

The Risk Measurement of China's Insurance Fund Investment—Based on VaR Model

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Abstract

Since the 19th National Congress of CPC (the Communist Party of China), China has put forward more stringent requirements for the prevention and control of risks in the insurance industry. In order to measure the risk and performance of four main investment types of China's insurance fund (bank deposit, bond investment, stock investment, fund investment), the paper first introduces the development and present situation of the insurance fund investment in China, and then uses the VaR model to measure the risk of each investment type. Finally, the performance evaluation of each investment type is carried out through the RAROC (Risk Adjusted Return on Capital) method. The result shows that China's insurance industry still has problems such as asset-liability mismatch, hidden liquidity risk and increased credit risk. Additionally, it also reveals that there is still room for improvement in the investment structure of China's insurance fund investment. This result not only provides relevant policy suggestions for risk management in China's insurance industry, but also fills the blank of research in this field in recent years.

Keywords

Insurance Fund Investment, VaR Model, RAROC Method, Policy Suggestions

1. Introduction

What is known to all is that insurance plays an increasingly important role in family financial assets. In the meantime, insurance fund investment has become an important business related to the national economy. Therefore, its importance has attracted strong attention from all sectors of insurance in China. In addition, since the 18th National Congress of CPC (the Communist Party of China), due to the radical operation and investment of a few insurance institutions, the normal order of the capital market has been affected. Consequently, at

the 19th National Congress of CPC, China puts forward more stringent requirements for the prevention and control of risks in the insurance industry.

As one of the most widely used risk measurement model in the financial market, VaR model has received more and more attention in the insurance industry. Thus, based on the above background, this paper empirically analyses the risk of China's insurance fund investment through VaR model, and puts forward relevant policy suggestions for China's insurance fund investment.

This paper mainly has two contributions, and I will elaborate on the two aspects of theoretical contributions and empirical contributions. From the perspective of theoretical contributions, with the shift of the focus of Chinese scholars in the research of insurance fund investment, research in this field has gradually been neglected; therefore, the appearance of this paper just fills the blank of research in this field in recent years. It's true that this paper not only makes a relatively complete review of the previous research, but also provides some useful ideas and methods for the scholars who want to study this field in the future. From the perspective of empirical contributions, insurance institutions can use risk information to re-adjust the insurance fund investment structure, and further diversify the investment risk. Additionally, they can closely monitor the risk of insurance fund investment, make the institution perfect the internal control mechanism of risk management, and improve the management ability of the market risk. For the supervision department, the risk measurement of insurance fund investment not only can monitor the industry risk and improve the risk management system mechanism, but also can enhance the pertinence and effectiveness of risk prevention.

The structure of the paper is organized as follows. Section 2 is a literature review that examines domestic and foreign research on VaR model and its application. Section 3 introduces the development and present situation of insurance fund investment in China. Section 4 briefly introduces the VaR model. Section 5 presents empirical results. Section 6 gives the main conclusions and some policy recommendations.

2. Literature Review

For the reason that the time of insurance fund investment in China is relatively short compared with those in developed countries, so the risk measurement and performance evaluation of insurance fund investment still have great exploration space in Chinese academia. Next, we will expound the present situation of home and abroad research from the introduction of the model and the empirical research in two aspects:

2.1. Model Introduction

Niu (1997) and Zheng (1997) first introduced the background and characteristics of the VaR model and mainstream VaR calculation approaches, and they explained the necessity of introducing the VaR model. Jorion (2000) defines VaR as the value that a holding asset loss may exceed after a period of time at a

given level of confidence. Manganelli & Engle (2001) discussed the three most commonly used methods of calculating VaR, including parameter method, semi-parametric method and non-parametric method, and analyzed their basic assumptions and logical defects. Zhou (2009) pointed out that each method should be balanced while using the VaR model, and the pressure test can be used to make up for its limitation. In recent years, scholars' innovation and research on the VaR model is still continuing. Zhang (2016) introduced the advantages and limitations of the component VaR (CVaR), and he revealed that the CVaR can capture financial risks better under extreme conditions. Su, Xie, & Zhou (2018) reviewed some theories of financial risk measurement including VaR model, and further introduced the current development and application of VaR model.

