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Retraction

Retracted: Mathematical Model of Quantitative Evaluation of Financial Investment Risk Management System

Mathematical Problems in Engineering

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] X. Wang, "Mathematical Model of Quantitative Evaluation of Financial Investment Risk Management System," *Mathematical Problems in Engineering*, vol. 2022, Article ID 2439549, 14 pages, 2022.

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Research Article

Mathematical Model of Quantitative Evaluation of Financial Investment Risk Management System

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The financial investment risk management system refers to an 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 purpose of this article is to use a digital model to evaluate financial investment risk management system. The investment risk value can be better evaluated by building a digital model. This paper first introduces financial investment risks and then elaborates the evaluation system and related digital models. The standards of the evaluation system are also given. The GARCH model is established to analyze the LME copper and LME aluminum case selected by this paper by investigation and analysis of the current status of corporate financial investment risks. The experimental results show that the evaluation results are often close to the reality when using the GARCH model evaluation of financial investment risk management system, and the accuracy is quite high. In addition to the EGARCH-N model, the established model is more accurate at 90% confidence level, which is more accurate and is relatively close to a given significance level.

1. Introduction

With the development of the economy, the rapid development of the national economy and the urbanization process have promoted the rapid development of financial investment. Meanwhile, China's financial investment projects continue to maturity. In order to improve the competitiveness of financial investment and reduce financial investment risks, most people choose evaluation through financial investment risk management systems. Financial risks refer to financial related risks, such as financial market risks, financial product risks, financial institutions, etc. The financial investment risk management system refers to an 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 nice choice for the analysis of the financial investment risk management system.

Today, in the development of financial investment and multiproject investment development, how investors control financial investment risks in multiproject decisions and how they use financial investment opportunities to obtain investors and society's largest investment benefits for development and growing financial markets have far-reaching significance. Financial investment risk management systems have small restrictions on problems, and their application range is very wide. In recent years, scholars have studied this system which is used to solve the problem of real investment, but the mathematical model of quantitative analysis in financial investment risk management system is relatively small. Therefore, this paper studies the mathematical model of quantitative analysis of financial investment risk management system, which has certain theoretical significance and a certain practical significance.

With the depth research of financial investment, more and more scholars have studied financial investment risk management systems. S Jirásková analyzed fiscal risk management earlier, defining 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 in the end of the article. Later, Korzh N studied the essence and nature of financial risks. He classified them and also 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 analyzing concepts. In order to determine the investment project, theory and system provided the possibility of clearing the basic characteristics of the investment project, ensuring effective interaction with internal and external dynamic environments [3]. But they did not deal with the calculation of 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, namely, commercial, paid class, and professional class investors, which explained the preference style and their investment model in investment decisions [4]. But 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 company and its impact on enterprise economic security. They found that financial risks and the operation mode of today's enterprises were closely related [5]. But 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 a method of 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 monitoring system in writing did not take into account reality influencing factors. In contrast, Tang et al. [7] used descriptive statistics and variance analysis to invest in three types of investors, namely, commercial, paid class, and professional class investors, which explained the preference style and their investment model in the investment decision [7]. But 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, which has greatly reduced the risk of investors. (2) The GARCH model is applied to the quantitative analysis of the evaluation of financial investment risk management system and made a survey on 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 itself to assess financial investment risks, thereby giving a risk predictive value.

2. Evaluation of Financial Investment Risk Management System

2.1. Features and Risk Assessment of Financial Venture Investment

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 into the company also have speciality.

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

It also has a basis for different investment decisions. The most important question of venture capitalists in investing in 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 control of the company, 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 huge risk from its operation beginning. The financing, project screening, evaluation, and decision-making stages, or 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, at this stage of venture capitalists, it will be cautiously invested in a small amount of funds, and more enterprises will be required to ensure higher expected yields [6].

Foundation period (start period): At this stage, the enterprise starts production operation, 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 grows rapidly, 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 risks such as reduced market growth rates and hindered company listings. The funds entered at this stage are to maintain profitability, wait for the opportunity to prepare for listing or resell to other investors or allow other companies to merge, or partially realize the previous investment in order to adjust the equity structure and the manager's shares. For venture investors, it is mainly the risk of exit [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 analyzed [13]. The integration class business model is one of the main modes of logistics finance. Its operational basis is a delegate agency theory, referring to one or more objects to specify other objects 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 information is often the agent. Therefore, under this theory, due to the information asymmetry between subjects, it will lead to the situation of moral hazard and adverse selection to some extent. 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].

2.2. Processing of the Indicator System of Financial Risk. Financial risk refers to the possibility that financial market entities will suffer losses in the process of 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 is mainly to analyze and forecast the possibility of financial asset loss and financial system damage that may occur in the process of financial operation and to provide countermeasures and suggestions for financial security operation. The indicator of financial risk involves many aspects, and it 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.

2.2.1. Macroenvironment (Y1). The indicators of the macroenvironment are shown in Table 1. It can be seen that, in the GDP growth rate, when the financial risk is high, the growth rate is in a polarized state, which may be <3.5 or >12.5. It shows that different companies have different states when facing financial risks.

2.2.2. Inside the Bank (Y2). As shown in Table 2, within the bank, when the financial risk is relatively high, the nonperforming loan ratio of wholly state-owned commercial banks increases significantly to >22, indicating that financial risk has a great impact on the nonperforming loan ratio.

2.2.3. National Debt (Y3). As shown in Table 3, it can be found that treasury bonds are relatively stable under different risk conditions.

2.2.4. Foam Type (Y4). As shown in Table 4, when the financial risk is high, the total stock market value of the bubble type exceeds 91, which shows that financial risk has a deep influence on it.

2.2.5. Foreign Trade (Y5). As shown in Table 5, when the financial risk is high, the external debt is greater than 31, while the short-term external debt is greater than 36, which shows that the impact of financial risk on the foreign trade industry is very large.

2.3. 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 [16].

(1) Z and ZETA scoring models

$$Z = 1.2Y_1 + 1.4Y_2 + 3.3Y_3 + 0.6Y_4 + 0.999Y_5. \tag{1}$$

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 great risk; when $Z > 2.99$, the enterprise bears less risk [17].

