

Research on Financial Engineering and Exchange Rate Risk Management

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Abstract: As economic globalization enters the new era, the financial market enters a period of high-quality development. It is necessary to stay true to the financial thought with innovation as the core and put forward the financial proposition that meets the needs of enterprises and individuals for exchange rate risk management. Based on the dynamic development of financial engineering, the theoretical, analytical framework of financial engineering and risk management is built according to the internal logic of structural changes, market challenges, and intelligent technology. We can explain financial innovation and change brought about by regulatory and coordination mechanisms of financial engineering and foreign exchange risk. In addition, we continue to explore the possibility of moving towards high-quality development from the two-way upgrading, shared responsibility, and value reversion of financial engineering development. Financial engineering and exchange rate risk management aim to provide enterprises and individuals with financial products and services that meet the expected standards. At the same time, the government is committed to improving the quality of financial engineering and the effectiveness of exchange rate risk management. In addition, the government should strengthen the exchange rate risk control based on the structural change in financial engineering, construct the mechanism of interaction and cooperation between financial innovation and market competition, and establish the evaluation system for intelligent technology and financial industry transformation to promote the high-quality development of financial engineering and exchange rate risk management. Finally, it will boost economic globalization and meet the needs of enterprises and individuals.

1. Introduction

Exchange rate risk management is one of the primary responsibilities of financial markets, and it is connected with financial engineering. It can be divided into basic exchange rate risk management and non-basic exchange rate risk management, which consists of hedging and financial derivatives. The financial market entrusts financial institutions to design and implement financial engineering to improve the efficiency and effectiveness of exchange rate risk management. Since economic globalization, financial engineering has become the key to the financial market, and financial innovation has become a key content. Unlike traditional exchange rate risk management, financial engineering emphasizes innovation, coordination, and optimization [1]. Therefore, we set out to combine financial engineering and exchange risk management, and intelligent technology has provided new impetus and new means for this research.

Financial engineering originates from the financial thought with innovation-centered. It contains structural changes, market challenges, and intelligent technologies. It is also a tool for financial innovation. From the perspective of financial engineering structure, financial engineering pursues high-quality development and realizes the modernization of exchange rate risk management through the combination of basic and non-basic ways. Currently, financial engineering has implemented a unique path that keeps pace with the times. The comprehensive advancement of financial technology has changed financial markets, reflects economic globalization, and will change the financial sector and impact social development. Therefore, the financial engineering and exchange rate risk management discussion must have a forward-looking, strategic vision and pattern. Therefore, the

proposition of financial engineering and exchange rate risk management is put forward in high-quality development. In short, financial engineering and exchange rate risk management are the necessary conditions and guarantees for economic globalization. Financial engineering and exchange rate risk management have progressed in practice, but there are also shortcomings. The managers have yet to find a practical path to exchange rate risk and are still progressing. Therefore, financial engineering and exchange rate risk management also need innovation, collaboration, and optimization, which is not only a market requirement but also a challenge for financial institutions [2].

Based on the above analysis, this paper proposes a theoretical framework for the transformation and development process of the financial industry faced with the challenge of intelligent technology, aiming to explore how to achieve high-quality development of financial engineering and exchange rate risk management. The fit, coordination, and change mechanisms issues are analyzed using a literature review and case analysis. In addition, the research content includes strategies and suggestions such as two-way upgrading, shared responsibility, and value reversion, which effectively copes with risks such as market turbulence and domination and has theoretical and practical value.

