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Financial Engineering and Innovation

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Abstract

With the continuous opening of the financial market, financial engineering has gradually focused on and developed from theoretical research to practical application. In the face of fierce financial competition, how to strengthen the prevention of financial risks in the process of maintaining economic security and ensuring stable economic development has become a problem worthy of attention and research. Through a brief overview of financial engineering, this article clarifies its importance in the application of the financial industry in China, thus leading to the following general description of the development status of financial engineering technology in China. Through analyzing financial engineering's role in financial innovation, from the perspective of economics expounding the essence and principles of financial engineering, suggestions and measures for the scientific application of financial engineering-related technologies are proposed to promote the healthy advancement of China's financial engineering construction and put forward some reasonable and specific improvement countermeasures.Financial engineering is an emerging discipline. In the development of financial theory and practice, with the aid of numerical analysis technology, systems engineering, operations research, and artificial neurons, etc., modern financial theory and engineering management technology are integrated into one and gradually evolved to become a cutting-edge technology featuring financial product innovation and new financial technology development. In response to the increasingly complex international economic environment, financial engineering has creatively provided methods and suggestions for solving various financial problems from innovative financial instruments and technical means.

Keywords

financial engineering, numerical analysis technology, artificial neurons, engineering management technology.

1. Overview of Financial Engineering

In the middle and late 20th century, with the rapid development of the global financial industry, the promotion of financial innovation has become more and more perfect and vigorous. A variety of new technologies and methods have been widely applied in the financial sector, so financial engineering was born. Financial engineering, there are many different definitions of it, and they are all different, but the definition proposed by American financier John Finnerry is the most appropriate. He believes that financial engineering includes the design, exploration, and implementation of innovative financial instruments and methods, and renders creative decisions to financial issues. In the era of increasing global economic integration, the financial industry has become the most active role. Thus, the one who can take the initiative in financial activities can be invincible in global financial competition. Meanwhile, implementing financial engineering almost is becoming a pass to participate in international financial activities. In the era of rapid economic development, financial engineering is widely used in many fields, such as corporate finance, personal finance, and risk management. In summary, in the current era of

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high-speed economic promotion, financial engineering is required by economic growth, which indicated its significance.

2. Development Status and Discipline Characteristics of Financial Engineering

In 1991, the establishment of the "International Financial Engineering Association" has continuously accelerated the connotation of financial engineering. Some quantitative research tools and scientific methods are also widely used in the financial sector such as pricing models, portfolio theory, risk management theory, etc. It has laid a theoretical foundation for the advancement of the discipline of financial engineering. From the perspective of more than ten years since the birth of financial engineering, its development is still not perfect, especially in China. As far as the current situation is concerned, China still understands and applies financial engineering at a relatively basic stage. There are many obstacles and instability factors that restrict the evolution of financial engineering in our country. If China can avoid risks by financial engineering like the United States to accelerate the speed for capital allocation and flow, and it will further realize to provide a full range of financial services. To reach the target, China must make changes to the future development of financial engineering.

From the perspective of management and risk avoidance, financial engineering involves many aspects, such as accounting, auditing, law, taxation, marketing, etc. At the same time, by virtue of modern mathematics technology, statistical methods, as well as computer technology, it is beneficial to effectively reduce uncertainty in financial management. Therefore, in essence, financial engineering can be summarized as "innovation". Financial innovation not only needs to improve the financial environment from the system, but also needs to realize the scientific allocation of financial derivatives and trading methods such as futures, forwards, options, and swaps from the innovation of financial products, especially the advancement of modern communication technology, which has laid a technical foundation for the innovation of financial engineering and provides the most reliable method for the construction of financial engineering discipline.

3. Relevant Principles and Applications of Financial Engineering

3.1. The Principles of Financial Engineering

The application of financial engineering in China is still in the fledging period. During the process of designing and developing financial products, financial engineers have undoubtedly injected new vitality into the deepening of financial reform through the research and practical analysis of relevant principles of financial engineering. For the comprehension of the principles of financial engineering, we can classify from the following five aspects:

1. Transfer and redistribution of financial risks
2. Help companies circumvent the restrictions of the financial system
3. Compare advantages based on the change of benefits
4. Effectively ease the asymmetry of financial information
5. Apply the liquidity principle

3.2. The Application of Financial Engineering in Innovation

The essence of financial engineering lies in financial innovation and creation. Its method consists in taking advantage of relevant financial principles, combining with specific financial problems and characteristics, to design a holistic financial service plan that meets financial needs and takes all stakeholders into account. For instance, during the period of financial innovation, the convenience of issuance of items like swaps, options, bills, and forward interest

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rate agreements, etc., to a certain extent, meet the needs of customers for the refinement of financial products and risk aversion. But at the same time, it should also be seen that the financial risks under the increasingly fierce market competition are also intensifying. How to enhance the liquidity of financial products in the process of seeking for or acting as a counterparty to trade, how to cultivate the trading market of financial products, etc., have all raised new contradictions for financial engineers. To this end, it is necessary to scientifically decompose and evaluate all sorts of risks encountered by customers to achieve an effective choice and reorganization of the risk-return relationship, and render certainty and standardized through the legal contract to truly achieve the perfection of the construction of financial engineering.

