Research on Market Economy Development Based on Financial Mathematics

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Abstract: Financial markets refer to financial securities markets such as bonds, funds, stocks, futures and options. Modern financial theory refers to the results of the theoretical application of financial mathematics to study the prevention and control of financial risks, the operation of capital markets, the structure and pricing of capital assets in financial economics. Financial mathematics refers to the analysis of probability and statistics and functional analysis. Based on the mathematical theory of stochastic analysis and theory, experts pointed out that statistics, economic theory and mathematics are all necessary to truly understand the quantitative relationship in modern economic life. Mathematics to the economic community Bringing new perspectives, new ideas, and abstract mathematical tools are very practical and valuable once they are accurately cut into the financial market. This paper establishes the relationship between financial mathematics and the real economy, studies financial data correlation, and uses mathematics knowledge to solve many practical problems in financial analysis. It has far-reaching significance in China's rapidly developing market economy era.

1. Introduction

Finance is a method of mathematical modeling and quantitative analysis using mathematical tools such as probability theory and mathematical statistics, partial differential equations, stochastic processes, mathematical analysis, etc., in order to find new disciplines in the internal laws of finance. Since its inception, this discipline has been continuously absorbed and used by financial scientists. Due to the uncertainty of financial research issues, it is destined to make stochastic analysis widely used as a major tool, although financial mathematics is a young discipline. However, after two Wall Street revolutions, financial mathematics has developed rapidly. The core content is to study the optimal selection theory and asset pricing theory of portfolio under uncertain random environment. Arbitrage, optimality and equilibrium are the basic economic ideas and three basic concepts of financial mathematics. Financial mathematics not only has a direct impact on the innovation of financial engineering and the effective operation of financial markets, but also in the development of market economy, The effective solution to the actual problem cannot be based solely on economic qualitative analysis, but on quantitative analysis, mathematical model analysis and other methods, so the weight of mathematics in the field of financial economic analysis is heavy.

2. Financial Mathematics and Real Economy

Modern financial mathematics was developed in the context of two Wall Street revolutions, and financial mathematics also played a role in economic development. The results of the first revolution are reflected in the study of static portfolio theory. In 1952, Markowitz proposed a portfolio problem based on the mean-variance model, which quantified the risk and return of investment, thus creating a precedent for the study of financial problems by mathematical and physicochemical methods. However, in his model, the covariance problem of each risk asset price is calculated, which is a large amount of calculation. Based on such shortcomings, Sharp proposed a camp asset pricing model in 1964. According to the model, in the equilibrium market, the expected rate of return of all assets is a

linear function of market risk, that is, the expected rate of return of any risk is equal to zero risk rate plus a risk. Compensation, which confirms that system risk is the only factor that affects the expected rate of return on the asset. However, in the equilibrium market, arbitrage opportunities are not allowed, that is, zero-risk interest rates cannot be obtained. Based on this reality, Ross proposed the arbitrage pricing theory (apt) in 1976.He believes that asset prices are affected by several systemic risk factors rather than market factors alone. Although the apt model shows that the return on risk assets is a linear combination of risk factors, the question is whether the individual risk factors are not clearly answered.

The second Wall Street revolution evolved from static decision making to dynamic decision making. In 1970, the Bretton Woods Agreement collapsed, and the floating exchange rate replaced the fixed exchange rate. Many financial derivatives such as options and futures were produced immediately. These financial derivatives were introduced mainly for the management of financial risks, but scientifically effective for risks. Management requires scientific pricing of derivatives. Bachelor's Brownian motion model prompted a pair of twins: continuous-time stochastic process mathematics and continuous-time option pricing for the birth of financial engineering. The introduction of mathematical tools was primarily for the management of financial risks, but for risks Scientific and effective management requires scientific pricing of derivatives. Black and Hughes made breakthroughs in 1973 on the basis of Bachelier. They proposed the famous "bs" model. The basic idea of the model is that the options in the complete market can pass the risk-free bond and corresponding The portfolio of underlying stocks is replicated, that is, the risk of risk can be offset by a certain percentage of the stock portfolio, thus becoming a risk-free portfolio. They prove that the expected return of the asset is risk neutral, that is, the price of the option is not dependent on the investor's risk appetite. Shortly thereafter, Merton used another rigorous mathematical method to derive the pricing formula and promote it. The option pricing formula has brought unprecedented convenience to financial traders and bankers in the trading of financial derivative products. The rapid development of options trading has quickly become the main content of the world financial market. The theory of Black, Hughes and Morton has become a milestone in modern financial economics, and until now it is still an important source of modern financial theory exploration.

