Research On Quantitative Evaluation of Financial Investment Risk Based on The GARCH Model

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Abstract: The financial investment risk management system refers to analysing and controlling the intelligent approach to investing in the lower financial situation so that investors quickly understand the case in the financial industry. This article aims to use a digital model to evaluate financial investment risk management systems. The investment risk value can be better estimated by building a digital model. This paper introduces financial investment risks and then elaborates on the evaluation system and related digital models. The standards of the evaluation system are also given. The GARCH model is established to analyse the LME copper and LME aluminium cases selected by this paper by investigating and analysing the current status of corporate financial investment risks. The experimental results show that the evaluation results are often close to reality when using the GARCH model evaluation of financial investment risk management system, and the accuracy is relatively high. In addition to the EGARCH-N model, the established model is more accurate at a 90% confidence level, which is more accurate and is pretty close to a given significance level.

1. Introduction

With the development of the economy, the rapid development of the national economy and the urbanisation process have promoted the rapid development of financial investment. Meanwhile, China's financial investment projects continue to maturity. Most people choose evaluation through financial investment risk management systems to improve the competitiveness of financial investment and reduce financial investment risks. Financial risks refer to financial risks, such as financial market risks, financial product risks, financial institutions, etc. The financial investment risk management system relates to the analysis and control of the intelligent system to invest in the lower financial situation so that investors quickly understand the situation in the financial industry. The analysis of the underlying financial industry is a control of financial investment risks in multi-project decisions. How they use financial investment opportunities to obtain investors and society's largest investment benefits for developing and growing financial markets has far-reaching significance. Financial investment risk management systems have minor restrictions on problems and an extensive application range. In recent years, scholars have studied this system, which is used to solve the

problem of real investment. Still, the mathematical model of quantitative analysis in financial investment risk management systems is relatively small. Therefore, this paper studies the mathematical model of quantitative analysis of financial investment risk management systems, which has specific theoretical significance and a particular practical significance. With the in-depth research on financial investment, more and more scholars have studied financial investment risk. It is an excellent choice for analysing financial investment risk management systems.

Today, in financial and multi-project investment development, how investors manage earlier defines the basic terms related to risk management. He also explained the negative consequences of risk and pointed out the importance of financial risk management [1]. However, he did not write very comprehensively at the end of the article. Later, Korzh N studied the essence and nature of financial risks. He classified them and discussed the characteristics and main management methods of financial risk management [2]. However, he did not use the latest data in the text. Later, Nikitina et al. [3] determined the essence of investment projects by analysing concepts. To determine the investment project, theory and system provided the possibility of clearing the essential characteristics of the investment project, ensuring effective interaction with internal and external dynamic environments [3]. However, they did not deal with calculating the effective interactive part of the inner and outer parts. Gunjan et al. [4] used descriptive statistics and variance analysis to invest in three types of investors: commercial, paid class, and professional class investors, explaining the preference style and their investment model in investment decisions [4]. However, they did not use the most suitable model to study in the empirical analysis phase. After the study of other scholars, Hmyria et al. [5] studied the financial risk assessment of Irish iron and steel companies and its impact on enterprise economic security. They found that financial risks and the operation mode of today's enterprises were closely related [5]. However, they did not perform a detailed analysis discussion on the operation mode of the company in the article. However, Kotova et al.[6] had proposed forming a natural monopoly subject investment plan to establish a monitoring system to perform long-term investment projects of natural monopoly before them [6]. However, the concept of a monitoring system in writing did not consider reality influencing factors. In contrast, Tang et al. [7] used descriptive statistics and variance analysis to invest in three types of investors: commercial, paid class, and professional class investors, explaining the preference style and their investment model in the investment decision [7]. However, they did not make a more detailed explanation of investment models. The innovation of this article is as follows: (1) In terms of financial investment decisions, digital models to evaluate financial investment risks can firstly be used. Then, financial investment can be achieved, significantly reducing investors' risk. (2) The GARCH model is applied to the quantitative analysis of the evaluation of financial investment risk management system and surveyed the status quo of financial enterprises' living conditions. In other applications, GARCH is often an algorithm model. However, this article is committed to in-depth characteristics and advantages within GARCH, applying the algorithm to assess financial investment risks, thereby giving a risk predictive value.

