{CO}(F_{ij}|C_{i,j-1}) = a^2_{j-1}.$$

*2. the conditional expectation of the ultimate claim for a single accident year coincides with* (2.2)

*3. the conditional process variance of the ultimate claim for a single accident year* $i$ *is given by*

$$\begin{aligned}
\mathrm{Var}(C_{iJ}|\mathcal{D}_I) &= C^2_{i,I-i} \Big[ \sum_{j=I-i}^{J-1} \prod_{n=j+1}^{J-1} \Big(1 + a^2_n\Big) f^2_j \Big( \frac{\sigma^2_j}{C_{i,I-i}} \prod_{m=I-i}^{j-1} f_m + a^2_j \prod_{m=I-i}^{j} f^2_m \Big) \Big] \\
&= E[C_{ij}|\mathcal{D}_I]^2 \Big[ \sum_{j=I-i}^{J-1} \Big( \frac{\sigma^2_j / f^2_j}{E[C_{ij}|\mathcal{D}_I]} \Big) \prod_{n=j+1}^{J-1} (1 + a^2_n) \Big].
\end{aligned}$$

As to the parameter estimation, [36] points out that the sequence $a_j$, usually can not be estimated from the data unless the portfolio is very large. Hence in general $a_j$ can only be estimated from the whole insurance market. The author proposed an iterative estimation for $f_j$ and $\sigma^2_j$, that is

$$\begin{aligned}
\widehat{f}^{(0)}_j &= \frac{\sum_{i=0}^{I-j-1} C_{i,j+1}}{\sum_{i=0}^{I-j-1} C_{i,j}} \\
\widehat{\sigma^2_j}^{(k)} &= \frac{1}{I-j-1} \sum_{i=0}^{I-j} C_{i,j} (F_{i,j+1} - \widehat{f}_j^{(0)})^2 - \frac{\widehat{a}^2_j \widehat{f^{(k-1)}_j}^2}{I-j-1} \Big( \sum_{i=0}^{I-j} C_{i,j} - \frac{\sum_{i=0}^{I-j} C^2_{i,j}}{\sum_{i=0}^{I-j} C_{i,j}} \Big) \\
\widehat{f}^{(k)}_j &= \frac{\sum_{i=0}^{I-j-1} C_{i,j+1} / \Delta^{(k)}_{i,j}}{\sum_{k=0}^{I-j-1} C_{kj} / \Delta^{(k)}_{i,j}}, \quad where \Delta^{(k)}_{i,j} = \widehat{\sigma^2_j}^{(k)} + \widehat{a}^2_j \widehat{f^{(k-1)}_j}^2 C_{ij}.
\end{aligned}$$

## 2.2 Bornhuetter-Ferguson related Method

The Bornhuetter-Ferguson method (referred to as BF method below) goes back to Bornhuetter and Ferguson (1972) [4]. .

**Model Assumption 2.4** *1. There exist parameters* $\mu_0, \mu_1, \cdots, \mu_I > 0$ *and* $\beta_0, \beta_1, \cdots, \beta_J > 0$ *with* $\beta_J = 1$ *such that for all* $0 \le i \le I$ *and all* $0 \le j \le J$ *we have*

$$E[C_{i0}] = \mu_i \beta_0 \text{ and } E[C_{i,j} | \mathcal{F}_{i,j-1}] = C_{i,j-1} + \mu_i(\beta_j - \beta_{j-1}) \tag{2.19}$$

*2. The incremental claims* $C_{i,J} - C_{i,I-i}$ *was independent of* $C_{i,0}, \cdots, C_{i,I-i}$*.*

Under Model Assumption 2.4, it is easy to see that

$$E[C_{i,j}] = \mu_i \beta_j \tag{2.20}$$

for all $0 \le j \le J$ and

$$E[C_{i,J}|\mathcal{D}_I] = C_{i,I-i} + E[C_{iJ} - C_{i,I-i}] = C_{i,I-i} + (1 - \beta_{I-i})\mu_i \tag{2.21}$$

Then a BF estimator for $E[C_{iJ}|\mathcal{D}_I]$ is given by

$$\widehat{C}_{i,J}^{BF} = \widehat{E}[C_{i,J}|\mathcal{D}_I] = C_{i,I-i} + (1 - \widehat{\beta}_{I-i})\mu_i \tag{2.22}$$

where $\widehat{\beta}_{I-i}$ is an appropriate estimator for $\beta_{I-i}$ and $\mu_i$ is a prior estimator for the expected ultimate claims $E[C_{i,J}]$.

Recall that under Model Assumption 2.1, for any $j$, we have

$$E[C_{i,J}] = E[E[C_{i,J}|C_{i,J-1}]] = f_{J-1}E[C_{i,J-1}] = \cdots = \prod_{k=j}^{J-1} f_k E[C_{i,j}], \tag{2.23}$$

and hence,

$$E[C_{i,j}] = \prod_{k=j}^{J-1} f_k^{-1} E[C_{i,J}]. \tag{2.24}$$

Using (2.20), we find that $\prod_{k=j}^{J-1} f_k^{-1}$ plays the role of $\beta_j$. Therefore if we set

$$\widehat{\beta}_j^{(CL)} = \prod_{k=j}^{J-1} \widehat{f}_k^{-1}, \tag{2.25}$$

it can be readily justified that

$$\widehat{C_{i,J}}^{BF} = C_{i,I-i} + (1 - \widehat{\beta}_{I-i})\mu_i \text{ and } \widehat{C_{i,J}}^{CL} = C_{i,I-i} + (1 - \widehat{\beta}_{I-i})\widehat{C_{i,J}}^{CL}. \tag{2.26}$$

This indicates that the BF estimator and the CL estimator differ only in the estimator of the ultimate claim $C_{i,J}$.

# 3 Bayesian Models

There are two main directions in the framework of Bayesian theory for claim reserving. One is the exact Bayesian method, such as [1], [10],[11], [33] and [34]. The other is the credibility theory, one can refer to [12], [17], [22] and [35].

## 3.1 Benktander-Hovinen credibility method

This is not a Bayesian method in strict sense, but it has a similar form of credibility theory (see e.g., Bühlmann and Gisler, 2005) in non-life insurance. In this subsection, it is for the time being assumed that $\mu_i$ and $\beta_j$ are known so that $\widehat{C_{i,J}}^{CL} = C_{i,I-i}/\beta_{I-i}$ and $\widehat{C_{i,J}}^{BF} = C_{i,I-i} + (1-\beta_{I-i})\mu_i$. If we let

$$u_i(c) = c\widehat{C_{i,J}}^{CL} + (1-c)\widehat{C_{i,J}}^{BF}$$

for any $c \in [0,1]$, we get a mixture of the CL estimator and BF estimator. This type of estimators for the ultimate reserves is due to Benktander (1976) and Hovinen (1981). Benktander (1976) suggested to take $c = \beta_{I-i}$ such that

$$u_i(\beta_{I-i}) = \beta_{I-i}\widehat{C_{i,J}}^{CL} + (1-\beta_{I-i})\widehat{C_{i,J}}^{BF} = C_{i,I-i} + (1-\beta_{I-i})\widehat{C_{i,J}}^{BF}.$$

It corresponds to an iterated BF estimator using the BF estimate to institute for the prior $\mu_i$ in the formula for BF estimator $\widehat{C_{i,J}}^{BF}$.

If we let $\mu_i = \kappa_i \Pi_i$, then we get the Cape-Cod Model (see Bühlmann (1983)), where $\kappa_i$ reflects the average loss ratio and $\Pi_i$ can be interpreted as the premium received in accident year $i$.

Generally, we can choose $c$ to be the minimizer of the (unconditional) MSEP for the reserve estimator $\widehat{R_i}(c)$,

$$\mathrm{msep}_{R_i}(\widehat{R_i}(c)) = E[(R_i - \widehat{R_i}(c))^2]. \tag{3.27}$$

In order to minimize (3.27), we assume that $\mu_i, i = 0, 1, \ldots, I$ in (2.19) are independent of the data $C_{i,J}$ and $E\mu_i = EC_{i,J}$. The following theorem is due to Mack (2000) [17].

**Theorem 3.1** *Under Model Assumption 2.1, the optimal credibility factor $c_i^*$, which minimizes the (unconditional) MSEP* (3.27) *is given by*

$$c_i^* = \frac{\beta_{I-i}}{1-\beta_{I-i}} \frac{\mathrm{Cov}(C_{i,I-i}, R_i) + \beta_{I-i}(1-\beta_{I-i})\mathrm{Var}(U_i)}{\mathrm{Var}(C_{i,I-i}) + \beta_{I-i}^2 \mathrm{Var}(U_i)}$$

### 3.2 Exact Bayesian Models

The Bayesian method is called exact since the Bayesian estimator $E[C_{iJ}|\mathcal{D}_I]$ is optimal in the sense that it minimizes the squared loss function (MSEP) in the class $L^2_{C_{iJ}}(\mathcal{D}_I)$, in which all estimators for $C_{iJ}$ that are square integrable functions of the observations in $\mathcal{D}_I$, that is

$$E[C_{iJ}|\mathcal{D}_I] = \underset{Y \in L^2_{C_{iJ}}(\mathcal{D}_I)}{\operatorname{argmin}} E[(C_{iJ} - Y)^2|\mathcal{D}_I].$$

**Model Assumption 3.1** *1. Given $\Theta_i$, the random variables $Y_{ij} = \frac{X_{ij}}{\mu_i \gamma_j}$, $j = 0, \cdots, J$ are independent for all $i \in \{0, \cdots, I\}$,where $\gamma_j \geq 0$ and $\sum_{j=0}^{J} \gamma_j = 1$.*

*2. The pairs $(\Theta_i, (X_{i0}, \cdots, X_{iJ}))$ $(i = 0, \cdots, I)$ are independent and $\Theta_0, \cdots, \Theta_I$ are i.i.d.*

**Model Assumption 3.2** *1. $Y_{ij} = \frac{X_{ij}}{\gamma_j \mu_i}$ belong to the EDF($\sigma^2, \omega_{ij}, \Theta_i$), i.e., $Y_{ij}$ have density*

$$f(x|\theta_{i,j}) = a\big(x, \frac{\sigma}{\omega_{ij}}\big) \exp\Big\{\frac{x\theta_{i,j} - b(\theta_{i,j})}{\sigma/\omega_{i,j}}\Big\}, \tag{3.28}$$

*where $b(\cdot)$ is twice-differentiable w.r.t $\theta_i$, $\sigma$ and $\omega_{ij}$ are some positive real-valued constants.*

*2. $\Theta_i$ with densities (w.r.t the Lebesgue measure)*

$$u_{\mu,\tau^2}(\theta) = d(\mu, \tau^2)\exp\Big\{\frac{\mu\theta - b(\theta)}{\tau^2}\Big\}$$

For $i = 0, \cdots, I$, the posterior distribution of $\Theta_i$ given $Y_{i,0}, \cdots, Y_{i,I-i}$ is proportional to

$$\exp\Big\{\theta\Big[\frac{1}{\tau^2} + \sum_{j=0}^{I-i} \frac{\omega_{ij}}{\sigma^2} Y_{ij}\Big] - b(\theta)\Big[\frac{1}{\tau^2} + \sum_{j=0}^{I-i} \frac{\omega_{ij}}{\sigma^2}\Big]\Big\}$$

If $\exp\left(\mu_i\theta - b(\theta)\right)/\tau^2$ disappears on the boundary of $\Theta_i$ for all $\mu_i, \tau$, then we have

$$\widetilde{\mu(\Theta_i)} \overset{\text{def}}{=} E[\mu(\Theta_i)|Y_{i,0}, \cdots, Y_{i,I-i}] = \alpha_i \overline{Y}_i + (1 - \alpha_i)\mu$$

where $\mu(\Theta_i) = E[Y_{ij}|\Theta_i]$ and

$$\alpha_i = \frac{\sum_{j=0}^{I-i} \omega_{ij}}{\sum_{j=0}^{I-i} \omega_{ij} + \sigma^2/\tau^2}, \quad \overline{Y}_i = \frac{\sum_{j=0}^{I-i} \omega_{ij} Y_{ij}}{\sum_{k=0}^{I-i} \omega_{ik}}$$

**Estimator 3.1** *Under Model Assumption 3.1 and 3.2, the $\mathcal{D}_I$-measurable estimators with minimized conditional MSEPs for $E[X_{i,j}|\mathcal{D}_I]$ and $E[C_{iJ}|\mathcal{D}_I]$ are, respectively, given by*

$$\widehat{X_{i,j}}^{EDF} = \gamma_j \mu_i \widetilde{\mu(\Theta_i)}$$

$$\widehat{C_{iJ}}^{EDF} = C_{i,I-i} + \sum_{j=I-i+1}^{j} \widehat{X_{i,j}}^{EDF}$$

*for $1 \leq i \leq I$ and $j \in \{I - i + 1, \cdots, I\}$.*

So far we have assumed that $\mu_i$, $\gamma_j$, $\sigma^2$ and $\tau^2$ are known. Under these assumptions we have that the Bayesian estimators was optimal in the sense that it minimized the (conditional) MSEP. If the parameters are not known, the problem becomes substantially more difficult and in general one loses the optimal results.

If the above parameters are unknown one can follow different approaches. Either one uses 'plug-in' estimators for these parameters or one also uses a Bayesian approach.

**(a) 'Plug-in' estimator.** There is no canonical way how the 'plug-in' estimator for $\gamma_j$ should be constructed. In practice it is estimated by

$$\widehat{\gamma_j}^{CL} = \widehat{\beta_j}^{CL} - \widehat{\beta_{j-1}}^{CL} \tag{3.29}$$

As to the estimation of $\mu_i$, usually one takes a plan value, a budget value or the value used for the premium calculation. For known $\mu_i$ and $\gamma_j$ one can give unbiased estimators for these variance parameters.

**(b) Bayesian estimator** The Bayesian approach would be consistent in the sense that one applies a full Bayesian approach to all unknown model parameters. However in such a full Bayesian approach there is, in general, no analytical solution to the problem and one needs to completely rely on numerical solutions such as MCMC.

### 3.3 Bühlmann-Straub Credibility Model

In most of the Bayesian models, the Bayesian estimator $\widetilde{\mu(\Theta_i)}$ can not be expressed in a closed analytical form for we do not know either $f(x|\theta)$ or $\mu(\theta)$, but just the following model.

**Model Assumption 3.3** *Conditionally, for all $i \in \{0, \cdots, I\}$, given $\Theta_i$, the first two moments of random variables $Y_{ij} = \frac{X_{ij}}{\mu_i \gamma_j}$, $j = 0, \cdots, J$ are given by*

$$E[Y_{ij}|\Theta_i] = \mu(\Theta_i) \quad \text{and} \quad Var(Y_{ij}|\Theta_i) = \frac{\sigma^2(\Theta_i)}{\omega_{ij}} \tag{3.30}$$

*where $\mu(\Theta_i)$ satisfies $\mu_0 \stackrel{\text{def}}{=} E[\mu(\Theta_i)] = 1$.*

An usual way in actuarial science is restrict the class of possible estimators to a small class, in which estimators are linear functions of the observations $\mathbf{Y}_i = (Y_{i0}, \cdots, Y_{i,I-i})$, then we have to solve the following problem

$$\widehat{\mu(\Theta_i)}^{cred} = \underset{\widetilde{\mu} \in L(\mathbf{Y}_i, 1)}{\operatorname{argmin}} E\big[(\mu(\Theta_i) - \widetilde{\mu})^2\big]$$

where $L(\mathbf{Y}_i, 1) = \big\{\widetilde{\mu} : \widetilde{\mu} = a_{i0} + \sum_{i=0}^{I} \sum_{j=0}^{I-i} a_{ij} Y_{ij}, a_{ij} \in \mathbb{R}\big\}$.

It is easy to check that under Model Assumption 3.1 and 3.3,the best linear estimator, which is individually unbiased and which has the smallest conditional variance, is given by

$$Y_i = \frac{\sum_{j=0}^{I-i} \omega_{ij} Y_{ij}}{\sum_{j=0}^{I-i} \omega_{ij}} \tag{3.31}$$

Because of the normal equation and the fact that $E[Y_{ij}] = \mu_0$, the credibility estimator must be of the form (3.32) and satisfy (3.33)

$$\widehat{\mu(\Theta_i)}^{cred} = \alpha_i Y_{i\cdot} + (1-\alpha_i)\mu_0 \tag{3.32}$$

$$Cov(\widehat{\mu(\Theta_i)}^{cred}, Y_{i\cdot}) = \alpha_i Cov(Y_i, Y_i) = Cov(\mu(\Theta_i, Y_{i\cdot})) \tag{3.33}$$

Define $\sigma^2 = E[\sigma^2(\Theta_i)]$ and $\tau^2 = Var(\mu(\Theta_i))$ and note that

$$Var[Y_i] = \frac{\sigma^2}{\sum_{j=0}^{I-i} \omega_{ij}} + \tau^2 \quad \text{and} \quad Cov(\mu(\Theta_i), Y_i) = \tau^2$$

Denote that $\omega_{i\cdot} = \sum_{j=0}^{I-i} \omega_{ij}$, then it follows

$$\alpha_i = \frac{\tau^2}{\frac{\sigma^2}{\omega_{i\cdot} + \tau^2}} = \frac{\omega_{i\cdot}}{\omega_{i\cdot} + \frac{\sigma^2}{\tau^2}} \tag{3.34}$$

**Estimator 3.2** *The inhomogeneous credibility estimator of* $\mu(\Theta_i)$ *and* $C_{iJ}$ *are, respectively, given by*

$$\begin{aligned} \widehat{\mu(\Theta_i)}^{cred} &= \alpha_i Y_i + (1-\alpha_i)\mathbf{1} \\ \widehat{C_{iJ}}^{cred} &= C_{i,I-i} + (1-\beta_{I-i})\mu_i \widehat{\mu(\Theta_i)}^{cred} \end{aligned} \tag{3.35}$$

*where* $Y_i$ *and* $\alpha_i$ *are given by* (3.31) *and* (3.34), *respectively.*

**Theorem 3.2** *Under Model Assumption 3.1 and 3.3, with* $\omega_{ij} = \mu_i^\delta \gamma_j$ *for some appropriate* $\delta \geq 0$, *the MSEP of the inhomogeneous credibility reserving estimators is given by*

$$\mathrm{msep}_{C_{iJ}}(\widehat{C_{iJ}}^{cred}) = \mu_i^2[(1-\beta_{I-i})\frac{\sigma^2}{\mu_i^\delta} + (1-\beta_{I-i})^2\tau^2(1-\alpha_i)]$$

*for* $1 \leq i \leq I$.

**Remark 3.1** *Under Model Assumption 2.3, we can also consider another type of credibility estimator, which is referred to in the literature as the homogeneous credibility. We defined the homogeneous credibility estimator of* $\mu(\Theta_i)$ *as the best estimator in the class of collectively unbiased estimators*

$$\left\{\widehat{\mu(\Theta_i)} : \widehat{\mu(\Theta_i)} = \sum_{i=0}^{I}\sum_{j=0}^{I-i} a_{ij}X_{ij}, E[\widehat{\mu(\Theta_i)}] = E[\mu(\Theta_i)] a_{ij} \in \mathbb{R}\right\}.$$

**Remark 3.2** *The credibility Model can also apply to the individual development factors.*

# 4 Distributional Models

The Log-normal model was first considered by [13] and described in [15] and [30], section 7.3. The model considers cumulative claims and Log-normal distributions.

**Model Assumption 4.1** *1. The individual development factors $F_{ij}$ are Log-Normally distributed with deterministic parameters $\xi_j$ and $\sigma_j^2$, that is*

$$\eta_{ij} = \log(F_{ij}) \sim N(\xi_j, \sigma_j^2) \tag{4.36}$$

*for all $i \in \{0, 1, \cdots, I\}$ and $j \in \{0, 1, \cdots, J\}$, where $C_{i,-1} = 1$.*

*2. $\eta_{ij}$ are independent for $i \in \{0, 1, \cdots, I\}$ and $j \in \{0, 1, \cdots, J\}$.*

**Estimator 4.1** *We estimate the parameters $\xi_j$ and $\sigma_j^2$ as follows*

$$\widehat{\xi_j} = \frac{1}{I-j+1} \sum_{i=0}^{I-j} \log\Big(F_{ij}\Big) \quad \text{and} \quad \widehat{\sigma_j^2} = \frac{1}{I-j} \sum_{i=0}^{I-j} \Big(\log F_{ij} - \widehat{\xi_j}\Big)^2 \tag{4.37}$$

*Moreover, $\widehat{\xi_j}$ and $\widehat{\sigma}_j^2$ are stochastically independent.*

First we assume that the variances $\sigma_0^2, \cdots, \sigma_J^2$ are known. Define $Z_{ij} = \log C_{ij}$, hence we have

$$E[Z_{iJ}|\mathcal{D}_I] = Z_{i,I-i} + \sum_{j=I-i+1}^{J} \eta_{ij}$$

which is estimated by

$$\widehat{Z_{iJ}} = E\widehat{[Z_{iJ}|\mathcal{D}_I]} = Z_{i,I-i} + \sum_{j=I-i+1}^{J} \widehat{\xi_j}$$

Note that

$$\begin{aligned} E[C_{iJ}|\mathcal{D}_I] &= E[\exp\{Z_{iJ}\}|C_{i,I-i}] \\ &= \exp\{Z_{i,I-i}\} \prod_{j=I-i+1}^{J} E[\eta_{ij}|C_{i,I-i}] \\ &= C_{i,I-i}\exp\Big\{\sum_{j=I-i+1}^{J} \xi_j + \frac{1}{2}\sum_{j=I-i+1}^{J} \sigma_j^2\Big\} \end{aligned} \tag{4.38}$$

and

$$\begin{aligned} E[\exp\{\widehat{Z_{iJ}}\}|C_{i,I-i}] &= \exp\{Z_{i,I-i}\}E[\exp\{\sum_{j=I-i+1}^{J} \widehat{\xi_j}\}] \\ &= C_{i,I-i}\exp\Big\{\sum_{j=I-i+1}^{J} \xi_j + \frac{1}{2}\sum_{j=I-i+1}^{J} \frac{\sigma_j^2}{I-j+1}\Big\} \end{aligned} \tag{4.39}$$

thus, the next estimator is straightforward from (4.38) and (4.39).

**Estimator 4.2** *Under Model Assumption 4.1 with $\sigma_j^2$ known, for $i = 1, \cdots, I$, an unbiased estimator for $E[C_{iJ}|\mathcal{D}_I]$ is given by*

$$\widehat{C_{iJ}}^{LN} = \widehat{E}[C_{iJ}|\mathcal{D}_I] = \exp\Big\{\widehat{Z_{iJ}} + \frac{1}{2}\sum_{j=I-i+1}^{J}\sigma_j^2\Big(1 - \frac{1}{I-j+1}\Big)\Big\} \tag{4.40}$$

*and the conditional MSEP is given by*

$$\mathrm{msep}_{C_{iJ}|C_{i,I-i}}\Big(\widehat{C_{iJ}}^{LN}\Big) = E[C_{iJ}|C_{i,I-i}]^2\Big(\exp\{\sum_{j=I-i+1}^{J}\sigma_j^2\} + \exp\{\sum_{j=I-i+1}^{J}\frac{\sigma_j^2}{I+j-1}\} - 2\Big)$$

However, in general, the variances $\sigma_j^2$ need also be estimated from the data. We could obtain an estimator by replacing $\sigma_j^2$ by $\widehat{\sigma_j^2}$ in (4.40), but this estimator is no longer unbiased.

**Estimator 4.3** *Under Model Assumption 4.1 with $\sigma^2$ unknown, the estimator for $E[C_{iJ}|\mathcal{D}_I]$ is given by*

$$\widehat{C_{iJ}}^{LN_\sigma,2} = \widehat{E}[C_{iJ}|\mathcal{D}_I] = \exp\Big\{\widehat{Z_{iJ}} + \frac{1}{2}\sum_{j=I-i+1}^{J}\widehat{\sigma_j^2}\Big(1 - \frac{1}{I-j+1}\Big)\Big\} \tag{4.41}$$

**Remark 4.1** *In [10], several distribution models for incremental claims are introduced,and most of them can be regarded as a special case of generalized linear model. Hence we will illustrate them in the next section.*

# 5 Generalized Linear Models

The standard GLM techniques for the derivation of estimates for incremental data in a claim reserving context was first implemented by Renshaw [25] and Renshaw and Verrall [26]. A good overview on this can refer to [10] and [11].

## 5.1 Generalized Linear Models Framework for Claim Reserving

As the usual generalized linear model, the generalized linear model for claim reserving has three components. We illustrate them in the form of Model Assumption.

**Model Assumption 5.1** *1. The increments $\{X_{i,j}, i = 0, \cdots, I, j = 0, \cdots, J\}$ of different accident years $i$ and development year $j$ are independent and satisfy*

$$E[X_{i,j}] = x_{i,j} \quad \text{and} \quad Var(X_{i,j}) = \frac{\phi_{i,j}}{\omega_{i,j}}V(x_{i,j}) \tag{5.42}$$

*where $V(\cdot)$ is an appropriate variance function.*

*2.* $\{x_{i,j}, i = 0, \cdots, I, j = 0, \cdots, J\}$ *can be specified by a number of unknown parameters* $\mathbf{b} = (b_1, \cdots, b_p)$ *which produce a linear predictor* $\boldsymbol{\eta} = (\eta_{i,j})_{\{i=0,\cdots,I,j=0,\cdots,J\}}$*:*

$$\eta_{i,j} = \Gamma_{i,j}\mathbf{b} \tag{5.43}$$

*for appropriate (deterministic)* $(1 \times p)$*-design matrices* $\Gamma_{i,j}$*.*

*3. There exist a monotone link function* $g$ *such that*

$$g(x_{i,j}) = \eta_{i,j} = \Gamma_{i,j}\mathbf{b} \tag{5.44}$$

**Example 5.1** *Assume that* $X_{i,j}$ *has density* (3.28) *with* $b'^{-1}(\cdot)$ *exists and we have a multiplicative structure*

$$x_{i,j} = \mu_i \gamma_j \tag{5.45}$$

*with* $\mu_i$ *standing for the exposure of accident year* $i$ *and* $\gamma_j$ *denotes the claim pattern over different year* $j$*.*

For the multiplicative structure, an straightforward choice for link function is the log function. Then we have

$$\log(x_{i,j}) = \eta_{i,j} = \log(\mu_i) + \log(\gamma_j). \tag{5.46}$$

Therefore we have $p = I + J + 1$ and

$$\mathbf{b} = (\log(\mu_1), \cdots, \log(\mu_I), \log(\gamma_0), \cdots, \log(\gamma_J))' \tag{5.47}$$

and

$$\Gamma_{i,j} = (0, \cdots, 0, e_i, 0, \cdots, 0, e_{I+j+1}, 0, \cdots, 0) \tag{5.48}$$

for $1 \leq i \leq I$ and $0 \leq j \leq J$, where the entries $e_i = 1$ and $e_{I+j+1}$ are on the $i$th and $(I + j + 1)$th position respectively.