3. Data Association Analysis

Under the current market economy conditions, financial banks have developed rapidly, and financial mathematics has important guiding functions in many aspects such as market analysis, capacity planning, investment and wealth management, and futures risk assessment. There is an interesting phenomenon: in a supermarket, diapers and beer are sold together. But this strange move makes diaper Sales of beer and beer have both increased. This is not a joke, but a real case of a supermarket in the Wal-Mart store in the United States, and has always been talked about by the business. Walmart With the world's largest data warehouse system, in order to accurately understand the customer's buying habits in their stores, Wal-Mart conducts a shopping basket analysis of its customers' shopping behaviors, and wants to know which products customers often purchase together. The Wal-Mart data warehouse centralizes the detailed raw transaction data of its stores. Based on these raw transaction data, Wal-Mart uses data mining methods to analyze and mine these data. One unexpected finding was: "The most expensive item to buy with a diaper is beer! After a lot of actual investigation and analysis, it reveals a behavioral pattern of Americans hidden behind "diapers and beer": in the US, some young my father often goes to the supermarket to buy baby diapers after work, and 30% to 40% of them also buy some beer for themselves. The reason for this phenomenon is that American wives often take their husbands off work. After buying diapers for children, the husbands brought back their favorite beer after buying diapers. According to conventional thinking, diapers are not incompatible with beer, if not in financial mathematics. Data mining technologyfor the mining and analysis of a large amount of transaction data, it is impossible for Wal-Mart to discover the valuable law inherent in the data.

Data association in financial mathematics is an important class of discoverable knowledge that exists in databases. If there is some regularity between the values of two or more variables, it is called association. Associations can be divided into simple associations, temporal associations, and causal associations. The purpose of association analysis is to find out the associated networks in the database. Sometimes don't know the database Medium dataThe correlation function, even if it is known, is uncertain, so the rules generated by the association analysis have credibility. Association rule mining finds a lot of data Medium itemAn interesting association or related link between sets. Agrawal first proposed in 1993 to explore the association rules between item sets in the customer transaction database. Later, many researchers conducted a lot of research on the mining of association rules. Their work includes the optimization of the original algorithm, such as the introduction of random sampling, parallel ideas, etc., to improve the efficiency of algorithm mining rules; the application of association rules. Association rule mining is an important topic in data mining and has been widely studied in the industry in recent years. It can be seen that using mathematical methods to analyze the actual market has a strong guiding effect on a company's operating performance.

Using financial mathematics techniques to obtain real-life option pricing theory has been extended to other financial issues, such as futures, bonds, convertible bonds, interest rate swaps, foreign exchange rates, etc., and is widely used in corporate bonds, a wide range of financial securities and contracts, including variable interest rates, low mortgages, mortgages, insurance and tax laws. The theory and method are not only applicable to the asset pricing of the securities market in the market economy, but also to the risk analysis in the economy. Its application has been valued by governments and has achieved good results.

4. Financial Mathematics Development Trends

4.1 More and more new problems

Financial mathematical models can only be established under the conditions of many hypotheses. Some of them are inconsistent or even contradictory to objective reality in a specific environment. Therefore, solving such problems is not ideal and the scope is very narrow. The model is improved, developed and improved. The financial backgrounds and management models of different countries in the world vary, and it is necessary to establish a large number of financial models and analytical methods that suit their national conditions. For example, camp is suitable for European options and is not suitable for American options. Even if the assumptions are reasonable, due to the constant changes in the financial environment and social needs and the development of the innovation movement, more and more questions are raised for financial theory and financial mathematics, and we are required to continue to explore.

4.2 Empirical research has become the main direction

The so-called empirical research is mainly to emphasize the importance of data, that is, to obtain data from the reality of financial market, analyze the data and establish a mathematical model, and then reveal the laws behind the data, and finally return the correctness of the data and the test results in reality. If you leave the support and testing of actual data, from concept to concept (the qualitative analysis of the habits of liberal arts researchers), or simply from the model to the model (that is, the logical reasoning that science researchers are used to), it is difficult to profoundly and objectively Reveal the law of development of financial markets.

4.3 Prospects for financial mathematics

The financial system has become a complex system due to its non-linearity and uncertainty. It has put forward higher requirements for financial mathematics, especially the characteristics of financial markets: volatility, emergencies, incomplete market, information asymmetry, etc. Important topic. Fluctuations in financial markets can generally be attributed to random problems, such as geometric Brownian motion, followed by random analysis. However, in most cases, financial markets do not

satisfy stable assumptions, and unusual fluctuations often occur. The latest research results in recent years can be used well in the self-regressive conditional heteroscedasticity model.

5. Conclusion

With the development of society, the field of financial mathematics will face new problems and new directions. It is a "high-tech" tool that uses the excellent results of modern mathematics to measure and characterize financial, economic, management and other issues. The combination of mathematics has attracted more and more attention from the international financial community, mathematics, and economic circles. Financial mathematics has also begun to receive more and more attention in China. We should encourage our financial decision-makers to make full use of the financial and mathematical skills, and better plan the healthy development of the social market economy that I have lived on the basis of the analysis of a large number of economic data. Using the analytical data theory of financial mathematics to guide China's financial system reform, and China's financial market and international financial market, provide theoretical guidance for future participation in international financial market competition, and promote the healthy and rapid development of China's unique new socialist market economy.

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