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Application and Optimization Strategy of Financial Engineering in Risk Management

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Abstract: Financial engineering, as a collection of mathematics, statistics, engineering, computer science and other multidisciplinary fields, provides strong technical support for risk management. Through the technology and methods of financial engineering, risks can be quantitatively analyzed, predicted and controlled, so as to help enterprises and financial institutions better cope with risks and ensure their stable operation. Through the study of risk management practice, we can constantly improve the theoretical system of financial engineering and make it more realistic.

Keywords: Financial engineering; Risk management; Application and optimization; Strategy

1. Research background

With the continuous development of the global economy and the increasing complexity of the financial market, financial engineering plays an increasingly important role in risk management. Especially in the past few decades, the frequent global financial crises, such as the global financial crisis in 2008, make risk management become an indispensable part of financial institutions and enterprises. The application of financial engineering in risk management is not only the application of theory, but also the summary and refinement of practical experience.

Traditional risk management methods often rely on experience and intuition, and lack science and accuracy. With the application of financial engineering, risks can be analyzed more accurately and quantitatively through mathematical models and algorithms, thus improving the efficiency and accuracy of risk management. The stability of financial markets is essential to the health of the overall economy. The application of financial engineering in risk management can help financial institutions and enterprises to better identify, evaluate and control risks, thereby reducing systemic risks in financial markets and promoting market stability and development.

The application of financial engineering can not only better manage risks, but also drive innovation in financial products and services.

2. Current situation of financial engineering risk management

Financial engineering risk management is a complex system involving multiple subject areas, which aims to identify, evaluate, monitor and control various risks faced by financial institutions in the course of operation. With the continuous development and innovation of the global financial market, financial engineering risk management plays an increasingly important role in ensuring financial stability and promoting economic development. This paper will expand the current situation of financial engineering risk management from the perspective of literature review at home and abroad.

In recent years, domestic scholars have achieved fruitful research results in the field of financial engineering risk management. These studies not only involve the theoretical framework and methodology of risk management, but also cover the practical application and case studies of risk management. In terms of theory, domestic scholars have proposed risk management models based on financial markets, such as risk measurement methods based on VaR (value at risk) and CVaR (conditional value at risk), and risk assessment methods based on extreme value theory and Monte Carlo simulation. These models and methods provide financial institutions with more scientific and accurate risk management tools. In practice, domestic scholars combined with the actual situation of China's financial market, the application of risk management has been deeply studied. For example, domestic scholars have put forward corresponding management strategies and measures for different types of risks such as bank credit risk, stock market risk and foreign exchange risk. At the same time, domestic scholars also evaluate and analyze the actual effect of risk management based on specific cases, which provides useful reference for financial institutions.

Compared with the domestic, foreign scholars in the field of financial engineering risk management research started earlier, and the research results are more abundant. The research focus of foreign scholars mainly focuses on the theoretical innovation and technical application of risk management. In terms of theoretical innovation, foreign scholars have put forward a variety of theoretical models and methodolo-

gies for risk management. For example, option pricing theory, portfolio theory, capital asset pricing model and other classical theories provide theoretical basis for risk management. In addition, foreign scholars also put forward corresponding management strategies and models for different types of risks, such as CreditMetrics model for credit risk and VaR model for market risk. In terms of technology application, foreign scholars have actively explored the application of new technology in financial engineering risk management. For example, the application of emerging technologies such as big data technology, artificial intelligence technology, and blockchain technology has brought new opportunities and challenges to risk management. The application of these technologies can not only improve the efficiency and accuracy of risk management, but also help financial institutions better cope with the complex and changeable financial market environment.

Scholars at home and abroad have achieved fruitful research results in the field of financial engineering risk management. These achievements not only provide financial institutions with more scientific and accurate risk management tools and methods, but also provide a strong guarantee for the stability and development of financial markets. However, with the continuous innovation and development of financial market, financial engineering risk management still faces many challenges and opportunities. In the future, we need to further strengthen academic exchanges and cooperation at home and abroad, promote the continuous innovation and development of financial engineering risk management theory and technology, and make greater contributions to the stability and development of the financial market.

