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Risk Assessment and Management System of Financial Product Portfolio based on VaR

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Abstract. Previous studies based on VaR and CVAR under the condition of stable distribution are based on the premise that securities returns are independent of each other, but the calculation methods of VaR and CVAR for portfolio investment under the condition that securities returns are not independent of each other are seldom discussed. The application of VaR and CVAR in investment portfolio is studied by using historical simulation method, Monte Carlo simulation method and optimization method. Research shows that VaR, as a widely adopted advanced risk assessment method, introduces China's securities portfolio risk assessment will play an important role in promoting the development of China's securities market. It also proves that it not only allows us to fully understand the risk status of the portfolio, but also helps us to better manage risk and improve the risk-return characteristics of the portfolio.

Keywords: VaR Financial Products, Investment in Financial Products, Investment Risk Assessment.

1. Introduction

With the constant development of China's securities market and the emergence of new financial instruments, people pay more and more attention to the management and prevention of financial risks [1]. More importantly, the international financial market has undergone some major structural changes since the 1990s. The VaR approach is based on the fact that some traditional methods fail to meet modern investment risk management objectives [2]. Although the theoretical circles have different definitions and expressions of financial risks, they all believe that the nature of financial risks is accompanied by the uncertainty of income (Guo Shiping, 2011) [3]. For the integrated risk measurement of portfolios, the use of Cop-ula functions has matured in recent years. The name of Copula was originally from Sklar (1959). After Sklar proposed the theorem, Cobrula was introduced into financial quantitative analysis by Embrechtsetc. (1999) [4]. Experience-based traditional portfolio risk analysis methods have been unable to meet the objective needs, and the mathematical model of quantitative analysis is the direction of future risk analysis development [5]. If financial institutions or investors can not accurately grasp the changes in market risk, the use of derivatives will bring a devastating blow [6]. The quantitative definition of financial risk originated from Markowitz's mean-variance portfolio theory (Markowitz, 1952). They greatly increase the relevance, complexity, uncertainty and volatility of financial markets and instruments, and make financial market risky and complex in structure, which makes it difficult to measure and analyze [7].

Revenue and risk coexist in the securities market. If the risk of investment is acceptable and tolerated by the investors, the investors will willingly bear the risk in order to obtain excess returns. Four basic market price factors, including interest rate, stock price, exchange rate and commodity price, affect the market value of financial instruments and portfolios through a certain mapping transmission process [8]. Traditional calculating methods such as ALM asset-liability management have the problem of over-reliance on statements, and CAPM capital asset pricing model cannot integrate financial derivatives. Broadly speaking, risk can be defined as "uncertainty of time outcome". `There are two elements, namely, `loss'and `uncertainty' [9]. The advantage of using the Copula function to measure the integration risk of a portfolio is that the Copula function does not require the normal nature of the edge distribution in dealing with a single asset yield distribution, but can be any other distribution. This has a very good application for modeling the "spike and tail" characteristics of financial assets yield. The super-threshold extremum method (POT) can reflect the data

heterogeneity at a higher confidence level by setting the threshold. The extreme value theory can be used to effectively calculate the variance-covariance of dynamic data [10].

2. Methodology

At the same time, the development of the financial derivatives market has also intensified market volatility. While financial derivatives have their own hedging capabilities, high leverage allows derivatives to multiply gains and losses, which is a fatal temptation for speculators who prefer risk. The Value at Risk Model (VaR) is the most common method of calculating portfolio risk. Because the traditional GARCH model has many shortcomings such as excessive parameter limits, the innovations of the GARCH family model are numerous, among which the well-known GJR-GARCH, EGARCH, which is considered for the leverage effect, is suitable for the extremely high fluctuation APGARCH. Financial risk refers to the possibility of loss due to the influence of various unpredictable uncertainties in the process of financing and operation of monetary funds, which makes the actual income of fund managers deviate from the expected income. With the application and improvement of this method, it has gradually become the main method to control market risk. VaR method is characterized by using a simple market risk to evaluate investment risk. Moreover, the method is intuitive and clear, and investors with no professional background can make judgments by observing the value.

The next step is to test the accuracy of C VaR model under the assumption that securities returns are independent of each other. The test results are shown in Table 1.