Since $X_{i,j}$ belong to Exponential Dispersion Family, we have

$$E[X_{ij}] \stackrel{\text{def}}{=} x_{ij} = b'(\theta_{ij}) \quad \text{and} \quad Var(X_{ij}) = \frac{\phi_{ij}}{\omega_{ij}} b''(\theta_{ij}) \tag{5.49}$$

then the variance function is given by

$$V(x_{ij}) = b''((b'^{-1}(x_{ij})) \tag{5.50}$$

**Remark 5.1** *In [10] and [11], several incremental models are proposed, such as the Poisson model, Gaussian Model, all these models can be regarded as a special class of GLM with* $V(x_{i,j}) = x_{i,j}^p$*. For example,* $p = 0$ *we get the Gaussian Model,* $p = 1$ *we get the Poisson Model and* $p = 2$ *we get the Gamma Model.*

### 5.2 Parameter Estimation in the EDF

Now we use MLE on the set of observations $\mathcal{D}_I = \{X_{i,j}; i+j \leq I, 0 \leq j \leq J\}$ to estimate the unknown parameter in Example 5.1. Refer to (5.49) and (3.28), the log-likelihood function can be written as

$$\begin{aligned} I_{\mathcal{D}_I}(\mathbf{b}) &= \log \prod_{i+j\leq I} f(X_{ij}; \theta_{ij}, \phi_{ij}, \omega_{ij}) \\ &= \sum_{i+j\leq I} l(X_{ij}; x_{ij}, \phi_{ij}, \omega_{ij}) \\ &= \sum_{i+j\leq I} l(X_{ij}; \mu_i\gamma_j, \phi_{ij}, \omega_{ij}) \end{aligned}$$

We maximize $I_{\mathcal{D}_I}(\mathbf{b})$ by setting the $I+J+1$ partial derivatives w.r.t the unknown parameters $\mu_i$ and $\gamma_j$ equal to zero. Thus we obtain $\widehat{\mu}_i$ and $\widehat{\gamma}_j$ and hence

$$\widehat{\mathbf{b}} = \left(\widehat{\log(\mu_1)}, \cdots, \widehat{\log(\mu_I)}, \widehat{\log(\gamma_0)}, \cdots, \widehat{\log(\gamma_J)}\right) \tag{5.51}$$

with $\widehat{\log(\mu_i)} = \log(\widehat{\mu}_i)$ and $\widehat{\log(\gamma_j)} = \log(\widehat{\gamma}_j)$. Hence we derive the following estimator.

**Estimator 5.1** *The MLE in the EDF Model 4.1 is given by*

$$\widehat{X}_{ij}^{EDF} = \widehat{x}_{ij} = \widehat{E[X_{ij}|\mathcal{D}_I]} = \widehat{\mu}_i\widehat{\gamma}_j$$

$$\widehat{C}_{ij}^{EDF} = \widehat{E[C_{ij}|\mathcal{D}_I]} = C_{i,I-i} + \sum_{j=I-i+1}^{J} \widehat{X}_{ij}^{EDF}$$

*for* $i+j > I$.

**Remark 5.2** *Usually the calculation of MLE and MSEP need to use numerical methods, such as the Fisher's scoring method or the Newton-Raphson algorithm.*

## 6 Bootstrap Methods for claim reserving

The general idea behind bootstrap is to make a data resampling from the data themselves. In the actuarial literature, bootstrap methods appears, for example, in [11], [29], [31] and [32].

Assume we have $n$ i.i.d realizations $Z_1, \cdots, Z_n$ from an an unknown distribution $F$ and $h(F)$ is a parameter of $F$, such as the mean or variance. $g$ is an unknown function of the data $Z_1, \cdots, Z_n$ which estimate $h(F)$. Our goal is to learn more about the probability distribution of $\widehat{\theta}_n \stackrel{def}{=} g(Z_1, \cdots, Z_n)$.

If we know the data generating mechanism $F$, we can sample new i.i.d observations from $F$. This would give a new value for $\widehat{\theta}_n$. Repeating this procedure several times would lead to the empirical distribution of $\widehat{\theta}_n$. However, since $F$ is unknown, we use an estimator $F_1$ to reproduce observations. That is we generate new data

$$Z_1^*, \cdots, Z_n^* \quad \text{i.i.d} \overset{(d)}{\sim} F_1 \tag{6.52}$$

where $F_1$ is the empirical distribution of $Z_1, \cdots, Z_n$ in nonparametric case and in parametric case, $F_1 = F_{\widehat{\lambda}}$ since $F$ is known up to a finite vector of unknown parameters $\lambda_0$ ($\widehat{\lambda}$ is an estimator of $\lambda_0$ from $Z_1, \cdots, Z_n$). The new data vector $(Z_1^*, \cdots, Z_n^*)$ is called a bootstrap sample. Then for the bootstrap sample we can calculate a new value for the estimator $\widehat{\theta}_n$,

$$\widehat{\theta}_n^* = g(Z_1^*, \cdots, Z_n^*)$$

repeating this idea several times, we get an empirical distribution $\widehat{F}_n^*$ for $\widehat{\theta}_n^*$.

In the framework of claim reserving, we are interested in the distribution of

$$h(F) = \sum_{i+j \geq I} E[X_{ij} | \mathcal{D}_I] \tag{6.53}$$

which are expected open loss liabilities/outstanding claims reserves at time $I$.

## 6.1 Log-Normal Model for Cumulative Sizes

Recall that under Model Assumption 4.1, for any $j \in \{1, \cdots, J\}$,

$$\eta_{1,j}, \cdots, \eta_{I-j,j} \overset{i.i.d}{\sim} N(\xi_j, \sigma_j^2) \tag{6.54}$$

and

$$h(F) = \sum_{i=1}^{I} C_{i,I-i} \Big( \exp\{ \sum_{j=I-i+1}^{J} \xi_j + \frac{1}{2} \sum_{j=I-i+1}^{J} \sigma_j^2 \} - 1 \Big) \tag{6.55}$$

Since the parameters are not known they need to be estimated, and the appropriate estimators were provided by (6.1). This has led to the following estimator for $h(F)$, given the observations $\mathcal{D}_I$,

$$g(\mathcal{D}_I) = \sum_{i=1}^{I} \Big( \exp\{ \sum_{j=I-i+1}^{J} \widehat{\xi}_j + \frac{1}{2} \sum_{j=I-i+1}^{J} \widehat{\sigma}_j^2 (1 - \frac{1}{I-j+1}) \} - 1 \Big) \tag{6.56}$$

and our goal is to study the distribution of the estimator $g(\mathcal{D}_I)$.

Since we have explicit distribution assumptions to $\eta_{ij}$, we would like to apply the parametric bootstrap method. This means that we need to generate new independent observations $\eta_{ij}^*$, that is

$$\eta_{ij}^* \overset{(d)}{\sim} N(\widehat{\xi}_j, \widehat{\sigma}_j^2)$$

which leads to the bootstrap reserves

$$g^*(\mathcal{D}_I) = \sum_{i=1}^{I} \Big( \exp\{ \sum_{j=I-i+1}^{J} \widehat{\xi}_j^* + \frac{1}{2} \sum_{j=I-i+1}^{J} \widehat{\sigma_j^2}^* (1 - \frac{1}{I-j+1}) \} - 1 \Big) \tag{6.57}$$

where $\widehat{\xi_j}^*$ and $\widehat{\sigma_j^2}^*$ are estimated by with the bootstrap sample $(\eta_{i,1}^*, \cdots, \eta_{I-j,j}^*.)$ Repeating this procedure several times we obtain the empirical distribution of $g^*(\mathcal{D}_I)$, given observations $\mathcal{D}_I$.

## 6.2 Generalized Linear Models

In order to apply Efron's nonparametric bootstrap method to example 5.1, we once again need to find identically distributed residuals that allow for the construction of the empirical distribution $F_1$, see (6.52).

In the following, we assume that $\phi = \frac{\phi_{ij}}{\omega_{ij}}$ is constant and as in England and Verrall (2002, 2007), we choose the Pearson residuals given by

$$R_{ij}^{(P)}(x_{ij}) = \frac{X_{ij} - x_{ij}}{V(x_{ij})^{1/2}} \tag{6.58}$$

.

Note that the residuals have mean 0 and variance $\phi$. Therefore $R_{ij}^{(P)}(x_{ij})$ is a natural object to define the bootstrap distribution. Hence, we set for $i + j \leq I$,

$$Z_{ij} = \frac{X_{ij} - \widehat{x}_{ij}}{V(\widehat{x}_{ij})^{1/2}} \tag{6.59}$$

.

These $\{Z_{ij}, i + j \leq I\}$ defines the bootstrap distribution $\widehat{F}_{\mathcal{D}_I}$. Then we resample i.i.d residuals

$$Z_{ij}^* \sim \widehat{F}_{\mathcal{D}_I}$$

and hence we define the bootstrap observations of $X_{ij}$ by

$$X_{ij}^* = \widehat{x}_{ij} + V(\widehat{x}_{ij})^{1/2} Z_{ij}^* \tag{6.60}$$

These bootstrap observations $X_{ij}^*$ now lead to bootstrap claims reserving triangles $\mathcal{D}_I^* = \{X_{ij}^*, i + j \leq I\}$. Using GLM methods, we calculate bootstrap estimates $\mu_i^*$, $\gamma_j^*$ and $\widehat{x}_{ij}^*$ from the bootstrap observations $\mathcal{D}_I^*$. This leads to the bootstrap claims reserves $\{X_{ij}^*, i+j > I\}$. Repeating this bootstrap sampling several times we obtain the bootstrap distribution of the claim reserves, conditioned on $\mathcal{D}_I$.

### 6.3 Chain Ladder Method

Under Model Assumption 2.3, the individual development factors are given by

$$F_{i,j+1} = \frac{C_{i,j+1}}{C_{ij}} = f_j + \sigma_j C_{ij}^{-1/2} \varepsilon_{i,j+1}$$

for the time being we assume that $\sigma_j$ is known.

In order to apply the bootstrap method we again need to find appropriate residuals that allow for the construction of the empirical distribution $F_1$, from which the bootstrap observations are constructed.

Consider the following residuals for $i + j \leq I, j \geq 1$,

$$\widetilde{\varepsilon}_{ij} = \frac{F_{ij} - \widehat{f}_{j-1}}{\sigma_{j-1} C_{i,j-1}^{-1/2}} \tag{6.61}$$

where the estimator $\widehat{f}_j$ are given in (2.3). Note that $E[\widetilde{\varepsilon}_{ij}|\mathcal{B}_{j-1}] = 0$ and

$$Var(\widetilde{\varepsilon}_{ij}|\mathcal{D}_{j-1}) = 1 - \frac{C_{i,j-1}}{\sum_{i=0}^{I-j} C_{i,j-1}} < 1$$

which means that we should adjust our observable residuals $\widetilde{\varepsilon}_{ij}$ in order to obtain the correct order for the estimation error.

Define

$$Z_{ij} = \left(1 - \frac{C_{i,j-1}}{\sum_{i=0}^{I-j} C_{i,j-1}}\right)^{-1/2} \frac{F_{ij} - \widehat{f}_{j-1}}{\sigma_{j-1} C_{i,j-1}^{-1/2}} \tag{6.62}$$

where $\widehat{f}_j$ and $\widehat{\sigma}_j^2$are given in (2.3) and (1.8). These residuals $\{Z_{ij}, i + j \leq I\}$ defines the bootstrap distribution $\widehat{F}_{\mathcal{D}_I}$. Then we resample i.i.d residuals

$$Z_{ij}^* \sim \widehat{F}_{\mathcal{D}_I}$$

and hence we define the bootstrap observations $\{F_{ij}^*, i + j \leq I\}$ by

$$X_{ij}^* = \widehat{x}_{ij} + V(\widehat{x}_{ij})^{1/2} Z_{ij}^* \tag{6.63}$$

In contrast to the methods in subsections 5.2 and 5.3, the next step of reproducing bootstrap observations $F_{ij}^*$ of $F_{ij}$ is not straightforward.

# 7 Multivariate Reserving Methods

The study of Multivariate claims reserving methods are motivated by the fact that, in practice, it is quite natural to subdivide a nonlife run-off portfolio into subportfolios such that each satisfies certain homogeneity properties. They have been studied by [5], [27], [28] and [36]. Another type of multivariate claim reserving method is studied by [18] and [24], where one combines different sources of information in the same estimate.

In the following we assume that the subportfolios consist of $N \geq 1$ run-off triangles of observations of the same size. The incremental and cumulative claims of triangle $n (1 \leq n \leq N)$ for accident year $i$ and development year $j$ are denoted by $X_{ij}^{(n)}$ and $C_{ij}^{(n)}$.

Usually at time $I$, we have a total set of observations given by $\mathcal{D}_I^N = \bigcup_{n=1}^N \mathcal{D}_I^{(n)}$ where $\mathcal{D}_I^{(n)} = \{\mathcal{C}_I^{(n)} : i + j \leq I\}$ is the observations for run-off subportfolio $n$. And we need to predict the random variables in its complement, which is given by

$$\mathcal{D}_I^{N,c} = \{C_{ij}^{(n)} : i + j > I, 1 \leq n \leq N, i \leq I\}$$

For the derivation of the conditional MSEP of multivariate methods it is convenient to write the $N$ subportfolios in vector form. Thus we define the $N$-dimensional random vectors of incremental an cumulative claims by

$$\mathbf{X}_{ij} = (X_{ij}^{(1)}, \cdots, X_{ij}^{(N)})' \qquad \text{and} \qquad \mathbf{C}_{ij} = (C_{ij}^{(1)}, \cdots, C_{ij}^{(N)})'$$

for $i \in \{0, \cdots, I\}$ and $j \in \{0, \cdots, J\}$. Moreover, we define for $k \in \{0, \cdots, J\}$,

$$\mathcal{D}_k^N = \{\mathbf{C}_{ij} : i + j \leq I, 0 \leq j \leq k\}$$

and the $N$-dimensional column vector consisting of 1's by $\mathbf{1} = (1, \cdots, 1)'$.

## 7.1 Multivariate Chain-Ladder Method

We define for $n \in (1, \cdots, N)$, $i \in (0, \cdots, I)$ and $j \in (1, \cdots, J)$ the individual development factors for accident year $i$ and development year $j$ by

$$F_{ij}^{(n)} = \frac{C_{ij}^{(n)}}{C_{i,j-1}^{(n)}} \qquad \text{and} \qquad \mathbf{F}_{ij} = (F_{ij}^{(1)}, \cdots, F_{ij}^{(N)})'$$

and denote by $D(\mathbf{a})$ for the $N \times N$ diagonal matrix generated by the $N$-dimensional vectors $\mathbf{a} = (a_1, \cdots, a_N)' \in \mathbb{R}^N$. Then we have

$$\mathbf{C}_{ij} = D(\mathbf{C}_{i,j-1})\mathbf{F}_{ij} = D(\mathbf{F}_{ij})\mathbf{C}_{i,j-1}$$

for all $j = 1, \cdots, J$ and $i = 0, \cdots, I$ The distribution-free multivariate CL model is then given by the following definition.

**Model Assumption 7.1 (multivariate CL model)** *1. Cumulative claims $\mathbf{C}_{ij}$ of different accident years $i$ are independent.*

*2. $(\mathbf{C}_{ij})_{j\geq 0}$ form an $N-$dimensional Markov chain. There are $N-$dimensional deterministic vectors $\mathbf{f}_j = (f_j^{(1)}, \cdots, f_j^{(N)})' > \mathbf{0}$ and symmetric positive definite $N \times N$ matrices $\Sigma_j$ such that for all $0 \leq i \leq I$ and $1 \leq j \leq J$ we have*

$$\begin{aligned} E[\mathbf{C}_{ij}|\mathbf{C}_{i,j-1}] &= \mathrm{D}(\mathbf{f}_{j-1})\mathbf{C}_{i,j-1} \\ \mathrm{Cov}(\mathbf{C}_{ij}, \mathbf{C}_{ij}|\mathbf{C}_{i,j-1}) &= \mathrm{D}(\mathbf{C}_{i,j-1})^{\frac{1}{2}}\Sigma_{j-1}\mathrm{D}(\mathbf{C}_{i,j-1})^{\frac{1}{2}} \end{aligned} \tag{7.64}$$

Analogical to equality (2.2), we have the following theorem.

**Theorem 7.1** *Under Model Assumption 7.1, given $\mathcal{D}_j^N$, the conditional expectation and process variance for $\mathbf{C}_{iJ}$ are, respectively, given by*

$$\begin{aligned} E[\mathbf{C}_{ij}|\mathcal{D}_I^N] &= \prod_{l=I-i}^{j-1} D(\mathbf{f}_l)\mathbf{C}_{i,I-i} \\ \mathbf{1}'Var(\mathbf{C}_{iJ}|\mathcal{D}_I^N)\mathbf{1} &= \mathbf{1}'\Big(\sum_{j=I-i}^{J-1}\prod_{k=j+1}^{J-1} D(\mathbf{f}_k)\Sigma_{ij}^C \prod_{k=j+1}^{J-1} D(\mathbf{f}_k)\Big)\mathbf{1} \end{aligned} \tag{7.65}$$

*where $\Sigma_{ij}^C = E[\mathrm{D}(\mathbf{C}_{ij})^{\frac{1}{2}}\Sigma_j\mathrm{D}(\mathbf{C}_{ij})^{\frac{1}{2}}|\mathbf{C}_{i,I-i}]$.*

Under Model Assumption 7.1, conditional on $\mathcal{D}_j^N$, [23] and [28] propose the BLUE for $\mathbf{f}_j$,

$$\widehat{\mathbf{f}}_j = \Big(\sum_{i=0}^{I-j-1} \mathrm{D}(\mathbf{C}_{ij})^{\frac{1}{2}}\Sigma_j^{-1}\mathrm{D}(\mathbf{C}_{ij})^{\frac{1}{2}}\Big)^{-1} \sum_{i=0}^{I-j-1} \mathrm{D}(\mathbf{C}_{ij})^{\frac{1}{2}}\Sigma_j^{-1}\mathrm{D}(\mathbf{C}_{ij})^{\frac{1}{2}}\mathbf{F}_{i,j+1} \tag{7.66}$$

Then an unbiased estimator for $E[\mathbf{C}_{iJ}|\mathcal{D}_I^N]$ is given by

$$\widehat{\mathbf{C}_{ij}}^{CL} = (\widehat{\mathbf{C}_{ij}^{(1)}}^{CL}, \cdots, \widehat{\mathbf{C}_{ij}^{(N)}}^{CL})' = \widehat{E}[\mathbf{C}_{ij}|\mathcal{D}_I^N] = \prod_{l=I-i}^{j-1} \mathrm{D}(\widehat{\mathbf{f}}_l)\mathbf{C}_{i,I-i} \tag{7.67}$$

Using theorem 7.1 and (7.66) we have, the conditional estimation error of accident year $i \geq 0$ is given by

$$\begin{aligned} \mathbf{1}'\big(\widehat{\mathbf{C}}_{ij}^{CL} &- E[\mathbf{C}_{ij}|\mathcal{D}_I^N]\big)\big(\widehat{\mathbf{C}}_{ij}^{CL} - E[\mathbf{C}_{ij}|\mathcal{D}_I^N]\big)'\mathbf{1} \\ &= \mathbf{1}'\Big(\prod_{j=I-i}^{J-1} \mathrm{D}(\widehat{\mathbf{f}}_j) - \prod_{j=I-i}^{J-1} \mathrm{D}(\mathbf{f}_j)\mathbf{C}_{i,I-i}\mathbf{C}'_{i,I-i}\Big(\prod_{j=I-i}^{J-1} \mathrm{D}(\widehat{\mathbf{f}}_j) - \prod_{j=I-i}^{J-1} D(\widehat{\mathbf{f}}_j)\Big)\mathbf{1} \\ &= \mathbf{1}'\mathrm{D}(\mathbf{C}_{i,I-i})(\widehat{g}_{i|J} - g_{i|J})(\widehat{g}_{i|J} - g_{i|J})'\mathrm{D}(\mathbf{C}_{i,I-i})\mathbf{1} \end{aligned} \tag{7.68}$$

where $\widehat{g}_{i|j} = D(\widehat{\mathbf{f}}_{I-i}) \cdots D(\widehat{\mathbf{f}}_{j-1})\mathbf{1}$ and $g_{i|j} = D(\mathbf{f}_j) \cdots D(\mathbf{f}_{j-1})\mathbf{1}$.

In order to determine the conditional estimation error, analogous to the univariate case, we introduce stronger model assumptions.

**Model Assumption 7.2 (multivariate Time Series Model)** *1. Cumulative claims $C_{ij}$ of different accident years $i$ are independent.*

*2. There exist $N$-dimensional positive constants $\mathbf{f}_j = (f_j^{(1)}, \cdots, f_j^{(N)})'$ and $\boldsymbol{\sigma}_j = (\sigma_j^{(1)}, \cdots, \sigma_j^{(N)})'$ and $N$-dimensional random variables $\boldsymbol{\varepsilon}_{i,j+1} = (\varepsilon_{i,j+1}^{(1)}, \cdots, \varepsilon_{i,j+1}^{(N)})$ such that for $0 \leq i \leq I$ and $0 \leq j \leq J-1$, we have*

$$\mathbf{C}_{i,j+1} = \mathrm{D}(\mathbf{f}_j)\mathbf{C}_{i,j} + \mathrm{D}(\mathbf{C}_{ij})^{1/2}\mathrm{D}(\boldsymbol{\varepsilon}_{i,j+1})\boldsymbol{\sigma}_j$$

*3. The random variables $\boldsymbol{\varepsilon}_{i,j+1}$ are independent with $E[\boldsymbol{\varepsilon}_{i,j+1}] = \mathbf{0}$ and positive definite*

$$Cov(\boldsymbol{\varepsilon}_{i,j+1}, \boldsymbol{\varepsilon}_{i,j+1}) = E[\boldsymbol{\varepsilon}_{i,j+1}\boldsymbol{\varepsilon}_{i,j+1}^{'}] = \begin{pmatrix} 1 & \rho_j^{(1,2)} & \cdots & \rho_j^{(1,N)} \\ \rho_j^{(2,1)} & 1 & \cdots & \rho_j^{(2,N)} \\ \vdots & \vdots & \ddots & \vdots \\ \rho_j^{(N,1)} & \rho_j^{(N,2)} & \cdots & 1 \end{pmatrix}$$

*where $\rho_j^{(n,m)} \in (-1,1)$ for $n \neq m$.*

We now describe the conditional resampling approach in the multivariate setup, that is, we conditionally resample $\widehat{\mathbf{f}}_{I-i}, \cdots, \widehat{\mathbf{f}}_{J-1}$ given the triangle $\mathcal{D}_I^N$. Hence we generate 'new' observations $\widetilde{\mathbf{C}}_{i,j+1}$ for $i \in \{0, \cdots, I\}$ and $j \in \{0, \cdots, J-1\}$ using the approach

$$\widetilde{\mathbf{C}}_{i,j+1} = \mathrm{D}(\mathbf{f}_j)\mathbf{C}_{i,j} + \mathrm{D}(\mathbf{C}_{ij})^{1/2}\mathrm{D}(\widetilde{\varepsilon}_{i,j+1})\boldsymbol{\sigma}_j \tag{7.69}$$

where $\widetilde{\varepsilon}_{i,j+1}$,$\boldsymbol{\varepsilon}_{i,j+1}$ are i.i.d copies, given $\mathcal{D}_0^N$. This means that $\mathbf{C}_{i,j}$ acts as a deterministic volume measure and we resample successively the next observation $\widetilde{\mathbf{C}}_{i,j+1} \stackrel{(\mathrm{d})}{=} \mathbf{C}i, j+1$,given $\mathcal{D}_0^N$.

In the spirit of conditional resampling approach this leads to the following resampled estimates of the multivariate development factors

$$\begin{aligned} \widehat{\mathbf{f}}_j^{(*)} &= \Big(\sum_{i=0}^{I-j-1} \mathrm{D}(\mathbf{C}_{ij})^{1/2}\Sigma_j^{-1}\mathrm{D}(\mathbf{C}_{ij})^{1/2}\Big)^{-1} \sum_{i=0}^{I-j-1} \mathrm{D}(\mathbf{C}_{ij})^{1/2}\Sigma_j^{-1}\mathrm{D}(\mathbf{C}_{ij})^{1/2}\mathrm{D}(\mathbf{C}_{ij})^{-1}\widetilde{\mathbf{C}}_{i,j+1} \\ &= \mathbf{f}_j + \sum_{i=0}^{I-j-1} \mathrm{D}(\mathbf{C}_{ij})^{1/2}\Sigma_j^{-1}\mathrm{D}(\mathbf{C}_{ij})^{1/2}\Big)^{-1} \sum_{i=0}^{I-j-1} \mathrm{D}(\mathbf{C}_{ij})^{1/2}\Sigma_j^{-1}\mathrm{D}(\widetilde{\varepsilon}_{i,j+1})\boldsymbol{\sigma}_j. \end{aligned} \tag{7.70}$$

As in the univariate time series model, we denote the conditional probability measure of the resampled estimators by $P_{\mathcal{D}_I^N}^{(*)}$. This way we obtain the following lemma.