2. Evaluation of Financial Investment Risk Management System

2.1. Evaluaiton of Financial Investment Risk Management System

2.1.1. Risk Investment Has a Distinctive Feature Difference from Other Investment Methods

It has specific investment objects and methods. The field of venture capital is quite broad, such as logistics, gold, medical facilities, liquor, etc., covering almost all possible, high-quality, high-efficiency, low-cost products or services and high investment returns. The way and timing of risk capital entering the company are also exceptional.

Risk investment itself is a business behaviour. It is determined that the subject of venture capital can only be a business behaviour. The competitive characteristics of high-tech products or projects determine that private investment mains outside the country can only carry out this investment.

It also has a basis for different investment decisions. The most crucial question of venture capitalists in investing in the business is the ability of investment object management and whether the market is large enough or whether it has development potential, as well as the market competition environment faced by the company.

It has unique investment management and profitable channels. The entry of venture capital is not based on the company's control but through the operation of the equity investment income and the transfer of the shareholding in the capital market [8].

Risk investment is a high-risk investment method. Risk investment has a considerable risk from its operation beginning. The financing, project screening, evaluation, decision-making stages, investment in project management, and even final profitability have a lot of variables [9, 10]. It can be said that the operation of venture capital is the process of risk identification, evaluation, and management [11].

2.1.2. Investors' Goals and the Risk of Every Stage of Venture Capital Operations Are Different

The entry risk of funds in the seed period will be extremely high, and the products and operations of the company are only in a concept and plan. Therefore, venture capitalists will be cautiously invested in a small amount of funds at this stage, and more enterprises will be required to ensure higher expected yields [6].

Foundation period (start period): The enterprise starts production operations at this stage, but the investment risk is still very high. Venture capitalists usually enter with preferred stocks, and the funds invested are mainly used for planning marketing and testing market competition. But investors will also demand a higher expected rate of return of 40%–60% [4].

Growth period (development period): At this stage, the product starts to be sold, from not yet profitable to beginning to generate profit, but the net cash flow of the enterprise is very small at this time, and the investment risk is still high. At this stage, venture capital funds are mainly used to increase market share, purchase more equipment, expand productivity to achieve economies of scale, strengthen marketing, upgrade products, and maintain a stable profit growth rate. Investors will require 25%–50% of higher expected yields [7].

Mature period (exit period): At this stage, the enterprise proliferates, which is close to saturation, and the investment risk is low, but there may still be internal risks such as loss of managers, improper financial control, and external threats such as reduced market growth rates and hindered company listings. The funds entered at this stage are to maintain profitability, wait to prepare for listing or resell to other investors, allow other companies to merge, or partially realise the previous investment to adjust the equity structure and the manager's shares. For venture investors, it is mainly the exit risk [12].

Classification can also be classified in financial investment project risk recognition, as shown in Figure 1. It can be seen from the figure that financial investment risks can be divided into seven categories. In the financial world, investors or companies often pay more attention to credit risk. For example, the new fusion warehouse model at home and abroad is used as an example, and the risk of each link is analysed [13]. The integration class business model is one of the leading logistics modes finance. Its operational basis is a delegate agency theory, referring to one or more objects to specify other things in economic activities in economic activities in economic activities [14]. In most cases, the one with insufficient information and disadvantage in cooperation is often the principal, and the party with sufficient details is often the agent. Therefore, under this theory, the information

asymmetry between subjects will somewhat lead to moral hazard and adverse selection. It can be seen from Figure 2 that, in this model, the main body of the financial warehouse model is a two-party principal-agent model, and the third-party logistics, as an agent, plays a role in the communication and connection between the bank and the small and medium-sized enterprises [15].

2.1.3. Processing of the Indicator System of Financial Risk

Financial risk is the possibility that financial market entities will suffer losses in currency, capital, and credit transactions. As an economic phenomenon, financial risk will lead to financial crisis if it is not prevented and resolved. The so-called financial risk early warning mainly analyses and forecasts the possibility of financial asset loss and financial system damage during financial operation and provides countermeasures and suggestions for financial security operation. The indicator of financial risk involves many aspects and has five monitoring subsystems. If the financial investment risk status is divided into safety (S1), basic safety (S2), risk (S3), and greater risk (S4) [12], then the financial risk detection index system is as follows.

