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Retraction

Retracted: Performance Evaluation Method of Online Supply Chain Finance Logistics Enterprises Based on GARCH-VAR

Security and Communication Networks

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1].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) Manipulated or compromised peer review

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.

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[1] T. Xia and J. Yang, "Performance Evaluation Method of Online Supply Chain Finance Logistics Enterprises Based on GARCH-VAR," *Security and Communication Networks*, vol. 2022, Article ID 4500430, 9 pages, 2022.

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Research Article

Performance Evaluation Method of Online Supply Chain Finance Logistics Enterprises Based on GARCH-VAR

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In recent years, China's core enterprises have been plagued by high operating costs, difficult bank loans, and other practical problems in the supply chain. As a new financing model emerged in recent years, it has opened up new markets in finance and logistics industry and brought new ideas and vitality to all parties in the supply chain. Since the strengthening of supervision, the operation of the industry has gradually changed to the direction of normalization. The study of online loan interest rate fluctuation is helpful to understand the source and characteristics of online loan risk, which has important reference significance for China's Internet lending market. The measurement of interest rate risk can help to monitor market risk in time and improve financial supervision. This paper takes the online loan interest rate under the background of supervision as the research object, combining theoretical analysis and empirical research to explore the characteristics of interest rate fluctuations and the reasons behind the P2P online loan, and discusses the online loan business model. Based on the influencing factors of interest rate fluctuation, this paper analyzes the main characteristics of network loan interest rate from the aspects of interest rate trend interval distribution, regional distribution, and background distribution. This paper adopts the daily closing price data of domestic R insurance company to establish the daily logarithmic return rate series of stock prices. The results show that (1) GARCH-VAR model can effectively reflect the stock price fluctuation and market risk degree of the insurance company; (2) the company's VAR showed a trend of first rise and then slight decline, with the highest VAR in 2018; and (3) the interpretation of VAR value should be combined with financial indicators. The increase in net profit rate will also lead to the decline of VAR value in the next period. Based on this, countermeasures and suggestions for market risk management are proposed for insurance companies.

1. Introduction

With the continuous development of the financial system and social security system, the insurance industry, as a part of it, has become more and more important. The outbreak of the global financial crisis in 2008 led to the violent turbulence of the international financial market and the huge impact on the financial systems of various countries, which directly affected the survival and development of financial and insurance institutions [1–3]. For example, the global insurance giant American International Group was on the verge of bankruptcy due to a huge capital gap. At present, central banks of various countries keep cutting interest rates, and the global finance has entered the era of low interest rate.

The stable development of insurance industry is deeply affected by the basic variable of interest rate [4]. Low interest rate leads to the reduction of investment yield and increases the spread loss risk. The valuation of financial assets is distorted, and insurance companies are facing increasingly severe market risks. As China's economy steps into the new normal and the rise of the mixed business model, the control of financial risks is particularly important [5–7].

Risk measurement is the first step of market management, and the VAR model is also one of the classic measurement methods [8]. Generally speaking, there are four measures of market risk: sensitivity analysis is reflected by changes in expected portfolio value caused by changes in some market risk factors. Among them, the common market

risk factors of gap analysis and duration analysis are interest rates. Capital asset pricing model is a very classic measure of market risk, which is developed based on Markowitz's portfolio theory [9, 10]. The calculation of the commonly used method mainly depends on the historical data to calculate the VAR value, that is, to calculate the VAR of all financial assets in the portfolio and the income distribution of the entire portfolio [11–15].

Online supply chain finance is to realize the interconnection of the information systems of financial institutions and the upstream and downstream enterprises of the core enterprises in the supply chain through Internet technology under the condition of information to reduce the financial loss. [16, 17]. Compared with traditional supply chain finance, online supply chain finance has more efficient information communication, more accurate management process, and more controllable financial risks [18–20]. Compared with traditional supply chain finance dominated by logistics enterprises, online supply chain finance has a wider scope of credit, no longer limited to large enterprises, and dynamic pledge to fill positions more timely and transparent process. It can be seen from the above analysis that the domestic research studies on online supply chain finance are still in its infancy, and the main research contents are mode characteristics and functions, while the research on the performance evaluation of logistics enterprises in online supply chain finance is rarely involved. This paper takes online supply chain finance led by logistics enterprises as the entry point to study its performance evaluation indicators and methods [21]. It is expected to provide help for the promotion and application of this new online supply chain finance model in reality.