2. The Combination of Financial Engineering and Exchange Rate Risk Management Achieves Financial Innovation and Change

2.1 The Structural Change of Financial Engineering

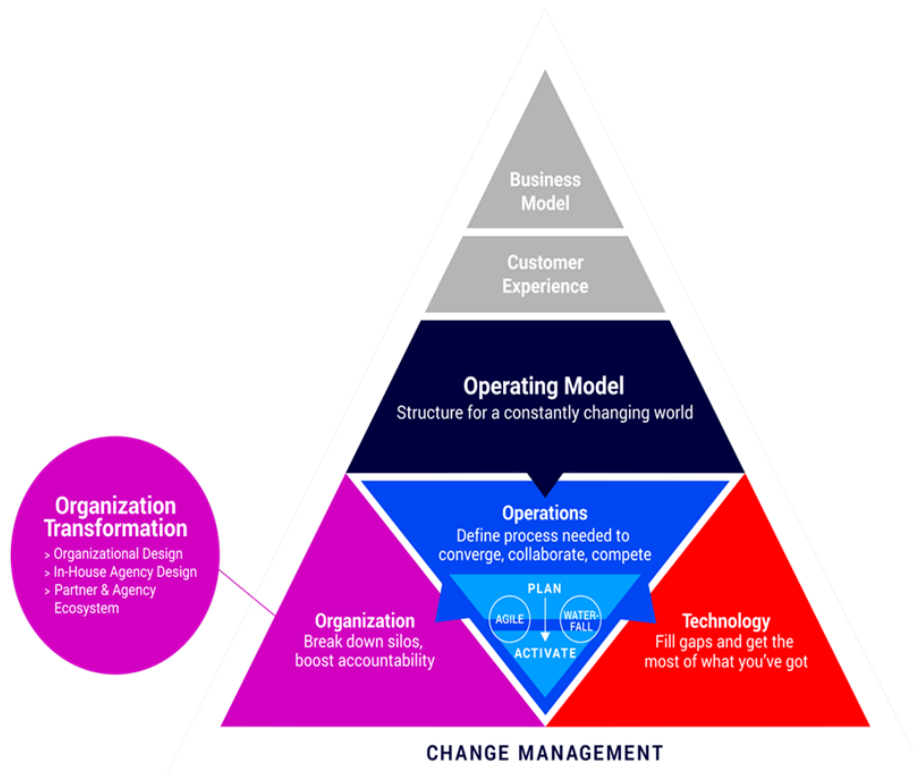


Figure 1 The form of structural change in financial engineering content

Structural change in financial engineering content is a concept that has developed alongside financial innovation. It contains innovative ideas, highlights the high-quality development direction of financial engineering, and reflects the reform strategy of the financial system since the reform and opening up. However, when we use some traditional financial standards to construct the definition and essence of financial engineering, getting a unified and accurate answer is still tricky. Because financial engineering content includes basic and non-basic financial instruments, it also includes various complex and comprehensive financial products or programs, which are diverse, flexible, and creative. Therefore, to understand and analyze the structural changes in financial engineering content, it is necessary to use modern financial theories and methods, such as arbitrage-free pricing [3] and risk-neutral pricing combined with the actual conditions and needs of the financial market. This paper

will discuss the structural change of financial engineering content from the following aspects: (1) Modernize exchange rate risk management by combining basic and non-basic; (2) Diversify exchange rate risk management through complex coordination and integration; (3) Innovate and optimize effective exchange rate risk management. The form of structural change in financial engineering content is shown in Figure 1.

2.2 Financial Innovation, Exchange Rate Risk, and Market Competition

Innovation is an essential criterion for financial engineering and objectively demonstrates financial efficiency and effectiveness. Economists and financial scientists discussed various definitions of financial innovation from theoretical, empirical, and historical perspectives. Furthermore, some researchers believe financial innovation shows the financial or technological activity level. Because financial innovation is more creative, coordinated, and optimized to a certain extent, it belongs to applied science to improve the quality of financial services and meet people's needs. The long history of financial innovation can be traced back to ancient times. The main activities include the invention of currency, the development of credit, and the establishment of banks. The concept and motivation of financial innovation are closely related to the stage of economic development. Through financial innovation, exchange rate risk management has become an important responsibility of financial markets. The financial innovation theory's main contribution to reform and opening up is to put forward the concepts of fit and coordination mechanisms. Therefore, the concept of financial innovation initially focused on the measurement based on market-oriented standard attributes [4].

3. Challenges Brought to the Market by Financial Engineering and Exchange Rate Risks

3.1 Market Turbulence: The Excessive Complexity of Financial Innovation Causes Market Imbalance

Compared with the traditional market theory, the chaos theory emphasizes the relationship between the market system and the external environment and has the characteristics of nonlinear, unpredictable, and sensitive dependence. Although some scholars question whether financial innovation is directly related to market turbulence, most scholars believe that financial innovation can assess market turbulence. Mandelbrot et al. proposed a classic geometric model of chaotic markets, including fractals, power laws, and scale invariance. Since then, this model has become a typical tool for chaotic market analysis, and the concept of financial fractals has been developed [5]. Scholars believe that financial innovation has self-organization and shows the edge of chaos. Only when financial innovation reaches a certain level will the market system change from orderly to chaotic. Thus, market turbulence is the result of financial innovation. In addition, some scholars take market turbulence as dynamic models, namely nonlinear dynamic models based on determinism and stochastic dynamic models based on randomness. The former focuses on the nonlinear factors within the market system, and the latter focuses on the random factors outside the market system, that is, noise. Although the market has experienced some practical failures, from the perspective of complexity, it reveals the laws and structure of the market system, and subsequently, the concept of adapting to the complex system has gradually become a consensus in the research and practice of financial engineering and exchange rate risk management.