2.2. Overview of Digital Models Related to Investment Risks

It first obtains the influencing factors that represent the credit situation of the enterprise, which is the measurement method of credit risk, then puts these influencing factors into the digital model to calculate and finally obtains the probability of corporate credit risk and the degree of corporate loss [10].

(1) Z and ZETA scoring models

$$Z = 1.2Y_1 + 1.4Y_2 + 3.3Y_3 + 0.6Y_3 + 0.999Y_5 \quad (1)$$

In this formula, Y_1 refers to the current asset rate, Y_2 represents the undistributed profit rate, Y_3 is the net profit rate, Y_4 is the interest market value debt rate, and Y_5 refers to the income rate.

When Z < 1.8, the enterprise bears significant risk; when Z > 2.99, the enterprise carries less risk [11].

(2) Logit model

The logit regression model uses some financial indicators to evaluate enterprises' default risk probability. CapQ_L means financial situation, Q_L 0 means no investment risk, and Q_L 1 means risk may occur. The formula for the probability of default risk is as follows:

(3) Credit Portfolio View Model

McKinsey Company researched this corporate credit risk measurement model based on econometric theory. It analyses the credit risk level in different production environments through extensive big data [18]. Based on comprehensive big data analysis, the Credit Portfolio View model can give

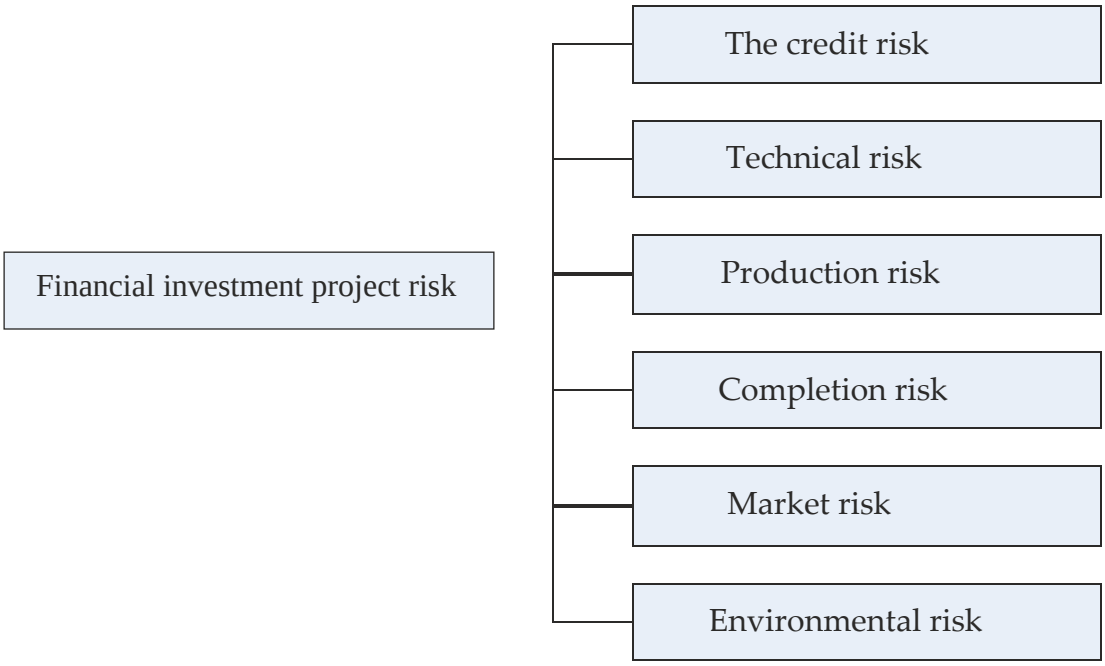

Figure 1: Financial investment project risk identification.