In the dynamic pledge mode of online supply chain finance led by logistics enterprises, financing enterprises apply for financing to the cooperative bank of the online platform through the electronic warehouse receipt provided on the online platform of logistics enterprises [22]. Online supply chain finance dominated by logistics enterprises, creditor enterprises, and debtor enterprises adopts collection mode. Banks sign contracts on the online supply chain finance platform provided by logistics enterprises and, on this basis, provide financial services to supply chain related enterprises through e-commerce. [23, 24]. Making the financing process more convenient online financial supply chain in the process of cargo circulation is not a bank in the ownership of the goods. On the contrary, the online platform provides the first choice of credit investigation list for enterprises in the supply chain of benign competition and credit investigation system construction [25–27].

The contributions of this paper are as follows. This paper adopts the daily closing price data of domestic R insurance company to establish the daily logarithmic return rate series of stock prices. The proposed combined algorithm results in online supply chain financial logistics enterprise performance evaluation.

2. Related Works

As can be seen from the above literature review, since the research of supply chain finance on the performance evaluation of logistics enterprises is relatively few, this paper summarizes the viewpoints of predecessors from three aspects: logistics supply chain enterprises, financial evaluation supply chain, and financial performance evaluation index system. Doan and Bui [28] believed that the evaluation of enterprise credit risk in supply chain finance is inseparable from the evaluation of enterprise operation ability, profitability, debt paying ability, and development ability. Meucci and Carrotani [29] believed that supply chain finance should not only pay attention to its performance management but also pay attention to the liquidity of supply chain finance and the visualization of supply chain. Yagi believed that supply chain finance should not only pay attention to its performance management but also pay attention to the liquidity of supply chain finance and the visualization of supply chain. The performance evaluation of logistics enterprises in the implementation of supply chain finance is carried out from the aspects of logistics operation ability, supply chain dynamic management ability, online platform operation ability, and financial operation ability. In particular, the financial operation ability of logistics enterprises is projected by the indicators of transaction efficiency and allocation efficiency. Elmanizar et al. [30] established a performance evaluation system for small- and medium-sized enterprises under the supply chain finance mode from the aspects of financial evaluation, customer evaluation, internal business process, and growth with balanced scorecard, in which customer complaint rate reflects product reliability and supply chain node interaction reflects learning and growth [31].

The direction of supply chain finance evaluation mainly involves supply chain finance risk evaluation, credit evaluation, supply chain performance evaluation, and so on [32]. However, there are few research studies on the financial performance evaluation of supply chain, and the financial research of supply chain performance evaluation is even more scarce. Therefore, this study hopes to supplement the problems we are facing [33]. Although there are few direct studies on the performance evaluation of supply chain finance, the comprehensive evaluation of other aspects of supply chain finance can also understand the study of supply chain financial performance evaluation from the side [34] With the development of supply chain finance, order financing based on supply chain relationship also appears in large numbers to authenticate the property rights of collateral [35]. There is an increasing demand for third-party institutions for value evaluation and supervision and control and for providing evaluation warehousing and monitoring services for inventory and receivables financing. Warehousing and logistics enterprises have become relatively standardized and developed. Conditions for the development of supply chain financial services are ripe. Warehousing and logistics enterprises should connect with banks and other financial

institutions, increase the supply chain finance business model with small- and medium-sized enterprises and core enterprises, and vigorously develop supply chain finance business. Enterprises have unique advantages in participating in supply chain finance financing, while the professional service advantages of logistics enterprises determine that their responsibilities in the supply chain are different from those of finance and enterprises. Therefore, it is necessary to study supply chain finance based on their own characteristics [36].

