

Research on the Advantages and Application of Financial Engineering in Financial Risk Management of Enterprises

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Keywords: financial engineering, enterprise, risk management, advantages, applications

Abstract: With the rapid development of the market economy in the 21st century and the continuous innovation and progress of financial markets, financial engineering technology is also rapidly improving. Especially for the financial risk management of enterprises, great progress has been made. Based on this, the advantages and applications in enterprise risk management are analyzed in this article. First of all, an overview of financial engineering is introduced, its meaning, operating principles and characteristics are introduced, then the advantages of financial engineering are explained from four aspects, and then the applications in management are analyzed, mainly are the management and control of price risk, agency risk, investment risk, and quantity risk. Then it analyzes the problems existing in the development of financial engineering in China and proposes corresponding strategies accordingly. Financial engineering creates huge benefits for the market and has a profound impact in the financial field.

1. Introduction

The financial market changed in the 20th century, and crises pervaded, and financial engineering was born under such a background. Finance is a necessary condition for economic development. The further development of finance cannot be separated from the high emphasis on risk management [1]. At present, both computer technology and mathematical analysis technology have been applied in financial engineering, providing strong theoretical guidance and technical support for problems in financial development and improving risk management. Financial engineering as a new type of financial product will have broad development space [2].

2. Financial Engineering Overview

2.1 The Meaning of Financial Engineering

From a narrow perspective, financial engineering mainly refers to the use of mathematical and computer technologies to carry out different forms of combination and decomposition of financial products on the basis of various existing basic financial products [3]. In the broad sense, financial engineering generally refers to the technical means of using engineering methods to solve financial problems, involving various aspects of financial product prices, risk management and control.

2.2 Principles of Financial Engineering

The operating principle of financial engineering is mainly divided into the following four items: risk transfer and redistribution, comparative advantages and swaps, mitigation of information asymmetry, and increased liquidity.

2.2.1 Risk transfer and redistribution

Market participants have different attitudes towards risk. Financial engineers use risk analysis and optimization techniques to create a large number of financial derivatives and risk management strategies to redistribute original risks between different topics. The core of engineering is to

introduce effective management tools and design complex risk management skills, including: futures contracts, options contracts, floating rate tools, asset and liability management, optimized risk evaluation and measurement technology, and various hedging technologies [4].

2.2.2 Comparative advantage and swap

Comparative interest refers to the fact that as long as there are differences in relative costs between different entities in the same period, that is, comparative advantages, through the exchange of comparative interests between the parties, all parties can reduce operating costs. Financial engineering takes full advantage of the relative differences in operating costs in the financial market, resulting in a large number of Swap financial instruments.

2.2.3 Mitigation of information asymmetry

The method of financial engineering is to design a "signal display" mechanism. Without infringing the principle of confidentiality, people with incomplete information can use this method to learn more. For example, "sellable stocks" stipulate that if when the ordinary stock price of the investor is lower than a certain set value, the holder can sell the resellable stock to the issuer at a preset price. This preset price shows investors the issuer's view on the future value of the company. For another example, "best-sale", the issuer bears the risk that the securities cannot be issued in full, forcing the issuer to try its best to sell, show its internal information, and reduce the risk of investors.

2.2.4 Increase liquidity

Financial engineering has used the liquidity of different products to create many new products, such as money market funds, and the use of financial engineering to increase liquidity can standardize non-standardized financial instruments so that they can be realized in the secondary market [5].

2.3 Characteristics of financial engineering

The most direct purpose of financial engineering is to avoid financial risks. Financial engineering uses a variety of modern financial methods and financial methods to deal with various types of economic difficulties, implement risk management, tap profit opportunities, and achieve high efficiency in the market. Strong mathematical rationality is reflected in engineering, and mathematical knowledge has become an important form of financial product pricing. The mathematical knowledge needed to have not only breadth but also depth. Not only that, financial engineering also reflects the characteristics of engineering. It is a reasonable combination of index science and natural science that makes financial engineering specialization and scientificization a favorable form of risk aversion.