2.2. Empirical Analysis of the Model

In the early years, when the insurance fund investment was strictly limited in China, empirical research mainly focused on VaR analysis of a single type of investment. Zhou (2008) selected 7 stocks invested by "Ping An Insurance corporation" in 2007 for empirical analysis, and after put forward policy suggestions for investment risk management of Chinese insurance institutions. In recent years, with the increasing demand for risk management in the insurance industry, the research focus of scholars has gradually shifted to the overall VaR measurement of insurance fund investment and the development of VaR model. Cai & Guo (2013) used GARCH model to measure the VaR of the four main investment types, providing theoretical basis and data support for risk management of insurance institutions. Jin (2016) pointed out that we have to consider both the impact of revenue and risk in the insurance fund investment, thus the VaR model should be combined with RAROC (Risk-Adjusted Return on Capital) method for performance evaluation.

2.3. Briefly Summary

In summary, the foreign research on the VaR model started earlier, not only the content of the research is more profound, but also the application of the model is more extensive. China's basic introduction to the VaR model is more comprehensive, but the empirical researches are limited. In addition, it is worth noting that China's insurance market is still in the stage of continuous improvement, and there are also some cutting-edge risk value measurement methods that cannot be applied to China's actual situation, hence now the empirical analysis at the macro level can only be used as a stage reference.

3. The Development and Present Situation of China's Insurance Fund Investment

3.1. The Development Stage of Insurance Fund Investment

3.1.1. Starting Stage (1979-1990)

Since adopting the policy of reform and opening up, China's insurance industry

has been initially established, and it has achieved a start-up phase from scratch. In 1984, with the State Council's agreement on the "Report on Accelerating the Development of China's Insurance Industry", China's insurance institutions began to manage their insurance fund, but the relevant departments imposed strict restrictions on specific investment types, so the return rate of investment was low. In 1988, insurance fund investment was gradually tightened due to the overheated macroeconomic growth. Its scope of investment was strictly limited to interbank borrowing and financial bonds. At the same time, insurance institutions began to adopt guarantees and collateral for risk control.

3.1.2. Disorderly Investment Stage (1991-1995)

Since 1991, China's policy of deepening economic restructuring has achieved remarkable results. The national economy has grown steadily and the policy on insurance fund investment has also been loosened. Under this good macroeconomic background, coupled with the fact that the insurance industry has not yet legislated, insurance fund is rapidly flowing into real estate, securities, and even loan market. In general, China's insurance fund investment has fallen into a blind and disorderly stage. The entire insurance industry has formed a large number of non-performing assets, and the quality of assets has declined sharply.

3.1.3. Legal Supervision Stage (1996-Present)

After experiencing the stage of disorderly investment, China's voice for insurance legislation is growing. In 1995, China's first Insurance Law was officially promulgated and implemented. Later, with the establishment of the CIRR (China Insurance Regulatory Commission), insurance fund investment in China has basically established a pattern in which the Insurance Law is the mainstay and supplemented by the policies of the CIRR.

At present, under the opening-up policy of China's financial industry, the scope and type of investment in insurance fund are steadily expanding. In the future, the market will have more choices and market vitality will be further stimulated.

3.2. The Present Situation of Insurance Fund Investment

3.2.1. Insurance Fund Investment Balance Has Gradually Increased

With the development of social economy and the awareness of residents' insurance, their demands have been moderately released, which leads to the simultaneous rise of insurance density and insurance penetration. **Table 1** shows the changes in total assets of China's insurance and the insurance fund investment balance from 2011 to 2017.