From the above analysis, we know that the above methods have studied performance evaluation of logistics enterprises in online supply chain finance. However, some problems still exist. For example, no scholar has applied the GARCH-VAR model to this field till now, so the research here is still a blank, which has great theoretical research and practical application value for logistics enterprises.

This paper consists of five parts. The first and second parts give the research status and background. The third part is the digital image-based crack repair model of ancient ceramics. The fourth part shows the experimental results. The experimental results of this paper are introduced and compared and analyzed with relevant comparison algorithms. Finally, the fifth part concludes the full paper.

3. Performance Evaluation of Supply Chain Finance Based on GARCH-VAR

3.1. Supply Chain Finance Performance Evaluation Index System. For any enterprise, capital is the source of its life; financing is a way to revitalize the enterprise capital, improve the effective utilization rate of capital, and obtain profits. With the emergence of modern new production organization mode, supply chain financing has become a research hotspot. However, enterprises must have their own unique conditions to conduct supply chain financing. Therefore, those who are most affected by stress and have the ability to take the most drastic and effective action for change are the most likely to achieve the best performance. This paper will establish the supply chain financial performance evaluation index system of warehousing and logistics enterprises from four dimensions, that are the pressure dimension, action dimension, ability dimension, and driving factor dimension. The whole system of the method is given in Figure 1.

In the process of establishing specific three-level indicators, financial indicators are selected as the standard of financial indicators of listed companies, while nonfinancial indicators of warehousing and logistics enterprises refer to high-frequency indicators and other referable standards formulated by the country or industry. According to the characteristic index of logistics enterprises, this paper chooses different methods to determine the weight of the index system and finally uses the analytic hierarchy process (AHP) to determine the financial performance evaluation index system.

3.2. GARCH-VAR Model. Although ARCH is a very simple volatility description model, it usually needs a lot of parameters to describe the volatility of return rate. And the fit effect of volatility is not very good. Here, we will talk about

an generalized ARCH model—GARCH model; the expression of GARCH (p, q) model is as follows, where the $p = q = 1$ in this paper:

$$a_t = \sigma_t \varepsilon_t, \tag{1}$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i a_{t-i}^2 + \sum_{q}^{j=1} \beta_j \sigma_{t-j}^2, \tag{2}$$

where σ_t^2 represents the positive term and a_t is the noise. Let us set the parameter innovation as follows:

$$\eta_t = a_t^2 - \sigma_t^2 = a_t^2 - E\left[a_t^2 | F_{t-1}\right]\left(\sigma_t^2 = E\left[a_t^2 | F_t - 1\right]. \tag{3}$$

Assume that

$$E(\eta_t) = 0, \text{cov}(\eta_t, \eta_{t-1}) = 0. \tag{4}$$

We have

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i \alpha_{t-i}^2 + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2, \tag{5}$$

and

$$a_t^2 - \eta_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i a_{t-i}^2 + \sum_{j=1}^{q} \beta_j \left(a_{t-j}^2 - \eta_{t-j}\right). \tag{6}$$

So, like the ARCH model, to keep stationary, the two sides will return expected:

$$\text{var}(a_t) = E\left[a_t^2\right] = \frac{\alpha_0}{1 - \sum_{i=1}^{\max(p,q)} (\alpha_i + \beta_i)}. \tag{7}$$

To ensure that variance is positive, that is, variance exists and is finite,

$$\sum_{i=1}^{\max(p,q)} (\alpha_i + \beta_i) < 1. \tag{8}$$

The GARCH $(1, 1)$ model is the most popular and useful GARCH model at present:

$$\sigma_t^2 = \alpha_0 + \alpha_1 a_{t-1}^2 + \beta_1 \sigma_{t-1}^2 (\alpha_1 \beta_1 \geq 0, \alpha_0 > 0, \alpha_1 + \beta_1 < 1). \tag{9}$$

