Portfolio Diversification across Listed Insurance Companies and Agri-technology Companies in China

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ABSTRACT

I look at how investors can use insurance market stocks to make a profit and reduce risk by increasing their investments in high-tech agricultural types of counter-cyclical industries. By comparing the correlation coefficient between the two companies, the investment target is determined, and then the scatter diagram is drawn to observe the distribution of the random portfolio. Then，the optimal portfolio is obtained by studying the efficient boundary on the scatter diagram and the Sharpe ratio in various special cases. Through these analyses, I found that the portfolio on the effective frontier is the maximum return at the corresponding risk or the minimum risk at the corresponding return. Moreover, investors can determine the best portfolio by calculating the maximum Sharpe ratio, and the portfolio corresponding to the maximum Sharpe ratio is also on the efficient frontier. This research has great significance in real life. It can let people not limited to the pure investment insurance business, but try to hold insurance company shares for a long period to get profit.

Keywords: listed insurance companies, listed agri-tech companies, portfolio, mean-variance perspective.

1. INTRODUCTION

Since China formally joined WTO in December 2001, China's insurance industry has entered the stage of all-round development. The development of China's insurance industry is faced with unprecedented challenges, and at the same time, China's insurance industry has huge potential. By the end of 2004, the insurance industry had completed the transition period for its accession to the WORLD Trade Organization, taking the lead in fully opening up the financial sector. The insurance industry has also become the industry with the earliest opening time and the highest opening degree in China's financial system. The stable development of the insurance market can improve the efficiency of financial resource allocation and promote regional financial integration [1]. China's insurance companies benefit from strong factors such as population growth, low penetration rate, and rising income and enjoy greater profit opportunities through the use of digital technologies such as artificial intelligence and big data. Besides, with the aging of China's population, the rising level of economic development, the increase of residents'

disposable income and other factors, people are becoming more and more able to buy insurance. This means the insurance industry has shown a strong and tenacious vitality. Figure1 shows the amount of China's national premium in the past five years. It can be clearly seen that with the improvement of people's economic level, the premium income is increasing year by year. This phenomenon is also reflected in the positive percentage of annual growth on the bar chart. According to Cox, Samuel H., and Robert G. Schwebach, after the experience to establish reliable records, the insurance company can determine its policy combination and the correlation of market portfolio and partly replace the traditional use of futures and options market stop-loss reinsurance. Thus, it provides risk-hedging business tools, allow entities to participate in the profitability of the market portfolio, and there is no need to register the insurance company. It may be better than the traditional transaction cost is lower [2]. All these data prove that people can make considerable profits by holding relative securities in the insurance market for a long period of time.
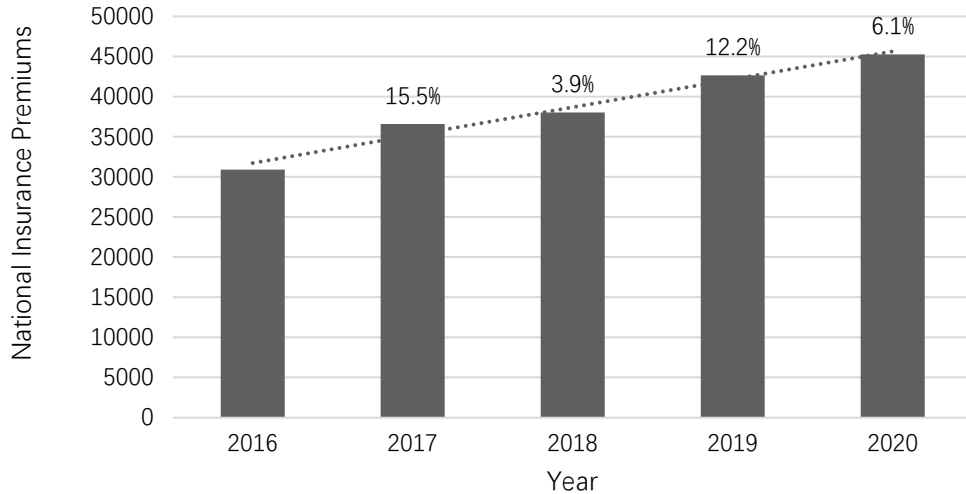
Figure 1. Premium amount bar chart (in one hundred million yuan for National Insurance Premiums)

This also means that many investors are looking at the securities market in the insurance industry rather than just investing in the insurance business. Therefore, many scholars around the world have studied the insurance market from various aspects. They summarize their experience from the trend of premium income growth over the years, predict the market from the innovation of various new types of insurance and evaluate the risk level from the relationship between the insurance market and other markets such as the financial market. Some of the cases have become very classic, such as whether or how foreign investment affects the development of insurance markets in EU-15 countries, the development of European insurance markets during the 2007 financial crisis, how COVID-19 has impacted China's insurance market, Flood Insurance Market Penetration and Expectations of Disaster Assistance [3-6]. The insurance industry will continue to push forward towards institutionalization, internationalization, legalization, marketization, integration and specialization, and eventually achieve big and strong by following a good and fast speed. For all the above reasons, I decided to study how to invest in the insurance market, that is, how to structure the investment portfolio of insurance companies.