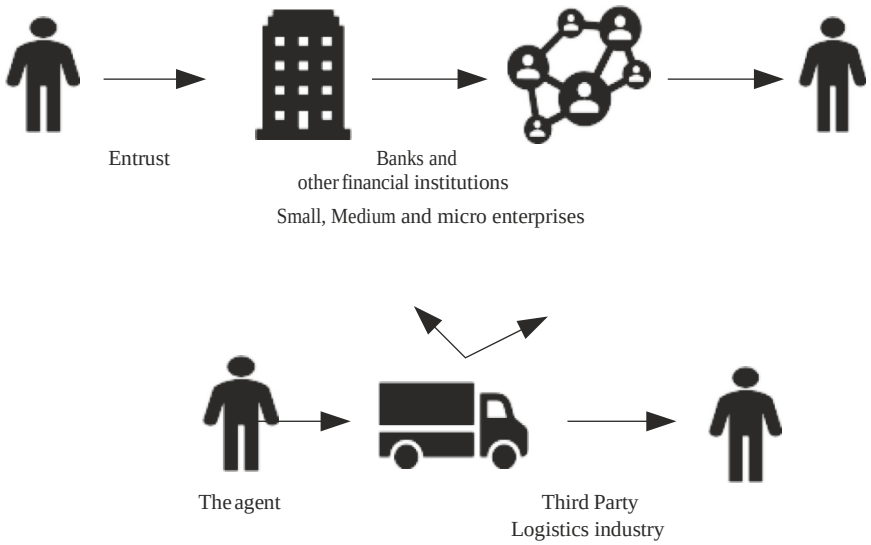

Figure 2: Financial warehouse business model.

Investors have a more accurate risk assessment with a high accuracy rate in the current environment. However, some macroeconomics in the model are hard to come by and are not very stable [12].

(4) GARCH (p, q) model

GARCH models are often used to analyse the in-use of its simplified form [13].

ϑY represents the interference item, TY is the corresponding return value of the financial asset in the Y period, and μk is the variance parameter, which reflects the influence of the variance lag period of the residual item on the variance of the current period [21]. This model can analyse things in combination with the whitening weight function. The commonly used whitening weight functions are upper limit measure whitening weight function, lower limit measure whitening weight function, and moderate measure whitening weight function. Among them, the reasonable measure whitening weight function is also called the triangular whitening weight function [12]. The primary functional forms of these three whitening weight functions are shown in Figure 2.

Assuming that this function is used to describe the classification degree to which the risk factors of financial investment belong, Figure 4 can be obtained. It can be seen that the classification degree of risk factors presents a stepped span.

3. Experiment of Quantitative of Financial Investment Risk Management System Evaluation

3.1. Formulate Evaluation Indicators

Establishing the evaluation index system is the precondition and the core of the risk evaluation model of financial investment projects. Whether selecting the evaluation index system is scientific and perfect determines whether the evaluation model is effective. It also determines the accuracy of the entire financial investment risk assessment. Principles for establishing the index system are very important for evaluating the risk of financial investment projects. Therefore, to ensure the scientific rationality of establishing the index system, the following principles should be followed when constructing the risk evaluation index system of financial investment projects [13].

(1)The principle of purpose. The construction of a risk evaluation index system of financial investment projects is the indefinite foundation for constructing a risk evaluation model. Therefore, when creating the evaluation index system, it should be guided by the purpose of construction and focus on the principle of purpose.

(2)Scientific principles. The selection of the index system must be based on recognised scientific theories. At the same time, it must be combined with the analysis of the current situation of the financial industry. The concept of the selected risk index of financial investment projects should be clear, with precise connotation and extension, and the index system should reflect the nature of the risk as reasonably as possible.

(3)Comprehensiveness principle. The construction of the risk evaluation index system of financial investment projects should fully and reflect entirely the risk situation of high-tech projects at all levels and aspects. At the same time, investors' current preferences and interests in investment should also be considered. And fully assess the project's various risks to ensure the comprehensiveness of constructing the risk evaluation index system.

(4)Systematic principles. Each index factor should be interrelated and mutually restrictive when constructing the risk evaluation index system of financial investment projects. Among them, the horizontal relationship reflects the mutual restriction relationship between different risk factors, and the vertical relationship reflects the inclusive relationship between different risk factors.

(5)Principle of independence. When constructing the risk evaluation index system of financial investment projects, the index factors in the system should be independent of each other, and the overlapping area between each index should be minimised. There cannot be any relationship between inclusion and inclusion between the indicators at the same level, so the indicator system can reflect the risk dynamics of high-tech project financing from all aspects.