**Lemma 7.1** *Under the resampling assumption, we have*
*1. the estimators $\widehat{\mathbf{f}}_0^{(*)}, \cdots, \widehat{\mathbf{f}}_{J-1}^{(*)}$ are independent and unbiased for $\mathbf{f}_j$ under the probability measure $P_{\mathcal{D}_I^N}^{(*)}$.*
*2. $E_{\mathcal{D}_I^N}^{(*)}[\widehat{f}_j^{(n)}\widehat{f}_j^{(m)}] = f_j^{(n)}f_j^{(m)} + W_j(n,m)$, where $W_j(n,m)$ is the entry $(n,m)$ of the $N \times N$ matrix defined by $W_j = \Big(\sum_{i=0}^{I-j-1} \mathrm{D}(\mathbf{C}_{ij})^{1/2}\Sigma_j^{-1}\mathrm{D}(\mathbf{C}_{ij})^{1/2}\Big)^{-1}$*

Using the above lemma, we obtain the following estimator for (7.68),

$$\mathbf{1}'\mathrm{D}(\mathbf{C}_{i,I-i})E^{*}_{\mathcal{D}_I^N}\big[(\widehat{g}_{i|J}-g_{i|J})(\widehat{g}_{i|J}-g_{i|J})'\big]\mathrm{D}(\mathbf{C}_{i,I-i})\mathbf{1} = \mathbf{1}'\mathrm{D}(\mathbf{C}_{i,I-i})\big(\Delta_{i,J}^{(n,m)}\big)_{1\le n,m\le N}\mathrm{D}(\mathbf{C}_{i,I-i})'\mathbf{1} \tag{7.71}$$

where the $(n,m)$ entry of $\big(\Delta_{i,J}^{(n,m)}\big)_{1\le n,m\le N}$ is given by

$$\Delta_{i,J}^{(n,m)} = \prod_{j=I-i}^{J-1}\big(f_j^{(n)}f_j^{(m)} + W_j(n,m)\big) - \prod_{j=I-i}^{J-1} f_j^{(n)}f_j^{(m)} \tag{7.72}$$

## 7.2 Multivariate Additive Loss Reserving Method

The multivariate ALR model was proposed by [14] and [28]. The multivariate ALR method is based on incremental claims, and hence is more in the spirit of the (univariate) GLM models. In this subsection we closely follow [19].

**Model Assumption 7.3 (multivariate ALR time series model)** *1. Incremental claims $\mathbf{X}_{ij}$ of different accident years $i$ are independent.*

*2. There exist $(N\times N)$-dimensional deterministic positive definite matrices $V_0,\cdots,V_I$ and $N$-dimensional constants $(j=1,\cdots,J)$*

$$\mathbf{m}_j = (m_j^{(1)},\cdots,m_j^{(N)})' \quad \text{and} \quad \boldsymbol{\sigma}_{j-1} = (\sigma_{j-1}^{(1)},\cdots,\sigma_{j-1}^{(N)})'$$

*with $\sigma_{j-1}^{(N)} > 0$ for all $n=1,\cdots,N$ as well as $N-$dimensional random variables $\boldsymbol{\varepsilon}_{ij}$ such that*

$$\mathbf{X}_{ij} = V_i\mathbf{m}_j + V_i^{1/2}D(\boldsymbol{\varepsilon}_{ij})\boldsymbol{\sigma}_{j-1}.$$

*3. The random variables $\boldsymbol{\varepsilon}_{i,j+1}$ are with the same assumption as in Model Assumption 7.2.*

**Theorem 7.2** *Under Model Assumption 7.3, we have for all $i\in\{1,\cdots,I\}$,*

$$\begin{aligned} E[\mathbf{C}_{iJ}|\mathcal{D}_I^N] &= E[\mathbf{C}_{iJ}|\mathbf{C}_{i,I-i}] = \mathbf{C}_{i,I-i} + V_i\sum_{j=I-i+1}^{J}\mathbf{m}_j \\ \mathbf{1}'Var(\mathbf{C}_{iJ}|\mathcal{D}_I^N)\mathbf{1} &= \mathbf{1}'V_i^{1/2}\sum_{j=I-i+1}^{J}\Sigma_{j-1}V_i^{1/2}\mathbf{1} \end{aligned} \tag{7.73}$$

In most practical applications we have to estimate the ratios $\mathbf{m}_j$ from the data in the upper triangle. [28] proposed the following unbiased estimator.

$$\widehat{\mathbf{m}}_j = \Big(\sum_{i=0}^{I-j}V_i^{\frac{1}{2}}\Sigma_{j-1}^{-1}V_i^{\frac{1}{2}}\Big)^{-1}\sum_{i=0}^{I-j}(V_i^{\frac{1}{2}}\Sigma_{j-1}^{-1}V_i^{\frac{1}{2}})V_i\mathbf{X}_{ij} \tag{7.74}$$

Then the multivariate ALR estimator for $E[\mathbf{C}_{ij}|\mathcal{D}_I^N]$ is, for $i+j>I$, given by

$$\widehat{\mathbf{C}_{ij}}^{AD} = (\widehat{C_{ij}^{(1)}}^{AD}, \cdots, \widehat{C_{ij}^{(N)}}^{AD})' = \widehat{E}[\mathbf{C}_{iJ}|\mathcal{D}_I^N] = \mathbf{C}_{i,I-i} + V_i \sum_{j=I-i+1}^{J} \widehat{\mathbf{m}}_j \tag{7.75}$$

**Remark 7.1** *In* (7.73)-(7.74)*, we assume* $\Sigma_{j-1}^{-1}$ *are known, otherwise* $\mathbf{m_j}$ *and* $\Sigma_{j-1}^{-1}$ *should be estimated iteratively,*

$$\widehat{\mathbf{m}}_j^{(k)} = \Big(\sum_{i=0}^{I-j} V_i^{\frac{1}{2}} \big(\widehat{\Sigma}_{j-1}^{(k)}\big)^{-1} V_i^{\frac{1}{2}}\Big)^{-1} \sum_{i=0}^{I-j} (V_i^{\frac{1}{2}} \big(\widehat{\Sigma}_{j-1}^{(k)}\big)^{-1} V_i^{\frac{1}{2}}) V_i \mathbf{X}_{ij}$$

$$\widehat{\Sigma}_{j-1}^{(k)} = \frac{1}{I-j} \sum_{i=0}^{I-j} V_i^{-1/2} \Big(\mathbf{X}_{ij} - V_i \widehat{\mathbf{m}}_j^{(k-1)}\Big) \Big(\mathbf{X}_{ij} - V_i \widehat{\mathbf{m}}_j^{(k-1)}\Big)' V_i^{-1/2}$$

**Lemma 7.2** *The estimator for the conditional MSEP of the ultimate claim for single accident year i is given by*

$$\begin{aligned}\widehat{\mathrm{msep}}_{\sum_n C_{ij}^{(n)}|\mathcal{D}_I^N}\Big(\sum_{n=1}^{N} \widehat{C_{ij}^{(n)}}^{AD}\Big) &= \mathbf{1}' V_i^{1/2} \sum_{j=I-i+1}^{J} \widehat{\Sigma}_{j-1} V_i^{1/2} \mathbf{1} \\ &+ \mathbf{1}' V_i \sum_{j=I-i+1}^{J} \Big(\sum_{l=0}^{I-j} V_l^{1/2} \widehat{\Sigma}_{j-1} V_l^{1/2}\Big)^{-1} V_i \mathbf{1}\end{aligned}$$

*and the estimator for the conditional MSEP of the ultimate claim for aggregated accident year is given by*

$$\begin{aligned}\widehat{\mathrm{msep}}_{\sum_{i,n} C_{ij}^{(n)}|\mathcal{D}_I^N}\Big(\sum_{i=1}^{I}\sum_{n=1}^{N} \widehat{C_{ij}^{(n)}}^{AD}\Big) &= \sum_{i=1}^{I} \widehat{\mathrm{msep}}_{\sum_n C_{ij}^{(n)}|\mathcal{D}_I^N}\Big(\sum_{n=1}^{N} \widehat{C_{ij}^{(n)}}^{AD}\Big) \\ &+ 2 \sum_{1\le i<k\le I} \mathbf{1}' V_i \sum_{j=I-i+1}^{J} \Big(\sum_{l=0}^{I-j} V_l^{1/2} \widehat{\Sigma}_{j-1} V_l^{1/2}\Big)^{-1} V_k \mathbf{1}\end{aligned}$$

**Remark 7.2** *In [20], Merz and Wüthrich combine Model 7.2 and 7.3 into one model. The consideration of such a combination is motivated by the fact that, in general, not all subportfolios satisfy the same homogeneity assumptions and/or sometimes we have a prior information for some selected portfolios.*

## 7.3 Munich Chain-Ladder

In practice, one often has the situation that different sources of information are available to predict the ultimate claim. For example, one has cumulative payments data and claims-incurred data to estimate the ultimate claim. Usually the CL method is applied to both data independently.

In the following we denote by superscript $Pa$ for the payment data and superscript $In$ for the claims-incurred data. Moreover, we define $\widetilde{\mathcal{D}}_j = \mathcal{D}_j^{Pa} \bigcup \mathcal{D}_j^{In}$ for $j = 0, 1, \cdots, J$.

If we assume both the data satisfy Model Assumption 2.1, we can independently predict the ultimate claim of accident year $i$ by

$$\widehat{C_{iJ}^{Pa}}^{CL} = C_{i,I-i}^{Pa} \prod_{j=I-i}^{J-1} \frac{\sum_{i=0}^{I-j-1} C_{i,j+1}^{Pa}}{\sum_{i=0}^{I-j-1} C_{i,j}^{Pa}} \quad \text{and} \quad \widehat{C_{iJ}^{In}}^{CL} = C_{i,I-i}^{In} \prod_{j=I-i}^{J-1} \frac{\sum_{i=0}^{I-j-1} C_{i,j+1}^{In}}{\sum_{i=0}^{I-j-1} C_{i,j}^{In}}$$

Since we predict the same random variable twice, namely $C_{iJ} = C_{iJ}^{Pa} = C_{iJ}^{In}$, we expect the two estimators are close to each other. The crucial idea in the MCL model proposed by [24] is to combine the information coming from cumulative payments and claims incurred data. This is done using the paid/incurred rations. That is, we consider

$$Q_{ij} = \frac{C_{ij}^{Pa}}{C_{ij}^{In}}$$

**Model Assumption 7.4 (MCL Model)** *1. Both the cumulative payments $C_{ij}^{Pa}$ and the Claim incurred $C_{ij}^{In}$ satisfy Model assumption 2.1 with parameters $(f_j^{Pa}, \sigma_j^{Pa})$ and $(f_j^{In}, \sigma_j^{In})$, respectively. Further we assume $C_{ij}^{Pa}$ and $C_{ij}^{In}$ are independent of different accident years.*

*2. There are constants $\lambda^{Pa}$, $\lambda^{In}$ such that for all $0 \le i \le I$ and $0 \le j \le J-1$ we have*

$$E\Big[\frac{C_{i,j+1}^{Pa}}{C_{ij}^{Pa}} | \widetilde{\mathcal{D}}_j\Big] = f_j^{Pa} + \lambda^{Pa} Var\Big(\frac{C_{i,j+1}^{Pa}}{C_{ij}^{Pa}} | \widetilde{\mathcal{D}}_j^{Pa}\Big) \frac{Q_{ij}^{-1} - E[Q_{ij}^{-1} | \mathcal{D}_j^{Pa}]}{Var(Q_{ij}^{-1} | \mathcal{D}_j^{Pa})} \tag{7.76}$$

$$E\Big[\frac{C_{i,j+1}^{In}}{C_{ij}^{In}} | \widetilde{\mathcal{D}}_j\Big] = f_j^{In} + \lambda^{In} Var\Big(\frac{C_{i,j+1}^{In}}{C_{ij}^{In}} | \widetilde{\mathcal{D}}_j^{In}\Big) \frac{Q_{ij}^{-1} - E[Q_{ij}^{-1} | \mathcal{D}_j^{In}]}{Var(Q_{ij}^{-1} | \mathcal{D}_j^{In})} \tag{7.77}$$

In this subsection we consider the approach proposed by [18]. That is, we have to solve the optimization problems

$$\widehat{Z_{ij}^{Pa}} = \underset{Z \in L(C_{ij}^{In}, 1)}{\text{argmin}} \; E[(E[C_{ij}^{Pa} | \widetilde{\mathcal{D}}_{j-1}] - Z)^2 | \mathcal{D}_{j-1}^{Pa}]$$

and

$$\widehat{Z_{ij}^{In}} = \underset{Z \in L(C_{ij}^{Pa}, 1)}{\text{argmin}} \; E[(E[C_{ij}^{In} | \widetilde{\mathcal{D}}_{j-1}] - Z)^2 | \mathcal{D}_{j-1}^{In}]$$

where $L(C_{ij}, 1) = \{a_{i,0} + a_{i,1} C_{i,j-1} : a_{i,0}, a_{i,1} \in \mathbb{R}\}$. The estimators $\widehat{Z_{ij}^{Pa}}$ are called best affine-linear one-step estimators of $E[C_{ij}^{Pa} | \widetilde{\mathcal{B}}_j]$ given $\mathcal{D}_j^{Pa}$ and $\mathcal{D}_j^{In}$. It can be shown that the estimators $\widehat{Z_{ij}^{Pa}}$ exist and are unique almost surely. Further, $\widehat{Z_{ij}^{Pa}}$ satisfies the (conditional) normal equations

$$E[(E[C_{ij}^{Pa} | \widetilde{\mathcal{D}}_{j-1}] - \widehat{Z_{ij}^{Pa}}) 1 | \mathcal{D}_{j-1}^{Pa}] = 1 \quad a.s. \tag{7.78}$$

$$E[(E[C_{ij}^{Pa}|\widetilde{\mathcal{D}}_{j-1}] - \widehat{Z_{ij}^{Pa}})C_{i,j-1}^{In}|\mathcal{D}_{j-1}^{Pa}] = 1 \quad a.s. \tag{7.79}$$

The same conclusions apply analogously to $\widehat{Z_{ij}^{In}}$. Based on (7.78) and (7.79), we obtain the following representation for $\widehat{Z_{ij}^{Pa}}$ and $\widehat{Z_{ij}^{In}}$.

**Theorem 7.3** *Under Model Assumption 7.4, the best affine-linear one-step estimators $\widehat{Z_{ij}^{Pa}}$ and $\widehat{Z_{ij}^{In}}$ given $\mathcal{D}_j^{Pa}$ and $\mathcal{D}_j^{In}$, are given by*

$$\widehat{Z_{ij}^{Pa}} = f_{j-1}^{Pa}C_{i,j-1}^{Pa} + \lambda^{Pa}Var\Big(C_{ij}^{Pa}|\mathcal{D}_{j-1}^{Pa}\Big)^{\frac{1}{2}}\frac{C_{i,j-1}^{In} - E[C_{i,j-1}^{In}|\mathcal{D}_{j-1}^{Pa}]}{Var(C_{i,j-1}^{In}|\mathcal{D}_{j-1}^{Pa})^{\frac{1}{2}}}$$

*and*

$$\widehat{Z_{ij}^{In}} = f_{j-1}^{In}C_{i,j-1}^{In} + \lambda^{In}Var\Big(C_{ij}^{In}|\mathcal{D}_{j-1}^{In}\Big)^{\frac{1}{2}}\frac{C_{i,j-1}^{Pa} - E[C_{i,j-1}^{Pa}|\mathcal{D}_{j-1}^{In}]}{Var(C_{i,j-1}^{Pa}|\mathcal{D}_{j-1}^{In})^{\frac{1}{2}}}$$

*where $\lambda^{Pa} = \mathrm{Cor}(C_{ij}^{Pa}, C_{i,j-1}^{In}|\mathcal{D}_{j-1}^{Pa})$ and $\lambda^{In} = \mathrm{Cor}(C_{ij}^{In}, C_{i,j-1}^{Pa}|\mathcal{B}_{j-1}^{In})$.*

Obviously, the estimator $\widehat{Z_{ij}^{Pa}}$ and $\widehat{Z_{ij}^{In}}$ are unbiased for $E[C_{ij}^{Pa}|\widetilde{\mathcal{D}}_{j-1}]$ and $E[C_{ij}^{Pa}|\widetilde{\mathcal{D}}_{j-1}]$, respectively.

In order to perform the MCL method we need to estimate/predict the two correlation coefficients $\lambda^{Pa}$ and $\lambda^{In}$ as well as $E[Q_{i,j-1}|\mathcal{D}_{j-1}^{In}]$, $E[Q_{i,j-1}^{-1}|\mathcal{D}_{j-1}^{Pa}]$, $Var[Q_{i,j-1}|\mathcal{B}_{j-1}^{In}]$ and $Var[Q_{i,j-1}^{-1}|\mathcal{D}_{j-1}^{Pa}]$.

For the derivation of reasonable estimates we assume that $E[Q_{i,j-1}^{-1}|\mathcal{D}_{j-1}^{Pa}]$ and $E[Q_{i,j-1}|\mathcal{D}_{j-1}^{In}]$ as well as $Var[Q_{i,j-1}^{-1}|\mathcal{D}_{j-1}^{Pa}]$ and $Var[Q_{i,j-1}|\mathcal{D}_{j-1}^{In}]$ are constants depending only on $j = 1, \cdots, J$. We set

$$\widehat{q}_j = \frac{1}{\sum_{i=0}^{I-j} C_{ij}^{In}}\sum_{i=0}^{I-j} C_{ij}^{In}Q_{ij} = \frac{\sum_{i=0}^{I-j} C_{ij}^{Pa}}{\sum_{i=0}^{I-j} C_{ij}^{In}}$$

$$\widehat{q_j^{-1}} = \frac{1}{\sum_{i=0}^{I-j} C_{ij}^{Pa}}\sum_{i=0}^{I-j} C_{ij}^{Pa}Q_{ij} = \frac{\sum_{i=0}^{I-j} C_{ij}^{In}}{\sum_{i=0}^{I-j} C_{ij}^{Pa}} = \widehat{q}_j^{\,-1}$$

$$\widehat{Var}(Q_{ij}|\mathcal{D}_j^{In}) = \Big(\sum_{i=0}^{I-j} C_{ij}^{In} - \frac{\sum_{i=0}^{I-j}(C_{ij}^{In})^2}{\sum_{i=0}^{I-j} C_{ij}^{In}}\Big)^{-1}\sum_{i=0}^{I-j} C_{ij}^{In}(Q_{ij} - \widehat{q}_j)^2$$

and

$$\widehat{Var}(Q_{ij}^{-1}|\mathcal{D}_j^{Pa}) = \Big(\sum_{i=0}^{I-j} C_{ij}^{Pa} - \frac{\sum_{i=0}^{I-j}(C_{ij}^{Pa})^2}{\sum_{i=0}^{I-j} C_{ij}^{Pa}}\Big)^{-1}\sum_{i=0}^{I-j} C_{ij}^{Pa}(Q_{ij}^{-1} - \widehat{q_j^{-1}})^2$$

for all $0 \le i \le I$ and $0 \le j \le J-1$.

**Lemma 7.3** *Under the assumption that $E[Q_{ij}^{-1}|\mathcal{B}_j^{Pa}]$, $E[Q_{ij}|\mathcal{D}_j^{In}]$, $\mathrm{Cov}[Q_{ij}^{-1}|\mathcal{D}_j^{Pa}]$ and $\mathrm{Cov}[Q_{ij}|\mathcal{D}_j^{In}]$ are constants depending only on $j$ for $0 \le j \le J$, we have*

*1. given $\mathcal{D}_j^{In}$, $\widehat{q_j}$ is an unbiased estimator for $E[Q_{ij}|\mathcal{D}_j^{In}]$ and $\widehat{Var}(Q_{ij}|\mathcal{D}_j^{In})$ is an unbiased estimator for $Var(Q_{ij}|\mathcal{D}_j^{In})$, and*

*2. given $\mathcal{D}_j^{Pa}$, $\widehat{q_j^{-1}}$ is an unbiased estimator for $E[Q_{ij}^{-1}|\mathcal{B}_j^{Pa}]$ and $\widehat{Var}(Q_{ij}^{-1}|\mathcal{D}_j^{Pa})$ is an unbiased estimator for $Var(Q_{ij}^{-1}|\mathcal{D}_j^{Pa})$.*

There remains to estimate the $\widetilde{\mathcal{D}}_{j-1}-$measurable correlation coefficients $\lambda^{Pa}$ and $\lambda^{In}$. They are estimated by

$$\widehat{\lambda^{Pa}} = \frac{\sum_{1\leq i+j\leq I} \widetilde{Q}_{i,j-1}^{-1}\widetilde{F}_{ij}^{Pa}}{\sum_{1\leq i+j\leq I}(\widetilde{Q}_{i,j-1}^{-1})^2} \quad \text{and} \quad \widehat{\lambda^{In}} = \frac{\sum_{1\leq i+j\leq I} \widetilde{Q}_{i,j-1}\widetilde{F}_{ij}^{In}}{\sum_{1\leq i+j\leq I}(\widetilde{Q}_{i,j-1})^2}$$

respectively with

$$\widetilde{Q}_{i,j-1} = \frac{Q_{i,j-1} - \widehat{q_{j-1}}}{\widehat{Var}(Q_{i,j-1}|\mathcal{D}_{j-1}^{In})^{1/2}} \quad \text{and} \quad \widetilde{Q}_{i,j-1}^{-1} = \frac{Q_{i,j-1}^{-1} - \widehat{q_{j-1}^{-1}}}{\widehat{Var}(Q_{i,j-1}^{-1}|\mathcal{D}_{j-1}^{In})^{1/2}}$$

$$\widetilde{F}_{i,j-1}^{Pa} = \frac{C_{i,j-1}^{Pa} - \widehat{f_{j-1}^{Pa}}C_{i,j-1}^{Pa}}{\widehat{\sigma_{j-1}^{Pa}}(C_{i,j-1}^{Pa})^{1/2}} \quad \text{and} \quad \widetilde{F}_{i,j-1}^{In} = \frac{C_{i,j-1}^{In} - \widehat{f_{j-1}^{In}}C_{i,j-1}^{In}}{\widehat{\sigma_{j-1}^{In}}(C_{i,j-1}^{In})^{1/2}}$$

Hence the predictors of the MCL method are given by

**Estimator 7.1** *The MCL estimators are given iteratively by*

$$\widehat{E}[C_{ij}^{Pa}|\widetilde{\mathcal{D}}_I] = \widehat{E}[C_{i,j-1}^{Pa}|\widetilde{\mathcal{D}}_I]\Big(\widehat{f_{j-1}^{Pa}} + \widehat{\lambda^{Pa}}\frac{\widehat{\sigma_{j-1}^{Pa}}}{\widehat{E}[C_{i,j-1}^{Pa}|\widetilde{\mathcal{D}}_I]^{1/2}}\widetilde{Q}_{i,j-1}^{-1}\Big)$$

$$\widehat{E}[C_{ij}^{In}|\widetilde{\mathcal{D}}_I] = \widehat{E}[C_{i,j-1}^{In}|\widetilde{\mathcal{D}}_I]\Big(\widehat{f_{j-1}^{In}} + \widehat{\lambda^{In}}\frac{\widehat{\sigma_{j-1}^{In}}}{\widehat{E}[C_{i,j-1}^{In}|\widetilde{\mathcal{D}}_I]^{1/2}}\widetilde{Q}_{i,j-1}^{-1}\Big)$$

*for $i+j>I$, where we set $\widehat{E}[C_{i,I-i}^{Pa}|\widetilde{\mathcal{D}}_I] = C_{i,I-i}^{Pa}$ and $\widehat{E}[C_{i,I-i}^{In}|\widetilde{\mathcal{D}}_I] = C_{i,I-i}^{In}$.*

# References

[1] Alba de, E. (2002). *Bayesian estimation of outstanding claim reserves.* North American Actuarial J. 6/4, 1-20.

[2] Barnett, G. and Zehnwirth, B. (2000). *Best estimates for Reserves.* Proc. CAS, Vol.LXXXVII, 245-321.

[3] Benktander, G. (1976). An approach to credibility in calculating IBNR for casualty excess reinsurance. The Actuarial Review, April 1976, page 7.

[4] Bornhuetter, R. L., and Ferguson, R. E. (1972). *The actuary and IBNR.* Proc. CAS 59, 181-195.

[5] Brehm, P. J. (2002). *Correlation and the aggregation of unpaid loss distributions.* CAS Forum (Fall), 1-24.

[6] Buchwalder, M., Bühlmann, H., Merz, M., Wüthrich, M.V. (2006). *The mean square error of prediction in the chain ladder reserving method (Mack and Murphy revisited).* Astin Bulletin 36 (2), 521-542.

[7] Bühlmann, H. and Gisler, A. (2005), *A course in credibility theory and its applications.* Springer, Berlin.

[8] England, P. D. and Verrall, R, J. (1999). *Analytical and bootstrap estimates of prediction error in claim reserving.* Insurance: Math. Econom. 25/3, 281-293.

[9] England, P. D. and Verrall, R, J. (2001). *A flexible framework for stochastic claim reserving.* Proc. CAS, Vol. LXXXVIII, 1-38.

[10] England, P. D. and Verrall, R, J. (2002). *Stochastic claim reserving in general insurance.* British Actuarial J. 8/3, 443-518.

[11] England, P. D. and Verrall, R, J. (2007). *Predictive distributions of outstanding liabilities in general insurance.* Ann. Actuarial Science 1/2, 221-270.

[12] Gisler, A. and Wüthrich, M. V. (2007). *Credibility for the chain ladder reserving method.* Conference paper, 37th Astin Colloquium 2007, Orlando, USA.