However, most of the time, it is well-known that the insurance industry is a pro-cyclical market, so it takes a lot of risks to build up a separate portfolio of insurance companies. According to Liu, G. and Molise, T, countercyclical capital is an effective buffer against the pro-cyclical nature of its predecessor [7]. To solve this problem, some counter-cyclical industries need to be considered to reduce risk, and here I've chosen three typical agri-tech companies. The main reason for choosing agriculture is that it is the basis of human production and life, providing food and raw materials and employment opportunities. In addition, modern agriculture pursues economic benefits and pays attention

to ecological functions and social stability [8]. According to the Chinese Academy of Agricultural Sciences, the contribution rate of scientific and technological progress in China's total agricultural output increased from 27% in 1972-1980 to 30% ~ 40% in 1981-1985. With the rapid development of the knowledge economy, science and technology as the first productive force will play an increasingly important role in China's agricultural modernization.

In this essay, I look at the recent business statements of three insurance companies and three high-tech agricultural companies and find their return on equity on a quarterly basis. Using the data, I calculate their return, risk, Sharpe ratio and correlation coefficients between the two companies. Under the premise of risk aversion, I identify three companies using the two smallest correlation coefficients and start to build a portfolio. In the scatter diagram of random weighting portfolios, I find several distinct situations. After a detailed analysis of their performance, I choose the best invested portfolio and has the smallest Sharpe ratio. In this way, the selection process of an investment portfolio has great guiding significance for actual investment. It can help people profit from the insurance market with less risk, and research has shown that portfolio theory seeks the best balance between yield and risk [9].

2. DATA AND RESEARCH METHOD

2.1. Data

In this study, the dataset covers the period from 30-Sep-2019 to 31-Mar-2021 with 548 trading days in total. The data are available at Eastmoney.com, consisting of Earnings per share, operating income, net profit, as well as net asset per share and return on equity on a quarterly basis. I choose to collect the companies which are already listed in China. To this end, six companies, including

China Life Insurance Company, Ping An Insurance Company of China, China Pacific Insurance Company, Yuan Longping Agricultural Science and Technology Co., LTD., New Hope Group and Dabei Agricultural Science and Technology Co., LTD, are analyzed in this article.

I first investigate the performance of each company. Table 1 reveals the mean, volatility, Sharpe ratio of each company, where the formula defines Sharpe ratio,

$$sharpe\ ratio = \frac{E(R_p) - R_f}{\sigma_p} \tag{1}$$

in which $E(R_p)$ is the expected return on the portfolio, R_f is the risk-free interest rate and σ_p is the standard deviation of the return rate.

Table 1. Historical performance of companies (in % for mean, volatility)

	Mean	Standard deviation	Sharpe ratio
Panel A: Listed Insurance companies			
Ping.An	13.9714	8.4721	1.6491
China.Life	10.6043	4.8896	2.1687
China.Pacific	10.0429	4.8958	2.0513
Panel B: Listed Agri-technology companies			
Dabeinong	8.2443	6.0471	1.3633
Longping	−1.7472	3.0062	−0.5812
Xin.Xiwang	12.1371	7.0414	1.7237

2.2. Data Presentation Analysis

Throughout the analysis, my basic assumption is that all investors are risk-averse. Put simply, risk aversion is the fear of uncertain investments or strategies in dealing with financial matters, and the result is to go with the less uncertain approach [10], An experiment also showed the participants who chose an option pays K (with certainty) rather than an option pays K /r with probability R (0 <r < 1) are risk-averse [11].

Table 2. The correlation coefficient between two companies

	Ping An	China Life	China Pacific	Dabeinong	Longping	Xin Xiwang
Ping An	1	0.9577	0.9938	0.2681	−0.511	0.8884
China Life	0.9577	1	0.9605	0.0622	−0.6373	0.7822
China Pacific	0.9938	0.9605	1	0.1919	−0.5597	0.8931
Dabeinong	0.2681	0.0622	0.1919	1	0.1598	0.4619
Longping	−0.511	−0.6373	−0.5597	0.1598	1	−0.5987
Xin Xiwang	0.8884	0.7822	0.8931	0.4619	−0.5987	1

Under this assumption, the smaller the correlation coefficient between companies, the less they can be influenced by each other, which means the less risky the portfolio composed of these companies will be, and then the more attractive it will be to risk-averse investors. Therefore, I found the most suitable investment company by comparing the correlation coefficient and setting up the investment portfolio.

After determining the company, I first observed the overall distribution of the portfolio. I randomly ran 60 portfolios with different weights and covered them in the scatter plot with the programming software R. I found that the portfolio was curved and almost symmetrical up and down. Then I began to study special circumstances, with the following the three represents the weight of more in-depth study: first is equal to the weighted, three companies accounted for one-third of the portfolio, 2 it is

under the condition of minimum variance, this is the least risky portfolio, the last is the lowest Sharpe ratio, it is a composite index, considering the benefits and risks at the same time.