Why can the GARCH model better describe volatility aggregation. Because a large a_{t-1}^2 or σ_{t-1}^2 can well describe volatility clustering,

$$K_a = (K_\varepsilon + 3)E\left[\sigma_t^4\right]\frac{\left(1 - (\alpha_1 + \beta_1)\right)^2}{\alpha_0^2}$$
$$- 3\frac{(K_\varepsilon + 3)\left(1 - (\alpha_1 + \beta_1)^2\right)}{1 - 2\alpha_1^2 - (\alpha_1 + \beta_1)^2 - K_\varepsilon Q_1^2} - 3, \tag{10}$$

$$K_a^\phi = \frac{3 - 3(\alpha_1 + \beta_1)^2}{1 - 2\alpha_1^2 - (\alpha_1 + \beta_1)^2} - 3. \tag{11}$$

For the GARCH model, we also adopt the maximum likelihood method and the parameters we want to estimate, so there is condition likelihood:
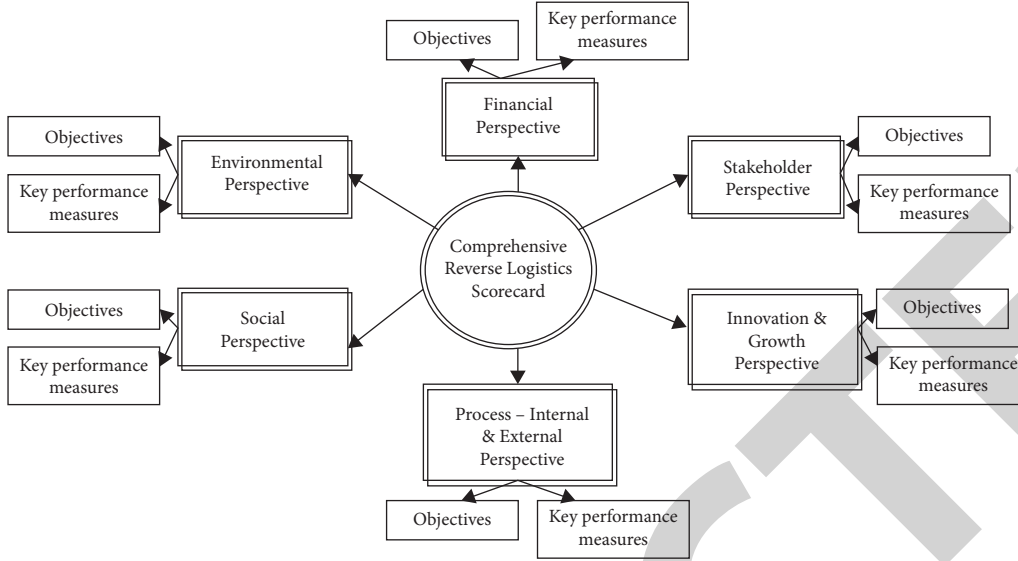
FIGURE 1: The whole system of the proposed method.

$$p(r_2, \ldots, r_T | r_1, \theta) = \prod_{t=2}^{T} p(r_t | \mathscr{F}_{t-1}, \theta), \tag{12}$$

$$b_{pqrs} = b_{pqrs} + V_{pqrs} \cdot \widehat{F}_{pqrs}. \tag{13}$$

It has been proved above that, compared with the normal distribution, the distribution of the random error term of the Internet financial index return rate presents a significant peak thick-tailed distribution. In order to describe the distribution characteristics more accurately, the random error terms of T and GED distributions of students in three forms are discussed, and the following results are obtained. If the sum of parameters is infinitely close to 1, it indicates that the influence of conditional variance is highly durable, and GARCH (1, 1) has high stability, which can better fit the data. Then, conditional heteroscedastic ARCH LM test is performed on the above equation to obtain the statistical results of residual sequence when the lag order $p = 3$.

The value of Internet financial products or services is lost due to market uncertainty, and the risk measurement of Internet financial market is used to measure the loss. The GARCH family model is used to model the volatility of Internet financial price index series and reflect the difference in the state and accuracy of volatility. Based on this, the AIC criterion is used to find the conditional variance of the model which can better fit the volatility. The VAR method can not only measure the risk of Internet finance but also describe the change of Internet finance income well, so it has a wide range of uses.