[13] Hertig, J. (1985). *A statistical approach to the IBNR-reserves in marine insurance.* ASTIN Bull. 15/2, 171-183.

[14] Hess, K. T., Schmidt, K.D. and Zocher, M. (2006). *Multivariate loss prediction in the multivariate additive model.* Insurance: Math. Econom. 39/2,185-191.

[15] Jong De, P. (2006). *Forecasting runoff triangles.* North American Actuarial J. 10/2,28-38.

[16] Mack, T. (1993). *Distribution-free calculation of the standard error of chain-ladder reserve estimates.* ASTIN Bull. 23, 213-225.

[17] Mack, T. (2000). *Credible claim reserves: the Benktander method.* Astin Bulletin 30 (2), 333-347.

[18] Merz, M. and Wüthrich, M. V. (2006). *A credibility approach to the Munich chain-ladder method.* Blätter DGVFM XXXVII, 619-628.

[19] Merz, M. and Wüthrich, M. V. (2009a). *Prediction error of the multivariate addtive loss reserving method for dependent lines of business.* Variance vol 3(1), 131-151.

[20] Merz, M. and Wüthrich, M. V. (2009b). *Combining chain ladder and additive loss reserving method for dependent lines of business.* Variance vol 3(2),270-291.

[21] Murphy, D. M. (1994). *Unbiased loss development factors.* Proc. CAS, vol LXXXI. 154-222.

[22] Neuhaus, W. (1992). *Another pragmatic loss reserving method or Bornhuetter-Ferguson revisited.* Scand. Actuarial J. 2, 151-162.

[23] Pröhl, C. and Schmidt, K. D. (2005). *Multivariate chain-ladder.* Dresdner Schriften zur Versicherungs mathematik 3/2005.

[24] Quary, G. and Mack, T. (2004). *Munich chain ladder.* Blätter DGVFM XXVI,597-630.

[25] Renshaw, A. E. (1995). *Claim reserving by joint modelling.* Astin Colloquium 1995, Leuven, Belgium.

[26] Renshaw, A. E. and errall, R, J.(1998). *A stochastic model underlying the chain ladder technique.* British Actuarial J. 4/4, 903-923.

[27] Schmidt, K. D. (2006a). *Methods and models of loss reserving based on run-off triangles: a unifying survey.* CAS Forum (Fall), 269-317.

[28] Schmidt, K. D. (2006b). *Optimal and additive loss reserving for dependent lines of business.* CAS Forum (Fall), 319-351.

[29] Taylor, G. C. (1987). *Regression model in claims analysis I: theory.* Proc. CAS, Vol. LXXIV, 354-383.

[30] Taylor, G. (2000). *Loss reserving: an actuarial perspective.* Kluwer Academic Publishers, Boston.

[31] Taylor G. and McGuire, G. (2005). *Synchronous bootstrapping of seemingly unrelated regressions.* Conference papaer, 36th Astin Colloquium 2005, Zürich, Switzerland.

[32] Taylor G. and McGuire, G. (2007). *A synchronous bootstrap to account for dependencies between lines of business in the estimation of loss reserve prediction error.* North American Actuarial J. 8/1, 37-44.

[33] Verrall, R, J. (1990). *Bayes and empirical bayes estimation for the chain ladder method.* Asin Bulletin 20/2, 217-243.

[34] Verrall, R, J. (2004). *A bayesian generalized linear model for the Bornhuetter-Ferguson method of claim reserving.* North American Actuarial J. 8/3, 67-89.

[35] Vylder De, F. (1982). *Estimation of claim IBNR claims by credibility theory.* Insurance: Math. Econom. 1/1, 35-40.

[36] Wüthrich, M.V. (2008). Prediction error in the chain ladder method. *Insurance: Mathematics and Economics*, **42**, 378-388.

[37] Wüthrich M.V. and Merz, M. (2008). *Stochastic claims reserving methods in insurance.* John Wiley & Sons.

[38] Verdonck, T., Van Wouwe, M. and Dhaene, A. (2009). A robustification of the chain-ladder method. *North American Actuarial Journal*, **13** (2): 280-298.

# Development of SCR in Solvency II QIS's

CHEN Donghui, SHI Xiang, WANG Wei
PICC Property & Casualty Company Ltd., Beijing, China, 100022

**Abstract:**The CEIOPS carried five rounds of Quantitative Impact Study (QIS) during the development of Solvency II, in order to quantitatively measure the impact on the insurance industry once the regulatory requirements change. QIS plays a key role in the establishment of Solvency II regulatory standards as an important means of consulting and reviewing. The article analyzes the development of Solvency Capital Requirement (SCR) in the 5 QIS's, focusing on the change of module structure and quantitative results. Several recommendations are provided to the Chinese regulators in developing the new solvency regime in China.

**Keywords:**Solvency II; QIS; SCR; Analysis of development

## Ⅰ.引言

2009 年 4 月 22 日，欧洲议会批准了偿付能力 2（Solvency II）指引，欧盟推行历时十年、投入巨大人力和物力进行研究和开发的这套保险监管制度势在必行。

在 Solvency II 的发展过程中，量化影响测试（QIS：Quantitative Impact Study）起到了非常重要的作用。作为 Solvency II 项目的一个重要部分，欧洲保险与企业年金监督官委员会（CEIOPS）进行了一系列大规模的 QIS，以考察定量监管要求对保险公司经营及偿付能力水平的影响，作为制定执行 Solvency II 的具体措施的主要参考因素。在历次 QIS 中，对偿付能力资本要求（SCR: Solvency Capital Requirement）的测试又是监管部门及保险公司关注的焦点，SCR 的计算结果被认为是欧盟偿付能力监管的重要参考指标。

目前我国保险业的偿付能力水平已成为监管重点，保监会高度重视并不断推动偿付能力监管体系建设，并于近期正式启动国内第二代偿付能力监管制度体系建设工作，目标是建设一套新的既与国际接轨、又符合国情的偿付能力监管制度体系。因此，对欧盟 Solvency II 的偿付能力监管体系，特别是理论、方法及历次量化测试结果的学习研究和借鉴尤为必要。目前，业界已经对 Solvency II 的监管体系和最后一次 QIS5 测试的方法及结果进行了大量的研究，而对历次 QIS 的发展和演变很少涉及。通过对历次 QIS 中 SCR 测试演变的研究，可以清晰地了解欧洲保险业监管者是如何逐步推进和完善对 SCR 测算标准的制定工作，如何不断推动整个项目、逐步提高市场对 Solvency II 项目的参与度和认同度。

本文重点就历次QIS中SCR定量模型的发展进行阐述，希望能对中国建立以风险为导向的偿付能力监管制度起到抛砖引玉的作用。本文分为三部分。第一部分为文章引言，第二部分介绍SCR在历次测试中的演变，第三部分提出对我国第二代偿付能力监管制度体系的建议。

## Ⅱ.SCR 在历次测试中的演变

### A. QIS 整体演变过程概述

QIS1 是一个学习和研究的过程，主要测试准备金谨慎程度和对准备金测算方法进行改进，并获取计算公式实用性的反馈信息。

QIS2 开始测试偿付能力要求，引入了资本需求的模块化结构。

QIS3 研究改进标准公式，首次关注保险集团层面的偿付能力，引入自有资本原则导向定义，第一次要求内部模型的结果。

QIS4 则是历次量化测试中最重要的一次，首次就市场一致性评估方法进行了全面推行，并对自有资本进行了定量化细分，引入了两种方法对集团公司的偿付能力进行测算。

QIS5 是最后一次全面综合的定量影响测试，为正式实施 Solvency II 做好准备。

## B. SCR 在历次测试中的演变概述

欧盟 Solvency II 将资本要求设置为两个层次：最低资本要求（MCR：Minimum Capital Requirement）和偿付能力资本要求（SCR）。如果保险公司的实际资本没有达到 MCR 要求，保单持有者利益就暴露在风险之下，监管机构可对其进行接管或责令其停业。如果公司的实际资本没有达到 SCR 要求，监管机构将针对公司面临的具体情况采取一定程度的监管措施。欧盟对 SCR 的标准公式计算采用的是模块化结构，利用不同的风险（子）模块对保险公司可能面对的全部风险分类考虑及测算相应的资本要求。

SCR 的标准制定共经历了 5 次量化测试，其演变过程体现出了管理层自身对 SCR 测算方法认识的不断加深和一些主要思想的不断完善，逐步形成了 SCR 测算的主要指导思想：1、基于风险的监管要求，即 SCR 的测算是基于风险（risk-based）的；2、鼓励更好的风险管理措施，即风险管理良好的公司其 SCR 的要求会相对降低；3、争取更多企业，特别是小企业的参与，在历次测试中，充分借鉴了各参与测试公司的反馈意见和建议，确保其规则的适用性。

关于 SCR 历次测试方法和结果的演变，从 QIS2 开始首先提出模块化结构，主要关注点在大的方法的选择上，模型因子的选择并没有统一，因此 QIS2 并没有给出行业定量的测试结果，只是定性的说明资本需求较 Solvency Ⅰ有所提高；QIS3 对 QIS2 的模块及方法进行了细化和改进，统一了 99.5%置信度的测量标准，更加关注模型因子的选择，首次给出了定量测试结果，非寿险公司 SCR 与 Solvency I 的比例约为 160%，而寿险公司计算出的偿付能力资本需求与 Solvency I 相当；QIS4 在历次测试中较为关键，在 QIS3 的基础上对各模块的方法、风险要素及因子选择进行了细化完善，QIS4 测算出的结果较 QIS3 有所提高，整体全行业的 SCR 值较 Solvency Ⅰ的比例约为 220%；QIS5 模块和方法已基本定型，并随着定量测试的不断深入，标准公式法中的各类风险子模块也得到了逐步的完善，所考虑的风险类型与具体技术细节也更加全面和周详。QIS5 测算结果较 QIS4 又有进一步提高，整体全行业 SCR 的结果较 Solvency I 增长比率为 241%。表 1 展示了历次测试的结果变化。

**表 1 历次 QIS 偿付能力资本要求（SCR）测算结果**

| 分类 | SCR 历次测试与 SI 比较 | | |
|---|---|---|---|
| | QIS5 与 SI | QIS4 与 SI | QIS3 与 SI |
| 行业整体 | 241% | 220% | - |
| 非寿险 | - | 约 160% | 约 160% |

## C. SCR 具体方法及结果的演变

### 1）QIS2 第一次提出 SCR 模块化结构

QIS2 在建立 SCR 与 MCR 的测算标准的进程中迈出了尝试性的一步，首次开始测试保险公司的 SCR，并提出模块化结构。

#### ①模块介绍

从图 1 可以看到，在 QIS2 中，将 SCR 分为非寿险承保风险、市场风险、信用风险、运营风险、寿险承保风险+和健康险承保风险等 6 个风险模块，往下又进一步细分为不同的风险子模块。

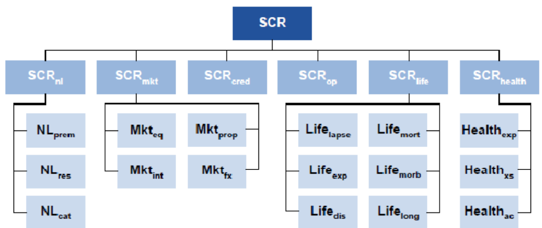



**图 1 QIS2 模块结构**

QIS2 中对 SCR 的测算采用了所谓的占位方法，SCR 计算的总公式为：

$$SCR = BSCR - RPS - NL\_PL$$

其中 BSCR 代表基础偿付能力资本要求，包括上述 6 个风险模块，各模块分别计算资本偿付能力，再按照一定的相关性综合起来得到的；RPS 是资本需求的减项，是针对分红产品而言的，可通过减少未来红利对未来风险进行补偿（主要应用于寿险业务）；NL_PL是非寿险中下一年承保业务的期望利润或损失，分为保费和准备金两方面考虑。

QIS2 没有设定 BSCR 中各风险模块相关系数的取值，要求参与测试的公司根据自身假设条件自行设定相关系数阵中的取值。同时，还提供了备选公式，即分别假设各风险模块之间完全独立或完全正相关（无风险分散效应）。

对于相关性处理的随意性是 QIS2 受到批评的主要问题之一。

**②主要模块测算方法介绍**

对非寿险业影响最大的两块风险是非寿险承保风险和市场风险。

非寿险承保风险模块（$SCR_{nl}$）包括三个子模块，分别为保费风险、准备金风险和巨灾风险。其中，保费风险指的是未来一定时期内的赔款加费用超过已赚保费的风险，计算公式为ρ(σ)P，σ是整体业务综合成本率的标准差；准备金风险指的是准备金误评以及未来赔款的随机波动所带来的风险，计算公式为ρ(σ)PCO，σ为行业给定准备金标准差因子；巨灾风险：是极端或非常规情况所带来的没有被保费和准备金风险所包含的风险。其计算方法可分为市场损失法和情景法。市场损失发是给定行业损失金额，各公司根据各自的市场份额进行分配。情景法给各公司较大的选择权，可自行建模，参考 99%分位点值，计算巨灾风险。

市场风险模块（$SCR_{mkt}$）包括四个子模块，分别为利率风险、股票风险、财产风险和汇率风险。其计算均是给定风险影响因子，再乘以相对应的净资产风险暴露而得到。利率风险指的是未来利率波动给公司带来的风险，其计算方法给定了较为粗略的利率上浮和下浮的影响因子；股票风险指的未来股票波动给公司带来的风险，设定影响因子为 40%；财产风险是不动产投资风险，影响因子是 20%；汇率风险指的是持有非本国货币，在兑换是的汇率变动的风险，风险因子是 25%。

**③测算结果展示及 QIS2 小结**

QIS2 没有给出定量的 SCR 计算结果，只是定性的指出 BSCR 比 Solvency I 的资本要求提高了。

QIS2 只是测试一种可行的方法，并不是校准，对参与公司给予了很大的自由权，要求各公司同时使用行业参数和公司参数测算各风险模块，甚至可使用自己的模型进行测算，以便监管者积累相关数据，在今后的测试中进行改进。其测算结果不能精确地反映其背后的风险，也不能与一年内 99.5%置信度下的资本要求相对应。

此次测试仍存在诸多问题，参与测试的公司反馈的意见主要集中在以下几点：1、多数公司认为保费风险和准备金风险的标准差波动因子过于审慎；2、目前是使用整体综合成本率的波动来测算非寿险保费风险，有些公司认为使用频率/案均的方法来计算保费风险更加合理；3、很多公司表示对非寿险利润/损失补偿NL_PL的计算方法太过于粗略了，并可能导致 SCR 取值为负；4、有证据表明，使用 QIS2 的方法和参数，小型保险公司受到的影响比大型保险公司要大。这一点在产品线单一的非寿险公司中体现的尤为明显。

虽然 QIS2 只关注对方法本身的研究与定量测算，但其累计了大量的测试数据和参与者意见，为欧盟进行下一次测试打下了良好的基础。

**2）QIS3 首次给出了定量测算结果**

QIS3 对 QIS2 的方法进行了细化和改进，增加了对各模块计算方法的指导，减少了公司自由选择的空间，首次给出了定量测试结果，测算结果更具可比性。

**①模块结构演变**

QIS3 的模块结构较 QIS2 有了一定的改变。首先，考虑到操作风险和其他风险模块的相关性有争议，将操作风险模块与 BSCR 并列处理，直接加到 BSCR 上，认为操作风险与 BSCR 完全相关。因此 QIS3 中 SCR 计算总公式变为为：

$$SCR=BSCR+SCR\_op$$

其中 SCR_op 表示操作风险的资本要求，相当于假设 BSCR 和 SCR_op 完全正相关；另外，QIS3 还将 QIS2 中对未来利润分享的风险缓解作用的调整放在 BSCR 下的各个风险模块中分别进行处理，而不是用RPS和NL_PL统一考虑，更加细化；其次是在$SCR_{nl}$模块中将保费风险与准备金风险子模块合并处理，考虑其内在真实的相关性，并在$SCR_{mkt}$模块中增加了集中风险和利差风险。对于寿险风险模块，调整了其子模块的构成，去掉了发病率子模块，并增加了给付风险和巨灾风险子模块。

在各风险模块及总的 SCR 的校准方面，QIS2 没有给出明确统一的标准，而 QIS3 明确校准至（再）保险公司的基本自有资本在一年期 VaR，其中 VaR 置信水平为 99.5%，相当于保险公司破产概率是200年一遇。从QIS3 开始，CEIOPS 提供了测算中使用的各风险模块之间的相关系数矩阵，使得测算结果具有可比性。

②主要模块测算方法演变

$SCR_{nl}$ 整体模块有较大变化，仅包括准备金/保费风险和巨灾风险两个子模块，与 QIS2 相比，将准备金和保费风险合并处理，更加准确的反应两类风险之间内在真实的相关性。合并后准备金/保费整体风险的计算公式变为 $\rho(\sigma)V$，V 代表保费和准备金风险暴露之和，$V_{(prem,lob)} = \max(P^{written}; P^{earned})$，σ表示保费和准备金共同作用下的标准差。并且没有再考虑未来预期利润/损失的扣减作用。对产品线又进行了进一步细分，由 12 个变为了 15 个。

对于巨灾风险，明确了洪水、冰雹、风暴和人为灾害（火灾、恐怖袭击等）几种灾因，对不同国家给定了巨灾发生的不同场景（基于 200 年一遇的假设），参与者可选择所属国家面临的巨灾风险取值，并假设各灾因独立，将各灾因合并处理。

$SCR_{mkt}$ 模块新增加了利差风险和集中风险，并降低了各子模块的风险因子系数。利率风险细化完善了利率上浮和下浮影响因子；股票风险将影响因子由原来的 40% 调整到了欧盟地区 32%，欧盟之外的地区 45%，另提供一种新方法，按照久期对净资产进行划分，然后乘以对应的影响因子；财产风险同样提供了按照久期划分资产的细化方法；汇率风险的影响因子由 25% 降低至 20%；本次测试增加了利差风险和集中风险，其中，后者是由于资产投资过于集中带来的风险，其计算方法是对资产所投资的公司进行分级，按照分级，对过于集中的资产给予一定的风险因子。市场风险模块的另一大重要变化是调整了相关矩阵的系数，将股票风险和利率风险的相关系数由 0.75 变为 0，导致了非寿险市场风险资本要求平均降低 6%。

③测算结果展示及 **QIS3** 小结

QIS3 首次与 SⅠ进行量化比较，结果表明，资本需求较 SⅠ有所提高，对于非寿险公司而言 SCR 平均与 SⅠ的比例是 160%左右，而寿险公司的 SCR 与 SⅠ差异不明显。

与 QIS2 相比，QIS3 对计算方法给予了更多的指导，减小了参与者的选择，并对计算公式和参数进行了细化，可见监管者通过 QIS2 的测试，对不同方法的结果有了一定的分析之后，开始尝试引导参与者使用合理统一的方法进行 SCR 的测算，并更加关注模型参数的选取。

参与公司同样提出了一些反馈意见，多家公司对将非寿险预计利润/亏损从 QIS3 的估算中移除表示惋惜，认为这个数据对反应真实的经济学非寿险业务估价有着重要意义。在一些参与公司反对操作风险和其他风险之间的 100% 的相关性，认为其模块计算过于简单，没有考虑保险公司内部操作风险的质量。

**3）QIS4 细化完善各模块计算方法及所包含风险要素**

QIS4 在 QIS3 的基础上对各模块的方法及要考虑的风险进行了细化完善。

①模块结构演变

QIS4 的主要变化是在模块中增加了风险吸收调整项（Adj），将 SCR 分成了三个主要模块，分别为基础 SCR（BSCR）、操作风险（SCROP）和调整项（Adj），SCR 的总公式表达式为：

$$SCR=BSCR - Adj + SCROp$$

其中风险吸收调整项（Adj）调整的是责任准备金和递延税金的风险吸收能力，主要包括未来利润分享的风险吸收能力和递延税金的风险吸收能力两部分。未来利润分享的风险吸收主要是指通过降低某些长期的业务（如寿险的分红业务）的未来给付水平来吸收风险。递延税调整是指通过降低递延税金起到吸收风险的作用。

②主要模块测算方法演变

$SCR_{nl}$ 整体模块基本沿用 QIS3 的测算方法，在计算准备金/承保风险时，QIS4 还考虑了地域分散的效应。在计算巨灾风险，QIS4 已经明确了方案，即提供了两种测算方法供参与公司使用，即标准公式法和情景法。

$SCR_{mkt}$模块的集中风险子模块考虑了未来利润的影响；对不动产风险的计量更加保守，损失因子从 QIS3 的贬值 20%上调到 QIS4 的 25%。

监管者对一些模块提供了简化计算的方法，方便参与者（特别是小公司）选择和使用。

③测算结果展示及 **QIS4** 小结

从偿付能力需求资本量上来看，QIS4 测算出的结果较 QIS3 有所提高，整体全行业的 SCR 值较 Solvency I 的比例约为 220%，该比例相对于 QIS3 也大大提高，反映出经过 08 年金融危

机，欧洲的监管机构整体上更加趋于保守。其中，由于几乎不受调整项的影响，非寿险部分的 SCR 上升的更为明显。

从偿付能力充足率上看，相对于 SolvencyI，QIS4 的偿付能力充足率总体在下降，主要是由于非寿险公司偿付能力充足率的下降。分看来看，寿险公司由 Solvency I 的 200%上升到 QIS4 的 230%；非寿险公司由 Solvency I 的 277%下降到 193%。

参与公司基本认为 QIS4 的框架结构是合理的，但表示最好再制定更详细的指引。QIS4 中操作风险计算标准公式继续受到质疑，主要认为操作风险与其他风险之间的相关性为 100%，没有反映不同公司内部实际经营管理水平的变化。QIS4 在非寿险业务承保风险计算中考虑了地域多元化的效应，但一些参与者也认为加入该因素后模型计算将更加复杂，测算成本的提高也许会高于要求资本的减少。对于市场风险，许多公司认为，为股票风险选择 32% 的校准太低了，可能 40%左右会更加合适。还有些意见指出，应当在利率风险模块中引入收益率形状变化的敏感性测试。并且建议将股票风险和利息率风险之间的相关系数提高，经计算，该系数从 QIS4 测试的 0%提高至 25%将使得市场风险平均提高 4%。很多公司认为计算毛的 SCR（考虑未来利润分享的风险缓解效果之前）是一个额外负担且没有必要。

**4）QIS5 模块和方法已基本定型**

QIS5 模块和方法已基本定型，并随着定量测试的不断深入，标准公式法中的各类风险子模块也得到了逐步的完善，所考虑的风险类型与具体技术细节也更加全面和周详。

**① 模块结构演变**

图 2 展示了 QIS5 的最终模块结构，与 QIS4 相比，其主要变化是在 BSCR 下增加了无形资产风险子模块，无形资产主要包括是商誉和其他无形资产，其主要受到两类风险的影响：一是市场风险，二是内部风险。

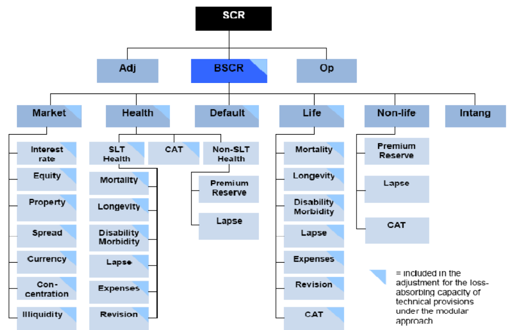



**图 2　QIS5 模块结构**

SCR 的总计算公式与 QIS4 相同，即：

$$SCR = BSCR + Adj + SCROp$$

其中 Adj 的计算金额改变了符号，因此其计算公式的符号也做了修改，对结果没有实质影响。

**② 主要模块测算方法演变**

QIS5 的 $SCR_{nl}$ 模块发生了一定的变化，首先在原来两个子模块的基础上又新增加了退保风险子模块，所谓退保风险是指由于预先假设的退保率与最终实际情况不符而产生的风险。对于巨灾风险模块，较 QIS4 监管者给出了更加详细的标准计算方法，对每一灾因给出了在不同国家及地区的风险因子以及相关系数。此外，在 QIS5 中，巨灾和保费/准备金风险的相关系数由 0 变为 0.25，这将会使得测算结果变小。QIS5 还提供了一系列计算 SCR 的方法，允许保险公司从中选择一个与其风险状况最相当的方法，备选方法主要包括：完全的内部模型、标准公式和部分内部模型、标准公式和公司自身的参数、标准公式和简化方法。

$SCR_{mkt}$ 市场风险模块中，增加了非流动性溢价风险模块。此外，集中风险不像在 QIS4 中仅针对利率风险、股票风险和分散风险 3 个模块而言，而是对于针对整个市场风险模块。

**③测算结果展示及 QIS4 小结**

从整个欧洲的平均测试结果来看，SCR 较 Solvency I 增长比率为 241%，比 QIS4 与 Solvency I 的比例上升了 21%。上升原因主要有 3 大方面，一是 BSCR 中增加了无形资产风险模块，二是非寿险承保风险里增加的退保风险模块，以及巨灾与保费、准备金风险相关系数的改变，三是由于市场风险增加的非流动性风险模块，以 SCR 的整体风险构成角度来看，对于非集团公司，BSCR 中占比最大的为市场风

险（102%），其次为非寿险风险（30%），寿险风险占比位居第三（28%）；对于寿险公司而言，市场风险占了整个 SCR 的大部分，约为 67%，其承保风险占比很小 23.7%，再次是违约风险（7.7%）；对于非寿险公司而言，其承保风险占了主要 52.4%，而市场风险位居第二 32.8%，再次是违约风险和健康险承保风险（各占 7%）；

## Ⅲ.对我国第二代偿付能力监管制度体系的建议

### A.高度关注进行定量影响测试，不断改进

我国的偿付能力制度改革，是一场根本性的革命，对保险业内外部环境都将产生重大和深远的影响。因此，决策判断一定要慎重，考虑周全。这就要求中国保险业必须在制度的制定过程中，学习欧盟的先进经验，多次反复进行全行业大范围的定量影响测试，给政策制定者和监管者及时的回应和反馈，真正做到政策制度拟定、修改、最终制定有理可依，有数可循，真正做到切合中国国情。

磨刀不误砍柴功，中国保险业应高度关注进行定量影响测试，不断改进，制定出最科学最合理的中国偿付能力管理体系。

### B.基于风险构建偿付能力资本需求，全面客观公正反映真实风险水平

偿付能力管理最重要的特征之一是基于风险：资本需求和保险个体风险特征紧密相关，风险越高，资本需求也相应越大。

从上文中，我们清晰地看出 Solvency II 新框架将重点放在了对风险的精确识别和测量上。历次 QIS 将公司面临的风险，即 SCR 进行了细分，研究了各种风险之间的相关性，考量了公司经营规模、业务种类等等对其承担风险的影响。并以这些对风险的定量影响为基础，设计 Solvency II 的框架体系。量化模型能否全面客观公正的反映保险公司真实风险水平，是中国新偿付能力标准能否成功的关键影响要素之一。作为 Solvency II 三支柱的基石，欧盟的监管者用了 10 年多的时间，扎扎实实地做好风险量化的基础工作，高度关注这一技术性工作。

基于风险构建偿付能力资本要求的另一个重要意义和作用是可以鼓励保险业实施更好的风险管理措施。Solvency II 设计的主要目的之一是激励企业更好促进风险管理，为了实现这一目的，QIS 在发展中不断进行变革，增加了诸如允许公司使用内部模型和内部参数、可以体现公司经营分散性效应以及认可风险减缓作用技术的内容。

### D.借鉴 Solvency II 的经验，学习但不照搬

Solvency II 对中国的借鉴意义，包括理论研究、实务操作、和监管制度建设三个方面。

现在大家谈论最多的是第一支柱，即量化的部分。对于基于风险计算资本要求的方法，我们不能生搬硬套，适用于欧洲的模型、参数和假设，能否适合中国保险市场的发展现状。我们决不能在没有准备好的情况下毫无把握地去计算风险资本。

总之，绝对不能简单地去模仿欧盟或美国的计算方法，更不能轻率地去将欧、美的方法各抽出一部分来拼凑成一

## References

[1] Committee of European Insurance and Occupational Pensions Supervisors, “QIS1-Summary report,”CEIOPS-FS-01/06, 17 March 2006.