Divestiture and hybridization are applied in financial engineering. The core of financial engineering is to create a new relationship between risk and return. Divestiture, decomposition, and hybridization are common characteristics of the exploration of financial products to strip coupons and be sold separately on national bonds from the principal. In the face of coupon-bearing bonds in financial products, outwardly, it can gain fixed interest. However, from the actual point of view, it is difficult for investors to get benefits. The first reason is that the transaction costs of coupon-bearing bonds are high, and the interest cannot be immediately used for investment; the second factor is due to the uncertainty of interest rates, which limits investors' investment behavior. For this purpose, the "TIGR" financial product was launched by Merrill Lynch in 1982. By replacing coupon-bearing bonds with zero-coupon bonds, it was effective to resolve the lack of coupon-bearing bonds.

Indexation and securitization are applied in financial engineering. In the financial market, in order to avoid losses caused by market fluctuations to financial products, items like stock indexes, LIBOR indexes, etc. are often linked to financial products. Meanwhile, in order to strengthen the liquidity of financial products, securitization is also the future development trend of the innovation of financial products, such as the application of asset swap securities, asset reserve bonds, and so on.

The margin system is applied in financial engineering. The margin system can effectively restrain both parties to the transaction and reduce the risk of default, aiming at ensuring the legal performance of the transaction process in the financial market. In addition, the application of the margin system also greatly reduces the capital reserve ratio of financial institutions. Therefore, the establishment of a margin system that meets the development needs of the financial market can effectively evade and control financial risks, and take the initiative to play a role in the overall optimization of financial engineering for various stakeholders.

The off-balanced business is applied in financial engineering. Due to the deepening of financial supervision, for financial institutions, by means of financial engineering, they have developed many financial products that are not listed in the balance sheet. It not only can realize the profit demands of financial institutions, but also ameliorate the structure of assets and liabilities. As a consequence, innovative financial products are gradually recognized, familiarized, and accepted by customers. In 1981, Gonggang Company eventually formed a set of simple and standardized currency conversion procedures after continuous standardization to achieve currency exchange with the World Bank, which reduced transaction costs, broadened financial markets, and promoted the development of financial products as well.

4. Conclusion

The advancement of financial engineering should be set up on the basis of a mature and stable financial environment, but the development of China's financial market is not standardized. It needs to absorb and draw on advanced experience from the international financial sector to speed up the burgeoning of the financial market for our nation. Accordingly, first of all, it is

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necessary to accelerate the transformation of government functions, improve the financial development system environment, and promote the innovation and development of financial engineering technology from the behavior regulation of micro-market entities. Second, it is essential to accelerate the construction of modern financial enterprise management systems and guide economic entities to form rational thinking so as to accelerate a concordant and orderly competitive environment. Third, drawing lessons from the management advantages of Western capital markets, it is available to encourage the development of investment banks. As the protagonist of the development of financial engineering, investment banks achieve a dominant position relying on pioneering and creative superiority, which are unmatched by other financial companies. Thus, it is helpful to promote the rapid development of investment banks in terms of improving the financing system and other supporting arrangements. Besides, we should set about exploring the financial instruments, accelerating the pace of innovation, and enhancing the efficiency of financial engineering. Finally, while China introduces mature, high-tech technical means and models for the promotion of financial engineering from overseas, we also have to consider the particularity of the economic market of China. So, it is beneficial to formulate and design relevant investment strategies that meet the needs of the majority of small and medium-sized investors in China and adapt to the development of large economic markets according to the demands of national conditions. In general, in addition to the above methods, we can strengthen the construction of financial information systems, boost the operation of the financial sector, establish financial risk prevention systems, strive to evade and resolve financial risks, intensify the innovation in financial engineering, constantly strengthen the ability of the financial industry to resist risks, pay attention to the cooperation of relevant departments, focus on the construction of the credit system of the financial industry, etc. These are constructive suggestions concerning optimizing financial engineering in our sustainable development. As long as we keep initiative and aggressive attitudes, discard the dross and select the essential, I firmly believe that financial engineering will surely have a bright future in China.

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