3. Advantages of Financial Engineering in Risk Management

Financial engineering refers to the use of engineering technology to deal with financial problems. In essence, financial engineering is a creative thinking method for solving financial problems and the embodiment of this method—the design and application of new financial instruments, whose purpose is to provide services to customers. Financial engineering emerged from financial institutions in the 1970s in order to solve some practical problems in risk management, and it developed rapidly in the 1980s and 1990s, so that it surpassed the original field of risk management [6]. There is a blood relationship between them, and risk management is the core content of financial engineering. Generally speaking, the method of financial engineering management risk can be achieved without changing the original risk trend by establishing a risk trend that is exactly opposite to the original business positions to perfectly balance the risks of off-balance sheet business and on-balance sheet business. Financial engineering has the following advantages:

3.1 Higher Accuracy and Timeliness

When using financial engineering for risk management, a large number of engineering thinking methods are introduced, and mathematical modeling, numerical analysis, artificial intelligence and simulation simulation, and computer technology are used to identify, analyze, and evaluate financial

risks, and select the appropriate technology combination. It can be said that quantification and modeling has become an important feature of financial engineering management risk, and this change directly reflects the scientific measurement and management of financial risk. For example, the Var model can be used to reduce the risks faced by assets. Summarized by a number that gives probability loss, it is very clear and intuitive, thereby improving the accuracy of risk management. Financial engineering technology enables the risk management of economic entities to be provided through products and financial transactions are resolved. Derivative financial products are the main products currently managed by economic entities. Financial engineering has always played a key role in designing and creating rich derivative financial products. Because the price of derivative products is controlled by the underlying instruments changes, and such changes have obvious regularity, and through accurate pricing of derivatives and transaction matching, risks can be accurately avoided. The liquidity of mature derivatives can respond flexibly to changes in market prices and follow the underlying trading position changes in time and adjustment at any time, which better solves the time lag of risk management by traditional risk management methods [7].

3.2 Cost Advantage

In the face of risks, financial engineering often uses financial derivative products or tools designed by itself to achieve risk diversification, risk control, and risk transfer, so its cost advantage is mainly reflected through derivative products and their transactions. First, financial derivatives when product transactions are operated, financial leverage is often used, that is, large amounts of transactions can be controlled by paying a small amount of money. The closing of a position after a certain period of time is only for settlement of differences, and the funds used are small, which can greatly save the company's hedging cost. That is, derivative transactions can enable hedgers to achieve effective risk management. Second, because the derivatives of on-the-spot trading create a risk transfer market that can centrally handle risks, this greatly reduces the information cost of finding counterparties, and the standardization and concentration of transactions greatly reduces transaction costs. Third, financial derivatives can also easily improve the structure of assets and liabilities in order to avoid risks and reduce the cost of financing. This is more fully reflected in swap transactions. For example, the most famous first currency swap occurred in the World Bank in 1981 with IBM, and through the swap, IBM converted 10% interest rate German mark debt into 8.15% interest rate USD debt (at the time, the U.S. Treasury's funding cost was about 15% interest rate) For the World Bank, the ability to convert 16% interest rate USD debt to 10.13% interest rate DM debt is lower than raising directly in the Mark bond market. Both have enjoyed cost benefits, and it also avoids exchange rate risks arising from the use of currencies that are different from the financing currency [8].

3.3 Greater Flexibility

The reason why financial engineering instruments represented by financial derivatives can gradually replace traditional management tools and become important risk management tools is inseparable from the economic function of dismantling risks. Financial engineering can carry out the risks of basic financial instruments. "Unbundling" separates various risks in basic financial instruments, and then "bundles" some risks together as needed, so that hedging people can avoid most risks in normal operations through a certain method. Investment banks based on this, the family can create financial products at any time according to customer needs through stripping, combination, and other methods to meet the different risk preferences and risk management needs of different customers, this flexibility cannot be compared with traditional financial instruments. Financial products have their own magical effects. For example, buyers of options can seize the opportunity of price changes that are beneficial to them to earn income from price changes on the basis of realizing hedging risks, and continue to hedge when price changes are not good for themselves. Financial products created by financial engineering need to hedge risks through market transactions, and it is convenient for traders to make up at any time as needed.

3.4 Can Effectively Avoid Systemic Risks

There are two ideas for risk management: risk diversification and risk transfer. The so-called risk diversification is based on the principle of "don't put all eggs in the same basket" for risk management. The portfolio of securities is the main method. The method can well reduce non-systematic risks and appropriately diversify risks, but it has little effect on systemic risks that account for the majority in the securities market and has great limitations. The so-called risk transfer is to transfer risk to investors with the ability or willingness to take risks [9]. Structured financial derivatives created through financial engineering belong to this way. By using risk diversification, risk control, and risk transfer, they can effectively avoid systemic risks and become a modern financial market. The most important tool for risk management.

4. Application of Financial Engineering in Risk Management

In general, the entire process of modern risk management can be divided into three links, namely risk identification, risk measurement and risk management control.