3. Application of financial engineering in risk management

3.1 Price risk control

Financial engineering can realize effective control of price risk in risk management practice. Due to the fluctuation of exchange rate, interest rate and other factors, price risk is a common risk type. Financial engineering, through innovative applications, can optimize the risks associated with price fluctuations. It has a variety of tools and instruments that can be used individually or in combination to play an integrated role in risk management. Financial engineering enables precise risk management, especially "peer-to-peer" risk control.

Financial engineering, as a comprehensive subject that applies financial theory and engineering technology to solve financial problems, plays a vital role in risk management. Especially in the price risk control, the application of financial engineering is indispensable. Price risk, also commonly referred to as market risk, is the possibility of loss of asset value due to changes in market prices (such as interest rates, exchange rates, stock prices, commodity prices, etc.).

Financial engineers use sophisticated mathematical models and statistical methods to quantify and predict price movements. Through the analysis of historical data, the prediction model is established, and the corresponding risk management strategy is formulated on this basis. Hedging, which involves buying and selling different financial products at the same time, reduces the risk of price changes in a single product. For example, buying a stock is accompanied by selling the corresponding futures contract to mitigate losses from a fall in the share price. Financial engineering also emphasizes spreading risk by diversifying investments. Investing your money in a number of different markets, asset classes or regions reduces the impact of a single market or asset price movement on your entire portfolio. VaR is a measure of the maximum possible loss of a financial asset or portfolio over a certain period of time at a certain level of confidence. By calculating VaR, financial engineers can more accurately assess and manage price risk. Financial engineering also emphasizes the dynamic management of risk. This includes regularly reassessing risks, adjusting risk management strategies, and taking timely responses to changes in the market.

To sum up, financial engineering has wide application and far-reaching influence in price risk control. It not only helps financial institutions and enterprises to predict and manage price risk more accurately, but also promotes the stability and development of financial markets by providing scientific risk management tools and strategies.

3.2 Improve the technical level

Financial engineering has played an important role in improving the technical level of risk management and has provided strong support for the steady development of the financial industry. With the continuous progress and innovation of technology, the application of financial engineering in the field of risk management will be more extensive and in-depth.

Financial engineering has effectively promoted the improvement of technical level in risk management. In the context of financial engineering, associated risk management projects can demonstrate a higher level of professionalism. Financial engineering improves the accuracy and efficiency of risk identification, assessment, monitoring and control by introducing advanced mathematical models, algorithms and computing techniques.

Financial engineering has played an important role in upgrading the technical level of risk management. Through the use of advanced mathematical models, statistical methods and computational techniques, financial engineering can identify, quantify and manage various financial risks more accurately. These risks may stem from many aspects such as market fluctuations, credit risks, and operational errors. By constructing complex financial models and algorithms, financial engineering can carry out refined analysis and prediction of these risks and

provide scientific decision-making basis for financial institutions.

At the same time, financial engineering also provides more means and options for risk management through innovative financial products and instruments. For example, by designing various derivative products, financial institutions can hedge and transfer risks and reduce risk exposure. In addition, financial engineering also promotes the popularization and application of risk management technology, so that more financial institutions can enjoy efficient risk management services.

3.3 Control quantity risk

In financial engineering, quantitative risk refers to the uncertainty of sales volume, trading volume, and output of related products. This risk mainly comes from the supply of users and producers. Financial engineering provides two kinds of effective financial products to control quantitative risk: one is commodity options, and the other is derivative products designed according to the actual production and operation of enterprises. These financial products can help companies lock in risks, hedge potential losses, and optimize risk management strategies.

In financial engineering, quantitative risk control and management is very important. Due to the uncertainty of sales volume, trading volume and production of related products, enterprises and investors are often faced with the risk of potential losses. This risk mainly comes from the fluctuation of user demand and the instability of producer supply. In order to effectively deal with these challenges, two important financial products have been developed in the field of financial engineering: commodity options and derivative products based on the actual production and operation of enterprises.