(2) Logit model

Logit regression method is a model that uses some financial indicators and then evaluates the probability of default risk of enterprises. Q_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:

$$Q_L = Q\left(\frac{1}{C_L}\right). \tag{2}$$

(3) Credit Portfolio View Model

This model is a corporate credit risk measurement model researched by Mckinsey Company based on econometric theory. It analyzes the credit risk level in different production environments through a lot of extensive big data [18]. Based on extensive big data analysis, the Credit Portfolio View model can give

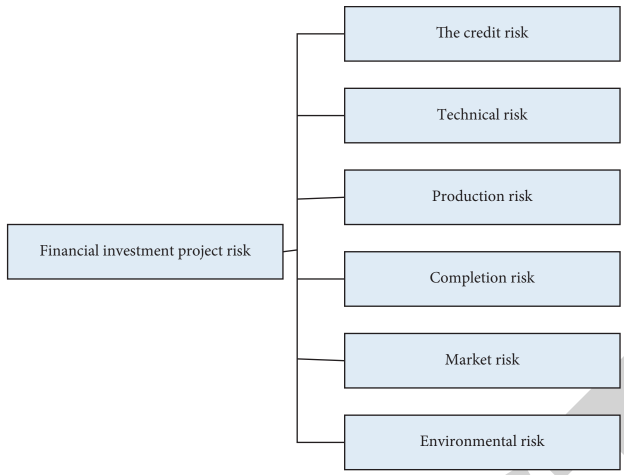


Figure 1: Financial investment project risk identification.

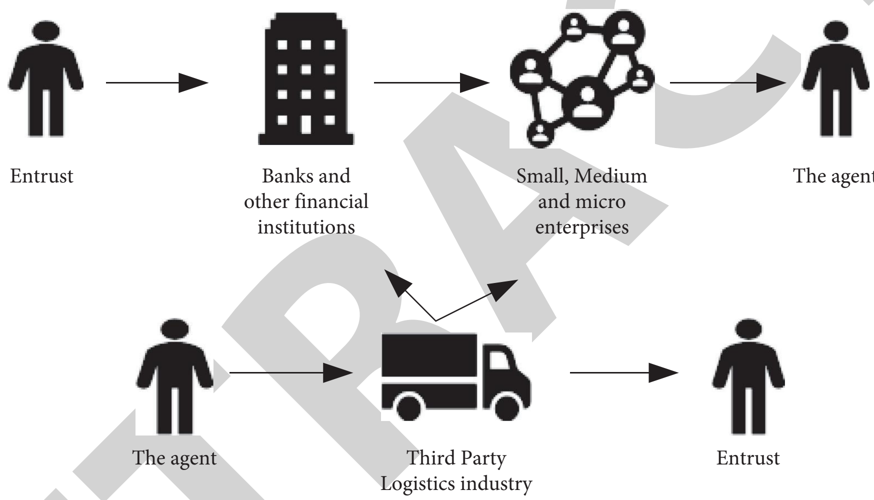


Figure 2: Financial warehouse business model.

investors a more accurate risk assessment in the current environment with a high accuracy rate. But some macroeconomics in the model are hard to come by and it is not very stable [19].

(4) GARCH (p, q) model

GARCH models are often used to analyze the interactions among many financial markets, such as volatility spillovers and correlations. The economic meaning of this model is better, but because of the large number of parameters of this model, it limits its wider application. In general, it is more common to use its simplified form [20].

As shown below, in this model, E is a $(M(M+1)/2) \times 1$-dimensional vector, and S_L, N_L are both $M(M+1)/2$-dimensional square matrices.

$$\begin{aligned} \mathrm{VECH}(J_Y) &= E + \sum_{L=1}^{W} S_L \mathrm{VECH}\left(\vartheta_{Y-1} - \vartheta_{Y-1}^{Y}\right) \\ &\quad + \sum_{K=1}^{Q} N_K \mathrm{VECH}(J_Y - K). \end{aligned} \tag{3}$$

The general formulation of the GARCH (p, q) model includes the mean and variance equations, which are expressed as

$$\begin{aligned} T_Y &= \vartheta_Y + S_1 T_{Y-1} + \cdots + S_Q T_{Y-Q} + \vartheta_Y, \\ \vartheta_Y | O_{Y-1} &\sim \prod \left(0, j_y\right), \\ J_Y &= \rho + \sum_{l=1}^{w} \sigma_l \tau_{Y-1}^2 + \sum_{k=1}^{\vartheta} \mu_k j_{Y-1}, \end{aligned} \tag{4}$$

ϑ_Y represents the interference item, T_Y is the corresponding return value of the financial asset in the Y period, and μ_k 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 analyze 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 moderate measure whitening weight function is also called the triangular whitening weight function [21]. The basic functional forms of these three whitening weight functions are shown in Figure 3.

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 basically presents a stepped span.

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

3.1. Formulate Evaluation Indicators. The establishment of the evaluation index system is the precondition and the core of the risk evaluation model of financial investment projects. Whether the establishment of 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 the establishment of the index system are very important for the evaluation of the risk of financial investment projects. Therefore, in order to ensure the scientificity and rationality of the establishment of the index system, the following principles should be followed when constructing the risk evaluation index system of financial investment projects [22].

(1) The principle of purpose. The construction of risk evaluation index system of financial investment projects is the indefinite foundation for the construction of risk evaluation model. Therefore, when constructing 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 recognized 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 completely reflect 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 consider the various risks faced by the project to ensure the comprehensiveness of the construction of the risk evaluation index system.

(4) Systematic principles. When constructing the risk evaluation index system of financial investment projects, each index factor should be interrelated and mutually restrictive. 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 minimized. There cannot be any relationship between inclusion and inclusion between the indicators at the same level, so that the indicator system can reflect the risk dynamics of high-tech project financing from all aspects.

(6) The principle of universality and the construction of risk rating index system for financial investment projects are the premise and foundation of risk evaluation and management. Therefore, the constructed system must have broad applicability; that is, it can reflect the needs of risk assessment of financial investment projects in different industries. In addition, the constructed system should also be flexible; that is, it can be adjusted and used flexibly according to different high-tech projects of different industries and enterprises.