3.2 The Global Operation of Exchange Rate Overtopping

Globalization is the application of international relations thinking in the economic field. To overcome its shortcomings, it has entered the research field as an alternative model: a global governance framework. The basic idea of the framework is as follows. First, global governance must ensure the effective delivery of global public goods. Second, establish professional standards for global economic production. Third, gain benefits from international organizations, etc. Fourth, use multilateral consultation to allocate global responsibilities. The global governance framework restructures the international order, emphasizes international cooperation, and improves mutual trust, reciprocity, assistance, and complementarity among countries [6].

3.3 The Birth of Derivative Risks under Market Domination

The birth of derivative risk under market domination challenges financial engineering and exchange rate risk management, which embodies the contradiction between financial innovation and financial supervision. The financial crisis directly reflects the stability of financial markets and institutions. Some elements of financial innovation are gradually taking shape, and financial derivatives and various evaluation systems have gradually received attention. However, viewed from the perspective of globalization, the practice of some financial derivative products is still at the stage of free business, contrary to the logical framework and formation mechanism of financial engineering. Thereby, the problem of spreading financial risks arises. For example, the subprime mortgage crisis in the United States was caused by excessive financial derivatives, such as the securitization of credit assets. It led to the spread and accumulation of credit risk and liquidity risk on a global scale and finally triggered a severe financial crisis. Therefore, effectively preventing and controlling the birth of derivative risk under market domination is a significant issue for financial engineering and exchange rate risk management.

4. Solutions to Transform and Develop the Financial Industry in the Face of Intelligent Technology

4.1 Two-way Upgrading: Financial Engineering Gets Rid of Challenges

4.1.1 Technical Improvements in Financial Engineering Enable High-quality Migration of Exchange Rate Risk Management

From the perspective of technology, the technical improvement of financial engineering is the essential link between exchange rate risk management and the core embodiment of financial engineering. Therefore, financial engineering takes innovation as the main logic. Innovation is the main driving force of financial engineering, but also the main competition of financial engineering. Currently, financial engineering strengthens exchange rate risk control from a market-oriented perspective, and there are three main forms. The first is the use of contracts. Make it clear that financial engineering achieves risk transfer between supply, demand, and price. The second is standardization. Therefore, standardized control of financial engineering is achieved by formulating financial engineering product standards and transaction standards and disclosing them to the market. The third is process-oriented internal process reengineering. In recent years, people have used artificial intelligence, blockchain, and other technical means to improve efficiency and improve the efficiency of exchange rate risk management. However, compared with the international advanced level, the technicality of financial engineering in China needs to be further improved.

This paper proposes an exchange rate risk management method based on the VaR model. We use the risk measurement of the VaR model to transform the problem of exchange rate fluctuation into the problem of loss probability and calculate the VaR value of exchange rate risk to realize effective control. In addition, to verify the effectiveness of this method, this research uses Excel as a simulation platform to generate exchange rate data of different currencies with different holding periods and confidence levels. It uses it as an input to the VaR model. The simulation results show that this method can realize exchange rate risk management in various market environments and has good adaptability and sensitivity. VaR is a risk measurement model based on historical data, which estimates the maximum loss that may be caused by exchange rate changes under a given holding period and confidence level. The function/model of the VaR model is expressed as follows:

$$VaR = \alpha\sigma\sqrt{T} \quad (1)$$

In the formula, VaR is the VaR value of the exchange rate risk, α is the standard normal distribution quantile corresponding to the confidence level, σ is the standard deviation of the exchange rate yield, and T is the holding period.

4.1.2 Upgrade of Financial Engineering under Intelligent Domestication

The fundamental difference between financial engineering upgrading in smart domestication and traditional financial engineering lies in its intelligent properties. The traditional technical standards and quality guidelines of financial engineering are aimed at efficiency, while the development of financial engineering mainly demonstrates technology and professionalism. In the challenges of intelligent technology, accurately identifying, predicting, evaluating, and controlling exchange rate risk is the core value and criterion of financial engineering development. The diversity of financial engineering types and differences in exchange rate risks make financial engineering complex. Artificial intelligence, blockchain, and other technical means can improve the efficiency of financial engineering, but financial supervision still needs to be improved, and financial engineering needs a self-regulation mechanism. They led to a lack of financial engineering that affects exchange rate risk management.

4.2 Shared Responsibility: Dealing with System Optimization and Market Governance with Financial Innovation

From the system's perspective, financial supervision does not accurately provide the institutional guarantee financial innovation needs. The financial market regards satisfaction assessment as the main form of financial innovation, but financial supervision lacks relevant information and coordination mechanisms. The mismatch between financial innovation and regulation may be at the heart of the problem. In global governance, financial innovation is often described as market domination, and its impact on exchange rate risk directly reflects market turbulence. However, global governance provides mainly information about international organizations and multilateral negotiations, and there is a lack of information about financial innovation. Often, the details of financial innovation take time to obtain or measure. Asymmetric information and imperfect systems directly lead to obstacles in the market. Therefore, optimizing the system and market governance using the principle of sharing is an important subject for financial innovation.