[2] Committee of European Insurance and Occupational Pensions Supervisors, “QIS1 specification Technical provisions,”CEIOPS-FS-11/05.

[3] Committee of European Insurance and Occupational Pensions Supervisors, “QIS2-Summary report,”CEIOPS-SEC-71/06S.

[4] Committee of European Insurance and Occupational Pensions Supervisors, “Quantitative Impact Study 2 Technical Specification,”CEIOPS-PI-08/06.

[5] Committee of European Insurance and Occupational Pensions Supervisors, "CEIOPS' Reprot on its third Quantitative Impact Study(QIS3) for Solvency Ⅱ," CEIOPS-DOC-19/07.
[6] Committee of European Insurance and Occupational Pensions Supervisors, "QIS3 Technical Specifications PART Ⅰ : INSTRUCTIONS," CEIOPS-FS-11/07.
[7] Committee of European Insurance and Occupational Pensions Supervisors, "CEIOPS' Reprot on its fourth Quantitative Impact Study(QIS4) for Solvency Ⅱ," CEIOPS-SEC-82/08.
[8] EUROPEAN COMMISION, FINANCIAL INSTITUTIONS, "QIS4 Technical Specifications:," Brussels, 31 March 2008, MARKT/2505/08.
[9] EUROPEAN INSURANCE AND OCCUPATIONAL PENSIONS AUTHORITY "EIOPA Reprot on the fifth Quantitative Impact Study(QIS5) for Solvency Ⅱ," EIOPA-TFQIS5-11/011, 14 March 2011.
[10] EUROPEAN COMMISION, FINANCIAL INSTITUTIONS, "QIS5 Technical Specifications:," Brussels, 5 July 2010.

# SCR 在 SolvencyII量化影响测试中的演变分析

陈东辉 ，史翔 ，王维
中国人民财产保险股份有限公司，北京，中国，100022

**摘　要**：在欧盟 Solvency II 的发展历程中，欧洲保险与企业年金监督官委员会进行了一系列大规模的量化影响测试，以定量的手段考察了监管要求的改变对保险公司经营及偿付能力水平的影响。量化影响测试作为 Solvency II 监管标准制定和实施的重要参考因素，起到了非常关键的作用。本文对历次量化测试中偿付能力资本需求（SCR: Solvency Capital Requirement）的模块方法及结果的演变进行了分析，并给出了对我国保险业偿付能力二代建设工作的建议。

**关键词**：Solvency II；量化测试；SCR；演变分析

# The Applications and its Strategies of AdaBoost Algorithm in the Credit Ratings on Feature Selection: Taking Iron and Steel Sector For Example

LI Hui[1,2]
1 School of Statistics, Renmin University of China, Beijing, PRC, 100872;
2 School of Science and Information, Qingdao Agricultural University, Qingdao, PRC, 266109

**Abstract:** In this paper, Adaboost algorithm is applied in credit ratings firstly, and empirical analysis shows that Adaboost algorithm on the basis of 18 indexes selected as regression variables fits the credit rates of 39 listed iron and steel companies of China very well. The discrimination errors are 2.56% after 10 iterations, given iterations added then its errors could reach zero and output classification results stably. In additions, the index importance outputs used from two aspects can reselect and refine the nine key indexes among the eighteen indexes. After using Adaboost algorithm to test again, we can find that the nine indexes reduced do not cut down the classification information of the models and the rating corrections do not slide down either.
**Keywords:** credit ratings; feature selection; AdaBoost algorithms; iron and steel sector

## Ⅰ.Introduction

Most of regression models, which reflect realistic economy and society events, are relate to feature selection, and then credit rating involves them. The essence of credit ratings is to provide a risky symbol to investors, discovering and delivering some information of credit risks. Therefore, credit rating describes credit risk by credit symbols, which could be considered as a kind of classifications, and that is a kind of qualitative regressions.

From feature selection on qualitative regression, we can find qualitative regression is bound up with feature selection and good or bad of selection will influents correction and effects directly. However modern feature selection methods are divided as three classes: Filter, Wrapper, Embedded[1].

Filter is a kind of general feature selection method, and it uses some scores on indexes importance to accomplish data preprocessing. Before Filter is used to model, a score statistic should be built then ranked to all indexes. At last, some unimportant indexes will be cancelled under standard predetermined. Some common Filter includes Pearson correlation coefficient, T-test, chi-square test and Information gain method[2, 3, 4, 5, 6] etc.

Unlike to Filter, Wrapper often mixes classification model together, evaluates good or bad of index set selected through forecast accuracy. Firstly,what kind of classification models should be determined when we use Wrapper. Some common classification models include Support Vector Machine (SVM), Decision Tree, Naïve Bayes, Discrimination Analysis, Logistic Regression, BP Neural Network and Nearest etc[7,8,9,10,11];Secondly, a rational search regular need to device as an input or output machine. Currently these search machine involve Branch and Bound, Simulated Annealing, Best First Algorithm, The Greedy Search Strategies and Adaptive Forward-backward greedy algorithm etc [12,13,14,15].

Wrapper process builds on the basis of classification model, and reaches destination by some search strategy, which evaluates all the index sets of model including by reaching the highest classification accuracy. While the classification model resembles an black box, which inputs an index set from its front and outputs classification accuracy from its back then the highest accuracy index set is the best one.

Embedded combines model construct and feature selection organically, alternating them in the computing process, which is reached through a common object function. Some typical Wrappers include Lasso model [16], Adaptive Lasso[17], Bridge Lasso[18], Elastic net Lasso[19], SCAD Lasso[20]etc. Their common forms can show mathematic model below:

$$\min_{\beta\in R^p}\left\{\frac{1}{2n}\|Y-X\beta\|^2+\sum_{j=1}^{p}p_\lambda(|\beta_j|)\right\}$$

Among the formulation, $p_\lambda(\cdot)$ is a penalty function.

In this paper, Adaboost algorithm combines regression classification with index selection, and reaches the key indexes selection on the basis of forecast accuracy. The process will be divided three steps, first classification then index selection last classification again. Therefore, Adaboost algorithm can be considered a kind of Wrapper methods.

About the application of Adaboost algorithm, we search 50 relevant English papers mainly focus on face distinguish, biological classification and medical statistic classification meanwhile 37 relevant Chinese papers which mostly concentrate on face distinguish exception for one about credit scores [21]. In general, we find nothing to apply the algorithm in multi-class credit rating models.

There are many credit risk factors reflecting iron and steel sector, and we need not only build classification models through these factors but also refine these among many factors then effectively select the key indexes we wanted. In the paper, we will use the Adaboost algorithm to class for credit rates of iron and steel sector, and then we will also use the stability of iterations to realize feature reselection.

We first introduce the principal of Adaboost algorithm below.

## Ⅱ .AdaBoost algorithm theory[22,23]

Freund(1997) first proposed Adaboost algorithm, and pointed out the application strategy on two and multi class problems. Schapire(1999) etc. given the classifier trained confidence and provided a standard to evaluate all kinds of algorithms, boosting the algorithm classification accuracy greatly.

The key idea of Boosting algorithm is to transfer a weak classifier to a strong one by integration and train. Adaboost algorithm is a kind of Boosting algorithms, which is an adaptive Boosting one. Adaboost algorithm can adjust weight distribution of the training samples adaptively, and consistently select the best weak classifier of sample weight distribution, to integrate all weak classifier and vote by an certain weight to form a strong classifier. Multi class methods of Adaboost algorithm mainly include AdaBoost.M1, AdaBoost.M2 and AdaBoost.MH. Adaboost.M1 is the most directive methods among them. We take AdaBoost.M1 for example and introduce its train process in details below.

1） Given train sample set

$$S=\{(x_1,y_1),(x_2,y_2),\cdots,(x_n,y_n)\}$$

weak classifier space $H$, $x\in X$, X is a sample space, $y=\{1,2,3,\cdots,K\}$ is a class label set. Initiating sample probability distribution $D_t(i)=1/n$, $i$=1,2,⋯,$n$.

2) For t=1,2,…,T, T is the feature numbers needed.

①To every weak classifier h of $H$, we can do below:

a) Dividing sample space $X$, we can get

$$x_1,x_2,\cdots,x_m$$

b) Under the training sample probability distribution

$D_t$, we can calculate

$$W_k^i=P(x_i\in X_j,y_i=k)=\sum_{\substack{x_i\in x\\ y_i\in k}}D_t(i)$$

c) Setting the outputs of weak classifier in the divisions $h_t(x,l)=\ln W_l^j$, $j$=1,2,⋯,$m$; $l$=1,2,⋯,$k$

d) Calculating normalization factor:

$$Z_t=K\sum_{j=1}^{m}\left(\prod_{k=1}^{K}W_t^j\right)^{1/k}$$

②Selecting $h_t$ out of weak classifier space and subjecting to minimize $Z_t$, that is

$$Z_t=\min Z \qquad h\in H$$
$$h_t=\arg\min Z \quad h\in H$$

③ Calculating rate of misclassification

$$\varepsilon^{(t)}=\frac{\sum_{i=1}^{n}D_{(t)}^i[y_i\neq T^{(m)}(x)]}{\sum_{i=1}^{n}D_{(t)}(i)}$$

④Calculating $\alpha(t)$:

$$\alpha(t)=\lg\frac{1-\varepsilon(t)}{\varepsilon(t)}$$

⑤Refreshing weight of sample:

$$D_{(t+1)}^i=\frac{D_{(t)}^i\exp(\alpha(t)[y_i\neq T^{(m)}(x)])}{Z_t}$$

3) Combined classifier

$$H(x)=\arg\max_l\{f(x,l)\}$$

and

$$f(x,l)=\sum_{t=1}^{T} h_t(x,l)。$$

# Ⅲ.Empirical Analysis

## A. Data resource and feature selection

In this paper, 39 samples listed iron and steel companies bond issued are drawn from Wind Information Corporation, and there are 18 second indexes from four aspects as enterprise scale, operation and management, profitability and debt paying ability to use as variables of credit rating models. Then, enterprise scale includes the two indexes: total assets and gross operating income; operating management of enterprise includes eight indexes: market share, elasticity coefficient of income price, elasticity coefficient of cost price, capitalized liability ratio, total debt to EBITDA, long term asset ratio, accounts receivable turnover and inventory turnover ratio; profitability of enterprise includes three indexes: total profit, ROE and EBITDA profit ratio; debt paying ability of enterprise includes five indexes: asset-liability ratio, liquidity ratio, quick ratio, operational cash flow net to interest-bearing debt and EBIT to interest fees. Because the data is so big that it is not listed completely in this paper, we only list 39 bond issuers and the newest bond issuers' credit rating in 2011 below Table 1.

**Table1 39 iron and steel industries and their rates in 2011**

| Number | Issuer name | The newest credit rates of bond issuer | Rating agencies | The newest rating date |
|---|---|---|---|---|
| 1 | Angang Steel Company Limited | AAA | China Cheng Xin International Credit Rating Corporation Limited(CCXI) | 2011-9-30 |
| 2 | Anshan Iron and Steel Group Co. | AAA | CCXI | 2011-10-18 |
| 3 | Anyang Iron & Steel Co., Ltd. | AA | China Cheng Xin Rating of Security Co., Ltd.(CCXR) | 2011-7-18 |
| 4 | Baosteel Group Xinjiang Bayi Iron & Steel Co., Ltd. | AA | CCXI | 2011-8-1 |
| 5 | Baosteel Metal Co., Ltd. | AA+ | Shanghai Brilliance Credit Rating & Investors Service Co., Ltd. | 2011-11-11 |
| 6 | Baosteel Co., Ltd. | AAA | CCXI | 2011-10-14 |
| 7 | Benxi Steel Group Co., Ltd. | AA | China Lianhe Credit Rating Co., Ltd. | 2011-5-16 |
| 8 | Benxi Steel Group Co., Ltd. | AA+ | CCXI | 2010-12-2 |
| 9 | Dongbei Special Steel Group Co., Ltd. | AA- | China Lianhe Credit Rating Co., Ltd. | 2010-12-29 |
| 10 | Sansteel MinGuang CO., LTD. | AA | CCXR | 2011-5-13 |
| 11 | Hangzhou Iron & Steel Co., Ltd. | AA | Shanghai Brilliance Credit Rating & Investors Service Co., Ltd. | 2011-8-22 |
| 12 | Hebei Iron & Steel Co., Ltd. | AAA | CCXR | 2011-6-30 |
| 13 | Valin Steel Group Co., Ltd. | AA+ | Dagong Global Credit Rating Co., Ltd. | 2011-6-30 |
| 14 | Jiangsu Shagang Group Co., Ltd. | AA+ | CCXI | 2011-9-6 |
| 15 | Jiangyin Xingcheng Special Steel Co., Ltd. | AA | China Lianhe Credit Rating Co., Ltd. | 2011-3-14 |
| 16 | Jiuquan Steel Group Co., Ltd. | AA | China Lianhe Credit Rating Co., Ltd. | 2011-2-22 |
| 17 | Kun Steel Group Co., Ltd. | AA | CCXI | 2011-6-30 |

| | | | | |
|---|---|---|---|---|
| 18 | Kun Steel Holding Co., Ltd. | AA+ | CCXI | 2011-7-7 |
| 19 | Laigang Co., Ltd. | AA | Shanghai Brilliance Credit Rating & Investors Service Co., Ltd. | 2011-4-7 |
| 20 | Lingyuan Iron & Steel Co., Ltd. | AA | CCXR | 2011-6-8 |
| 21 | Liuzhou Iron & Steel Co., Ltd. | AA | China Lianhe Credit Rating Co., Ltd. | 2011-5-30 |
| 22 | Ma Steel Co., Ltd. | AA+ | CCXI | 2011-11-14 |
| 23 | Nanjing Iron & Steel Co., Ltd. | AA | Shanghai Brilliance Credit Rating & Investors Service Co. | 2011-3-17 |
| 24 | Nanjing Iron & Steel Union Co., Ltd. | AA- | Shanghai Brilliance Credit Rating & Investors Service Co. | 2011-6-9 |
| 25 | Inner Mongolia Baogang Uinion Co., Ltd. | AA | China Lianhe Credit Rating Co. | 2011-1-31 |
| 26 | Panggang Group Co., Ltd. | AA | China Lianhe Credit Rating Co. | 2010-9-14 |
| 27 | Shandong Iron & Steel Group Co., Ltd. | AAA | CCXI | 2011-10-24 |
| 28 | Shanxi Taigang Stainless Co., Ltd. | AAA | Dagong Global Credit Rating Co., Ltd. | 2011-10-19 |
| 29 | Taiyuan Iron & Steel Group Co., Ltd. | AAA | China Lianhe Credit Rating Co. | 2011-7-18 |
| 30 | Guofeng Iron and Steel Co., Ltd. | AA | China Lianhe Credit Rating Co. | 2011-3-24 |
| 31 | Tianjin Pipe Group Co., Ltd. | AA | Dagong Global Credit Rating Co., Ltd. | 2011-3-23 |
| 32 | Wuhan Iron and Steel Group Co. | AAA | CCXI | 2011-10-17 |
| 33 | Wuhan Iron and Steel Co., Ltd. | AAA | China Lianhe Credit Rating Co. | 2011-7-26 |
| 34 | Wuyang Iron & Steel Co., Ltd. | AA- | China Lianhe Credit Rating Co. | 2010-12-30 |
| 35 | 西宁特殊钢股份有限公司 | AA | China Lianhe Credit Rating Co. | 2011-4-22 |
| 36 | 新疆八一钢铁股份有限公司 | AA | CCXR | 2011-7-7 |
| 37 | 新兴际华集团有限公司 | AAA | China Lianhe Credit Rating Co. | 2010-11-30 |
| 38 | 新兴铸管股份有限公司 | AA+ | China Lianhe Credit Rating Co. | 2011-3-1 |
| 39 | 重庆钢铁股份有限公司 | AA | CCXR | 2011-6-30 |

Data resource: Wind Information Co.

## B. AdaBoost classification results

We use results which are rated by rating corporations as dependent variable and 18 indexes as variable, to build model through adaboost.M1 of R software. And then we can get the ratings of iron and steel sector, which are affected by iteration numbers. Hence, we respectively select five different iterations results to test the stability of Adaboost algorithm classification results. By comparisons, when the iterations exceed 50, the results of classification will become very stable. The credit rates of different iterations show in Table2.

**Table 2 Classification results through 18 indexes based on Adaboost algorithm**

| Origin rate | 10 iterations | 50 iterations | 100 iterations | 500iterations | 1000 iterations |
|---|---|---|---|---|---|
| AAA | AAA | AAA | AAA | AAA | AAA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |

| | | | | | |
|---|---|---|---|---|---|
| AA+ | AA* | AA+ | AA+ | AA+ | AA+ |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AA | AA | AA | AA | AA | AA |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AA- | AA− | AA- | AA- | AA- | AA- |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AA | AA | AA | AA | AA | AA |
| AA- | AA− | AA- | AA- | AA- | AA- |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AA- | AA− | AA- | AA- | AA- | AA- |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AA | AA | AA | AA | AA | AA |

Note: star shows misclassification

From the classifications, when Adaboost algorithm iterations exceed 10, the number of misclassification is one with 2.56% rate of misclassification, while these exceed 50 with zero rate of misclassification, in additions , the classification results are very stable iterations added.

## C. Feature reselection

Adaboost algorithm classification outputs will still produce 18 indexes' importance to affect ultimate classification results in R software, and the kind of importance will change with the difference of iteration numbers (Table 3). In order to select indexes, we should consider both importance of indexes and stability of the importance, and that is the importance of indexes will not become divergence with iterations added. Considered, we firstly cancel indexes with importance less than 3, which include market share, long term asset ratio, EBITDA profit ratio, asset-liability ratio, liquidity ratio, quick ratio, operational cash flow net to interest-bearing debt, EBIT to interest fee. However, asset-liability ratio, liquidity ratio, quick ratio, operational cash flow net to interest-bearing debt and EBIT to interest fee can reflect ability of debt paying, which is a very important factor of credit risk, so these indexes can not be cancelled all and should be leave one at least. Considering the stability of importance, we find only EBIT to interest fee shows the strongest convergence and EBIT to interest fee is also the basis of operational cash flow net to interest-bearing debt from finance analysis aspect. Then, we select EBIT to interest fee left. To the other 10 indexes, we calculate these indexes coefficient of variation from 2007 to 2010 from influence and stability of indexes (Table 4). By comparison, the importance both accounts receivable turnover and ROE are slow relatively while the coefficient of variation of accounts receivable turnover is higher than ROE. Therefore, we need consider cancel ROE. Meanwhile, asset total and gross operating income both are high correlation (Figure 1), then we keep gross operating income. At last, we get 9 indexed left: gross operating income, elasticity coefficient of income price, elasticity coefficient of cost price, capitalized debt ratio, total debt to EBITDA, accounts receivable turnover, inventory turnover ratio, profit and EBIT to interest fee.

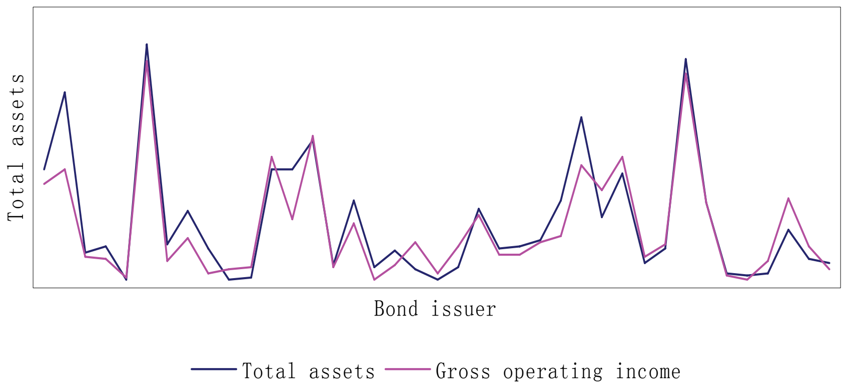



**Figure1 Relation figure between total assets and gross operating income**

**Table 3 Volatility on importance of indexes[1]**

| Index | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|
| Asset total | 0.84 | 0.83 | 0.79 | 0.79 |
| Gross operating income | 0.87 | 0.78 | 0.78 | 0.81 |
| Elasticity coefficient of income price | 0.54 | 1.65 | 1.84 | 0.39 |
| Elasticity coefficient of cost price | 0.61 | 1.76 | 2.57 | 0.45 |
| Capitalized debt ratio | 0.28 | 0.22 | 0.22 | 0.22 |
| Total debt to EBITDA | 0.52 | 0.36 | 0.57 | 0.51 |
| Accounts receivable turnover | 3.89 | 5.97 | 6.65 | 4.54 |
| Inventory turnover ratio | 0.53 | 0.32 | 0.37 | 0.36 |
| ROE | 0.67 | 1.12 | 1.77 | 0.79 |
| Gross profit | 1.29 | 1.56 | 2.13 | 2.04 |

**Table 4 Coefficient of variation of 10 indexes[2]**

| Index name | 10 iterations | 50 iterations | 100 iterations | 500 iterations | 1000 iterations |
|---|---|---|---|---|---|
| Asset total | 11.904762 | 11.3537118 | 13.1578947 | 12.8892734 | 12.4621376 |
| Gross operating income | 14.285714 | 20.0873362 | 18.8596491 | 18.8148789 | 18.9528343 |
| Market share | 0.000000 | 0.0000000 | 0.0000000 | 0.0000000 | 0.0000000 |
| Elasticity coefficient of income price | 9.523810 | 16.1572052 | 15.1315789 | 15.1816609 | 15.2964085 |
| Elasticity coefficient of cost price | 7.142857 | 4.3668122 | 3.7280702 | 3.6764706 | 3.7429684 |
| Capitalized debt ratio | 9.523810 | 10.9170306 | 8.7719298 | 9.9480969 | 10.3418434 |
| Total debt to EBITDA | 2.380952 | 5.6768559 | 5.4824561 | 3.5034602 | 3.8944180 |
| Long term asset ratio | 7.142857 | 2.6200873 | 3.7280702 | 4.5847751 | 4.1107746 |
| Accounts receivable turnover | 2.380952 | 3.4934498 | 4.6052632 | 4.7577855 | 4.7382086 |
| Inventory turnover ratio | 4.761905 | 5.6768559 | 5.2631579 | 5.1903114 | 4.8896582 |
| Gross profit | 9.523810 | 4.8034934 | 4.8245614 | 5.2768166 | 5.0194721 |
| ROE | 4.761905 | 3.930131 | 5.9210526 | 4.9307958 | 5.4089139 |
| EBITDA profit ratio | 2.380952 | 2.6200873 | 0.4385965 | 1.7301038 | 1.3197750 |
| Asset-liability ratio | 4.761905 | 2.6200873 | 2.6315789 | 1.6868512 | 1.6226742 |
| Liquidity ratio | 2.380952 | 1.3100437 | 0.2192982 | 0.4757785 | 0.6707053 |
| Quick ratio | 4.761905 | 0.8733624 | 2.6315789 | 2.2058824 | 2.2501082 |
| Net cash flow to interest-bearing debt | 2.380952 | 2.1834061 | 2.6315789 | 3.2439446 | 3.2020770 |
| EBIT to interest fee | 0.000000 | 1.3100437 | 1.9736842 | 1.9031142 | 2.0770229 |

[1] Elasticity coefficient of income price equals to gradient of operating income to gradient of iron general price; Elasticity coefficient of cost price equals to gradient of operating cost to gradient of iron ore mean price imported.