(7) Operability principle. When constructing the risk evaluation index system of financial investment projects, the difficulty and reliability of the index quantification and data acquisition involved in the system should be considered. It should construct a reasonable index system with as few indexes as possible to achieve the goal of optimizing the overall function of the index system. In this way, it is more convenient and effective for investors to analyze financial investment risks.

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 future prospects. The subjects of the questionnaire 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

Table 1: Macroenvironmental stability subsystems.

Index	The risk status			
	S1	S2	S3	S4
Y1(1): GDP growth rate	5.5–8.5	5–6.5 or 9.5–11	3.5–5 or 11–12.5	<3.5 or >12.5
Y1(2): growth rate of fixed asset investment	14–18	10–13 or 19–22	7–10 or 22–25	<7 or >25
Y1(3): inflation rate	<4	4–7	7–10 or (−2)–0	<(−2) or >10
Y1(4): M2 growth rate	5–16	15–20	0–5 or 20–25	<0 or >25
Y1(5): Enterprise asset-liability ratio	<46	45–65	65–85	>85

Table 2: Bank internal stability subsystem.

Index	The risk status			
	S1	S2	S3	S4
Y2(1): nonperforming loan ratio of wholly state-owned commercial banks	<12	12–17	17–22	>22
Y2(2): capital adequacy ratio of wholly state-owned commercial banks	>12	8–12	4–8	<4
Y2(3): capital gains of wholly state-owned commercial banks	0.4	0.2–0.4	0–0.2	<0

Table 3: Treasury shock risk subsystem.

Index	The risk status			
	S1	S2	S3	S4
Y3(1): debt dependence	<11	10–21	21–31	>31
Y3(2): negative yield of treasury bonds	>14	16–21	21–26	<26
Y3(3): ratio of fiscal revenue to GDP	>23	21–25	16–21	<15

Table 4: Bubble risk subsystem.

Index	The risk status			
	S1	S2	S3	S4
Y4(1): stock price/earnings ratio	<41	41–61	61–81	>81
Y4(2): total market value of stocks/GDP	<31	31–61	61–91	<91

Table 5: Foreign trade shock risk subsystem.

Index	The risk status			
	S1	S2	S3	S4
Y5(1): external debt/GDP	<21	21–24	26–31	>31
Y5(2): short-term external debt/total external debt	<16	14–24	26–36	>36
Y5(3): time of import supported by foreign exchange reserves (month)	>7	5–7	16-213-4	<4
Y5(4): current account balance/GDP	0–4	3–4.5	4.5–5	<0 or >5

distribution industries are food, textile, electromechanical, steel, Internet, etc. We divided this survey into two parts .

(1) The first part of the investigation: Whether a new round of financial crisis will recur and what the biggest difficulty facing small and medium-sized enterprises is.

As shown in Figure 5, 51% of companies believe that financing is difficult. Even if they think that the capital turnover is good, they still admit that “financing difficulty” is the biggest problem facing small and medium-sized enterprises, followed by too high labor costs, high taxes, and high production costs. 50% of SMEs believe that a new round of financial crisis will appear. Recently, the world’s major economies have faced many problems such as slow economic recovery, stagnant development, and sovereign debt crisis, while emerging economies are also faced with the dilemma of weak growth and high inflation. Therefore, there is a view that a new round of financial crisis will reappear. 51% of companies find financing difficult. Even if they think that the capital turnover is good, they still admit that “financing difficulty” is the biggest problem facing small and medium-sized enterprises, followed by too high labor costs, high taxes, and high production costs.

(2) The second part: changes in the current overall operation of the enterprise compared with the previous year and whether the enterprise will expand capital and equipment investment in the coming year.