Since 2011, the total insurance assets of China have increased year by year, and insurance fund investment balance has also smoothly increased. As of the end of 2017, China's insurance fund investment balance was 14.92 trillion yuan, an increase of 11.43% from the beginning of the year.

3.2.2. Insurance Fund Investment Structure Tends to Be Diversified

The experience of international development reveals that the insurance fund

Table 1. Total insurance assets and insurance fund investment balance in 2011-2017 (Unit: trillion yuan).

Years	Total Insurance Assets	Insurance Fund Investment Balance
2011	6.01	5.55
2012	7.35	6.85
2013	8.29	7.69
2014	10.16	9.33
2015	12.36	11.18
2016	15.12	13.39
2017	16.75	14.92

Data Source: The 2012-2018 China Insurance Yearbook¹.

investment has become one of the core businesses of insurance institutions. **Table 2** shows the changes in China's insurance fund investment structure in 2011-2017. The numerical values in parentheses indicate the proportion of each investment type.

From **Table 2**, the following trends can be seen clearly:

1) The proportion of bank deposit and bond investment in insurance fund investment balance has gradually declined but a certain amount of capital scale has been maintained. Taking bank deposit as an example, although the proportion of bank deposit in insurance fund investment balance has dropped from 31.89% in 2011 to 12.94% in 2017, the capital scale was raised from 1.77 trillion yuan in 2011 to 1.93 trillion yuan in 2017, and also maintain a certain steady state. This trend is closely related to the rising insurance fund investment balance in China and the release of the rules for insurance fund investment.

2) Equity investment (Including stock investment and fund investment) generally showed an upward trend. First of all, the proportion of equity investment rose from 12.07% in 2011 to 12.33% in 2017. However, it is a spiral rise rather than a straight rise. Moreover, the capital scale of equity investment has increased year by year since 2011, and by the end of 2017, it has reached 1.84 trillion yuan. In general, the performance of equity investment is closely relevant to China's developing stock and fund markets.

3) Types of other investment are very plentiful, including real estate investments, policy pledges, trusts and others. From the proportion of other investment in insurance fund investment balance, we know that it has risen from 9.01% in 2011 to 40.21% in 2017, a total increase of more than 4 times. This is mainly relevant to China's policy background of deepening market-oriented reforms in recent years and moderately expanding the scope and type of insurance fund investment.

¹Since December 2010, China has implemented the "Accounting Standards Interpretation No.2", which has led to changes in the statistics of premiums. Thus, the starting year of the data in this paper is 2011.

Table 2. Changes in the Insurance Fund Investment Structure in 2011-2017 (Unit: trillion yuan).

Years	Bank Deposit	Bond Investment	Equity Investment	Other Investment
2011	1.77 (31.89%)	2.61 (47.03%)	0.67 (12.07%)	0.50 (9.01%)
2012	2.34 (34.16%)	3.06 (44.67%)	0.81 (11.82%)	0.64 (9.34%)
2013	2.26 (29.39%)	3.34 (43.43%)	0.79 (10.27%)	1.30 (16.91%)
2014	2.53 (27.12%)	3.56 (38.16%)	1.03 (11.04%)	2.21 (23.69%)
2015	2.40 (21.43%)	3.80 (33.93%)	1.70 (15.18%)	3.30 (29.46%)
2016	2.48 (18.51%)	4.31 (32.16%)	1.78 (13.28%)	4.83 (36.04%)
2017	1.93 (12.94%)	5.16 (34.58%)	1.84 (12.33%)	6.00 (40.21%)

Data Source: The 2012-2018 China insurance yearbook.

3.2.3. Increased Stability of Investment Income of Insurance Fund

With China's market-oriented reform policy, the investment of insurance fund gradually displays a diversified pattern. Under this circumstance, the stability of the return rate of insurance fund investment has steadily increased. The data as shown in **Figure 1**.