4. Experimental Results and Analysis

4.1. Introduction to Experimental Environment and Data Set. With the continuous development in recent years, R Insurance Company has become the representative of the mixed operation of China's insurance industry. At present,
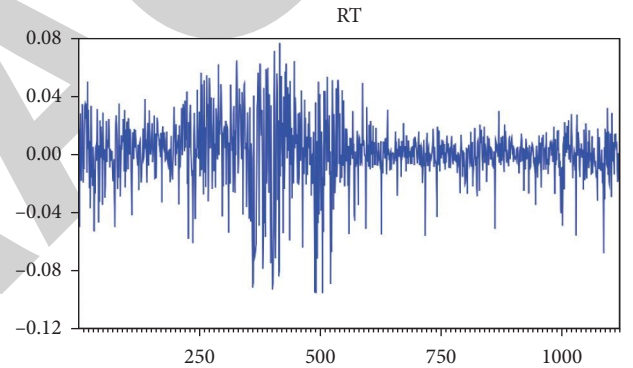

FIGURE 2: The stationarity results of experimental data.

its market value is up to one trillion yuan, ranking in the forefront of large domestic insurance companies. As a large listed insurance company in China, R Insurance Company is faced with one of the major financial risks and its impact on the company's operation and even the insurance industry, which cannot be ignored.

Therefore, in order to avoid the influence of abnormal fluctuations of the stock market as much as possible, this paper sets the time span of the research data as January 1, 2016, to May 1, 2020, and calculates the corresponding pair based on the daily closing price P of R Insurance company rate of return. All data in this paper are from NetEase Financial website. In the descriptive analysis of the data, EVIEM8.0 software was used to depict the time series diagram of the stock return rate. According to Figure 2, the logarithmic return rate fluctuated up and down with 0 as the center value, and its fluctuation range was obvious in most of the time periods, with different fluctuations. The amplitude is concentrated in different time periods, which indicates that the time series of return rate has strong characteristics of fluctuation agglomeration.
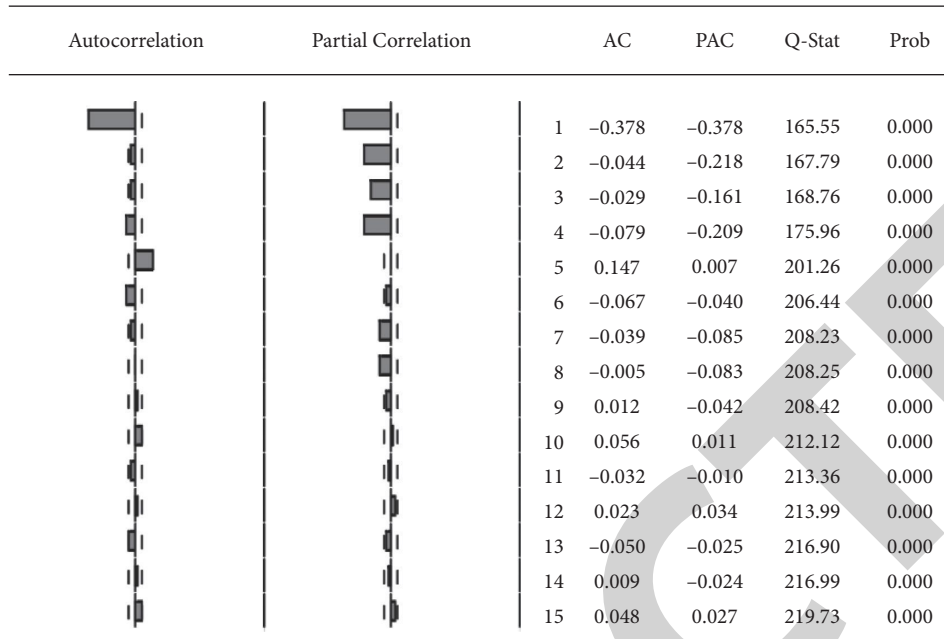
				AC	PAC	Q-Stat	Prob
Autocorrelation		Partial Correlation					
			1	−0.378	−0.378	165.55	0.000
			2	−0.044	−0.218	167.79	0.000
			3	−0.029	−0.161	168.76	0.000
			4	−0.079	−0.209	175.96	0.000
			5	0.147	0.007	201.26	0.000
			6	−0.067	−0.040	206.44	0.000
			7	−0.039	−0.085	208.23	0.000
			8	−0.005	−0.083	208.25	0.000
			9	0.012	−0.042	208.42	0.000
			10	0.056	0.011	212.12	0.000
			11	−0.032	−0.010	213.36	0.000
			12	0.023	0.034	213.99	0.000
			13	−0.050	−0.025	216.90	0.000
			14	0.009	−0.024	216.99	0.000
			15	0.048	0.027	219.73	0.000