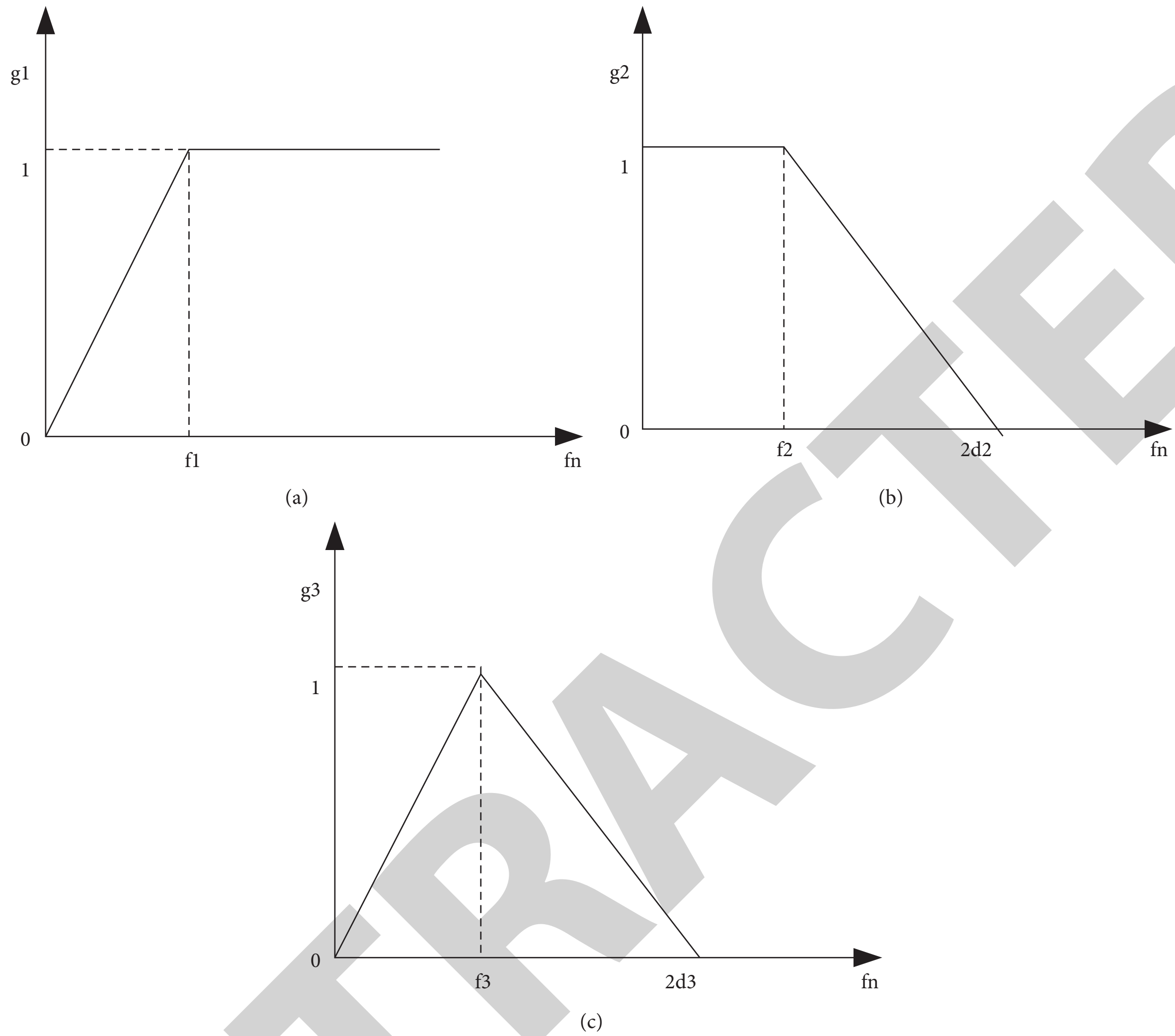


Figure 3: Basic functional form of whitening weight function. (a) Upper measure whitening weight function, (b) lower bound measure whitening weight function, (c) moderate measure whitening weight function.

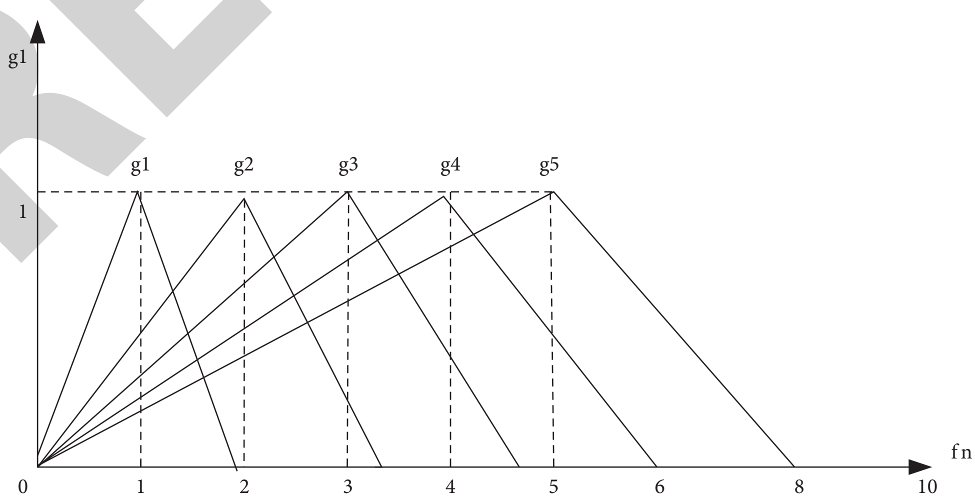


Figure 4: Whitening weight function for risk evaluation of financial investment projects.

As shown in Figure 6, 36% of companies reported that their operating conditions were worse than the previous year. The main reason is that the current small and medium-sized enterprises are facing an unprecedented survival dilemma, such as difficulty in financing, labor shortage, and high cost, which continue to squeeze the living space of small and medium-sized enterprises. 57.3% of enterprises will expand capital investment in the next year. At the same time, 27.3% of corporate decision makers indicated that they would not expand capital and equipment investment. This shows that the survival status of each enterprise basically belongs to a state of vigorous and upward development.

3.3. Quantitative Digital Model of Financial Investment Risk Management System Evaluation. Timely and accurate evaluation of the risk level of financial investment projects is 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 the project construction. This chapter comprehensively applies the theory of financial investment risk management system. It builds the GARCH digital model for risk assessment of financial investment items and applies it.

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

$$T_{O,Y} = \mathrm{IN}\left(Q_{O,Y-1}\right), \quad L = 1, 2, 3. \tag{5}$$

$T_{O,Y}$ 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 Figure 7. It can be seen that there are volatility agglomeration and explosiveness in all of them, and it can be considered that the two return sequences are random.

3.3.2. Parameter Estimation. The estimated results of the three-variable DCC model are as follows.

When $L = 1$, 2, 3, and $S_{LK}, N_{LK}\ (L \neq K)$ in the variance formula is obviously not equal to 0, it means that the market K(L) has volatility overflow to the market $L(K)$. Then the mean formula can be obtained as

$$\begin{aligned} T_{1,Y} &= 0.000226 - 0.03978^{*} T_{1,Y-1} \\ &\quad - 0.013515 T_{L,Y-1} + \varphi_{1,Y}, \\ T_{2,Y} &= -0.000313 + \delta_{2,Y}, \\ T_{3,Y} &= -0.000166 + \sigma_{3,Y}, \end{aligned}$$

$$\begin{pmatrix} J_{11,Y} \\ J_{22,Y} \\ J_{22,Y} \end{pmatrix} = \begin{pmatrix} 0.00000638 \\ 0.00000055 \\ 0.00000027 \end{pmatrix} + \begin{pmatrix} 0.096578 & -0.066408^{*} & 0.118344 \\ -0.004912 & 0.040377^{***} & 0.045218 \\ -0.000298 & -0.01514^{***} & -0.010334 \end{pmatrix} \begin{pmatrix} \beta^2_{1,Y-1} \\ \beta^2_{2,Y-1} \\ \beta^2_{3,Y-1} \end{pmatrix}. \tag{6}$$

