

Application of statistics and data analysis tools in the risk management of financial markets

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ABSTRACT

financial market risk management is the financial institutions and investors in the face of market volatility, uncertainty and potential losses of a series of strategies and measures, and a series of strategies and measures are based on statistics and data analysis tools under scientific analysis as a decision aid, this paper aims to introduce the risk and decision-making tools in the financial market.

1 Introduction

Financial risk management refers to the gains and losses between profit and profit organizations and non-profit organizations and non-profit organizations. With the development of financial integration and economic globalization, financial risks are becoming increasingly complex and diversified, and the importance of financial risk management becomes more and more prominent. It includes the identification of financial risk, measurement, and control risk classification^[1].

According to the root cause of financial risk: static financial risk and dynamic financial risk. Static financial risk refers to the risk caused by natural disasters or other force majeure, which basically conforms to the law of large numbers and can be predicted more accurately. Dynamic financial risk is the risk caused by the change of macroeconomic environment. The probability of its occurrence and the influence of each occurrence change with time, so it is difficult to accurately predict^[2].

According to the scope of financial risk involved: micro financial risk and macro financial risk. Microfinancial risk refers to the possibility that the subject participating in economic activities will lose its assets and reputation due to changes in the objective environment, decision-making mistakes or other reasons. Macro financial risk is the sum of all micro financial risk^[3].

According to the categories of financial institutions: bank risk, securities risk, insurance risk, trust risk and other theoretical basis: early financial theory that in a perfect market, hedging or hedging can not affect the value of the company. However, in the real economic life, the financial risk management has attracted more and more attention from the academic circle and the practical circles. The parties advocating financial risk management believe that the demand for risk management is mainly based on the following theoretical basis: the real economy and financial markets are not perfect, so the value of the company can be enhanced through risk management^[4].

2 Financial risk management objectives

The ultimate goal of financial risk management is to control and prepare the possible financial risks on the basis of identifying and measuring risks, so as to prevent and reduce losses and ensure the steady progress of monetary fund raising and business activities.

Risk evaluation: including the evaluation of financial risk identification, financial risk

measurement, the selection of various risk disposal tools, and financial risk management countermeasures. Among them, risk identification is the first step of financial risk evaluation, which refers to the actual investigation and the analysis of various documents, the use of various methods to identify the potential and existing risks that have not occurred, and measure the probability and loss range^[5].

2 Classification and application of statistical and data analysis tools

Risk measurement: Risk measurement is an important part of risk management in financial markets. The following are some cases of the application of risk measurement in financial markets:

2.1 VaR (Value at Risk, Value at Risk)

Bank market risk management: For example, the concept of VaR proposed by JP Morgan company is widely used in the market risk management of banks. By calculating the maximum possible loss of a portfolio at a certain confidence level, banks can quantify market risk management. Assuming a banks stock portfolio has a VaR of \$10 0,000 in the next week, there is a 95% chance that the portfolio will lose no more than \$10 0,000 in that period. Banks can adjust their investment strategies, set stops, and allocate capital according to this VaR value.

Securities investment decisions: Investors can use VaR to assess the risk size of different securities or portfolios to make more reasonable investment decisions. For example, when choosing a stock, if two stocks have similar expected returns, but one has a higher VaR, then investors may be more likely to choose the stock with a lower VaR, because its potential loss risk is relatively small^[6].

2.2 CVaR (Conditional Value at Risk, conditional value at risk)

Credit risk management of financial institutions: In credit risk management, CVaR can help financial institutions to evaluate the possible losses when the borrower defaults. For example, when making loans, banks will calculate the CVaR of customers with different credit grades to determine the appropriate loan interest rates and guarantee requirements. For customers with lower credit ratings, with higher CVaR, banks may demand higher interest rates or stricter guarantee measures to reduce risk. **Asset Management performance evaluation:** Asset managers can use CVaR to evaluate the performance of their fund managers. CVaR considers not only the average returns of fund managers, but also their losses in extreme cases. If a fund manager has a lower CVaR, it can better control its losses when the market falls, which is a positive signal for investors to say^[7].