From **Figure 1**, we can know the return rate of the insurance fund investment increased from 3.39% in 2012 to 7.56% in 2015. In 2016, affected by the weak capital market and the low interest rate environment, the return rate of investment was 5.66%. Although the return rate of the entire insurance industry has fell back slightly, it is not easy to achieve this result in this difficult environment. In 2017, benefit from the continuous optimization of the investment structure of insurance funds, the return rate of investment rebounded slightly to 5.77%.

3.3. The Main Problems of Insurance Fund Investment

3.3.1. The Problem of Mismatch of Assets and Liabilities

The problem of asset-liability mismatch of insurance funds is mainly reflected in the phenomenon of "Use long-term money for short-term investments" and "Use short-term money for long-term investments". From 2010 to 2015, the asset-liability gap of the insurance industry for more than 15 years climbed from 1.37 trillion yuan to 5.40 trillion yuan, showing a trend of increasing year by year. Under this circumstance, the investment period of insurance fund is short and the fluctuation of return rate was changeable, which made it difficult to reflect the advantage of insurance fund as long-term fund. On the one hand, the cost of insurance liabilities remains in a high level. On the other hand, the return rate of investment decreases rapidly, which makes it more difficult for insurance institutions to manage their assets and liabilities.

3.3.2. Hidden Liquidity Risk

At present, some short-term and medium-term insurance products with a maturity of 1 - 3 years have a capital cost of more than 5%, which forces insurance fund to invest in alternative investments with lower liquidity and longer maturities

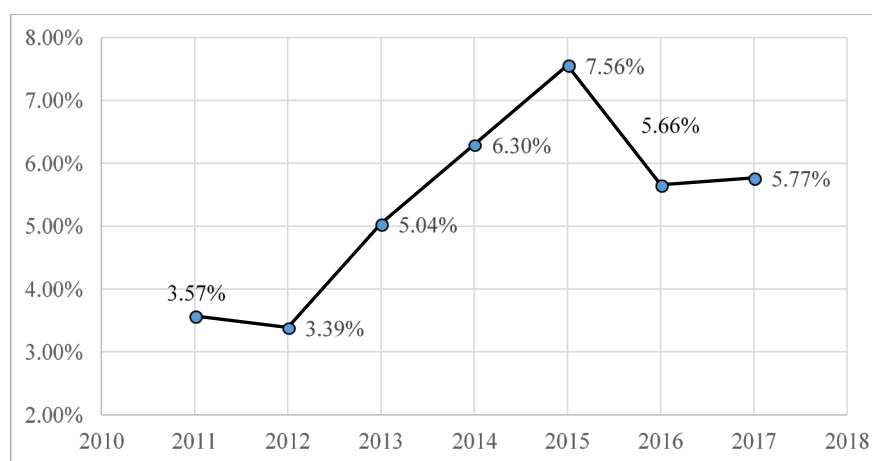


Figure 1. Changes in the return on insurance fund investment in 2011-2017. Data Source: The 2012-2018 China insurance yearbook.

such as real estate and infrastructure. Although this has expanded the investment structure, the hidden risk of liquidity is slowly rising.

3.3.3. Increased Credit Risk

In the context of China's supply-side reform, the main task is to deleverage, cut overcapacity and reduce excess inventory. In this process, the profitability and credit qualifications of enterprises in the traditional manufacturing have been weakened by varying degrees, and the possibility of debt default has increased, which leads to increased credit risk in the insurance industry. Moreover, under the background of "asset shortage" (adequate capital but lack of good investment targets), some insurance institutions are forced to change their risk attitude and increase high-risk and high-income investments in order to improve their competitiveness. Obviously, it has a certain negative impact on insurance fund investment.

4. VaR Model

Value at Risk (VaR) can be defined informally as the maximum possible loss of a certain financial asset or portfolio within a certain confidence interval. The VaR model is currently used as a mainstream tool for the financial institutions to measure market risk. For example, if an institution's VaR for a day is 1 million at 99% confidence level, it can be simply stated as: In the normal market environment, there is a 99% probability that the maximum loss of the portfolio in a day is less than 1 million yuan. Whereas, there is still a 1% chance that the loss will exceed 1 million yuan, and this situation can never be ruled out.