1) Risk identification

The first step in managing risk is to identify risks, which involve different types of risks. According to different natures, they can be divided into economic risks, political risks, social risks, etc.; according to the scope of occurrence, they can be divided into systemic risks and non-systematic risks. The most important risk classification and identification is to classify according to different causes. The main fees are market risk, credit risk, liquidity risk, and operational risk.

2) Risk measurement

Among all the aforementioned risks, operational risk comparison focuses on qualitative analysis and system construction but is less technical, so the risk measurement mainly focuses on market risk, credit risk and liquidity risk. The risk system includes at least three components: sensitivity analysis, value-at-risk, scenario analysis, and stress testing. Credit risk measurement includes two aspects. The first is the probability of default and the probability of a change in credit status. The second is the estimation of the default loss rate.

3) Risk management and control

Risk management and control mainly includes five parts: risk diversification, risk hedging, risk transfer, risk avoidance, and risk compensation and preparation.

4.1 Financial Engineering's Management and Control of Price Risk

The iron law of value, which fluctuates around the value, has always commanded the behavior of the market, and when the market comes into contact with relevant information, price fluctuations will form, and this fluctuation will bring the risk of capital security returns to market entities. The price risk of financial commodities includes the risks associated with frequent market fluctuations in interest rates, exchange rates, stock returns, commodity prices, etc. Once the price is not in an equilibrium position, there are large loopholes. The loss of financial funds, In order to solve the problem of the equilibrium of financial commodity prices, new financial instruments must be combined using basic financial instruments and derivative financial instruments in financial engineering [10]. Financial engineering's management and control of price risk will be mainly through financial innovation and by providing financial instruments formed by risk management tools and derived financial products create economic value, thereby compensating for risks caused by market fluctuations. Financial engineering provides different management and control methods for different price risks, thereby ensuring effective price risk evasion. Financial engineering can provide a variety of risk management tools that can effectively control and manage price risk, such as forwards, futures, options and swaps.

4.2 Financial Engineering's Management and Control of Agency Risks

Agency risk is mainly concentrated in the company's financial risk management. In modern enterprises, the ownership and management of the company are separated. The manager of the

company does not own the majority of the company's equity. Although the company's profit plan also takes into account the development of the enterprise, but most of the time, it is based on its own interests and seeks to achieve the company's business objectives. However, in the long-term management, because of factors such as market judgment and its own ability and willingness, it affects the realization of economic benefits of the company. It cannot bring the maximum benefits to the company's operation. To this end, the agency risk needs to be controlled and managed in the development of the company. The company's management personnel own the company's shares, so that the interests of the management personnel are tied to the company's operating effect. The company's development provides a guarantee.

4.3 Financial Engineering's Management and Control of Investment Risk

Investment risk means that investors use their idle funds to make commercial investments to achieve corresponding income in a short period of time to achieve the expected goals, but investment in financial markets is always affected by risk factors, and investors' funds. It is likely to suffer losses that make it impossible to achieve the expected goals. The use of financial engineering technology, especially its related derivative financial products, can reduce the impact on investment risk. In investment, you can use a diversified and diversified investment matching model to relevant risks can be hedged to reduce the total loss of capital. Investment risks depend on the type of investment and the timing of investment, and related mathematical analysis in financial engineering will provide a complete technical analysis system and thinking mode to reduce the blindness of investment and improve the targeting of investments.

4.4 Financial Engineering Management and Control of Quantitative Risk

Quantitative risk mainly refers to the phenomenon of too much or too little quantity in the market economy due to insufficient information, the emergence of alternative products, and fluctuations in market demand. The impact on the profit income of the total investment. When economic entities create a large amount of market supply due to good information, excessive investment will be formed under limited market demand, and investment capital recovery will not be in place, which will likely result in Change. Quantitative risk appears to emerge from a smaller economic entity, but it will affect the development of the entire industry, and will eventually affect the entire economic order and economic system. Financial engineering provides commodity options and macro-derived financial products and other types of financial products. The use of these new products will diversify the quantitative risk in the transaction process.

5. Problems Existing in the Development of Financial Engineering in China

5.1 Lack of a Sound Regulatory System

Good financial supervision is a necessary condition for the development of China's financial engineering, but China's current financial supervision system is not complete and there are many problems. First, the content and goals of China's financial supervision are not clear enough, and the content and scope of supervision are too narrow, and the supervision of different financial sectors is too independent, and cannot be jointly supervised between departments, which cannot meet the development needs of the financial market. Second, the methods and means of financial supervision in China are relatively simple, and most rely on administrative approval and on-site supervision. It is similar to the use of laws and economic means of supervision, which cannot be fully and effectively supervised. Finally, the technology of supervision is relatively backward, and it is mainly limited to traditional supervision technologies, lacking the use and innovation of new technologies. Under the regulatory system, it is difficult for China's financial engineering to develop healthily and rapidly.

