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Exploration of the Impact of Financial Mathematics on Modern Financial Markets

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Abstract: Financial development has a significant impact on economic development. With the continuous changes in financial theory, China's financial industry has begun to develop, especially the stock market, which is greatly influenced by the financial market. Therefore, using financial mathematics to transform the financial market will be beneficial for its development. Under the profitability of modern financial markets, the financial industry has begun to innovate and develop continuously, and its derivative products are also very high. Therefore, in the process of innovation and service of new financial products, attention should be paid to capital innovation and development to ensure the efficient development of the financial market. This article takes financial mathematics as the research object, explores the influence of financial mathematics in finance, and explores the specific applications of financial mathematics in financial markets from multiple aspects.

Keywords: Financial Mathematics; Financial markets; Influence

Under the background of modern social development, the arrival of the big data economy has promoted the rapid development of the financial market. In the process of development, China's financial market needs to improve its system, use relevant theoretical knowledge of financial mathematics to complete various financial calculations and analyses, then create new financial operation models, and finally use the models to create new financial models, laying the foundation for China's financial development and ensuring the stability of the financial market order.

1. The influencing factors of modern financial markets in financial mathematics

The application of financial mathematics in modern financial markets will have an impact on the market. Through research, it has been found that the application of financial mathematics in modern financial markets is beneficial for improving market efficiency and transparency, promoting innovation in financial products and services, and strengthening financial risk management.

1.1 Enhance the efficiency and transparency of financial markets

Financial mathematics uses mathematical tools such as probability theory, statistics, and calculus to model and analyze price changes, risk management, investment portfolios, and other issues in financial markets, thereby improving the efficiency and transparency of financial markets. These mathematical models can accurately reflect the laws of market operation, helping market participants better understand market dynamics and make wiser decisions.

1.2 Promote innovation in financial products and services

The application of financial mathematics in financial markets has promoted innovation in financial products and services. By constructing complex mathematical models, financial institutions can design financial products that are more in line with market demand and have better risk return ratios. At the same time, financial mathematics has also driven innovation in financial service models, such as the rise of new financial services such as intelligent investment advisory and quantitative trading, which can more accurately meet the needs of investors and improve the overall service level of the financial market[1].

1.3 Strengthen risk management capabilities

Financial mathematics plays an important role in risk management. Through quantitative analysis, financial mathematics can evaluate the risk level of investment portfolios and provide investors with risk measurement tools such as VaR (Value at Risk). These tools help investors measure risks more accurately, develop risk management plans, and effectively prevent financial risks.

2. The Specific Application of Financial Mathematics in Modern Financial Markets

2.1 Martingale theory

In general, financial markets are still developing, and investors are more focused on minimizing opportunity costs. To achieve this goal,

martingale theory in financial mathematics can be applied. The application of martingale theory in modern financial markets can achieve almost the minimum cost. When applying martingale theory, option curves and investment return curves can be created, and the intersection point between the two is where the investment opportunity cost is minimized. The core of financial theory can also be applied to the design and research of financial products. The current main function of this theory is to solve product derivative problems in the financial market, including the price positioning of certain products, to ensure that they are more scientific and reasonable, and to adapt to the development and changes of the market economy. At present, martingale theory occupies an extremely important position in financial markets and even the world economy, therefore, this theory has been widely promoted and applied.

2.2 Electronic Game Theory

Under the background of the development of modern financial markets in China, the continuous development and innovation of the national economy have led to the continuous development of financial market theory and the requirements for building a new market economy. From the perspective of current social development, the financial market is in a state of change, and the internal market is not stable enough, especially in the stock and securities markets, which are subject to certain constraints. Therefore, in order to promote the development of China's financial market and ensure its stability, a financial game theory model can be created, which requires the construction of a dynamic financial model and pricing theory to solve the problem of financial market volatility. In addition, under the background of financial and social development, economic assumptions can be created, and appropriate market volatility measures can be constructed using financial mathematical hypothesis models, thereby laying the foundation for the stable development of financial markets and highlighting the cultural value of financial markets.

2.3 Optimal stopping theory

Under the background of the development of financial markets, the optimal stopping theory has been used to improve various works, construct branch components of probability theory, and create a new theory to ensure that theoretical research achieves the best results and that social development is widely applied. Through the application research of the theory of optimal stopping in financial markets, it has been found that there is relatively little research on the theory of optimal stopping in financial markets in China, which is not deep enough and leads to insufficient integration of financial markets. Therefore, in the context of financial market development, attention should be paid to innovating and unifying its theory to confirm the feasibility of financial markets and lay a foundation for their development.

2.4 Random dynamic model

In terms of modern financial theory, another significance of mathematics in financial research lies in the application of differential game theory to options pricing, investment decision-making, and other aspects. The application of this field has achieved outstanding results. Due to the inconsistency between the overall laws of the financial market and the steady-state assumption, abnormal fluctuations in securities can cause abnormal changes that do not follow the Brownian motion law. In this case, stochastic dynamic models can be used to study and analyze complete investment decisions. However, this method has amplified biases both in assumptions and in practice. The use of differential methods to perform non geometric Brownian distributions on financial problems and disturbances in the stock market has important applications in the financial field. This method can not only effectively relax this assumption, but also turn uncertain interference into an unaffected illusion. Through in-depth analysis of the entire uncertain problem, combination strategies can achieve strong stability [2].

2.5 Random Optimal Control Theory

The theory of stochastic optimal control is a new theory applied in the development of modern financial markets, which is based on the Bellman principle to construct a stochastic optimization combination and create an opportunity theory for development. On the other hand, using metric theory and function analysis methods to implement stochastic analysis can achieve validation and management in the field of financial experts.

Through the research in this article, it is found that there are many studies on stochastic optimal control theory in China's financial field. It is recognized that stochastic optimal control theory can play an important role in the financial market, create financial transaction judgments, fully tap into the probability of the financial market, carry out targeted financial transaction judgments, and leverage the regularity of the financial market. In addition, relevant experts also attach great importance to studying the theory of random freedom, considering it as the best theory for the development of financial markets, ensuring the efficient development of financial market optimization and construction.

2.6 Empirical information verification

Under the background of modern information technology development, attention should be paid to the innovation and development of finance. Traditional finance utilizes genetic algorithms and wavelet analysis to complement and construct economic algorithms, enhance the coordination of financial markets, and create the best theory for financial markets. This article conducts research on financial markets, propos-

es financial knowledge in the context of information technology development, establishes the regularity of financial markets, and implements financial feasibility. In the context of modern social development, empirical information verification is also a common approach. This method can be applied in financial work to improve overall efficiency, and the financial market can leverage its advantages[3].

3. Conclusion

In the context of modern social development, China should pay more attention to keeping up with the times, creating mathematical and digital related economic principles, and ensuring the stable development of financial markets. In addition, as financial mathematics theory continues to be researched and promoted, more attention should be paid to innovation in financial mathematics theory, applying new theories to the financial market and assisting in the stable development of the market.

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