Variance formula:

$$\begin{pmatrix} 0.883276^{***} & 0.052306 & -0.290724 \\ 0.027268 & 0.898716^{***} & -0.331348^{**} \\ -0.014273^{*} & 0.081532^{***} & 1.0461216^{***} \end{pmatrix} \begin{pmatrix} J_{11,Y-1} \\ J_{22,Y-1} \\ J_{33,Y-1} \end{pmatrix}, \tag{7}$$

$$\begin{aligned} W_Y = \left(W_{OK,Y}\right) &= (1 - 0.0074 - 0.7564)\theta \\ &\quad + 0.0074 \gamma_{Y-1}\gamma_{Y-1} + 0.7564 W_{Y-1}, \end{aligned}$$

$*$ means obvious at 10%; $**$ means obvious at 5%; $***$ means obvious at 1%. According to the variance formula, we can see that the change of the LME aluminum residual series in the previous period will affect the variance fluctuation of the LME copper and the dollar. According to an OVA, there is a two-way volatility spillover effect between LME aluminum and USD index. The price fluctuations of LME copper and LME aluminum will affect the price fluctuations of the US dollar index, and the price fluctuations of LME copper are not significantly affected by the US dollar index.

3.3.3. The Dynamic Correlation of the Three. According to Figure 8, it can be seen that there is a high positive correlation between LME copper and LME aluminum, and the correlation coefficient is mainly concentrated between [0.69 0.71]. There is a negative correlation between LME copper and LME aluminum 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.

3.3.4. 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 BHHH algorithm. The estimated results are as follows:

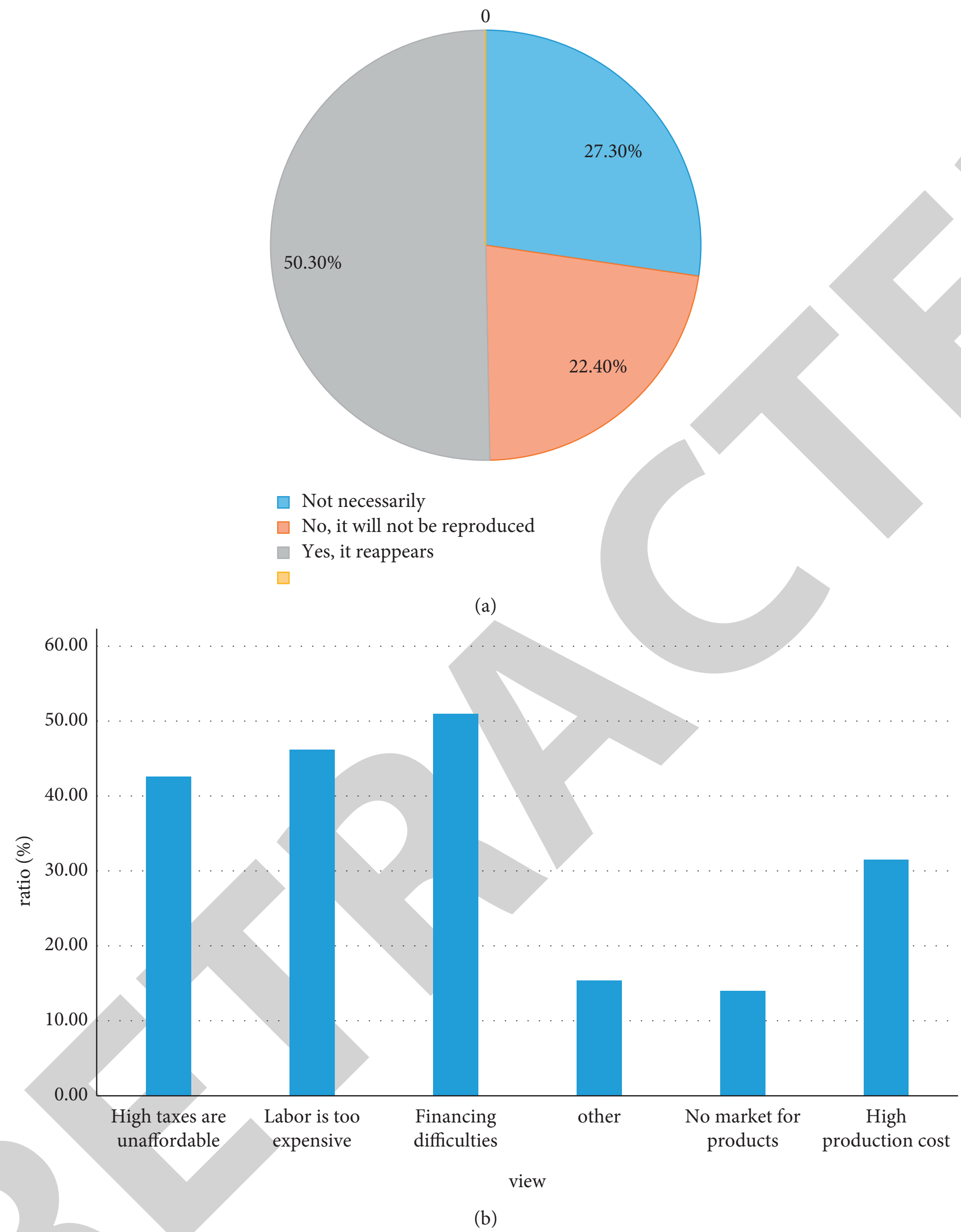


Figure 5: Part 1 survey results: (a) views on whether a new round of financial crisis will recur, (b) views on the greatest difficulties the business is currently facing.