[2] Coefficient of variation equals to sample standard deviation to sample mean, which reflects influence to model, if CV is greater and more influence of indexes to model; To single index, the stability of different indexes by years will more volatilities with more CV, should be cancelled.

We use the 9 key indexes selected to apply Adaboost algorithm to reclassify again, and get the classification results under different iterations (Table 5). From table 5, we can see the error number is one with 2.56% discrimination rate when iterations are 10. And when iterations are added to above 50, the discrimination rate will be keep zero stably. In another words, the model classification information does not cut down after reducing 9 indexes.

**Table 5 Classification results through 9 indexes based on Adaboost algorithm**

| Origin rate | 10 iterations | 50 iterations | 100 iterations | 500iterations | 1000 iterations |
|---|---|---|---|---|---|
| AAA | AAA | AAA | AAA | AAA | AAA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AA | AA | AA | AA | AA | AA |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AA− | AA− | AA− | AA− | AA− | AA− |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AA | AA | AA | AA | AA | AA |
| AA- | AA- | AA- | AA- | AA- | AA- |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AAA | AAA | AAA | AAA | AAA | AAA |
| AA- | AA** | AA- | AA- | AA- | AA- |
| AA | AA | AA | AA | AA | AA |
| AA | AA | AA | AA | AA | AA |

| | | | | | |
|---|---|---|---|---|---|
| AAA | AAA | AAA | AAA | AAA | AAA |
| AA+ | AA+ | AA+ | AA+ | AA+ | AA+ |
| AA | AA | AA | AA | AA | AA |

Note: double star shows misclassification

# Ⅳ.Conclusion and prospect

We use Adaboost algorithm to do some feature selection and rates testing in the process of credit rating in iron and steel sector, and we treat it as a kind of Wrapper. To the importance outputs through Adaboost algorithm, we use it to reduce indexes from 18 to 9. Meanwhile, correction rate of credit rating does not cut down (see Table 2, Table 5). From running outputs, the classifications are better by using Adaboost algorithm, and its discrimination rate is still 2.56% under 10 iterations after reducing 9 indexes. If iterations added, the discrimination rate would be zero. However, there are two problems below:

Firstly, we find the running results of Adaboost algorithm in R software will be different in different computers, and its reason maybe related to computers' bit (operating system or hardware has divided into 32 bit or 64 bit). The bigger bit would produce higher classification correction rate.

Secondly, we could get different index set at the same classification corrections, and give birth to great challenge about explanatory power of model as bad as Wrapper.

However, it is showed that the importance Adaboost algorithm produced can reselect indexes effectively through empirical analysis of credit rating in iron and steel sector. Under the same accuracy, it provides a new approach to select and reduce index, and can also extend more fields.

In this paper, the innovation includes two aspects: one is firstly apply Adaboost algorithm into credit rating fields, the other is that the importance produced by Adaboost algorithm is used creatively to reselect indexes, providing a kind of strategy reference combined quantitative with qualitative method about feature selection.

# Acknowledgements

The paper thanks for national statistics research project (2011LY031) of National Bureau of Statistics funding.

# Reference

[1] I. Guyon and A. Elissee. An introduction to variable and feature selection[J]. Journal of Machine Learning Research, 2003,3:1157-1182.

[2] Golub et al. Molecular Classification of Cancer: Class Discovery and Class Prediction by Gene Expression Monitoring[J]. Science,1999,286:531:537.

[3] P. Pavlidis et al. Gene functional classification from heterogeneous data [R]. New York: Association for Computing Machinery, 2000.

[4] M.A. Hall and L. A. Smith, Feature subset selection: A correlation based filter approach [R]. Conference on Neutral Information Processing and System, 1997, 855-858.

[5] J.R. Quinlan. Introduction of decision trees [J]. Machine Learning, 1986,1(1):81-106.

[6] Jaynes, E. T. Information Theory and Statistical Mechanics [J].Physical Review, 1957, 106(4):620-630.

[7] Altman E I. Financial ratios discriminate analysis and the prediction of corporate bankruptcy [J]. The Journal of Finance, 1968, 23(4): 589-609.

[8] Altman E I, Robet G H, Narayanan P. Zeta analysis: a new model to identify bankruptcy risk of corporations [J]. Journal of Banking and Finance, 1977, 1: 29-54.

[9] Martin D. Early warning of bank failure: a logit regression approach [J]. Journal of Banking & Finance, 1977, 1: 249-276.

[10] The Elements of Statistical Learning Data Mining, Inference, and Prediction(second edition). Trevor Hastie, Robert Tibshirani, Jerome Friedman, 2011.

[11] Breiman Leo, Friedman J. H., Olshen R. A., & Stone C. J. (1984). Classification and Regression Trees. Monterey, CA: Wadsworth & Brooks/Cole Advanced Books & Software.

[12]WANG Sichen, YU Lu, LIU Shui, TANG Jinyuan. Branch and bound algorithms and its application of research in feature selection[J].Modern Electricity Technology,2008,(10). (In Chinese)

[13] Zhang, T. Adaptive forward-backward greedy algorithm for sparse learning with linear models [J]. Neural Information Processing Systems, 2008,22:523-530.

[14]XIE Yun. The theory and application of simulated annealing algorithms[J]. Numer. Math. J. Chinese University,1999(03). (In Chinese)

[15] G. R. Hjaltason and H. Samet. Distance browsing in spatial databases. ACM Transactions on Database Systems (TODS), 24(2):265-318, 1999.

[16] Tibshirani, R. Regression shrinkage and selection via the LASSO [J].Journal of Royal Statistical Society, 1996(B58):267-288.

[17] Zou H. The adaptive Lasso and its oracle properties [J].Journal of Royal Statistical Society, 2006, 101:1418-1429.

[18] Fu W. Penalized regressions: the bridge versus the Lasso [J].Journal of Computational and Graphical Statistics, 1998, 7:397-416.

[19] Zou, H. and Hastie. T. (2005). Regularization and variable selection via the elastic net, Journal of the Royal Statistical Series B.67(2):301-320.

[20] Fan, J. and Fan, Y.(2008). High dimensional classification using features annealed independence rules, Annals of Statistics.

[21]YANG Haijiang, WEI Qiuping, ZHANG Jingxiao.Adaptive adaboost algorithms applies in the credit scores models. Statistics & Information Forum,2011,26(2):27-31. (In Chinese)

[22] Freund Yoav, Schapire Robert E. A decision-theoretic generalization of online learning and an application to boosting [J]. Journal of Computer and System Sciences, 1997,13(55):119-139.
[23] Schapire Robert E, Singer Yoram. Improved boosting algorithms using confidence rated predictions [J]. Machine Learning, 1999, 37 (3):297-336.

# Lee-Carter Model Negative Binomial Maximum Likelihood Estimation and Forecasting

## Application to Chinese Population Empirical Study

WU Xiaokun[1,2], WANG Xiaojun[1]
[1] School of Statistics, Renmin University of China, Beijing, China, 100872
[2] Department of Mathematics and Physics, North China Electric Power University, Baoding, Hebei, China, 071003

**Abstract:** Lee-Carter model is a classic and popular mortality model parameters in which can be estimated through singular value decomposition or Lee-Carter Poisson maximum likelihood methods. This paper using Chinese population data constructs Lee-Carte mortality model parameters in which estimated through Negative Binomial maximum likelihood method. By this study, Negative Binomial maximum likelihood method has some advantages over Poisson maximum likelihood method.

**Keywords:** Lee-Carter model; Negative Binomial; maximum likelihood

## Ⅰ.引言

在世界范围内，死亡率随时间呈明显的下降趋势，相应的，人口预期寿命逐步增加。死亡率的降低和人口寿命的延长给全球养老问题带来了严峻的挑战。人们试图通过建立死亡率模型，模拟死亡率的变动趋势，预测死亡率的未来走向，度量死亡率和长寿风险给养老金体系带来的压力，并为养老金体系的风险管理提供依据。

在数学上，我们可以用年龄与时期的函数来衡量死亡率的改善趋势。以 $T_x(t)$ 表示 $x$ 岁的人在时期 $t$ 的剩余寿命，它是一个随机变量，$T_x(t)$ 的期望 $E(T_x(t))$ 是 $t$ 时期 $x$ 岁的预期寿命。以 $q_x(t)$ 表示 $x$ 岁的人在时期 $t$ 在 $x+1$ 岁之前死亡的概率，$q_x(t)=\Pr[T_x(t)\le 1]$，与此对应的是生存概率 $p_x(t)=1-q_x(t)$。$\mu_x(t)$ 是 $t$ 时期 $x$ 岁的人的死亡强度函数，其定义为

$$\mu_x(t)=\lim_{\Delta\to 0}\frac{\Pr[x<T_0(t-x)\le x+\Delta \mid T_0(t-x)>x]}{\Delta}$$

。$m_x(t)$ 是 $t$ 时期 $x$ 岁的粗死亡率，也称为 $t$ 时期 $x$ 岁的中心死亡率。它来自于人口统计数据，$m_x(t)=D_{xt}/er_{xt}$，其中 $D_{xt}$ 为所研究人口在 $t$ 时期 $x$ 岁的死亡人口数。$er_{xt}$ 为观察到 $D_{xt}$ 死亡人口的风险暴露数（exposure-to-risk），经常用年中人口数代替。

Lee 和 Carter(1992)[1]构造了一个形式简洁、适用广泛的死亡率模型，用于描述死亡率随年龄和时间的变化，其形式为

$$\ln\mu_x(t)=\alpha_x+\beta_x\kappa_t \qquad (1)$$

在实际应用当中，我们无法确切得知 $\mu_x(t)$ 的理论值，也就无法得到 $\ln\mu_x(t)$ 的理论值及 $\alpha_x,\beta_x,\kappa_t$ 的确切值，所以常常使用如下形式

$$\ln\hat{\mu}_x(t)=\alpha_x+\beta_x\kappa_t+\varepsilon_{xt} \quad (2)$$

其中 $\hat{\mu}_x(t)$ 为 $\mu_x(t)$ 的估计值 $\hat{\mu}_x(t)=D_{xt}/er_{xt}$，$\varepsilon_{xt}$ 为一个独立分布的正态随机变量。这样，在一个回归模型的框架内估计 $\alpha_x,\beta_x,\kappa_t$ 的值，在最早的 Lee –Carter 模型中，参数 $\alpha_x,\beta_x,\kappa_t$ 的估计并不是使用一般统计方法一步到位的得到估计值，Lee 和 Carter (1992)[1]用样本均值估计 $\alpha_x$（相当于最小二乘法对常数项的估计）用矩阵奇异值分解的方法估计 $\beta_x$ 和 $\kappa_t$。针对原始模型 $\varepsilon_{xt}$ 为一个独立分布的正态随机变量的假定，有研究者提出了不同与改进，现在广为接受与使用的是假定 $D_{xt}$ 为泊松分布，也就是 $e^{\varepsilon_{xt}}$ 为泊松分布，最早提出泊松分布假定的可见于 Brouhns 和 Vermunt(2002)[2]。关于模型设定的讨论与改进至今仍未停止，Delwarde, etc(2007)[3]，Renshaw 和 Haberman(2008)[4]，在假定 $D_{xt}$ 服从负二项分布的基础上对 Lee–Carter 模型进行了估计和模拟。Delwarde, etc (2007)[3]假定所有年龄段的死亡人口都服从同一个离散参数 $k$ 的

资助信息：教育部规划项目，批准号 2010010346，我国社会保障核算、精算、预算整合模型研究与应用。

负二项分布，Renshaw 和 Haberman(2008)[4]设定每一个年龄拥有各自的离散参数$k_x$，对 Lee–Carter 模型进行了重新估计，Renshaw 和 Haberman(2008)[4]还利用模拟的方法度量了不同设定带来的拟合模型的不同随机性，但是两者都没有把重点放在死亡率预测的不确定性上。LI, Johnny Siu-Hang etc(2009)[5]利用加拿大与美国数据，对参数的不确定性进行了讨论，并对参数的不确定性产生的模型的不确定性通过模拟的方法进行度量，但是其并未报告模拟次数，模拟次数的多少对度量模型的不确定性很重要，如果模拟次数不够，那么所得结果的可靠性就值得怀疑。Claudia, etc(2005)[6]建议使用 MCMC 方法对参数进行模拟，不过需要对参数先给出一个先验分布。

基于中国人口数据的关于 Lee–Carter 模型参数估计的不确定性的研究还不多见，本文运用中国人口死亡数据，建立 Lee–Carter 模型，借鉴以上方法中的思想，尝试利用一种简洁的随机性方法来刻画与度量模型参数的随机性与不确定性及其带来的相关估计与预测的不确定性。

# Ⅱ. Lee-Carter 模型的负二项最大似然估计方法

## A.估计方法

原始的 Lee-Carter 模型中参数的估计是采用奇异值分解结合参数调整完成的。后来兴起并且现在被广泛采纳的泊松分布，是假定一个时期内，通常是一年或者几年内，抽样人口中的死亡人口数服从泊松分布，具体在模型（2）的估计中，假定，

$$D_{xt} \sim Poi(er_{xt}\exp(\alpha_x + \beta_x\kappa_t))$$

其分布律为，

$$P(X=d) = e^{-\lambda}\lambda^d / d! \quad d = 0,1,... \tag{3}$$

具体的，$\lambda = er_{xt}\exp(\alpha_x + \beta_x\kappa_t)$。泊松分布主要用来刻画完全随机事件发生的次数，适用于个体是否发生所要观察的事件是完全随机的情况（即个体之间独立同分布）。然而，实际上同期的同龄个体所面临的死亡风险并不完全一致，有健康的个体，亚健康的个体，身处疾病困扰的个体等，他们的死亡风险存在较大差异。而泊松分布的期望等于方差，即，$X \sim Poi(\lambda)$，那么，$E(X) = D(X) = \lambda$。而如果个体间的死亡概率存在差异，那么整个人群死亡的不确定性就会表现出比泊松分布更强的波动，也就是，$E(X) < D(X)$，满足这一假设的常见计数随机变量的分布可以选择负二项分布。负二项分布可以通过泊松分布参数$\lambda$的随机化来产生，当$\lambda$也是一个随机变量时，原来的泊松分布的方差就会变大，并且当$\lambda$服从伽玛分布时，原来的泊松分布就变成了负二项分布。当一个变量服从负二项分布时，其均值与方差分别可以写成如下形式，$E(X) = \delta$，$D(X) = \delta + k\delta^2$，我们将其分布可以简记为$X \sim NB(\delta, k)$，其分布率[3]为

$$P(X=d) = \frac{\Gamma(d+\frac{1}{k})}{\Gamma(\frac{1}{k})d!}\left(\frac{k\delta}{1+k\delta}\right)^d\left(\frac{1}{1+k\delta}\right)^{1/k}$$

$$d = 0,1,2,......, \tag{4}$$

其中$\Gamma(.)$为伽玛函数，$\Gamma(x) = \int_0^\infty t^{x-1} \quad e^{-t}dt$，当 $x>1$ 时，$\Gamma(x) = (x-1)\times \ \Gamma(x-1)$，当 $x$ 为正整数时，比如 $n$，伽玛函数的递推表达式具有很好的计算性质，$\Gamma(n) = (n-1)!$。只要在（4）中代入均值 $\delta = \delta_{xt} = er_{xt}\exp(\alpha_x + \beta_x\kappa_t)$，就可以得到负二项分布下$D_{xt}$的分布律。这样就可以很容易得到最大似然函数及相应的对数最大似然函数。如果 $t$ 年 $x$ 岁的受观察人口的人数（这里指风险暴露数）为$er_{xt}$，观察到的死亡人数为$d_{xt}$，时期 $t$ 的范围为 $t_1, t_2..., t_n$，年龄 $x$ 的取值范围为 $0,1,2,...,\omega$，$\omega$为所观察的最大年龄。这样得到的最大似然函数为[3]

$$L = \prod_{x=0}^{\omega}\prod_{t=t_1}^{t_n}\frac{\Gamma(d_{xt}+\frac{1}{k})}{\Gamma(\frac{1}{k})d_{xt}!}\cdot \left(\frac{k\cdot er_{xt}\exp(\alpha_x+\beta_x\kappa_t)}{1+k\cdot er_{xt}\exp(\alpha_x+\beta_x\kappa_t)}\right)^{d_{xt}}\cdot \left(\frac{1}{1+k\cdot er_{xt}\exp(\alpha_x+\beta_x\kappa_t)}\right)^{1/k} \tag{5}$$

如果我们认为每一个年龄观察人口其死亡的随机波动情况并不完全相同，表现在分布的性质上就是，$E(D_{xt}) = \delta_{xt}$，$Var(D_{xt}) = \delta_{xt} + k_x\delta_{xt}^{\ 2}$，$x = 0,1,...,\omega$，这样最大似然函数(5)就变为

$$L=\prod_{x=0}^{\omega}\prod_{t=t_1}^{t_n}\frac{\Gamma(d_{xt}+\frac{1}{k_x})}{\Gamma(\frac{1}{k_x})d_{xt}!}$$

$$(\frac{k_x er_{xt}\exp(\alpha_x+\beta_x\kappa_t)}{1+k_x er_{xt}\exp(\alpha_x+\beta_x\kappa_t)})^{d_{xt}} \quad (6)$$

$$(\frac{1}{1+k_x er_{xt}\exp(\alpha_x+\beta_x\kappa_t)})^{1/k_x}$$

对(5) (6)两式，取对数就得到对数似然函数，分别得到，

$$l\,(\alpha_x,\beta_x,\kappa_t,k)=$$
$$\sum_{x=0}^{\omega}\sum_{t=t1}^{t_n}(\sum_{j=1}^{d_{xt}}\ln(\frac{1}{k}+d_{xt}-j))+$$
$$\sum_{x=0}^{\omega}\sum_{t=t_1}^{t_n}d_{xt}\ln(k\cdot er_{xt}\exp(\alpha_x+\beta_x\kappa_t))$$
$$-\sum_{x=0}^{\omega}\sum_{t=t_1}^{t_n}(d_{xt}+\frac{1}{k})\ln(1+k\cdot \quad (7)$$
$$er_{xt}\exp(\alpha_x+\beta_x\kappa_t))+\text{常数}$$

与

$$l\,(\alpha_x,\beta_x,\kappa_t,k_x)=$$
$$\sum_{x=0}^{\omega}\sum_{t=t_1}^{t_n}(\sum_{j=1}^{d_{xt}}\ln(\frac{1}{k_x}+d_{xt}-j))$$
$$+\sum_{x=0}^{\omega}\sum_{t=t_1}^{t_n}d_{xt}\ln(k_x er_{xt}\exp(\alpha_x+\beta_x\kappa_t)) \quad (8)$$
$$-\sum_{x=0}^{\omega}\sum_{t=t_1}^{t_n}(d_{xt}+\frac{1}{k_x})\ln(1+k_x er_{xt}\cdot$$
$$\exp(\alpha_x+\beta_x\kappa_t))+\text{常数}$$

我们将分别考虑(7)、(8)两种形式的对数似然函数情况下，参数 $\alpha_x,\beta_x,\kappa_t,k,k_x$ 的估计。当参数 $k$ 或者 $k_x$ 趋近于零时，负二项分布就变成了泊松分布，相应的负二项分布下的（对数）似然函数就变成了泊松分布下的（对数）似然函数。这可以对(5)、(6)式中对 $k$ 或者 $k_x$ 取极限，并利用伽玛函数的性质得到，这跟源于 (4) 式中当 $k$ 趋近于零时的极限为 $e^{-\delta}\delta^d/d!$，这是由于

$$\frac{\Gamma(d+\frac{1}{k})}{\Gamma(\frac{1}{k})d!}(\frac{k\delta}{1+k\delta})^d=$$

$$\frac{(d+\frac{1}{k}-1)(d+\frac{1}{k}-2)......(\frac{1}{k})\Gamma(\frac{1}{k})}{\Gamma(\frac{1}{k})d!}\times$$

$$(\frac{\delta}{1/k+\delta})^d\xrightarrow{(k\to 0)}\frac{\delta^d}{d!},$$

与

$$(\frac{1}{1+k\delta})^{1/k}\xrightarrow{(k\to 0)}e^{-\delta}$$

利用这个性质很容易得到与(5)、(6)两式取极限相对应的泊松分布的似然函数。下面，给出负二项分布下的参数估计方法。其中未知参数的估计可以利用最优化的一些方法，比如牛顿-拉夫逊算法。当然也可以使用其他优化方法，比如模拟退火算法等求解全局最优化解，只是在导数存在的情况下牛顿算法的效率更高、速度更快。利用牛顿-拉夫逊[7]单变量迭代算法求解方程，$f(x)=0$ 的根的程序如下：首先任选一个初始值 $\xi_0$；接着计算第 $k+1$ 的值为，

$$\xi_{i+1}=\xi_i-\frac{f(\xi_i)}{f'(\xi_i)} \quad (9)$$
$$i=0,1,2,......$$

这样当 $\xi_{k+1}$ 与 $\xi_k$ 非常接近，并且导数存在的情况下，$f(\xi)$ 与 $0$ 就非常接近。在（偏）导数存在的情况下求解使得（对数）似然函数的问题可以转化为对应的（对数）似然函数的导数等于零的方程的解。方程求解就可以利用牛顿-拉夫逊算法来完成。具体我们首先看对数似然函数（7）中各参数的求解，然后我们将其推广到似然函数(8)。

对于任意的对数似然函数记为 $l(\theta)$，若其可导，并且导数为 $l'(\theta)$，那么 $l'(\theta)=0$ 的解为对数似然函数 $l(\theta)$ 的极值点，在最大值存在唯一且在 $\theta$ 取值的邻域内部取得的情况下，极值点也就是最大值点，这里假定这种情况得到满足。于是最大似然估计问题就转化为方程 $l'(\theta)=0$ 求解问题。利用牛顿-拉夫逊算法，在（9）式中带入 $f(\xi)=l'(\theta)$，就得到了关于参数 $\theta$ 的最大似然估计的迭代算法

$$\theta_{i+1}=\theta_i-\frac{l'(\theta_i)}{l''(\theta_i)},\ i=0,1,2,......, \quad (9)$$

其中，初值 $\theta_0$ 为提前设定的 $\theta$ 取值范围内的任意值。这里的 $\theta$ 可以为单参数也可以是向量参数，比如对于(7)式这样的对数似然的参数

估计，则 $\theta=(\alpha_x,\beta_x,\kappa_t,k)$，(8)式则是，$\theta=(\alpha_x,\beta_x,\kappa_t,k_0,k_1,\ ...,k_\omega)$。我们得到对数似然函数(7)、(8)对各参数的一、二阶偏导后代入公式(9)就得到各参数的迭代公式。如果与[3]一样对所有年龄使用统一的离散参数 $k$，得到的公式则完全与之一致；如果我们对每一个年龄使用各自的离散参数 $k_x$，则迭代公式稍有变动，由于公式形式稍显复杂，将其列于文后附录。以上利用负二项最大似然方法估计参数的公式，在离散参数趋近于 0 时，就得到泊松最大似然方法估计参数的公式。

## B. 数据说明

基于《中国人口统计年鉴》和《中国人口和就业统计年鉴》提供的数据，可以整理出从 1994 年到 2009 年的分男女和男女混合的中国人口分年龄死亡数据，包括分年龄年中人口数、年死亡人口数和中心死亡率。数据的年龄范围为 0~90 岁，对个别年份的数据进行了拆分延伸截断处理。

## C. 模型参数估计

对于模型的参数估计，我们先分别采用泊松最大似然方法估计参数 $\alpha_x,\beta_x,\kappa_t$，采用负二项最大似然方法估计参数 $\alpha_x,\beta_x,\kappa_t,k,k_0,k_1,...,k_\omega$，再判断在 Lee-Carter 模型的参数估计中，负二项最大似然方法是否优于泊松最大似然方法。这里我们采用最大似然函数值比较、似然比检验、AIC 准则、BIC 准则等[3]进行检验和判断，同时，判断采用泊松分布描述总人口在一定情况下的死亡人数是否合适？对于这一判断，我们利用甄别超离散性的 $t$ 统计量[8]，

$$t=\frac{1}{\sqrt{2n}}\sum_i\frac{(\theta_i-y_i)^2-y_i}{\theta_i} \qquad (10)$$

使用 Cameron and Trivedi（1986）[8]中 $l$ 等于 1 的简单情形。式中 $\theta_i$ 为相关量在泊松分布下的最大似然估计，$y_i$ 为相关量的样本值，$n$ 为样本容量。在我们的问题中(10)式变为，

$$t=\frac{1}{\sqrt{2n}}\sum_{xt}\frac{(\delta_{xt}-d_{xt})^2-d_{xt}}{\delta_{xt}} \qquad (11)$$

在死亡人数服从泊松分布时，$t$ 统计量渐近服从标准正态分布，即，$t\xrightarrow{n\to\infty}N(0,1)$，$n$ 为样本容量。经计算，对于男性人口 Lee-Carter 模型的泊松最大似然估计，$t$ 统计量为 19.80867，$P$ 值为 0。这样，我们完全有理由拒绝男性死亡人口数服从泊松分布的假设。相应的，对于女性人口模型，$t$ 统计量为 17.52049，男女混合建模时的 $t$ 统计量为 42.73016，这些值都远远超过了通常我们拒绝正态性检验的临界值 $z_{0.05}$=1.65，它们的 $P$ 值都可以认为为 0。因此，不管是分性别建模，还是男女混合建模，都有充足的理由拒绝使用泊松分布作为死亡人数的分布。

对于负二项最大似然方法是否优于泊松最大似然方法的判断，经过计算，在泊松分布假定下，男性死亡率模型中使用的对数似然函数值为-5521.148，使用单一离散参数 k 时，负二项分布假定下男性死亡率模型中使用的对数似然函数值为-5472.844，大于泊松假设下的值。