A commodity option is a financial contract that gives the holder the right to buy or sell an asset at a specific price at a specific time in the future. By purchasing options on commodities, businesses can lock in the cost of buying when the market price rises or the selling price when the market price falls. This mechanism provides flexibility in risk management and helps companies hedge against potential losses.

On the other hand, derivatives designed according to the actual production and operation conditions of enterprises, such as forward contracts, swaps and structured financial products, also provide enterprises with more personalized risk management solutions. These derivatives can be customized according to the specific needs and risk tolerance of enterprises, thereby helping enterprises to better manage quantitative risk and optimize risk management strategies.

In addition to controlling quantitative risk, these financial products can bring other advantages to companies. For example, by using derivatives for hedging operations, companies can reduce inventory costs, improve capital utilization efficiency, and optimize supply chain management. In addition, these financial products can also provide more financing channels for enterprises and promote the development and expansion of enterprises. However, while financial engineering provides effective tools to control quantitative risk, businesses also need to pay attention to risk management and compliance when using these products. Enterprises should establish a sound risk management mechanism to ensure that they will not speculate excessively or violate relevant laws and regulations when using financial products for risk management. At the same time, enterprises should also strengthen the monitoring and analysis of market dynamics in order to adjust risk management strategies in time to deal with potential market risks.

4. Optimization countermeasures of financial engineering in risk management

4.1 Use of credit swaps to manage credit risk

The enterprise can pay the accounts receivable insurance premium to the swap counterparty on a regular basis, and when the accounts receivable default occurs, the enterprise can get compensation from the swap counterparty or sell the accounts receivable to the swap counterparty at a favorable price. In this way, credit risk can be reduced and capital structure can be optimized without increasing financial risk.

Credit swap is a kind of financial derivative instrument, widely used in the field of credit risk management. Its core principle is to transfer the credit risk borne by one party to the other party through the form of contract, so as to realize the dispersion and management of credit risk. Such swaps allow participants the flexibility to adjust the allocation of credit risk according to their own risk tolerance and risk appetite.

In practical application, the credit swap market provides investors with a wide range of options, and they can choose different types of credit swap contracts according to their needs, such as total income swaps, credit default swaps, etc. The underlying assets in these contracts can be corporate bonds, loans, or even the debt of an entire country. By buying or selling these contracts, investors can effectively hedge or increase credit risk, thereby diversifying their portfolio and managing risk.

In addition, the credit swap market provides financial institutions with an important risk management tool. For example, a bank can reduce its own exposure by selling credit default swap contracts that transfer the credit risk of its loan portfolio to other investors. Such operations not only help banks improve the risk structure of their balance sheets, but can also create additional revenue streams for them.

However, there are certain risks and challenges in the credit swap market. First, because credit swap contracts often involve complex pricing and valuation issues, they require specialized financial knowledge and technical support. Second, the liquidity of the credit swap mar-

ket can be affected by market conditions, especially in times of financial crisis, when the market may experience severe illiquidity. Therefore, when using credit swaps for risk management, investors need to fully consider these factors and develop a reasonable investment strategy.

4.2 Optimize capital structure with swap technology

The swap technology provided by financial engineering can break through various limitations of increasing debt ratio, reduce financing cost and optimize capital structure. For example, the use of interest rate swaps can reduce financial risk so that the weighted average cost of capital falls faster as the ratio of liabilities increases. This kind of financial innovation helps enterprises maintain a dynamic optimal capital structure, so as to better respond to market changes and business operational risks.

Swap technology is a derivative instrument commonly used in the financial market, through which enterprises can effectively optimize their capital structure, thereby improving their financial soundness and operational efficiency.

Swap technology is a financial contract in which two or more parties agree to exchange a series of cash flows. According to the type of exchange cash flow, swaps can be divided into interest rate swaps, currency swaps, commodity swaps and equity swaps. These swap instruments provide enterprises with flexible risk management means and help to optimize the capital structure. Capital structure is an important embodiment of enterprise financing, which has an important impact on enterprise's operating results and financial risks. Optimizing the capital structure helps to reduce the financing cost of enterprises, improve the financial soundness, and create greater value for enterprises. Through swap technology, enterprises can effectively adjust their capital structure to adapt to the changes of market environment and the needs of corporate strategy development.