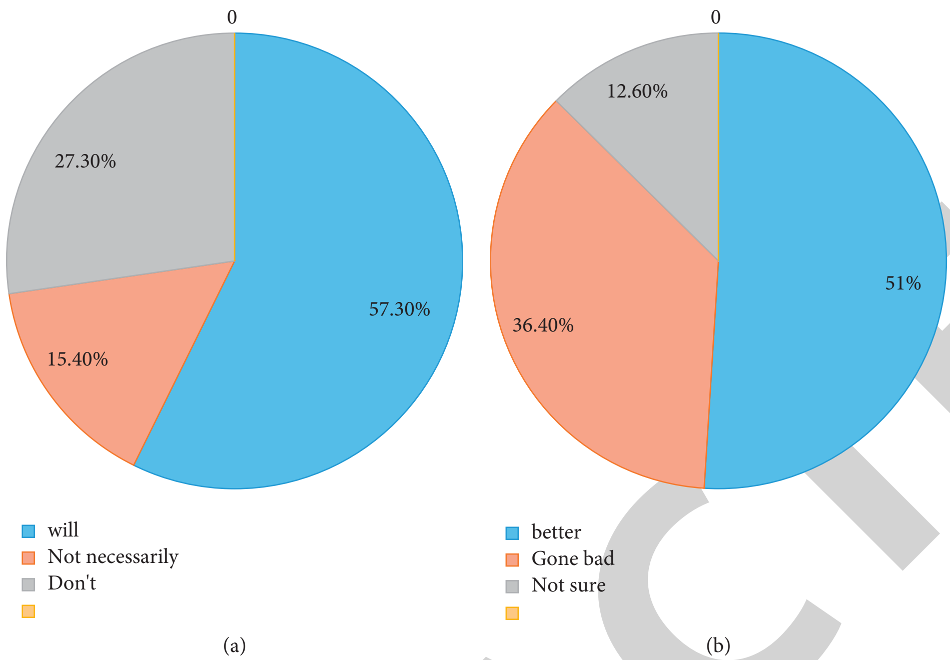


Figure 6: Part 2 survey results: (a) opinions on whether the company will expand capital and equipment investment in the next year, (b) views on how the current overall operation of the enterprise has changed compared to the previous year.

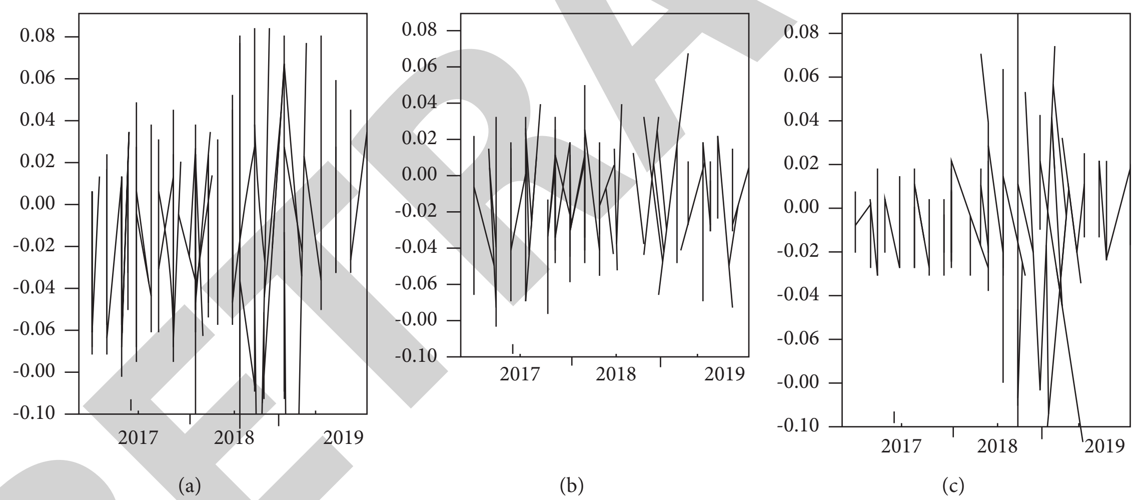


Figure 7: The yield sequence diagram of the three: (a) LME copper, (b) LME aluminum, (c) US dollar index UDI.

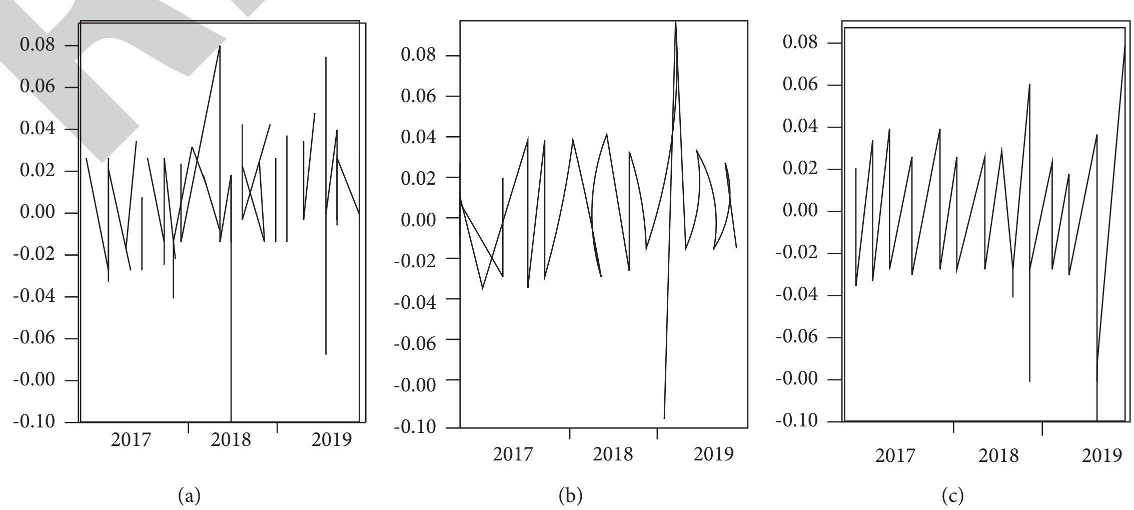


Figure 8: Dynamic correlation coefficient diagram under DCC model: (a) LEM Cu and LV dynamic correlation coefficient 12, (b) KME Cu and UDI dynamic correlation coefficient 12, (c) LME LV and UDI dynamic correlation coefficient 12.