Furthermore, VaR model can be written as the following mathematical equation:

$$P(\Delta L > VaR) = 1 - c = \alpha \quad (1)$$

Among them, P is Probability, ΔL is the loss of the portfolio during a certain holding period, α is the significance level, c is the confidence level, and

$$\alpha = 1 - c.$$

There are three main methods of calculating VaR: Delta-Normal method, Historical Simulation method and Monte Carlo method. This paper only introduces the first two methods based on the empirical needs.

Delta-Normal method is a kind of parametric VaR method. It is called parametric method because it requires the hypothesis that the data are normally distributed. What needs to be solved is to determine parameters such as the variance and covariance. When using the Delta-Normal method to measure risk, the equation of VaR for unit asset can be expressed as:

$$VaR = Z_{\alpha} \cdot \sigma \cdot \sqrt{t} = Z_{\alpha} \cdot \sqrt{X \cdot C \cdot X^T} \cdot t \quad (2)$$

Among them, Z_{α} is the quantile of the standard normal distribution corresponding to the significance level (α), σ is the standard deviation of the portfolio, t is the period of possession, X is a proportional matrix of various investment methods; C is the variance-covariance matrix of various investment methods, X^T is the transposed matrix of X .

Furthermore, the component VaR (CVaR) of each investment type can be calculated, so that the risk can be measured more accurately. The equation is as follows:

$$CVaR_i = X_i \cdot VaR \cdot \left[\frac{(C \cdot X^T)_i}{(X \cdot C \cdot X^T)} \right] \quad (3)$$

Historical Simulation method is one of the simplest method among the three main methods. First, we should collect historical samples (price data) and calculate their return series. Secondly, we have to sort them according to the rate of return. Thirdly, we need to find the quantile of the rate of return based on the selected confidence level and then calculate VaR accordingly.

5. Empirical Analysis of Risk Measurement of China's Insurance Fund Investment

5.1. Samples Selection and Processing

According to the 2017 China Insurance Yearbook, as of the end of December 2016, the total insurance assets was 15.1 trillion yuan, and the insurance fund investment balance was 13.4 trillion yuan. Among them, bond investment, bank deposit, stock investment and fund investment accounted for 32.15%, 18.55%, 7.23% and 6.05% respectively, accounting for 63.98% of the total. Therefore, analyzing these four investment types can generally reflect the risk and performance of all insurance fund.

The sample period is from July 1, 2015 to June 30, 2017 (for a total of 488 trading days). The SHIBOR (1-year Shanghai Interbank Offered Rate), the CBII (China Bond—Insurance Institution Investment Index²), the SSECI (Shanghai Stock Exchange Composite Index) and the SSEFI (Shanghai Stock Exchange Fund Index) are used to reflect the price fluctuations of bank deposit, bond in-

²The index collects bonds invested by domestic insurance institutions and weights them by the market value of the positions. The data comes from China Central Depository & Clearing Company.

vestment, stock investment and fund investment respectively. The data are from the RESSET Financial Database. In addition, based on the reference of many similar papers, the missing data are treated by list wise deletion.

In order to make the data more stable, this paper does the logarithmic and differential treatment to them. The equation is:

$$R_t = \ln P_t - \ln P_{t-1} = \ln(P_t/P_{t-1}) \quad (4)$$

Theoretically, the skewness of normal distribution is 0 and the kurtosis is 3. Hence, for judging whether the data are normally distributed, this paper uses Eviews 8.0 to describes the statistics of the data. The results are shown in the **Table 3**.