Through interest rate swaps, companies can convert fixed-rate debt into floating rate debt, or convert floating rate debt into fixed rate debt. This helps companies cope with the risk of interest rate fluctuations and reduce the cost of debt, thereby optimizing the capital structure. Currency swaps enable companies to convert their liabilities from one currency to another to cover exchange rate risk. Through currency swaps, enterprises can lock in favorable exchange rates and reduce the impact of exchange rate fluctuations on corporate finance, thereby optimizing capital structure. These swaps can be used to manage the risk of commodity prices and stock prices. Through these swaps, enterprises can adjust the risk level of their asset portfolios, optimize the capital structure, and improve the overall financial performance of enterprises.

Through swap technology, enterprises can effectively manage risks such as interest rates, exchange rates, commodity prices and stock prices, and reduce financial risks and operational risks. Swap technology enables companies to adjust their debt costs, reduce financing costs, and improve corporate profitability. Swap technology provides enterprises with flexible financing methods, so that enterprises can adjust the capital structure according to the needs of market environment and corporate strategic development.

Before implementing swap technology, enterprises should fully assess the risks they may face to ensure that they have appropriate risk management capabilities. Enterprises should formulate reasonable swap strategies according to their own financial situation, market environment and strategic objectives to ensure the effective application of swap technology. Enterprises should establish a sound risk management system, including risk assessment, risk monitoring, risk response, etc., to ensure the smooth implementation of swap technology and continuous optimization of capital structure.

4.3 Stabilize the balance between corporate income and risk

Through the combination of financial instruments and process adjustment, financial engineering can effectively reduce the impact of large price fluctuations on business performance and stabilize corporate earnings. At the same time, financial engineering can also avoid the government's financial regulatory constraints on enterprises and balance the financial risks in operation and development. According to the specific situation of enterprises, financial engineering can formulate personalized financial strategies, design and use new financial instruments in financing, investment, risk management, etc., so as to maximize the value of enterprises.

Stabilizing the balance between corporate returns and risks is a complex and critical management challenge, which requires enterprises to properly deal with various uncertainties and potential risks while pursuing economic benefits. In a highly competitive market environment, enterprises not only need to pay attention to how to improve earnings through innovation and optimization of operations, but also to be alert to potential risk factors, such as market fluctuations, technological changes, regulatory changes, etc., which may adversely affect the stable earnings of enterprises.

In order to achieve the steady growth of revenue, enterprises usually adopt a series of strategies, such as expanding the market, improving production efficiency, reducing costs and so on. However, these strategies often come with certain risks. For example, excessive expansion may lead to a tight capital chain, and technological innovation may lead to rising costs. Therefore, how to keep the risk controllable while pursuing profit has become an important topic of enterprise management.

The art of risk balancing is to find the right balance between return and risk. This requires enterprises not only to have a keen market in-

sight and flexible strategic adjustment ability, but also to establish a sound risk management system. Through risk assessment, risk early warning, risk response and other measures, enterprises can effectively avoid or mitigate the impact of potential risks on corporate stability while pursuing returns.

5. Summarize

Financial engineering risk management is a growing and progressive field that covers multiple aspects including portfolio optimization, derivative pricing, market risk assessment, credit risk management, and more. With the continuous development of the global financial market and the continuous emergence of financial innovation, financial engineering risk management plays an increasingly important role in ensuring financial security, improving investment returns, and promoting economic development.

The rapid development of financial technology has provided a broader application scenario and more efficient technical means for financial engineering risk management. For example, the application of emerging technologies such as big data, artificial intelligence, and blockchain will greatly improve the accuracy and efficiency of financial engineering risk management and promote the steady development of financial markets. Financial engineering risk management also needs to constantly adapt to new regulatory policies and regulatory requirements. With the continuous standardization and improvement of the financial market, the regulatory authorities have higher and higher requirements for the risk management of financial engineering. Therefore, financial engineering risk management needs to pay more attention to the construction of compliance and risk management framework to meet the regulatory requirements and improve the level of risk management.

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