如果使用似然比统计量 2(-5472.844-(-5521.148))=96.6，由于使用的是单一离散参数，负二项分布情况下的模型只比泊松情况多一个参数，所以，此时当两者之间差异不显著时，似然比统计量渐近服从自由度为 1 的卡方分布，但是似然比统计量为 96.6 远远超过了临界值，其对应的 $P$ 值为 0。所以，我们有理由认为单一离散参数的负二项分布的估计效果优于泊松分布。这样，我们是否就应该选择单一离散参数的负二项分布呢？如果我们认为每一年龄死亡情况的随机波动情况并不完全相同，也就是每一年龄死亡人数所服从的负二项分布的离散参数是不同的，就应该每一年龄 $x$ 对应各自的离散参数 $k_x$，而不是所有年龄使用统一的 $k$。对男性人口死亡率模型进行多离散参数的负二项分布最大似然建模，其似然函数值为-5354.432，大于泊松与单一参数的负二项分布情况，考虑其对单一参数负二项分布的似然比，似然比统计量为 236.824。考虑自由度为 90 的卡方分布，得到检验的 $P$ 值为 $7.99\times10^{-15}$，因此，从显著性检验的角度上说，在男性人口死亡率建模中使用多参数的负二项分布明显优于单参数负二项分布，当然更优于泊松分布。

如果用 AIC 准则，（AIC=2$p$－2log($L$)），其中 $L$ 为最大似然值。泊松分布假定下为 11438.3，负二项多离散参数下为 11286.86，单参数为 11343.69。

如果用 BIC 准则，（BIC=log($n$)$p$ − 2log($L$)）泊松分布假定下为 12484.42，负二项多离散参数下为 12813.78，单参数为 12395.09。可见在 AIC 与 BIC 准则下的结论并不一致，AIC 准则下，多参数负二项优于单参数负二项，单参数负二项优于泊松，AIC 准则下则是单参数负二项优于泊松，泊松优于负二项。但总的来说，利用负二项分布最大似然法来估计 Lee-Carter 模型中的参数优于泊松分布。关于女性及男女混模型，在不同分布假定下的相关各量，与前面给出的男性模型有相似的结论，我们将其列在表 1 中。

**表 1. 不同分布下模型评价量表**

| | 泊松分布 | | | 单参数负二项分布 | | | 多参数负二项 | | |
|---|---|---|---|---|---|---|---|---|---|
| | 男 | 女 | 男女混合 | 男 | 女 | 男女混合 | 男 | 女 | 男女混合 |
| 最大似然 | LP | | | LNB1 | | | LNBx | | |
| | −5521 | −5183 | −6385 | −5473 | −5154 | −6089 | −5354 | −5035 | −5962 |
| t 统计量 | 19.81$^{***}$ | 17.52$^{***}$ | 42.73$^{***}$ | | | | | | |
| 似然比 | 2(LNBx-LP)~ $\chi^2(91)$ | | | 2(LNB1-LP)~ $\chi^2(1)$ | | | 2(LNBx-LNB1)~ $\chi^2(90)$ | | |
| | 334$^{***}$ | 296$^{***}$ | 847$^{***}$ | 96$^{***}$ | 58$^{***}$ | 592$^{***}$ | 238$^{***}$ | 238$^{***}$ | 254$^{***}$ |
| AIC | 11438 | 10729 | 13167 | 11344 | 10705 | 12577 | 11287 | 10648.7 | 12502 |
| BIC | 12484 | 11775 | 14213 | 12395 | 11757 | 13628 | 12814 | 12176 | 14029 |

***表示 P 值<0.0001

从各准则判断，单参数负二项优于泊松。通过似然比检验，多参数负二项又是优于单参数。总的来说，中国人口的死亡人数服从多参数负二项分布应该是一个可行的改进。但在 BIC 准则下，多参数负二项的表现不佳，这主要是它引入多个参数，表现在模型上的劣势主要是计算速度较慢，这对于科技高速发展的今天已经不是太大的缺点。为了便于直观的比较不同分布假定下各参数估计的异同，我们将泊松最大似然方法估计的模型参数与多离散参数负二项估计的参数放在同一个图里进行直观比较，见图 1 和图 2。通过比较发现，$\alpha_x$ 在不同分布下的差异不明显，在多离散参数负二项分布假定下，$\kappa_t$ 的下降趋势稍大于泊松分布。男女之间的比较是，女性 $\beta_x$ 值较小，男性较大；女性 $\kappa_t$ 下降幅度大于男性下降幅度。其它则只能有一个整体轮廓，详细的比较信息还需进一步的解析计算。

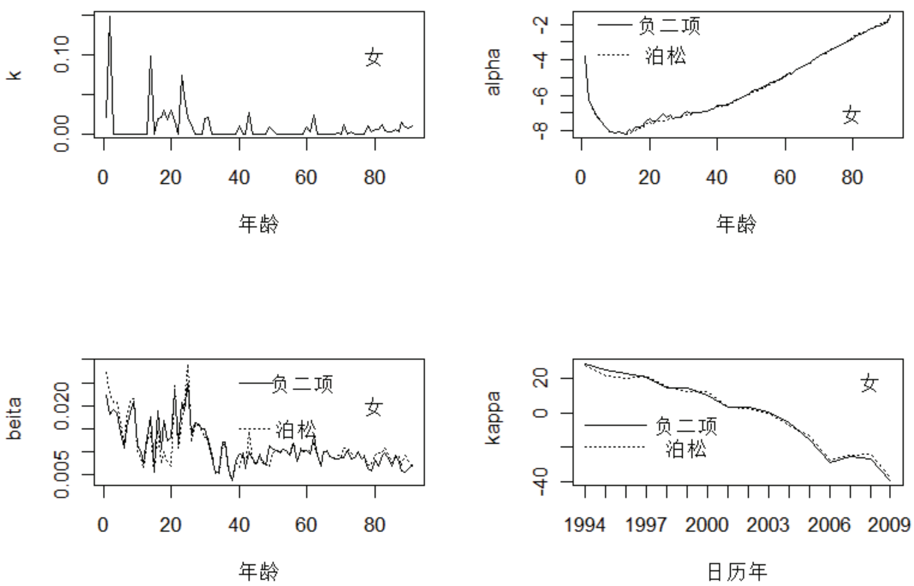



**图 1.　女性人口模型各参数估计**

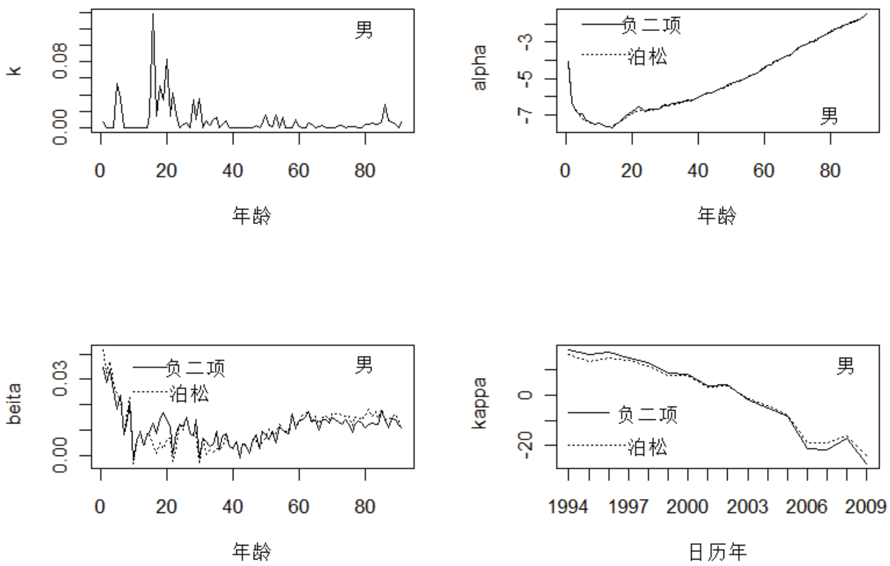



**图 2. 男性人口模型各参数估计**

## III. 预测

模型参数中 $\kappa_t$ 是死亡率中与时间相关部分，参数 $\kappa_{t_1},\kappa_{t_2},\ldots\ldots,\kappa_{t_n}$ 构成一个时间序列，如果 $\kappa_{t_1},\kappa_{t_2},\ldots\ldots,\kappa_{t_n}$ 满足带漂移的随机游走模型[1]，即

$$\kappa_t = \kappa_{t-1} + d + \xi_t\,, \qquad \xi_t \sim N(0,\sigma^2)$$

则

$$\kappa_{t_n+m} = \kappa_{t_n} + md + \sum_{t=1}^{m} \xi_t$$

相应地，

$$\mu_{x(t_n+m)} =$$

$$\mu_{xt_n} \exp(\beta_x (md + \sum_{t=1}^{m} \xi_t)) = \qquad (12)$$

$$\mu_{xt_n} \exp(\beta_x md) \exp(\beta_x \sum_{t=1}^{m} \xi_t)$$

如果 $\mu_{xt_n}$ 为已知数，则(12)式服从参数为 $(\ln \mu_{xt_n} + \beta_x md, \sqrt{m}\beta_x \sigma)$ 的对数正态分布。其均值为

$$\mu_{xt_n} \exp(\beta_x md + \ 0.5\beta_x{}^2 m\sigma^2) \quad (13)$$

方差为

$$\exp(2(\ln \mu_{xt_n} + \beta_x md) + 2\beta^2{}_x m\sigma^2) - \exp(2(\ln \mu_{xt_n} + \beta_x md) + \beta_x{}^2 m\sigma^2) \quad (14)$$

我们可以用

$$\hat{\mu}_{xt_n} \exp(\hat{\beta}_x m\hat{d} + \ 0.5\hat{\beta}_x{}^2 m\hat{\sigma}^2) \quad (15)$$

其中

$$\hat{d} = \frac{1}{t_n - t_1} \sum_{t=t_2}^{t_n} (\hat{\kappa}_t - \hat{\kappa}_{t-1})\,,$$

$$\hat{\sigma}^2 = \frac{1}{t_n - t_1} \sum_{t=t_2}^{t_n} (\hat{\kappa}_t - \hat{\kappa}_{t-1} - \hat{d})^2$$

来估计 $t_{n+m}$ 时的死亡率，如果 $\hat{d}$ 与 $\hat{\sigma}^2$ 为无偏估计，则死亡率的估计不会出现系统偏差。如果认为对每一个 $x$，$\mu_{xt}$ $\quad t = t_1, t_2, \ldots$，具有马尔科夫性，并假定 $\beta_x$ 是确定的，度量 $\mu_{xt_{n+m}}$ 的随机性就得到了简化，只要考虑 $t_n$ 时期死亡率 $\mu_{xt_n}$（也可以是死亡人数 $d_{xt_n}$）的随机性和时间序列 $\kappa_t$ 的随机部分 $\xi_t$ 就行。

另一种常用的估计是

[1] 经单位根检验，序列 $\kappa_t$ 存在单位根，其差分不存在单位根，带漂移的随机游走是适宜的。

$$\hat{\mu}_{x(t_n+m)} = \hat{\mu}_{xt_n} \exp(\hat{\beta}_x m\hat{d}) \quad (16)$$

然而此估计相对于(15)式是有系统偏差，即使 $\mu_{xt_n}$ 为常数，(16)式仍然有偏差。已经有很多学者发现了这一问题，相关文献可见于 LI, Johnny Siu-Hang etc.[5]及其所的参考文献。LI, Johnny Siu-Hang etc.[5]给出了改进，但是并没有改变系统性偏差的根源。

运用(15)式，可以给出特定年份、特定年龄的死亡率预测。比如 2020 年 50 岁男性死亡率：泊松分布下的中心预测为 0.009166244，模拟的中心预测的 95%置信区间为(0.004583122，0.009407461)；负二项分布下中心预测为 0.00894917，模拟的中心预测的 95%置信区间(0.004474585, 0.009655684)。这里是运用的简化模拟，中心预测以 2009 年观察值为确定值做出发点进行预测，置信区间预测以 2009 年数据为随机数据进行模拟。更系统的模拟预测还需要进一步的研究及大量工作。

下面我们给出 2020 年男性人口死亡率的模拟预测，见图 3。我们模拟了 10000 次。图中蓝色实线表示泊松分布假设下运用(12)式进行模拟预测的 2020 年男性各年龄死亡率的中位预测（可视为一种中心预测），蓝色断线表示泊松分布下 95%置信区间；黑色粗实线表示负二项分布下中位预测，粗虚线表示相应的 95%置信区间。

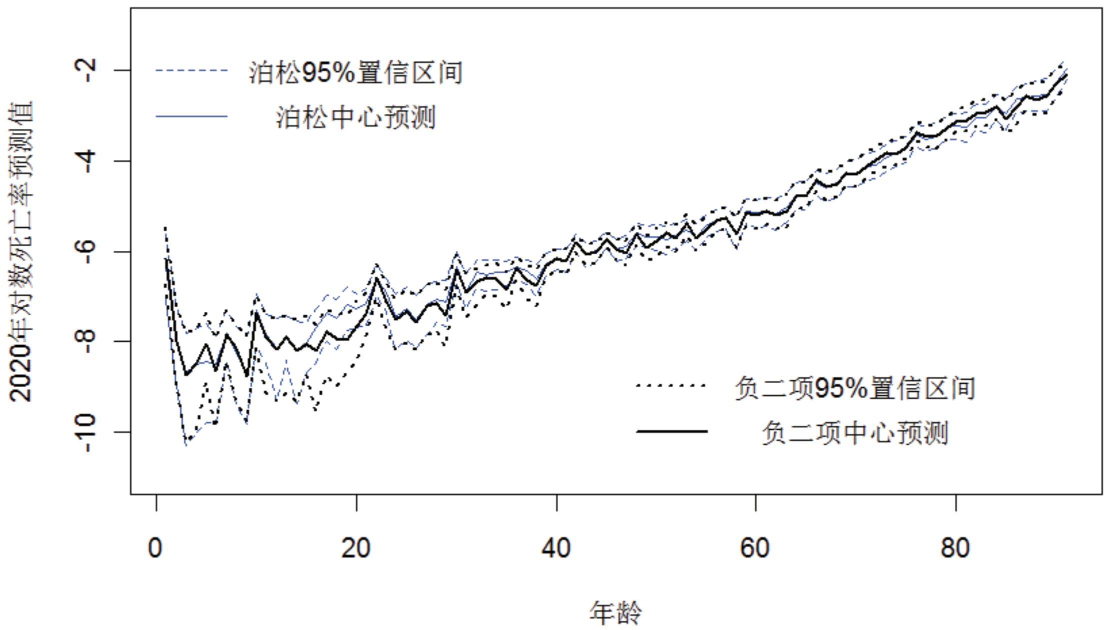



**图 3. 2020 年男性人口死亡率预测**

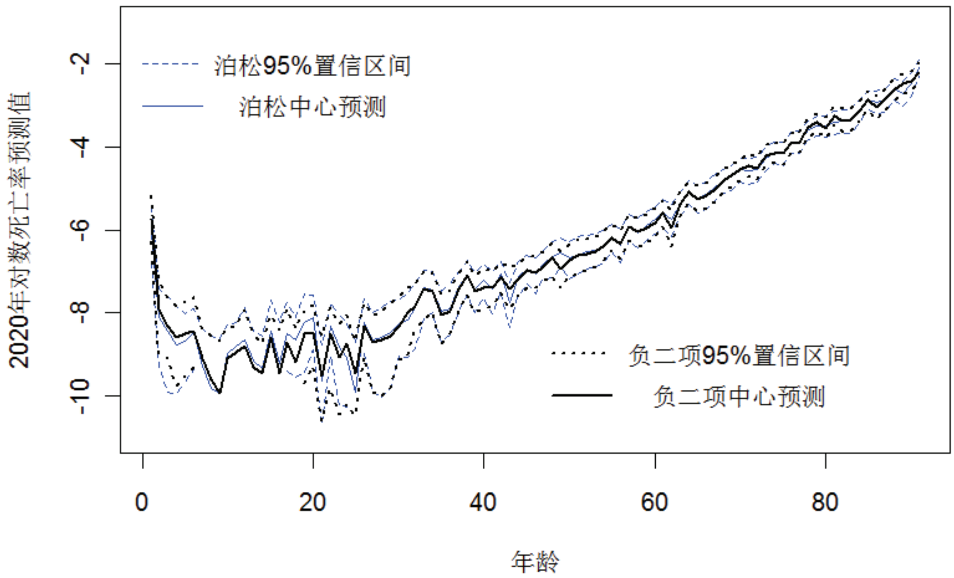



图 4. 2020 年女性人口死亡率预测

在死亡率预测的基础上，可以计算预期寿命。在泊松分布假定下，男性出生人口预期寿命的 95%置信区间为(76.22387，81.82558)，中位预测为 78.67214；负二项分布假定下，出生预期寿命的 95%置信区间为(76.21489，81.77561)，中位预测为 78.80658。在泊松分布假定下男性 30 岁时余寿的中位预测与 0.95 的区间预测分别为(47.59967，52.92843)与 50.38716；负二项分布假定下为(47.59518，52.87195)与 50.51413。如果改用(15)作点预测（也可以作为一种中心预测），则泊松分布假定下，出生预期寿命与 30 岁余命分别为 79.04561，50.27024；负二项分布下相应的分别为 79.16921 与 50.38799。如果用(16)式做点预测，泊松分布假定下出生预期寿与 30 岁余命分别为 79.17214 与 50.38716；负二项分布下则分别为，79.30658 与 50.51413。(16)式的预测也可以作为一种中心预测，不过具有系统偏差。(16)式较(15)的预测，死亡率偏低，相应的预期寿命偏高，然而(15)式的预测更接近于中位预测，又中位预测具有稳定的统计性质，可见，本文推荐的(15)式具有较好的统计稳定性。

图 4 为女性人口 2020 年的模拟预测。在此不再进行解析讨论。图中负二项分布假定下年龄在十几岁时死亡率的置信下限有一段没有图像，是因为模拟计算相应分位点的死亡人数为零引起的，这里期待更进一步的工作与研究。

从结果看，中位预测与中心预测的结果都有负二项分布假定下预测的预期寿命大于泊松分布假定下的预测的迹象。然而负二项分布假定下的区间预测值与区间长度都有小于泊松分布假定下的预测的迹象，说明相同置信水平下负二项的预测精度更高，结果更可靠。

至于其它年份的预测，按照同样的方法可以得到，在此不再进行展示。

## Ⅳ.结论

本文的研究表明，认为一定时期一定总人口的中国人口死亡人数服从负二项分布比服从泊松分布更合适；Lee-Carter 负二项最大似然估计在 Lee-Carter 模型参数估计方面有很多优于泊松最大似然估计的优点，体现在最大似然值、似然比检验、AIC 准则，区间估计的精确性等方面。另外，本文给出了一个没有系统偏差的预测人口死亡率的预测式，将其用于短期人口预测应该会明显优于传统的预测，因为短期预测对精度的要求更高；长期预测也是值得推荐的，因为推荐方法预测结果较传统方法更接近中位预测，中位数具有统计稳健性，而长期预测的稳健性更重要。

# References

[1]Lee RD, Carter L(1992). Modelling and forecasting the time series of US mortality. Journal of the American Statistical Association 1992; 87:659–671.

[2]Brouhns N., Denuit M. & Vermunt J.K. (2002). Measuring the Longevity Risk in Mortality Projections, Bulletin of the Swiss Association of Actuaries, 2002, nr. 2, pp. 105-130.

[3]Delwarde, A., Denuit, M., and Partrat, Ch. (2007). Negative binomial version of the Lee–Carter model for mortality forecasting. Applied Stochastic Models in Business and Industry, 23, 385–401.

[4]Renshaw, A. E. and Haberman, S. (2008). On simulation-based approaches to risk measurement in mortality with specific reference to poisson Lee–Carter modelling. Insurance: Mathematics and Economics, 42, 797–816.

[5]LI, Johnny Siu-Hang, HARDY, Mary, TAN, Ken Seng (2009) Uncertainty in Mortality Forecasting An Extension to the Classical Lee-Carter Approach

[6]Czado,C.,Delwarde,A.,Denuit,M.(2005).BayesianPoissonLog-bilinearMortalityProjections. Insurance: Mathematics and Economics,36,260-284.

[7] Pitacco, E., M. Denuit, S. Haberman, and A. Olivieri (2009), “Modelling Longevity Dynamics for Pension and Annuity Business”, Oxford University Press.pp.193.

[8]Cameron and Trivedi（1986）, Econometric models based on count data: comparisons and applications of some estimators. Journal of Applied Econometrics 1986; 46:347–364.

# Lee-Carter 模型负二项最大似然估计与预测

## 基于中国人口的实证研究

吴晓坤[1 2]，王晓军[1]
[1]统计学院，中国人民大学，北京，中国，100872
[2]数理学院，华北电力大学，保定，中国，071003

**摘　要**：Lee-Carter 模型作为一个经典的、常用的人口死亡率模型，其参数的估计方法通常有奇异值分解法与 Lee-Carte 泊松最大似然法。本文针对中国人口，利用 Lee-Carte 负二项最大似然法建立中国人口死亡率模型，研究表明 Lee-Carte 负二项最大似然法在很多方面都优于 Lee-Carte 泊松最大似然法。

**关键词**：Lee-Carter 模型；负二项分布；最大似然估计

**附录 A**

为了得到所要估计向量中的每一个元素的迭代公式，参照 Delwarde, A., Denuit, M., and Partrat, Ch. (2007)，首先引入记号 $h=1/k$ 与 $h_x=1/k_x$，用 $\hat{\alpha}_x{}^{(i)},\hat{\beta}_x{}^{(i)},\hat{\kappa}_t{}^{(i)}$ 表示参数 $\alpha_x,\beta_x,\kappa_t$ 的第 $i$ 步迭代值；用 $\hat{\delta}^{(i_\alpha,i_\beta,i_\kappa)}=er_{xt}\exp(\alpha_x{}^{(i_\alpha)}+\hat{\beta}_x{}^{(i_\beta)}\hat{\kappa}_t{}^{(i_\kappa)})$ 表示参数 $\alpha_x,\beta_x,\kappa_t$ 分别经 $i_\alpha,i_\beta,i_\kappa$ 步迭代后得到的死亡人数的拟合值。

$$\hat{\alpha}_x{}^{(i+1)}=\hat{\alpha}_x{}^{(i)}-\frac{\sum_{t=t_0}^{t_n}\left(-(\hat{h}_x{}^{(i)}+d_{xt})\frac{\hat{\delta}_{xt}{}^{(i,i,i)}}{(\hat{\delta}_{xt}{}^{(i,i,i)}+\hat{h}_x{}^{(i)})}+d_{xt}\right)}{\sum_{t=t_0}^{t_n}\left(-\hat{h}_x{}^{(i)}(\hat{h}_x{}^{(i)}+d_{xt})\frac{\hat{\delta}_{xt}{}^{(i,i,i)}}{(\hat{\delta}_{xt}{}^{(i,i,i)}+\hat{h}_x{}^{(i)})^2}\right)},\quad \text{(A1)}$$

$$x=0,1,2,......,\omega.$$

接下来进行拟合更新，为下一步计算进行准备 $\hat{\delta}_{xt}{}^{(i+1,i,i)}=er_{xt}\exp(\alpha_x{}^{(i+1)}+\hat{\beta}_x{}^{(i)}\hat{\kappa}_t{}^{(i)})$，

$$\hat{\kappa}_t{}^{(i+1)}=\hat{\kappa}_t{}^{(i)}-\frac{\sum_{x=0}^{\omega}\left(\hat{\beta}_x{}^{(i)}\left(-(\hat{h}_x{}^{(i)}+d_{xt})\frac{\hat{\delta}_{xt}{}^{(i+1,i,i)}}{(\hat{\delta}_{xt}{}^{(i+1,i,i)}+\hat{h}_x{}^{(i)})}+d_{xt}\right)\right)}{\sum_{x=0}^{\omega}\left((\hat{\beta}_x{}^{(i)})^2\left(-\hat{h}_x{}^{(i)}(\hat{h}_x{}^{(i)}+d_{xt})\frac{\hat{\delta}_{xt}{}^{(i+1,i,i)}}{(\hat{\delta}_{xt}{}^{(i+1,i,i)}+\hat{h}_x{}^{(i)})^2}\right)\right)}$$

（A2 ）

$$t=t_1,t_2,......,t_n$$

为下一参数计算进行更新$\hat{\delta}_{xt}^{(i+1,i,i+1)} = er_{xt}\exp(\alpha_x^{(i+1)} + \hat{\beta}_x^{(i)}\hat{\kappa}_t^{(i+1)})$，

$$\hat{\beta}_x^{(i+1)} = \hat{\beta}_x^{(i)} - \frac{\sum_{t=t_0}^{t_n}(\kappa_t^{(i+1)}(-(\hat{h}_x^{(i)} + d_{xt})\frac{\hat{\delta}_{xt}^{(i+1,i,i+1)}}{(\hat{\delta}_{xt}^{(i+1,i,i+1)} + \hat{h}_x^{(i)})} + d_{xt}))}{\sum_{t=t_0}^{t_n}((\kappa_t^{(i+1)})^2(-\hat{h}_x^{(i)}(\hat{h}_x^{(i)} + d_{xt})\frac{\hat{\delta}_{xt}^{(i+1,i,i+1)}}{(\hat{\delta}_{xt}^{(i+1,i,i+1)} + \hat{h}_x^{(i)})^2}))} \quad \text{(A3)}$$

$$x = 0,1,2,......,\omega.$$

拟合更新，$\hat{\delta}_{xt}^{(i+1,i+1,i+1)} = er_{xt}\exp(\hat{\alpha}_x^{(i+1)} + \hat{\beta}_x^{(i+1)}\hat{\kappa}_t^{(i+1)})$，

$$\hat{h}_x^{(i+1)} = \hat{h}_x^{(i)} - \frac{\sum_{t=t_0}^{t_n}((\sum_{j=1}^{d_{xt}}\frac{1}{\hat{h}_x^{(i)} + d_{xt} - j}) + \ln\frac{\hat{h}_x^{(i)}}{(\hat{\delta}_{xt}^{(i+1,i+1,i+1)} + \hat{h}_x^{(i)})} + \frac{\hat{\delta}_{xt}^{(i+1,i+1,i+1)} - d_{xt}}{(\hat{\delta}_{xt}^{(i+1,i+1,i+1)} + \hat{h}_x^{(i)})})}{\sum_{t=t_0}^{t_n}((\sum_{j=1}^{d_{xt}}\frac{-1}{(\hat{h}_x^{(i)} + d_{xt} - j)^2}) + \frac{1}{\hat{h}_x^{(i)}} + \frac{d_{xt} - 2\hat{\delta}_{xt}^{(i+1,i+1,i+1)} - \hat{h}_x^{(i)}}{(\hat{\delta}_{xt}^{(i+1,i+1,i+1)} + \hat{h}_x^{(i)})^2})} \quad \text{(A4)}$$

每一轮更新后都要对参数进行调整，以确保所估计参数具有可识别性，

$$\hat{\beta}_x^{(i+1)} = \hat{\beta}_x^{(i+1)} / \sum_x \hat{\beta}_x^{(i+1)} \quad \text{(A5)}$$

$$\hat{\kappa}_t^{(i+1)} = (\hat{\kappa}_t^{(i+1)} - \sum_t \hat{\kappa}_t^{(i+1)} / (t_n - t_1 + 1))(\sum_x \beta_x^{(i+1)}) \quad \text{(A6)}$$

$$\hat{\alpha}_x^{(i+1)} = \hat{\alpha}_x^{(i+1)} + \hat{\beta}_x^{(i+1)}\sum_t \hat{\kappa}_t^{(i+1)} / (t_n - t_1 + 1) \quad \text{(A7)}$$

其实，如果按照（A5）、（A6）、（A7）的顺序调整，（A6）式中的$\sum_x \beta_x^{(i+1)}$并不起作用，而（A7）式本身也不会起作用。如果将其顺序打乱则不同。

# An Empirical Study on China's Growth of Property Insurance by Autoregressive Distributed Lag Model

YU Jiamin
Institute of Insurance, Shanghai Finance University, Shanghai, China, 201209

**Abstract**： This article builds an Autoregressive Distributed Lag Model (ARDL) on growth of property insurance premium. The growth of China's property insurance premium is empirically analyzed by Engle-Granger two-step method. The research shows that, the premium of property insurance and GDP is conintegrated, and new ARDL model has better goodness of fit and predictive ability than CLRM.