Obviously, it shows that the return series of four investment types all have different degrees of hyper-peak state phenomenon. In addition, the CBII, the SSECI and the SSEFI all have different degrees of left-skewed, but the SHIBOR is right-skewed. Therefore, it can be judged that the return series of four investment types are not normally distributed. If only the Delta-Normal method is used, it will lead to large errors. Therefore, this paper will combine Historical Simulation method based on the Delta-Normal method, which can improve the accuracy of the measurement results.

5.2. Empirical Analysis

5.2.1. Empirical Analysis of the Delta-Normal Method

From Equation (2) and Equation (3), we can know that in order to calculate VaR and CVaR of insurance fund investment under existing conditions, it is only necessary to set a corresponding confidence level. Therefore, we could calculate the covariance matrix of return series of four investment types, as shown in **Table 4**.

Secondly, it can be calculated that at a confidence level of 95% and 99%, the VaR holding for one day is 41.388 billion yuan and 58.822 billion yuan respectively. Then, the Equation (3) can be used to calculate the CVaR of four investment types, as shown in **Table 5**.

As can be seen from **Table 5**, at the confidence levels of 95% and 99%, the risk of stock investment is the largest among the four investment types, which is

Table 3. Descriptive statistics of the return series of each investment type.

Statistics	SSECI	SSEFI	SHIBOR	CBII
Minimum	-8.87×10^{-2}	-6.93×10^{-2}	-9.02×10^{-3}	-1.49×10^{-2}
Maximum	5.60×10^{-2}	6.54×10^{-2}	1.79×10^{-2}	6.54×10^{-3}
Average	-5.99×10^{-4}	-2.29×10^{-4}	5.43×10^{-4}	-3.57×10^{-5}
Standard Deviation	1.71×10^{-2}	1.01×10^{-2}	2.29×10^{-3}	1.77×10^{-3}
Kurtosis	9.60	21.10	19.30	15.10
Skewness	-1.37	-1.27	2.29	-1.72
Observations	488	488	488	488

Table 4. Covariance matrix of return series of four investment types.

	SHIBOR	SSEFI	SSECI	CBII
SHIBOR	5.25×10^{-6}	-6.16×10^{-8}	-7.67×10^{-7}	-8.81×10^{-7}
SSEFI	-6.16×10^{-8}	1.02×10^{-4}	1.50×10^{-4}	-6.10×10^{-7}
SSECI	-7.67×10^{-7}	1.50×10^{-4}	2.92×10^{-4}	-8.59×10^{-7}
CBII	-8.81×10^{-7}	-6.10×10^{-7}	-8.59×10^{-7}	3.13×10^{-6}

Table 5. CVaR of four investment types (Unit: 100 million yuan).

Significant Level	Bank Deposit	Bond Investment	Stock Investment	Fund Investment	Total
95%	13.75	28.08	252.67	119.38	413.88
99%	19.44	39.70	357.27	168.81	585.22

more than twice the risk of fund investment. This is related to China's 2015 stock market crash. Besides, the risk of bank deposit and bond investment are much lower than the risk of stock investment and fund investment. Among them, the risk of bank deposit is lower than the risk of bond investment, which is related to China's weak bond market affected by macroeconomic performance and monetary policy in 2016.

5.2.2. Empirical Analyses of Historical Simulation Method

Because the return series and weight of four investment types are known, the Equation (5) can be used to calculate the return rate of the portfolio. Among them, r_p is the rate of return on portfolio, r_i is the rate of return on each type of investment, w_i is the weight of each type of investment.

$$r_p = \sum w_i r_i \quad (5)$$

After calculating the return rate of the portfolio, sort it from small to large. Since the sample size is 488, if the confidence level chosen is 95%, then the 5% quantile ($5\% \times 488 \approx 25$) is about the 25th rate of return after sorting, that is, the VaR of the unit portfolio asset is about the absolute value of the 25th rate of return after sorting, and its value is 0.003. Multiply it with the insurance fund investment balance in 2016 (13.4 trillion yuan), and the VaR value of insurance fund investment is 40.2 billion yuan in the next day, with 95% confidence level. In the same way, it can be calculated that in the next day, with a confidence level of 99%, the VaR value of insurance fund investment is 101.84 billion yuan. In order to make the above results more intuitive, it is shown in **Table 6**.