Mean formula:

$$\begin{aligned} T_{1,Y} &= 0.00065 - 0.03635T_{1,Y-1} - 0.01267T_{1,Y-3} + \varepsilon_{1,Y}, \\ T_{2,Y} &= -0.00006894 + \varepsilon_{2,Y}, \\ T_{3,Y} &= -0.00023116 + \varepsilon_{3,Y}. \end{aligned} \tag{8}$$

Variance formula coefficient matrix estimates

$$\begin{aligned} V &= \begin{pmatrix} 0.003143^{***} & 0 & 0 \\ 0.00087 & 0.00128^{***} & 0 \\ -0.000014 & -0.00013 & 0 \end{pmatrix}, \\ S &= \begin{pmatrix} 0.298431^{***} & 0.006082 & -0.012908 \\ -0.0837498 & 0.1102728^{***} & -0.014008 \\ 0.351747^{**} & 0.143898 & 0.1497217^{***} \end{pmatrix}, \\ N &= \begin{pmatrix} 0.950187^{***} & 0.011703 & 0.0064179 \\ -0.0029019 & 0.9694506^{***} & 0.0016893 \\ -0.1274555^{***} & -0.0636107^{***} & 0.9928174^{***} \end{pmatrix}, \end{aligned} \tag{9}$$

* means obvious at 10%; ** is significant at 5%; *** is significant at 1%; when $S_{LK,}S_{LK}\ (l \neq k)$ is obviously not equal to zero in the variance formula, it means that market K(L) has volatility overflow to market L(K).

3.3.5. VaR Prediction and Effect Evaluation Based on Multivariate GARCH Model. As shown in Figure 9, it can be seen from the dynamic combined weight map under the two models that the two models are basically not very different. But UDI and UDL obviously have the highest weight values, both floating around 0.8.

It can be known from the above that a comprehensive market risk evaluation of multiple financial assets can be realized through the multivariate GARCH family model. At the same time, it is also possible to evaluate the market risk of one of the assets. The key difference between this evaluation and the univariate GARCH family model is that the multivariate GARCH family model can introduce the shock of exogenous variables or the previous fluctuations of exogenous variables into the financial asset under study. It reflects the indirect impact of the shock of the exogenous variable innovation on it and the degree of the indirect impact of the fluctuation of the exogenous variable. For example, the variance formula for the conditional variance J of LME copper at time Y in the three-variable BEKK model is as follows:

$$IN\left(J_{11.Y}\right) = \omega + \alpha\left[\frac{\vartheta - L}{\sigma - L}\right] + \gamma\left[\left[\frac{\vartheta - L}{\sigma - L}\right] - \mu\right] + \beta J_{11,Y}. \tag{10}$$

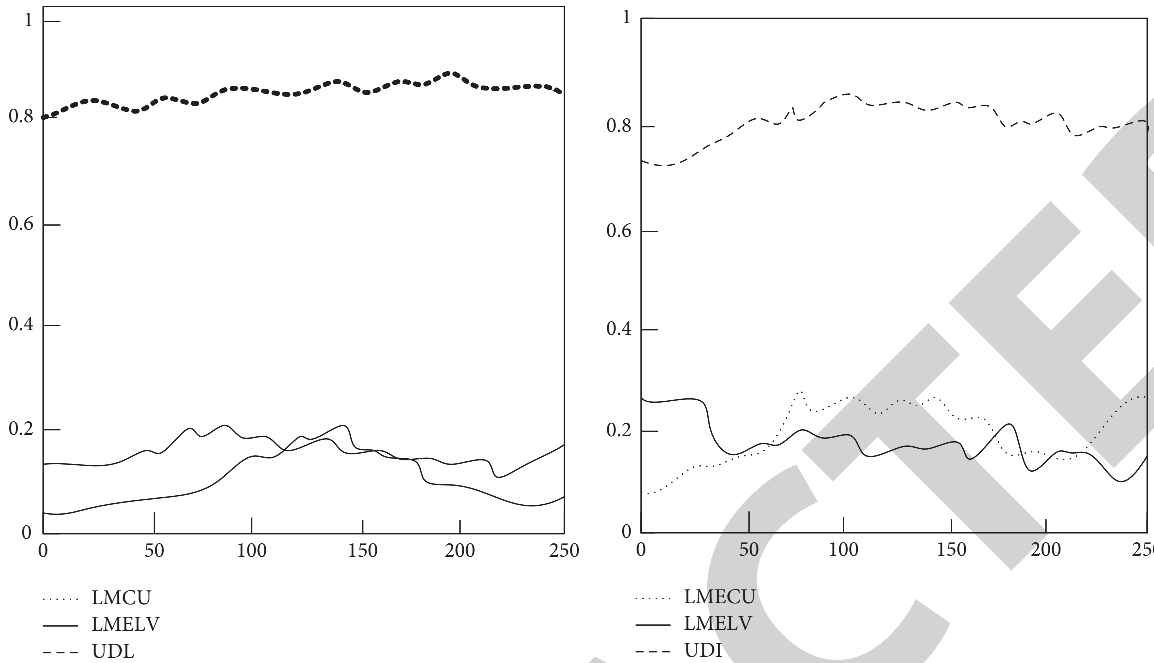
3.3.6. VaR Evaluation of LME Copper under Different Models. Confidence levels of 90%, 95%, and 99% are selected accordingly and then compared with the actual portfolio returns. The specific situation is shown in Figure 10. It can be seen that the higher the confidence level is, the greater the absolute value of dynamic risk is, and the less the portfolio return exceeds the risk value, that is to say, the lower the failure rate of evaluation is. These models are suitable for evaluating VaR of financial investment risk.

On the whole, these models are more suitable for evaluating financial investment risk. Considering the obtained data, the evaluation effect of EGARCH-T is the best in general, the evaluation effect of DCC-T model is second, and the evaluation effect of EGARCH-N is the worst. In the process of evaluating financial investment risks, the models we have established show that the evaluation results of the models cover actual losses. It is too small for the partial value compared with it, indicating that the estimated result is too conservative. In addition to the EGARCH-N model, the established model is more accurate in evaluating financial investment risk at the 90% confidence level. It is relatively close to the given significance level. This shows that the use of digital models to study the evaluation of financial investment risk management systems can indeed make the evaluation results closer to the actual risk evaluation and improve the accuracy of investment.