Table 1. LE Test Results of C VaR Model Based on Gauss Distribution and Stable Distribution under the Assumption of Independence of Securities Returns

Project	LEE of 95% C VaR	LEE of 97.5% CVaR	LEE of 99% C VaR
Gaussian distribution	0.096	0.182	0.147
Stable distribution	0.047	0.061	0.35

There are many methods to calculate VaR, among which there are four main methods: historical simulation, Monte Carlo simulation, parameter method and extreme value method. Because investors never fear that the return value is higher than the expected value, they are more concerned about the inadequate part, which makes the semi-variance closer to the investors' psychology. Secondly, the difference between VaR and traditional risk assessment methods is that VaR risk indicators can measure and predict risks in advance. With the increase of the scale, dynamics and complexity of financial markets and financial transactions, and the development of financial theory and financial engineering, financial market risk measurement technology has become more comprehensive and complex. Wu Zhenxiang and Chen Min et al. (2006) first used Copula-GARCH method to investigate the risk of multi-asset portfolio investment, calculated the VaR value of portfolio investment at a certain time in the future, and gave the specific form of the corresponding portfolio weight under the principle of minimum risk. The impact of policy on transaction costs is an indirect factor of portfolio risk. Early VaR was only a way of measuring risk, and it was easy to report to management and decision makers. It was a passive and passive application. Under the trend of increasing global economic linkages and increasing openness of China's capital market, the risks faced by investors will be more complex, international and diversified, which raises the management ability and risk control ability of investors. Requirements. Therefore, the promotion of VaR risk measurement method has great significance in China's capital market.

Let us visually understand the inadequacy of the Va R tail loss measurement. Suppose there are two portfolios A and B, and their investment loss distribution is shown in Figure 1.

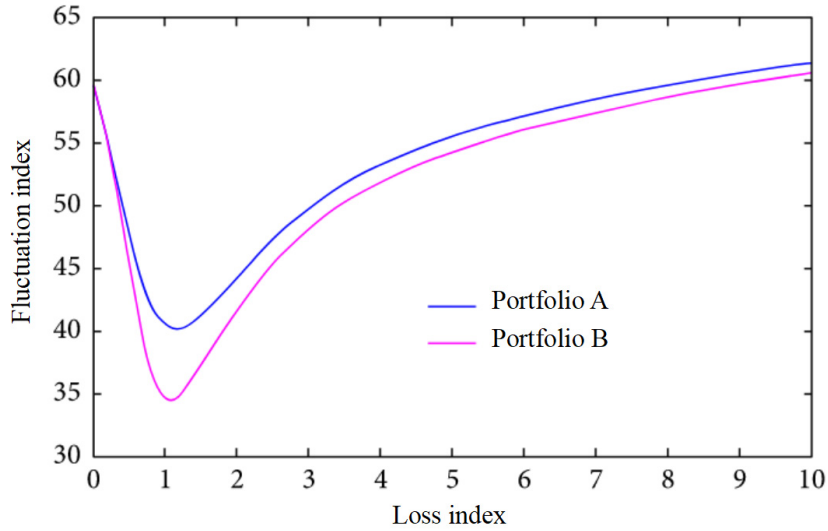

Fig. 1 Loss distribution of two portfolios

3. Result Analysis and Discussion

Regarding the VaR research, the VaR (Value-at-Risk) model first introduced by JP. Morgan was later developed into the CreditValueatRisk model, which is mainly to calculate VaR with RiskMetrics under the assumption of normal distribution. Generally, the policy indicators affecting financial markets can be divided into medium- and long-term continuous policies. The margin level in the transaction process, taking into account the stability and activity of the financial market, is the core of ensuring the financial market risk management system. Considering the income or risk of portfolio investment consisting of multiple assets, there is often a strong correlation between financial asset returns. Therefore, it is not enough to model and analyze the marginal distribution. It is necessary to consider how to construct the joint distribution of assets in the portfolio. Since we generally only discuss the loss caused by risk, the concept of risk can be further expressed as "the possibility of loss due to uncertainty of time results". Another advantage of VaR method is that it provides regulatory basis for regulators, and incorporates various risk factors into the model design, including interest rate risk, exchange rate risk, stock and commodity price risk and other market risks. Therefore, scholars have conducted a direct measurement of investor losses. Value at Risk (VaR) is a typical representative of this risk measurement method.