5.2.3. Empirical Conclusions

By comparing the empirical results of the Delta-Normal method and the Historical Simulation method, we can find that when the confidence level is 95%, the VaRs of two methods are close, about 40 billion yuan. When the confidence level is 99%, the VaRs of two methods are far apart, existing a gap of about 40 billion yuan. Combining the two methods, we can find that at 95% confidence level, the

Table 6. Empirical analyses of historical simulation method (Unit: 100 million yuan).

Significant Level	Corresponding Quantile Order	VaR of Unit Portfolio Asset	VaR
95%	25	0.30×10^{-2}	402.00
99%	5	0.76×10^{-2}	1018.40

results of risk measurement are relatively closer to the true value. Hence, at 95% confidence level, the VaR of China's insurance fund investment can be locked in the vicinity of 40 billion yuan.

5.3. Empirical Extension

The size of the risk is only one aspect of the performance evaluation of insurance fund investment. For making the results of performance evaluation more objective and accurate, this paper further introduces the concept of RAROC. RAROC, the risk-adjusted asset return, is a comprehensive indicator that considers both revenue and risk.

$$\text{RAROC} = \frac{\text{Net Income} - \text{Excepted Loss}}{\text{Economic Capital}} \quad (6)$$

Some of the investment types seem to be good when considering the rate of return only. But if its VaR is large, then the RAROC will not be as high as the rate of return. That is to say, considering the rate of return or risk only is not a quite correct approach. Hence, it is necessary to introduce the concept of RAROC in performance evaluation. For simplify the calculation, the expected loss is neglected here, and the net income can be replaced by the daily average rate of return. Therefore, the RAROC can be rewritten as the following equation.

$$\text{RAROC} = \frac{\text{Daily Average Rate of Return}}{\text{VaR}} \quad (7)$$

Furthermore, at 95% confidence level, the results are shown in **Table 7**.

From **Table 7**, the RAROC ranking of four investment types is: Bank Deposit > Bond Investment > Fund Investment > Stock Investment, and only the RAROC of bank deposits and bond investment is positive, and the others are negative. This means during the sample period, the performance of bank deposit and bond investment is better than stock investment and fund investment, which is mainly related to China's weak capital market and low interest rate environment in 2016. At that time, the return rate of stock investment was negative, and also the return rate of some fixed-income products sharply declined.

6. Research Conclusion and Policy Recommendations

6.1. Research Conclusion

1) By analyzing the development stage, present situation and main problems of China's insurance fund investment, it can be found that China's insurance fund investment balance has gradually increased, and the stability of the rate return has increased. But there are still problems such as mismatch of assets and

Table 7. RAROC of each investment type.

Investment	Daily Average Rate of Return (%)	CVaR (100 million yuan)	RAROC
Bank Deposit	5.40×10^{-2}	13.75	3.93×10^{-3}
Bond Investment	5.49×10^{-4}	28.08	1.96×10^{-5}
Stock Investment	-7.48×10^{-2}	252.67	-2.96×10^{-4}
Fund Investment	-2.81×10^{-2}	119.38	-2.35×10^{-4}

liabilities, hidden liquidity risk and increased credit risk. Indeed, since the implementation of market-oriented reforms in insurance industry since 2012, insurance institutions have obtained greater autonomy in operations and investment, but they have created many hidden risks. Therefore, policy makers must carefully consider the prominent contradictions of supervision and industry, find the best policy solution, and solve the main problems at this stage.