3.2. Investigation on Status Quo of Existence of Financial Enterprises

The questionnaire on "The Survival Predicament of Small and Medium-Sized Enterprises" truly reflects the current living conditions of small and medium-sized enterprises and their attitudes towards prospects. The questionnaire subjects were 143 small and medium-sized enterprises from all over the country. Most of them come from the Yangtze River Delta and the Pearl River Delta, and some companies come from Sichuan, Beijing, Shanxi, Hunan, and other places, covering a wide range. The distribution industries are food, textile, electromechanical, steel, Internet, etc.

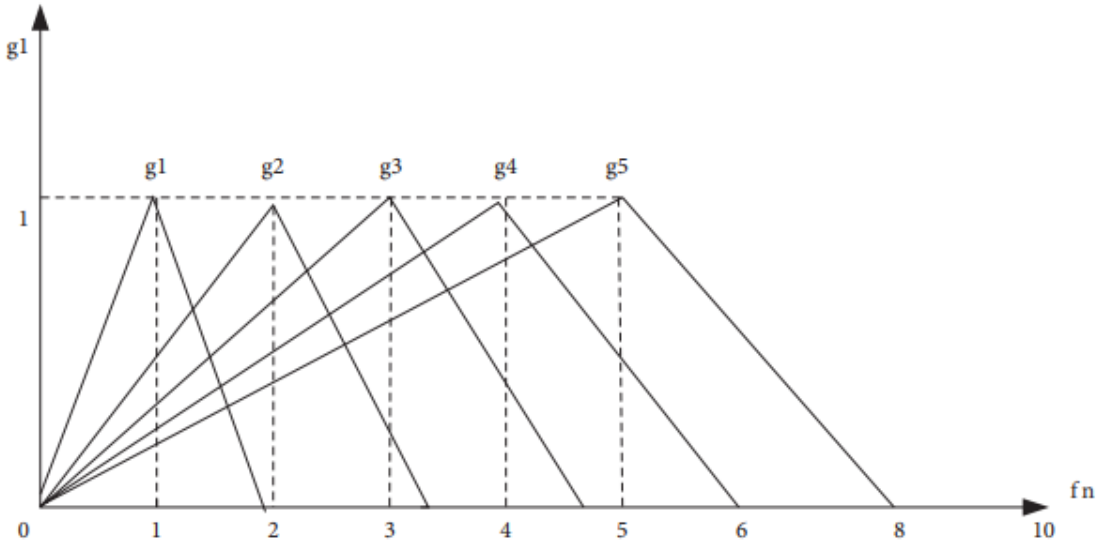

Figure 3: Whitening weight function for risk evaluation of financial investment projects

Quantitative Digital Model of Financial Investment Risk Management System Evaluation. Timely and accurate evaluation of the risk level of financial investment projects of great significance to the management and implementation of financial investment projects. A quantitative evaluation result is more conducive to the sponsors of financial investment projects to make scientific decisions. It takes reasonable risk aversion measures to raise the funds needed for construction. This chapter comprehensively applies the theory of financial investment risk management systems. It builds the GARCH digital model for risk assessment of financial investment items and uses it.

3.2.1. Data Extraction

This paper selects the daily closing price of copper and aluminium as the research object. The GARCH formula will be widely used for auxiliary calculation in the calculation process. The market return takes the form of a logarithmic daily return, which is defined as

$$T_{O,Y} = IN\left(Q_{O,Y-1}\right) \tag{2}$$

$T_{O,Y}$ represents the yield on day Y in the L-th market, and $Q_{O,Y}$ represents the price on the Y-day in the L market. The yield sequence chart of the three markets is shown in Fig. 7. It can be seen that there is volatility agglomeration and explosiveness in all of them, and it can be considered that the two return sequences are random.

3.2.2. The Dynamic Correlation of the Three

It can be seen that there is a high positive correlation between LME copper and LME aluminium, and the correlation coefficient is mainly concentrated between [0.69, 0.71]. A negative correlation exists between LME copper and LME aluminium and the US dollar index, respectively, and the correlation interval is concentrated between [-0.40, -0.35]. Their correlations with each other were significantly strengthened during the financial crisis.