2.3 ES (Expected Shortfall, expected loss)

Insurance product design: insurance companies can use ES to calculate the average loss amount of insurance that may be paid under different risk scenarios. For example, when designing a property insurance product, the insurance company will calculate the ES at different levels of loss based on historical data and risk models to determine the insurance rates and payout limits. This ensures that insurance companies can make reasonable profits while taking the risks.

Financial derivatives pricing: In the financial derivatives market, ES can be used to price derivatives such as options and futures. By calculating the average loss of derivatives over a specific period of time, traders can help to determine a reasonable buying and selling price. At the same time, ES can also help investors assess the risk level of derivatives to make more informed investment decisions^[8].

2.4 MDD (Maximum Drawdown, maximum drop)

Investment strategy adjustment: investors can adjust their investment strategy according to MDD. If a portfolio's MDD is found to be too high, investors can consider reducing the proportion of their investments in the portfolio, or adding other assets with low correlation to spread the risk. In addition, investors can set stops based on MDD to avoid excessive losses^[9] when the market falls sharply.

2.5 DaR (Drawdown at Risk, risk drop)

Hedge fund risk management: Hedge funds typically use the DaR to measure the risk exposure to their portfolios. Through hedging strategies, hedge funds can reduce the DaR of the portfolio and reduce the impact of market volatility on the portfolio. For example, a hedge fund may use futures contracts to hedge its stock positions, thereby reducing the DaR of its portfolio. Asset allocation of individual investors: Individual investors can refer to DaR to choose the appropriate investment products in their asset allocation. If an investment product has a low DaR, it means that its loss when the market falls is relatively small, which is a more appropriate choice for individual investors with low risk tolerance. At the same time, individual investors can also combine the products of different DaR according to their risk preference and investment objectives to achieve the purpose of risk diversification^[10].

3 Factor model

Stock market analysis: In the stock market, the factor model can help investors to understand and manage the market risk. For example, by including factors such as the market index, industry index, and company size in the model, investors can analyze the relationship between the price changes of individual stocks and these factors. If a change of a factor is found to have a large impact on the stock price, investors can adjust the portfolio according to the change of the factor to reduce the risk. Risk management strategy development: Financial institutions can use factor models to develop risk management strategies. In addition, the banks can also monitor the changes in the market risks through the factor models, and timely adjust the risk management strategies to deal with the potential risk^[11].

4 Time-series analysis

Exchange rate risk forecast: In the foreign exchange market, time series analysis can help investors to predict the fluctuation trend of the exchange rate, so as to develop the corresponding risk management strategies. Based on the forecast results, investors can take appropriate hedging measures, such as the purchase of foreign exchange options or futures contracts, to reduce currency risk. Interest rate risk management: For bond investors, interest rate risk is an important influencing factor. Time series analysis can help investors predict trends in interest rates to adjust their bond portfolios in a timely manner. For example, if interest rates will rise in the future, investors can reduce the proportion of long-term bonds and increase the proportion of short-term bonds to reduce the interest rate risk^[12]. The application of risk measurement technology in financial markets is widely used and important. Through the rational use of these technologies, financial institutions and investors can better identify, assess and manage risks, and improve the stability and efficiency of the financial markets.

5 Conclusion

To sum up, statistical and data analysis tools play an indispensable role in risk management in financial markets. They not only help financial institutions to assess and manage risk more accurately, but also provide strong support for investment decisions. However, it should be noted that any risk management tool is not a panacea, and financial institutions need to use them flexibly in combination with the actual situation and the market environment. With the continuous development and innovation of the financial market, the types and complexity of financial risks are also increasing. Financial institutions need to constantly update and improve the concept and methods of risk management to cope with new challenges. In short, financial market risk management is a complex and important field, which requires financial institutions and investors to constantly learn and adapt to it. By establishing a sound risk management mechanism and process, the risk resistance ability of financial institutions can be improved and the stable operation of the financial market can be guaranteed.

Funding

Fund performance evaluation: fund companies will pay attention to MDD indicators when evaluating the performance of their funds. MDD reflects the funds decline from peak to low over a period of time, and it can help investors understand the funds volatility and risk tolerance. For example, a fund with a larger MDD indicates that it may suffer large losses when the market falls, which may not be appropriate for investors with low risk tolerance.

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