The failure number of the corresponding model samples can be calculated by combining the VaR values calculated by the three models. The test results are shown in Figure 2.

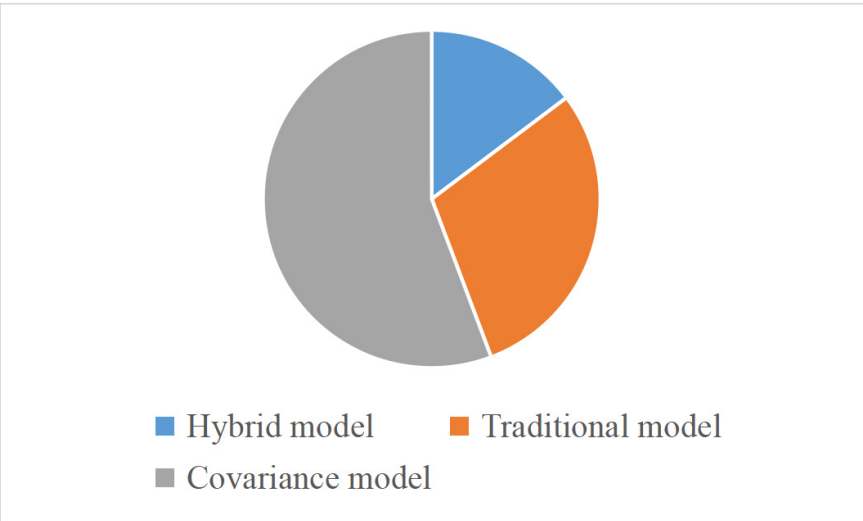

Fig. 2 Loss Rate of POT-VaR Mixed Model and Other Models

VaR refers to the maximum loss that a portfolio or a single asset may suffer in the foreseeable future under the normal operation of the market, given the probability level and holding period. The extreme value method is also a parameter method in essence, but it does not impose a specific model on the distribution of returns, but explains the tail distribution by the data itself, which reduces the risk of the model. However, the calculation is complex, and the accuracy of the VaR estimated by the extremum method is not very good for a large confidence level. If the degree of risk aversion is low, the confidence interval can be broadened, but the accuracy of prediction will be reduced. At present, the main methods of financial market risk measurement include Lux coefficient method, volatility analysis method and VaR method used to measure downside risk. The change in yield is the most direct factor affecting portfolio risk. A good investment environment is a prerequisite for the effective functioning of the portfolio in financial markets. But with the shift in VaR' s application philosophy, it is now more of an active risk management tool to help investors manage risk and control losses through adjustments to the portfolio structure, not just negatively measuring risk. Obviously, it is difficult to provide a satisfactory explanation for the basicacts of the financial product structure and the intrinsic link between the investment structure and the development of financial products, out of the specific needs of the portfolio for the allocation of funds.

4. Conclusion

In the past, when scholars studied VaR and CVaR, the preconditions were that the securities yields were subject to Gaussian distribution, but the study found that the securities yields showed the characteristics of sharp peaks and thick tails. Both historical simulation and Monte Carlo methods rely on historical data. It can be seen from the examples that the difference in VaR values calculated by these two methods is relatively large. As a widely used advanced risk assessment method, VaR will introduce China's securities portfolio risk assessment to promote the development of China's securities market, which will help to measure risks and lay a good foundation for financial risk management. Risk information is helpful to identify the main sources of risk in all risk exposure, which provides important help for us to improve the overall risk situation, evaluate investment opportunities, and analyze the impact of asset adjustment on portfolio risk. The author chooses the application in calculating portfolio VaR. Compared with previous studies, this paper considers the leverage effect and the disadvantage of parameter limitation in general GARCH. The EGARCH model is selected to model the marginal distribution of return rate, which has a good effect. The results show that the POT-VaR hybrid model is more accurate than the traditional VaR model in capital loss, and more effective than the VaR model based on variance-covariance method in data validity.

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