Finally, through the comparison and analysis of special and random situations, I conclude that the portfolio with the largest Sharpe ratio is the most suitable for investors, confirming the Sharpe ratio concept.

3. EMPIRICAL RESULTS

3.1. Correlation Coefficient and Company Selection

Table 2 shows the correlation matrix of the two companies. As I mentioned earlier, let's assume that all investors are risk-averse, which means they want as little risk as possible. As can be seen from the table, the correlation coefficient between China Pacific and China Ping An is the highest, which is 0.9938, so it cannot be considered at the same time. But we can also see that the correlation coefficients are even negative elsewhere, especially for three specific companies, namely Yuan Longping High-tech Agriculture Co., LTD., New Hope Group and China Life Insurance Co., LTD. The relatively low correlation between different companies also suggests that we might benefit from combining several companies into a single portfolio. So we identified these three specific companies for the portfolio study.

3.2. Portfolio Choose

A scatter plot of randomly selected portfolio distribution is constructed in Figure 2 by programming software R to understand the portfolio of selected companies.

And, of course, the top edge of the scatter plot is what we call the effective frontier. It is well-known that when people choose to invest in some companies, most of them prefer to obey two rules: one is to choose the largest return portfolio with the same risk, and the other is to choose the least risk with the same return. These two methods can make us get some effective combinations, and the collected collection of efficient portfolios is the efficient frontier [12]. Thus, people can analyze the points on the efficient boundary to maximize their profit and minimum their risk because the smallest variance point and the largest Sharpe ratio point are both on it.
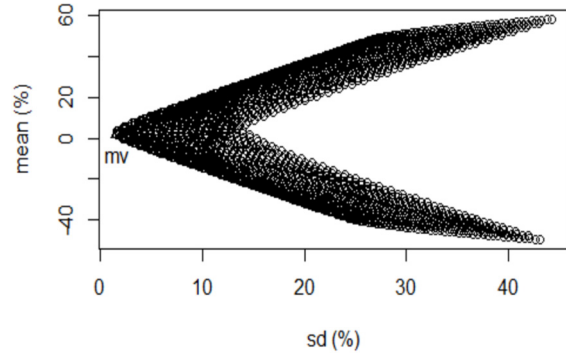

Figure 2. Random portfolio scatter plot

3.3. Results on Different Methods

To make a comprehensive analysis, there are special cases that need to be considered in addition to the points on the efficient boundary so that a more comprehensive analysis can be made. Some special portfolio models considered in this paper are 1/N equal-weighted rule (EW), minimum variance (MV) and maximum Sharpe ratio (MS). The detailed Settings of these models are shown in Table 3, including mean value, variance and Sharpe ratio.

When we compare the Sharpe ratios of the combinations in these three cases with those of the three companies alone, it is not difficult to find that the Sharpe ratios of the combinations are relatively large, especially those of MS and EM.

The Sharpe ratio is the return per unit of risk. In other words, in the classic Markowitz Setup, under the mean-variance Framework, the Sharpe ratio can be used as statistical data for investors of various styles to measure their investment performance [13]. It can also be seen from the formula of Sharpe ratio that the larger its value is, the bigger the mean value of the portfolio is, and the smaller the variance is. In other words, the return is higher, and the risk is smaller, which is very suitable for investment. Thus, we can conclude that the larger the Sharpe ratio, the better, so I choose the portfolio with the largest Sharpe ratio, which is also on the effective frontier.

Table 3. List of various asset allocation models

	Mean	Volatility	Sharpe ratio
EM	6.9981	3.2026	2.1851
MV	2.0008	1.6468	1.2150
MS	5.3108	2.2088	2.4044

4. CONCLUSION

I determined the research direction of the insurance market through the analysis of the modern Chinese

insurance market and sought for another market to reduce risks by using the concept of a counter-cyclical market. I determined the direction of agriculture through the status of agriculture in China and selected three listed insurance companies and three listed agricultural high-tech companies. The mean-variance and other data were used to analyze 6 listed companies. The correlation coefficients were calculated and compared using the investor risk aversion hypothesis to determine the best investment companies. Random scatter diagrams and the statistical risk-return analysis method are used to analyze and determine the potential portfolio of investment companies. Then special research points are found to analyze from general to specific.

By observing the distribution of the special case and the general case and analyzing the data, it is concluded that the portfolio corresponding to the maximum Sharpe ratio is the most worthwhile portfolio. As far as I am concerned, the modern social insurance industry is a long-term and stable industry, which makes continuous and steady progress with the growth of the national economy. Therefore, it is a very reliable choice to hold the securities of insurance companies for a long time. Therefore, I studied how to invest in insurance companies. My process and conclusion of finding the best portfolio can help people better analyze the insurance industry and the stock market and learn how to package other industries to reduce risk.

In addition, I think such analysis can also help people understand the development trend of the insurance industry, to better obtain profits. Of course, I also have shortcomings in some areas. I have not considered the risks brought by force majeure, such as COVID-19, extreme natural disasters, global financial crisis and so on. I think I can further study how to predict these situations and change investment strategies to deal with them.

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