5.2 Related Theories Are Not Developing Rapidly

The development of financial engineering needs to be based on certain financial theories, but the theoretical development of financial engineering in China is not fast enough. On the one hand, the

theory of financial science in China is relatively backward, and it is rarely involved in modern financial theory and new types of theory. As a result, China's financial engineering is still at the stage of theoretical analysis, qualitative analysis and empirical analysis, while mathematical analysis, statistics, and other cutting-edge science and technology have not been applied well in the study of financial theory. On the other hand, the financial engineering talent training mechanism in China is also not perfect. Most of the talent training mechanisms are set up in schools. The courses offered by universities are similar to the courses in finance. There is less teaching of financial engineering, and the theory and practice-related education is not perfect. The ability of mathematical analysis is poor. It is impossible to use financial engineering to design products and avoid risks. It is far from meeting the requirements of China's financial industry for relevant talents. Theoretical learning and application cannot be integrated, which has seriously inhibited the development of China's financial engineering.

5.3 Deficient Market Entities

Financial engineering can be developed efficiently only in a more developed financial market, and China's current market players are not perfect. The current financial market players in China are mainly state-owned commercial banks, state-owned enterprises, and non-state-owned economic units. The pace of reform is slow, and the operating system of the enterprise is very flawed, and it has not completely departed from the operating mechanism of the "planned economy." At the same time, the goal of enterprise-oriented operation of state-owned financial institutions has not been achieved, which makes it easy to achieve high returns, and the corresponding high risks are borne by the country.

6. Financial Engineering Development Strategy

6.1 Further Improving the Financial System

Financial engineering has a certain degree of complexity and is a relatively systematic project. It must rely on the macroeconomic system as a foundation, and it must also attach great importance to the development of financial markets from a micro perspective. In this case, China should accelerate the pace of reform of the financial system to ensure a harmonious relationship between banks and enterprises, to ensure that they can operate independently, and to be self-financing. In addition, in terms of the financial legal system, more human and material resources need to be invested. From the perspective, the construction of the financial system should be based on China's objective conditions and ensure the legality of financial engineering. In actual construction, the relevant standards of the international financial industry must be strictly observed, and government regulation and capital markets must maintain a harmonious relationship.

6.2 Building a Sound Financial Supervision System

First, set clear regulatory goals, scientifically define the regulatory responsibilities of each department, and ensure that financial supervisors can fully understand their responsibilities and obligations. Second, increase supervision. Supervisors should actively apply the corresponding administrative methods, the effective application of other means such as law and economy, and comprehensive supervision of financial institutions. In terms of supervision technology, multi-pronged approaches should be adopted to continuously innovate supervision methods. Finally, supervisory departments should maintain sufficient communication and cooperate with each other. The party and government should play a supervisory role, and the CBRC and the CSRC must play their own supervisory role to eliminate financial risks in a timely manner.

6.3 Establishing a Complete Financial Information Management System

In the process of realizing financial modernization, financial informatization is the foundation. In the financial industry, the core competitiveness has gradually increased to information technology, financial services, etc. If the two can be effectively integrated, in addition to providing a reliable

source for the development of financial engineering. The support platform can also help financial decision-makers and other personnel to make correct decisions. Therefore, when constructing financial projects, not only the comprehensive construction of information infrastructure, but also the comprehensive construction of financial information management systems.

6.4 Establishing a Sound Financial Risk Prevention System

First, establish a sound risk early warning system, do a good job of pre-setting according to the risk early warning index, refer to the level of the index, and pass corresponding risk signals to ensure that people can effectively identify financial risks. Second, build a sound financial risk control system. In risk management, whether it is the government, the market, or an individual, they should fulfill their responsibilities, strengthen the control of financial risks, and be able to effectively prevent financial risks. Finally, comprehensively build a social risk compensation system. In actual construction, we should learn from the risk compensation system of developed countries, and from the actual situation in China, build an efficient and feasible financial compensation mechanism. Once economic losses occur, corresponding compensation can be obtained, which will help maintain social stability. .

7. Conclusion

As an emerging discipline, financial engineering has advantages in both the provision of financial instruments and the control of financial risks. It can support the healthy development of the financial system. Financial engineering improves the liquidity of the market and creates convenient conditions for major investors. Financial engineering further promotes the development and improvement of modern new technologies, provide efficient solutions to problems in risk management, and promote the development of science and technology. In order to avoid risks in China's financial development, it is necessary to increase the research and application of financial engineering.

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