3.2.3. Parameter Estimation Results

The parameter estimation of the three-variable BEKK model is based on the assumption that the residuals follow the Student Y distribution, and it is done with the help of external software. The algorithm is the BH algorithm. The estimated results are as follow:

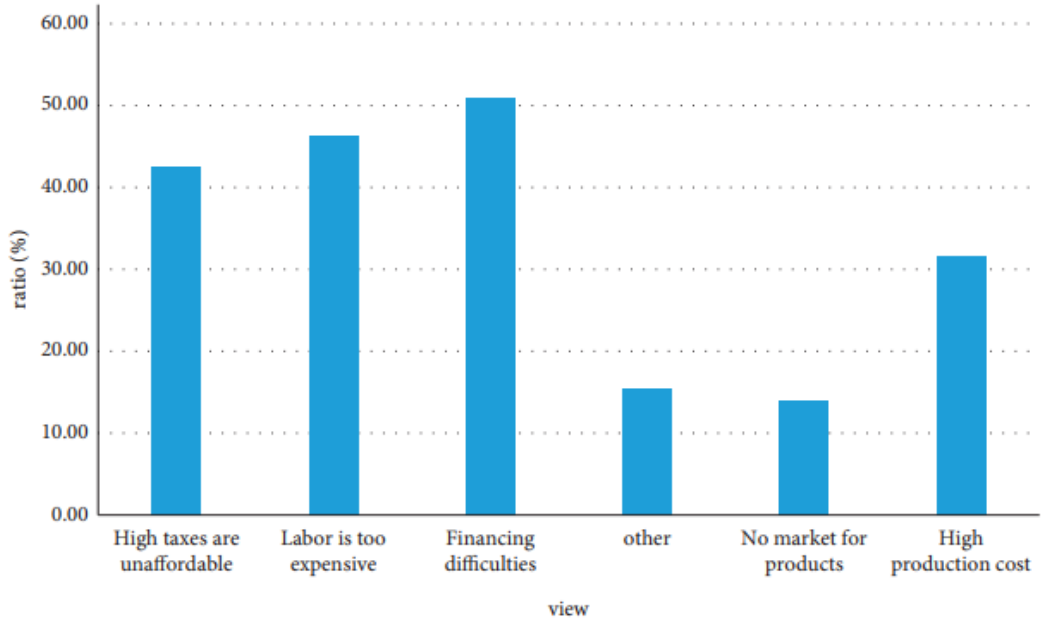

Figure 4: views on the most significant difficulties the business is currently facing