2) Insurance fund investment structure can still be improved in China. The empirical results of the delta-normal method and the historical simulation method show that when the confidence level is 95%, the VaR values of the two methods are close to each other, about 40 billion yuan. Therefore, the risk measurement results under the 95% confidence level are more accurate. Furthermore, this paper calculates the RAROC ranking of four investment type: Bank Deposit > Bond Investment > Fund Investment > Stock Investment, but the distribution ratio of China's insurance fund investment balance among four investment types is ranked as: Bond Investment > Bank Deposits > Stock Investment > Fund Investment. Hence, it can be found that the insurance fund investment structure has not reached the optimal state, and there is still room for further optimization.

3) In fact, the investment type of insurance fund in China has basically reached international standards, fundamentally changing the simple structure that can only be used to "deposit money, buy bonds". Thus, under this circumstance, the three main VaR methods actually have certain limitations. On the one hand, they are not able to fit the distribution of data perfectly, but simply measure and interpret the risk, which is worthy of further study on the accuracy of measurement. On the other hand, affected by data disclosure and data search abilities, the total amount of funds that can be measured actually accounts for about 64% of the insurance fund investment balance. However, the measurement of other investment with the ratio of 36% is lack of corresponding analyses and interpretation.

Therefore, based on the above conclusions, this paper puts forward the following policy recommendations for the measurement and management of China's insurance fund investment risk.

6.2. Policy Recommendations

6.2.1. Continuously Improve the Investment Structure of Insurance Fund

In 2016, China's economy remained in a reasonable range and financial supervi-

sion was further strengthened. In addition, the investment structure of insurance fund faces the challenge of weak capital market and low interest rate.

Under this circumstance, on the one hand, the government should carry out the supervision reform thinking of “opening the front-end and managing the back-end”, further promoting the market-oriented reform, steadily expanding the investment channels, giving the market sufficient space and choice, thus stimulating the market vigor. On the other hand, insurance institutions should first thoroughly research the global macroeconomic situation so that they can enhance their ability to dynamically adjust in the face of changes. Secondly, in the premise of guarding against the risk of the bottom line, insurance institutions should actively invest high-quality preferred stocks and fixed-income assets. Finally, insurance institutions should seize the opportunities of equity market and appropriately participate in overseas investment and other alternative investments.

6.2.2. Building an Investment Risk Management System with VaR Model as the Core

Although VaR is in the mainstream of modern investment theory, it still has many limitations. With the diversification of insurance investment types, the risks are becoming more and more changeable. Therefore, only by combining VAR model with other risk management techniques, and then constructing an investment risk management system with VAR model as its core, can we better adapt to the development and requirement of insurance market. For successfully building this system, we have to overcome the following difficulties. The first is to build a strong financial market database. Because China’s financial market is relatively immature, the timeliness and authenticity of information disclosure have been affected to some extent. But the data as the premise of the normal operation of VAR model, its importance is obvious. The second is to combine other risk management techniques. With China’s financial market becomes more and more open, the VaR model cannot comprehensively measure the insurance industry’s risk. Therefore, while continuously updating VaR technology, we must combine the methods of back-testing and stress testing for further analysis.

6.2.3. Further Improve the Internal Control Mechanism of Investment Risk Management

The government first needs to issue relevant internal control guidelines, and the insurance institutions are required to implement these regulations. Second, the government should earnestly promote the supervision before and after the event, firmly controlling the risk. Third, the government should strengthen the supervision of assets and liabilities and also explore a long-term mechanism for the management of asset and liability management. Finally, the government should establish a responsibility assurance system for insurance institutions, which could strength their ability to perform their duties.

As an insurance institution, the first is to improve the measurement accuracy and the sensitivity of various kinds of risks with the guidance of the CBRC’s

(China Banking Regulatory Commission) solvency risk management ability. Second, guided by the perspective of security and profitability, we will promote and implement the management and monitoring system of insurance fund in an all-round way. Besides, we should actively promote the establishment of the institution's internal standardized evaluation tools and strengthen the investment risk control process at all levels before, during and after the event. The third is to strictly implement special risk management such as asset classification and internal audit, to ensure closely monitoring the status of investment risk and taking feasible response measures in due course.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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