4. Discussion

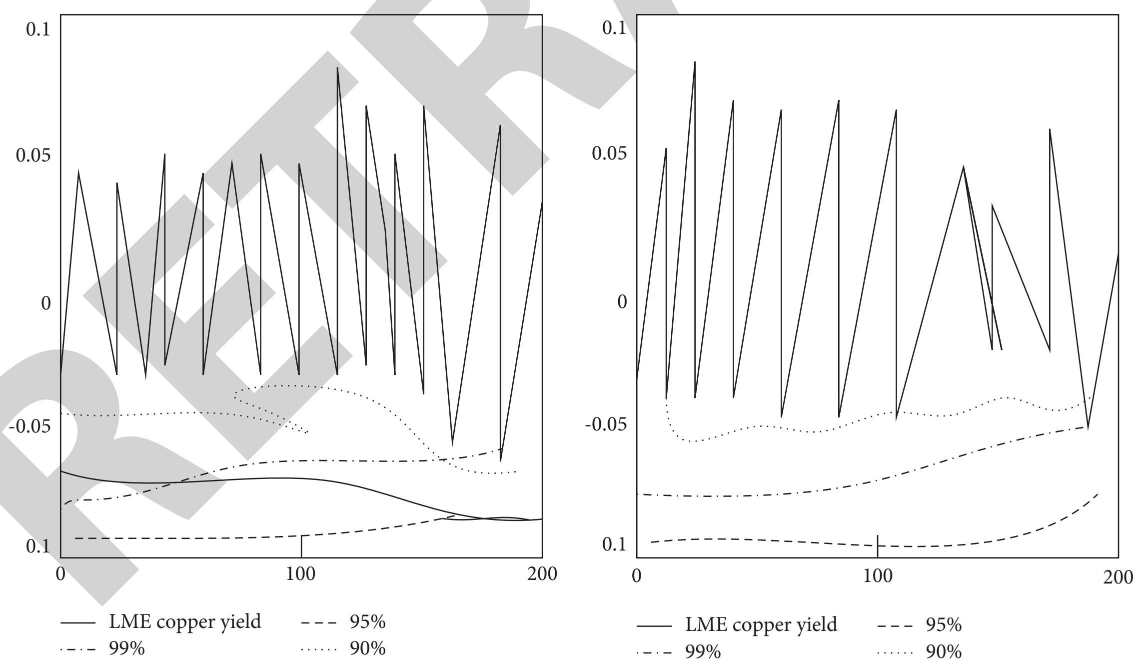
This paper is devoted to researching and designing a mathematical model for quantitative analysis of financial investment risk management system evaluation. This paper applies it to the complex analysis and treatment of investment risks in LME copper and LME aluminum. It not only expands the application scope of digital models, but also is a new attempt to evaluate the complexity of financial investment risk management systems. Through qualitative analysis of LME copper and LME aluminum investment risks, digital models are mined as an important tool to study system complexity. It has a certain potential in the study of the complexity of financial markets. In addition, on the basis of in-depth research on many models in China, the most suitable model is selected in this paper, combined with the survey of enterprise survival status. Combined with the special 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 system, this paper starts from the most basic introduction of financial investment risk, analyzes the evaluation system, and introduces a variety of digital models. It successfully combines the GARCH digital model and the financial investment risk management system evaluation and draws conclusions. In the stage of empirical analysis, the GARCH model is used to obtain effective chart data, and this paper analyzes the data in many aspects. The results show that the obtained results are in line with the actual situation.

Through the analysis of this case, it shows that the use of 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 greatly reduce financial investment risks and make decisions on multiproject portfolios. In the specific practical investment portfolio



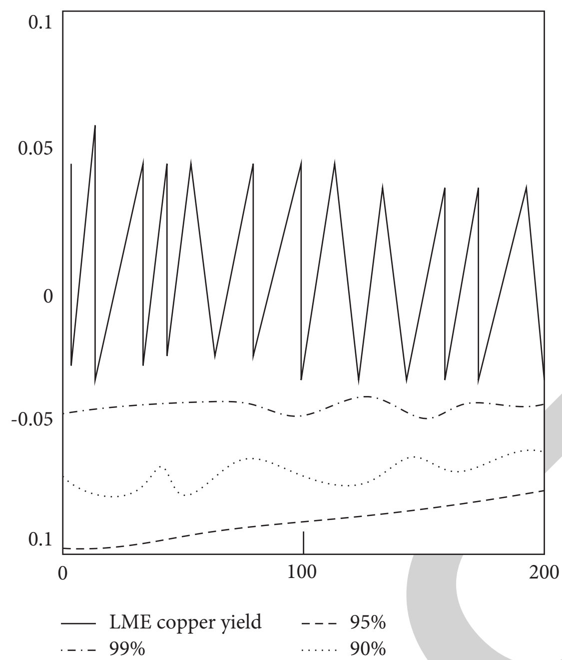
(a) (b)

Figure 9: Dynamic combination weights graph: (a) dynamic combination weights under the DCC model; (b) dynamic combination weights under the BEKK model.



(a) (b)

Figure 10: Continued.



(c)

Figure 10: LME copper VaR at different levels of significance. (a) GARCH-N, (b) GARCH-T, (c) EGARCH-N.

decision-making, enterprises or investors expect to formulate different investment strategies according to their own risk preferences and investment goals and choose the risk value and return goals of the project reasonably and flexibly. It substitutes the risk and return 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 aluminum investment risks as a case study. First, through the investigation and qualitative analysis of enterprise investment risk status, the investment risk data is determined. And 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 analysis of the data, it is concluded that the GARCH model applied in this paper is very suitable for quantitative analysis of the evaluation of financial investment risk management system.

5. Conclusion

Through the case study, the important conclusions are drawn: In general, the quantitative analysis of the financial investment risk management system evaluation using the GARCH model is very close to the reality. This means that the model has a very high degree of accuracy in evaluating financial investment risks. However, this is not absolute. It does not rule out the arrival of a special period, and some financial investment risks may have extremely unstable 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 effective 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. And real investment should also be combined with a variety of irresistible factors for investment analysis; the analysis of investment risk will have greater 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 taken into account, making this financial investment risk management system more scientific.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there are no conflicts of interest in the paper.

Acknowledgments

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