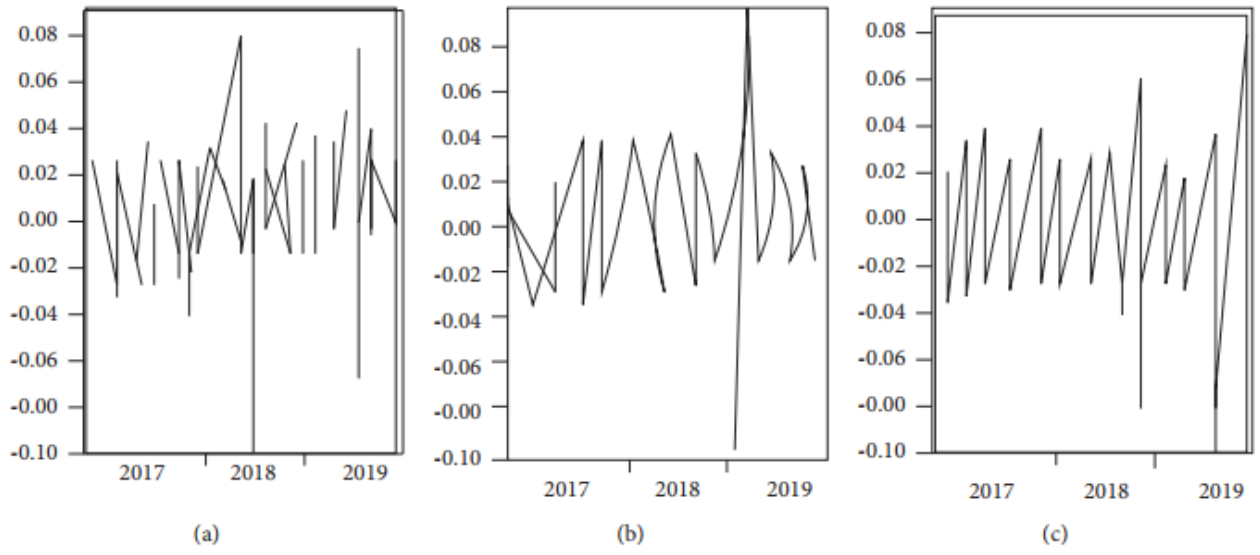

Figure 5: Dynamic correlation coefficient diagram under DCC model: (a) LEM Cu and LV dynamic correlation coefficient 12, (b) KME Cu and UDI dynamic correlation coefficient 12, (c) LME LV and UDI dynamic correlation coefficient 12.

4. Discussion

This paper is devoted to researching and designing a mathematical model for quantitative analysis of financial investment risk management system evaluation. This paper applies it to the complex accounting and treatment of investment risks in LME copper and LME aluminium. It expands the application scope of digital models and is a new attempt to evaluate the complexity of financial investment risk management systems. Through qualitative analysis of LME copper and LME aluminium investment risks, digital models are mined as an essential tool to study system complexity. It has a particular potential to explore the complexity of financial markets. In addition, based on in-depth research on many models in China, the most suitable model is selected in this paper, combined with a survey of enterprise survival status. Combined with the unique environment in which the Chinese financial market is located, it makes the model suitable for the investment environment of the Chinese financial market. For the research on the evaluation of financial investment risk management systems, this paper starts with the most basic introduction of financial investment risk, analyses the evaluation system, and introduces various digital models. It successfully combines the GARCH digital model and the financial investment risk management system evaluation and concludes. In the stage of empirical analysis, the GARCH model is used to obtain adequate chart data, and this paper analyses the data in many aspects. The results show that the obtained results align with the actual situation. The analysis of this case shows that using the financial investment risk management system to evaluate the quantitative analysis of the mathematical model is more effective than a single type of investment. Investors can use the model to assess risk. This can significantly reduce financial investment risks and make decisions on multi-project portfolios. In the specific practical investment portfolio

decision-making, enterprises or investors expect to formulate different investment strategies according to their own risk preferences and investment goals and choose the project's risk value and return objectives reasonably and flexibly. It substitutes the risk and returns target value into the investment portfolio decision for calculation and analysis, selects the optimal investment portfolio plan, and makes the most effective investment decision.

This paper takes LME copper and LME aluminium investment risks as a case study. First, the investment risk data is determined through the investigation and qualitative analysis of enterprise investment risk status. It uses the GARCH model to evaluate the investment portfolio according to the investor's risk level. Through the analysis of the data, it is concluded that the digital model applied in this paper is still very accurate for financial investment risk prediction. Through the study of the data, it is supposed that the GARCH model used in this paper is very suitable for quantitative analysis of the evaluation of the financial investment risk management system.

5. Conclusion

The case study draws important conclusions: In general, the quantitative analysis of the financial investment risk management system evaluation using the GARCH model is very close to reality. This means that the model has a high degree of accuracy in evaluating financial investment risks. However, this is not absolute. It does not rule out the arrival of a particular period, and some financial investment risks may have volatile factors, such as the research project in this case. This requires investors to conduct more detailed research and quantitative analysis of the program. It can determine a more compelling investment risk value. The project discussed in this paper is to use a digital model to conduct a quantitative analysis of the evaluation of financial investment risk management systems to determine the investment risk value. However, the selection of projects is relatively limited, and the realistic financial investment risk evaluation will often face more combination choices. Real investment should also be combined with various irresistible factors for investment analysis; the

investment risk analysis will have more excellent value. Of course, it will also be more difficult. But it is undeniable that, with the progress of society and the rapid development of the financial world, there are more and more studies related to text topics. There can also be better solutions to the problem of financial investment risk assessment. The future of the financial industry is still promising. At the same time, we also believe that the risk factors considered in the study of financial investment risk evaluation by the digital model will be more comprehensive and specific, and more detailed issues that have not been considered in this article can also be considered, making this financial investment risk management system more scientific.

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