**Key words**: property insurance; Autoregressive Distributed Lag model; Error Correction Model; cointegration

## 一、 引言

国内外学者众多研究表明经济（GDP 或 GNP）增长是财产险保费增长最重要的决定性因素。其中代表性的实证研究普遍采用多元回归分析、面板数据回归等计量经济学方法。例如：Beenstock 等（1988）采用面板数据回归分析人均国民收入、利率、国别与人均财产险保费增长的关系。Outreville（1990）采用 55 个发展中国家的面板数据分析 GDP、金融发展程度(M2/GDP)、保费价格与财产险增长的关系。Browne 等（2000）通过多元回归分析得到了收入、外资保险市场份额、教育就业率、城市化程度、财富以及法律体系对保险需求增长的相关性。Esho 等（2004）应用广义矩估计方法（GMM）研究法律保护与财产险保险密度的相关关系。赵桂芹（2006）运用面板数据回归对我国各省(市)的产险市场需求进行实证分析，详细讨论了经济、保险意识和市场竞争程度等多个因素对产险保费收入的影响。钱珍(2006)建立了多元回归的时间序列模型，分别验证 GDP、固定资产投资、通货膨胀率和城乡储蓄存款对财产险增长的影响作用。李毅（2008）采用湖北省地市州产险保费、国内生产总值、固定资产投资、往年赔款和市场机构指标等面板数据，证明了国内生产总值、固定资产投资、前期赔款存在显著的正相关作用，而市场竞争程度与保费增长存在负相关关系。

由于财产保险大多为一年期保单且具有非常高的续保率，区别于以往的研究，本文将以高续保特征作为建立财产险增长模型的出发点。构建充分考虑续保性的自回归分布滞后财产险保费增长模型，并利用 1980-2010 年我国产险保费和 GDP 时间序列数据进行实证分析。

## 二、 模型设计和研究方法

### (一) 财产险保费增长理论分析与建模

财产保险是以财产及其利益为保险标的，对投保人或被保险人的经济损失进行补偿的金融工具。财富增长、经济活动繁荣以及风险意外的客观存在会直接刺激产险市场的发展和扩张。由于财产险保单绝大部分为短期保单（最常见为一年期），因此，只要财产及其经济利益不曾灭失，即便在经济零增长条件下，下一年度依然会对相关财产保险保单进行续保，例如汽车保险的连续续保。其次，由消费、投资及出口等国民经济活动带来的经济增长必然会增加物质财富及相关经济利益，然后催生新的财产保险需求，例如：耐用消费品汽车消费的增加会带动汽车保险增长、加大高速公路投资会增加工程保险保费、扩大出口会增加船舶和货运保险需求等。因此，下一年的财产险保费可以分解为两部分：上年保费的续保部分和经济增长

导致的新保险需求增长保费。

以 $P_t$ 表示 t 年财产险总保费，$GDP_t$ 表示 t 年的国民生产总值，$P_t$ 可以表示为

$$P_t = f(P_{t-1}) + g(GDP_t, GDP_{t-1}) \qquad (1)$$

$f(P_{t-1})$是保险续保部分，$g(GDP_t, GDP_{t-1})$为 t 年经济增长（或下降）造成的保费变化部分。

对式（1）中的$f(P_{t-1})$和$g(GDP_t, GDP_{t-1})$进行近似线性处理，即

$$\begin{cases} f(P_{t-1}) \approx \beta_0 \cdot P_{t-1} \\ g(GDP_t, GDP_{t-1}) \approx \beta_1 \cdot GDP_t + \beta_2 \cdot GDP_{t-1} \end{cases} \qquad (2)$$

可以得到

$$P_t = \beta_0 \cdot P_{t-1} + \beta_1 \cdot GDP_t + \beta_2 \cdot GDP_{t-1} + \varepsilon_t \qquad (3)$$

$\varepsilon_t$为误差项,且可以表示α为$\mu_t$与之和。则有

$$y_t = \alpha + \beta_0 \cdot y_{t-1} + \beta_1 \cdot x_t + \beta_2 \cdot x_{t-1} + \mu_t \qquad (4)$$

式（4）就是计量经济学中的自回归分布滞后模型（Autoregressive Distributed Lag model，ARDL），属于动态计量经济模型。在本文的财产险增长模型中，ARDL 模型中的被解释变量 y 是财产险保费时间序列 P，解释变量 x 为 GDP 时间序列。

## （二） 模型估计和检验方法

在计量经济学中，自回归分布滞后模型被广泛应用于动态经济分析。对 ARDL 模型进行回归分析和统计推断，可以得到被解释变量和解释变量间在时间变化过程中的响应关系，还可以对未来经济变量的走势作出相应预测。

对式（4）方程两边都减去$y_{t-1}$，得到

$$\begin{aligned} \Delta y_t &= \alpha - (1-\beta_0) \cdot y_{t-1} + \beta_1 \cdot x_t + \beta_2 \cdot x_{t-1} + \mu_t \\ &= \alpha - (1-\beta_0) \cdot y_{t-1} + \beta_1 \cdot \Delta x_t + (\beta_1 + \beta_2) \cdot x_{t-1} + \mu_t \\ &= \beta_1 \cdot \Delta x_t - (1-\beta_0)\left[y_{t-1} - \left(\frac{\alpha}{1-\beta_0}\right) - \left(\frac{\beta_1+\beta_2}{1-\beta_0}\right) \cdot x_{t-1}\right] + \mu_t \end{aligned} \qquad (5)$$

令 $\lambda = 1 - \beta_0$、$\alpha_0 = \alpha/(1-\beta_0)$以及$\alpha_1 = (\beta_1+\beta_2)/(1-\beta_0)$，式（5）可简化为

$$\Delta y_t = \beta_1 \cdot \Delta x_t - \lambda(y_{t-1} - \alpha_0 - \alpha_1 \cdot x_{t-1}) + \mu_t \qquad (6)$$

式（6）即为（一阶）误差修正模型(Error Correction Model，ECM)。$(y_{t-1} - \alpha_0 - \alpha_1 \cdot x_{t-1})$就是误差修正项，记作 ecm，式（6）可表示为

$$\Delta y_t = \beta_1 \cdot \Delta x_t - \lambda \cdot ecm + \mu_t \qquad (7)$$

根据 ECM 模型理论，如果变量$y_t$和$x_t$存在长期均衡关系（即协整关系），式（6）中的各参数就可以通过 OLS（最小二乘法）进行参数估计。此外，式（6）中的系数$\alpha_1$、$\beta_1$还有其实际经济意义：$\alpha_1$可视作经济变量 y 关于

x 的长期弹性（long-run elasticity），即本文中财产险保费 P 关于 GDP 的长期弹性；而$\beta_1$则为 y 关于 x 的短期弹性（short-run elasticity），意味着 $GDP_t$ 对财产险保费 $P_t$ 的短期拉动作用。

误差修正模型（ECM）具有以下优点：一阶差分项的使用可消除变量可能存在的趋势性因素，从而避免“虚假回归”（spurious regression）；一阶差分项也能消除模型可能存在的多重共线性（multi-collinearity）问题；引入 ecm 误差修正项可保证变量水平值的信息没有被忽视；由于误差修正项过程的平稳性，ECM 模型可以用经典的回归方法（OLS）进行参数估计，还可以使用 t 检验或 F 检验来检验统计显著性。

变量 y 和 x 间存在长期均衡关系，是建立 ECM 模型的前提条件。因此本文将使用 Engle-Granger 两步法建立 ECM 模型：第一步，检验产险保费 P 和 GDP 变量间的协整关系；第二步，如果协整关系存在，则以第一步求得的残差作为非均衡误差项 ecm 加入到误差修正模型中，并用 OLS 法估计出相应参数。

## 三、 实证研究

### （一） 样本数据来源和描述

本文选取1980-2010年中国大陆历年的国民生产总值（GDP）和财产险保费收入作为ARDL模型的解释变量和被解释变量。其中，历年GDP数据来源于《中国统计年鉴》，1980-1998年财产险保费数据摘自《财产保险》[9]，1999-2010年保费数据取自《中国统计年鉴》。

表1 1980-2010年财产险保费收入和GDP　　单位（亿元）

| 年份 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 |
|---|---|---|---|---|---|---|---|---|
| 保费 | 4.6 | 7.8 | 10.3 | 13.1 | 19.3 | 28.7 | 34.5 | 46.1 |
| GDP | 4,546 | 4,892 | 5,323 | 5,963 | 7,208 | 9,016 | 10,275 | 12,059 |
| 年份 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
| 保费 | 72.9 | 78.1 | 106.8 | 136.8 | 147.4 | 251.4 | 336.9 | 390.7 |
| GDP | 15,043 | 16,992 | 18,668 | 21,781 | 26,923 | 35,334 | 48,198 | 60,794 |
| 年份 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
| 保费 | 452.5 | 480.7 | 499.6 | 521.1 | 598.4 | 685.4 | 779.5 | 869.0 |
| GDP | 71,177 | 78,973 | 84,402 | 89,677 | 99,215 | 109,655 | 120,333 | 135,823 |
| 年份 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | |
| 保费 | 1,125.0 | 1,283.0 | 1,579.0 | 1,997.7 | 2,336.7 | 2,875.8 | 3,895.6 | |
| GDP | 159,878 | 184,937 | 216,314 | 265,810 | 314,045 | 340,507 | 401,513 | |

注：保费和GDP按当年价格统计

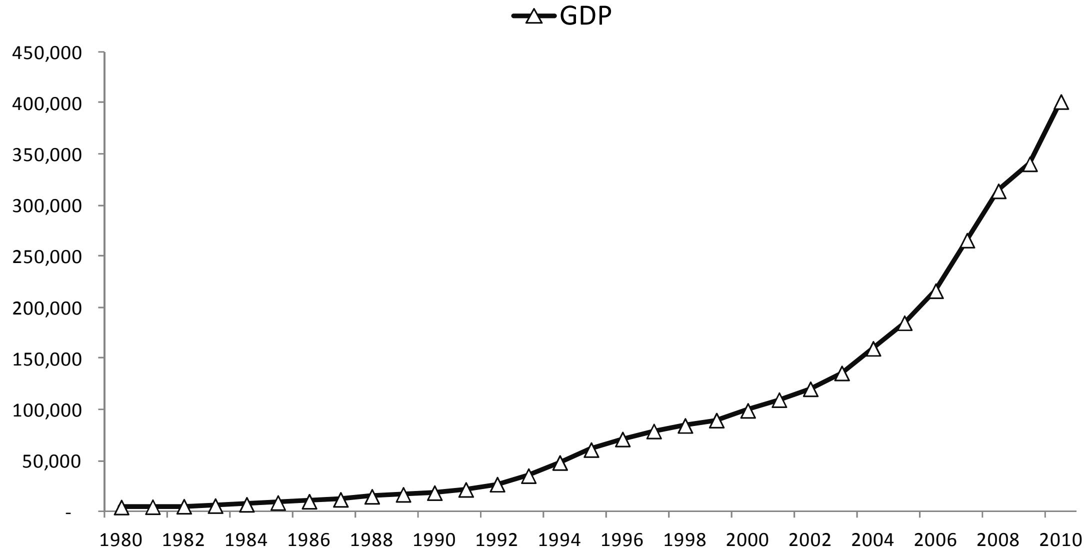



图1 1980-2010年GDP增长趋势图

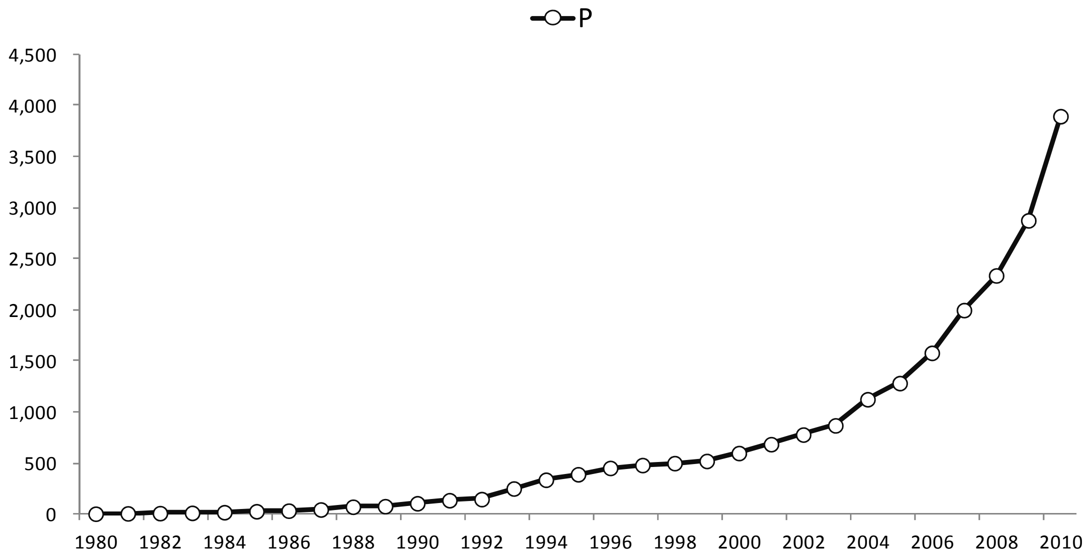



图2 1980-2010年财产险保费增长趋势图

从图1和图2中我国财产险保费和GDP增长趋势中可以看到：财产险保费和GDP增长具有很强的正相关性；财产险保费增长的速度要快于GDP增长，即其保险深度也存在上升趋势。

## （二） 实证分析

### 1. 协整检验

两个时间序列$y_t$和$x_t$存在协整关系，就意味着$y_t$和$x_t$的线性组合是平稳过程（即0阶单积序列I(0)）。在本文中，需要验证式（7）中$y_t$和$x_t$的线性组合ecm是I(0)的平稳序列。

因此，$y_t$和$x_t$必须同为I(1)序列才可能存在协整关系。显然，图1和图2中下凸的增长趋势，表明保费ΔP和ΔGDP不是I(0)序列，即$y_t$和$x_t$不可能是I(1)序列。

为得到满足I(1)平稳过程的$y_t$和$x_t$序列，

借鉴文献[10]、[11]中的数据处理方法，对保费P和GDP取自然对数。时间序列$y_t$和$x_t$变为

$$\begin{cases} y_t = \ln(P_t) = LP_t \\ x_t = \ln(GDP_t) = LGDP_t \end{cases} \qquad (8)$$

选择增广的DF检验法（ADF）对$\Delta LP_t$ 和$\Delta LGDP_t$进行序列平稳性检验，使用STATA软件dfuller命令进行单位根检验，检验结果如下

表2 $\Delta LP_t$ 和$\Delta LGDP_t$的ADF检验结果

| 变量 | ADF统计量 | 1%临界值 | p值 |
|---|---|---|---|
| $\Delta LP_t$ | -4.818 | -2.473 | 0.0000 |
| $\Delta LGDP_t$ | -2.661 | -2.473 | 0.0065 |

表2的检验结果表明$\Delta LP_t$ 和$\Delta LGDP_t$都是I(0)平稳序列，即$LP_t$ 和$LGDP_t$为I(1)的1阶单积序列。

将$LP_t$ 对$LGDP_t$做 OLS 线性回归，回归结果如下表 3 所示

表3 $LP_t$ 对$LGDP_t$回归结果

| 变量 | Coef. | Std. Err. | t | P>\|t\| | $R^2$ | $\bar{R}^2$ |
|---|---|---|---|---|---|---|
| $LGDF_t$ | 1.325 | 0.0352 | 37.55 | 0.000 | 0.9799 | 0.9792 |
| $\alpha_0$ | -8.782 | 0.3804 | -23.09 | 0.000 | | |

表3的回归结果表明拟合结果良好，调整的R2值为0.9792，且回归统计高度显著。

根据式（6），$LP_t$ 对$LGDP_t$的OLS回归残差就是ecm，ecm如果是I(0)平稳序列，那么就能证明$LP_t$ 和$LGDF_t$间存在长期均衡的协整关系。同样用STATA软件对ecm序列做ADF检验。得到

表4 ecm的ADF检验结果

| 变量 | ADF统计量 | 1%临界值 | p值 |
|---|---|---|---|
| ecm | -4.036 | -3.716 | 0.0012 |

因此，ecm是I(0)平稳序列，$LP_t$ 对$LGDP_t$间存在(1,1)阶协整关系。$LP_t$ 对$LGDP_t$协整回归方程为

$$\widehat{LP}_t = -8.781921 + 1.324962 LGDP_t \qquad (9)$$

2. ECM 参数估计

由于$LP_t$ 对$LGDP_t$间存在（1，1）阶协整关系，则可以按照式（7）进行OLS回归得到参

数$\beta_1$的估计。回归结果如下

表5 $\Delta LP_t$ 对$\Delta LGDP_t$回归结果

| 变量 | Coef. | Std. Err. | t | P>\|t\| | $R^2$ | $\bar{R}^2$ |
|---|---|---|---|---|---|---|
| $\Delta LGDP_t$ | 1.516 | 0.1171 | 12.95 | 0.000 | 0.8591 | 0.8490 |
| ecm | -0.3051 | 0.0708 | -4.21 | 0.000 | | |

表5的回归结果表明拟合结果良好，调整的R2值为0.8490，且回归统计显著。ECM模型方程如下

$$\Delta \widehat{LP}_t = 1.516\Delta LGDP_t - 0.3051(LP_{t-1} + 8.782 - 1.325LGDP_{t-1}) \quad (10)$$

根据式（10），$LP_t$ 关于$LGDP_t$的短期弹性为1.516，而长期弹性为1.325。

3. 预测

根据以上的ECM模型回归结果，便可以对各年的$LP_t$ 进行预测。比较ECM模型预测值与经典OLS回归（即式（9））预测值之间的差异，可以发现ECM模型具有更好的拟合效果。1981-2010年预测拟合比较效果如图3所示，$LP_t$ 为实际值，$LP1_t$ 为OLS预测值，$LP2_t$ 是ECM预测值。

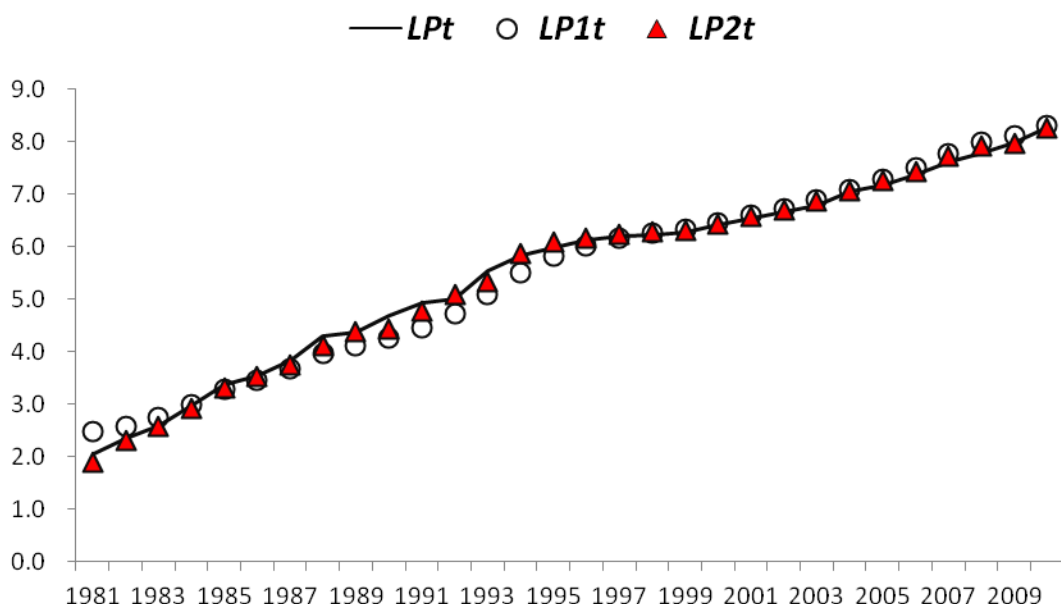



图3 1981-2010年$LP_t$ 序列及OLS、ECM预测值比较

以2010年为例，实际财产险总保费收入为3895.64亿元，OLS预测4080.84亿元，而ECM模型预测值为3843.47亿元。总体上，基于式（4）的考虑续保率的ARDL模型相比经典线性回归模型具有更好的拟合度和预测效果。

## 四、 总结

本文通过建立自回归分布滞后模型对我国1980-2010年财产险保费增长进行实证研究，得到以下结论：

1. 引入续保性假设建立ARDL模型是合理，新模型具有良好的拟合效果和预测能力；
2. 财产保险保费收入和GDP间存在协整关系，且长期弹性为1.325；
3. 财产险保费关于GDP的短期弹性系数（1.516）要高于长期弹性，即经济增长对保费的短期拉动作用要高于长期；
4. 固定资产投资和人力资本投资可以明显拉动产险增长[12]，多解释变量的ARDL模型是未来进一步研究的方向。

参考文献：

[1] Beenstock M, Dickinson G，Khajuria S. The Relationship between Property-Liability Insurance Premiums and Income: An International Analysis[J]. The Journal of Risk and Insurance, 1988, 55(2): 259-272.
[2] Outreville J F. The Economic Significance of Insurance Market in Developing Countries[J] . The Journal of Risk and Insurance, 1990, 57(3): 487 - 498.
[3] Browne M J, Chung J, Frees E W. International Property-Liability Insurance Consumption[J]. The Journal of Risk and Insurance , 2000, 67(1): 73-90.
[4] Esho N, Kirievsky A, Ward D, Zurbruegg R. Law and the Determinants of Property-Casualty Insurance[J]. The Journal of Risk and Insurance , 2004, 71(2): 265-283.
[5] 林宝清，洪锡熙，吴江鸣. 我国财产险需求收入弹性系数实证分析[J]. 金融研究, 2004（7）：90-99.
[6] 赵桂芹. 非寿险需求、经济发展与损失可能性—来自1997-2003年31个省（市）的实证分析[J]. 预测, 2006，25（3）：48-54.
[7] 钱珍. 我国非寿险需求影响因素的实证分析[J]. 统计教育, 2006（8）：27-29.
[8] 李毅. 湖北财产保险需求实证研究[J]. 保险研究, 2008，（1）：83-86.
[9] 乔林，王绪瑾. 财产保险[M]. 北京：中国人民大学出版社，2003.
[10] 杨舸，田澎，叶建华. 我国寿险需求影响因素的实证分析[J]. 中国软科学, 2005，（3）：51-54.
[11] 栾存存. 我国保险业增长分析[J]. 经济研究, 2004，（1）：25-32.
[12] 郁佳敏. 我国各省保险业与经济发展的相关性实证研究[J]. 金融理论与实践，2011，(2)：94-98.

基金项目：上海高校选拔培养优秀青年教师科研专项基金（sjr09009）和上海市人才发展基金资助项目(2010015)
作者简介：郁佳敏（1974－），男，管理学博士，中国精算师，副教授。上海金融学院保险研究所所长，主要从事保险精算和风险管理研究
联系方式：yujm@shfc.edu.cn 13817889258

# 基于自回归分布滞后模型的我国财产险保费增长实证研究

郁佳敏

上海金融学院保险研究所，上海 201209

[摘 要] 本文建立了财产险保费增长的自回归分布滞后模型，使用Engle-Granger两步法对1980-2010年我国产险保费增长进行了实证研究。研究结果表明，我国财产险保费与GDP之间存在着协整关系，自回归分布滞后模型比经典回归模型具有更好的拟合效果和预测能力。

[关键词] 财产保险 自回归分布滞后模型 误差修正模型 协整

[中图分类号] F840.3

编　辑：阎学煌

EDITOR：YAN Xuehuang



ISBN 978-7-89414-036-4

定价：100.00元