In studying the relationship between financial innovation, system optimization, and market governance, this paper selects some countries and regions from 2020 to 2023 as samples. It measures their financial innovation index (FII), institutional optimization index (IOI), and market governance index (MGI). The financial innovation index is based on a comprehensive assessment of the degree of innovation in financial products, financial services, institutions, and markets; the institutional optimization index is based on a comprehensive assessment of the progress and reforms in laws, regulations, policies, and taxation. In addition, the market governance index is based on a comprehensive evaluation of market competition, market efficiency, market stability, and market fairness. Table 1 shows the average and ranking of the three indexes of countries and regions.

Table 1 The average and ranking of the three indexes of countries and regions

Country / Region	Financial Innovation Index (FII)	Institutional Optimization Index (IOI)	Market Governance Index (MGI)
USA	0.82(1)	0.76(3)	0.78(2)
U.K.	0.80(2)	0.77(2)	0.79(1)
Germany	0.75(4)	0.74(5)	0.76(3)
Japan	0.74(5)	0.73(6)	0.72(6)
Singapore	0.78(3)	0.79(1)	0.75(4)
South Korea	0.71(7)	0.70(8)	0.69(9)
Hongkong	0.69(9)	0.68(10)	0.70(8)
Taiwan	0.70(8)	0.71(7)	0.71(7)
Australia	0.67(10)	0.65(12)	0.67(10)
France	0.66(11)	0.66(11)	0.68(11)
Switzerland	0.65(12)	0.64(13)	0.66(12)
Canada	0.64(13)	0.63(14)	0.65(13)
Sweden	0.63(14)	0.62(15)	0.64(14)
Netherlands	0.62(15)	0.61(16)	0.63(15)

It can be seen from Table 1 that there is a positive correlation between the financial innovation index, the institutional optimization index, and the market governance index. That is, the higher the level of financial innovation, the higher the level of system optimization and market governance, and vice versa. From the global governance perspective, the unfairness of the international financial order has long restricted the development of developing countries. In the 21st century, globalization, which integrates financial innovation and technological progress, has reshaped the global economic landscape through cross-border capital flows and financial market integration. However, the shortcomings of traditional international financial institutions and rules restrict multilateral cooperation. Due to the gap between developed and developing countries in financial resources, technology, and discourse power and the impact of geopolitics and trade frictions, global financial governance has yet to be perfected. Under shared responsibility, financial innovation is regarded as a direct way to enhance international competitiveness and cope with external shocks. However, the actual effect of financial innovation based on market domination on global financial stability and development remains to be discussed. At the same time, difficulties in regulatory coordination have led to a lack of prevention of global financial risks. Therefore, financial innovation does not consistently achieve the goal of optimizing the system and market governance. To sum up, financial innovation is not only a technical problem but also a problem related to global governance [7].

4.3 Value Reversion: Rectifying Market and Finance

From the perspective of value, market failure has restricted financial efficiency for a long time. Since the 21st century, a new financial instrument integrating financial innovation and financial supervision has reshaped value through fair value, but the drawbacks of traditional financial theory still restrict financial development. Due to market turbulence, financial stability needs to be improved. Under market domination, financial engineering is a direct way to correct the market and restore finance. However, the actual effect of financial engineering based on fair value on exchange rate risk remains to be discussed. At the same time, information asymmetry leads to the lack of self-regulation of financial engineering. Therefore, financial engineering does not always achieve the goal of value reversion. Financial engineering is not only a technical problem but also faces institutional problems.

5. Conclusion

Financial engineering has become an essential pillar of the financial industry, which poses new challenges and requirements for exchange rate risk management. Financial engineering symbolizes financial innovation technology, an essential means, and an urgent need to achieve financial efficiency and maintain financial stability. They embody the inherent requirements of market domination. Under the guidance of intelligent technology, financial engineering has constructed a theoretical analysis framework and practical mechanism to adapt to market changes. In recent years, modern information technologies such as artificial intelligence and blockchain have promoted the development of financial engineering, empowered financial engineering through fair value, and improved the accuracy and science of exchange rate risk management. Its value fits the internal logic of value return. Therefore, financial engineering also provides new ways to fix markets and restore public finances. To sum up, the sustainable improvement of financial engineering will help people better cope with market challenges and promote the transformation and development of the financial industry.

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