Figure 3: LR sequence autocorrelation and partial autocorrelation test results.

4.2. Experimental Results Analysis. Time series has the characteristic of autocorrelation, so the past values of variables can be used to predict their future values. To determine the mean value equation, we need to investigate the autocorrelation function (ACF) and partial autocorrelation function (PACF) of data. On this basis, we can choose the appropriate regression model and then combine with the information criterion to determine the best lag order.

Figure 3 shows the autocorrelation and partial autocorrelation test results of LR sequences. It can be seen that both ACF function and PACF function are trailing. Therefore, ARMA(1, 1), ARMA(1, 2), ARMA(2, 1), and ARMA(2, 1) were established, respectively, and AIC information criteria and lag time were compared. According to the conditional heteroscedasticity of financial logistics performance, interest rate fluctuation changes with time. Poor economic environment and low platform interest rate have become one of the unstable factors for the whole logistics enterprise. On the other hand, irrational behaviors of lenders and borrowers often occur, which also weakens the stable supply and demand mechanism of the market.

Firstly, with the continuous improvement of mobile payment application technology, the scale of its users is also increasing year by year. According to the statistics of China Internet Network Information Center of the People's Bank of China, from 2014 to 2018, the scale of Internet users increased from 300 million to 570 million, the growth rate decreased from 17% to 7%, with the growth rate dropping from 73.2 to 8.2. This means that on the one hand, the popularity of payment is increasing, and on the other hand, the competition for users in the industry is becoming increasingly fierce, as shown in Figure 4.

With the development of information technology, innovation in payment field is further evolving from payment mode innovation to payment media innovation. New technologies such as code payment, biometric payment, and NFC are emerging, and their application scope is gradually expanding. According to iResearch data statistics, in 2017, by virtue of the intelligent transformation of traditional POS machines, bank card orders accounted for 19.4% of the payment market size, Internet payment accounted for 16.8%, mobile payment accounted for 63.7% have become the absolute leader in new payment formats.

Drip travel allows merchants to offer mobile payments, such as the integration of financial closed loop in the mobile payment market rapid development at the same time, exposed the personal information leakage risk and capital risk mainly including the following several reasons: firstly, mobile banking and third-party payment platforms verify by verification code or dynamic password. Once the mobile phone is lost or stolen, there are huge security risks in customer transaction information. Second, when consumers make purchases on Taobao, the user's name, contact information, address, and consumption information will be recorded in the memory of the phone.

Many poorly managed online lending platforms usually face liquidity risks. From the rise of P2P online lending platforms to the present, online lending platforms that do not meet compliance requirements have been eliminated from the market. One side is the completion of multiple rounds of investment and financing and listed industry leading enterprises, while the other side is hovering on the edge of life and death, the face of bankruptcy at any time small platform statistics at the end of 2017, a total of 3902 problem platforms (excluding transformation), accounting for 70.9% of the total number of platforms, at least 643 in 2017. The number of problematic platforms decreased by 44.6% year on year. Among all the problematic platforms, 196 platforms lost contact and ran away, accounting for 30.5%. 160 platforms were closed without reason, accounting for 24.9%. A total of
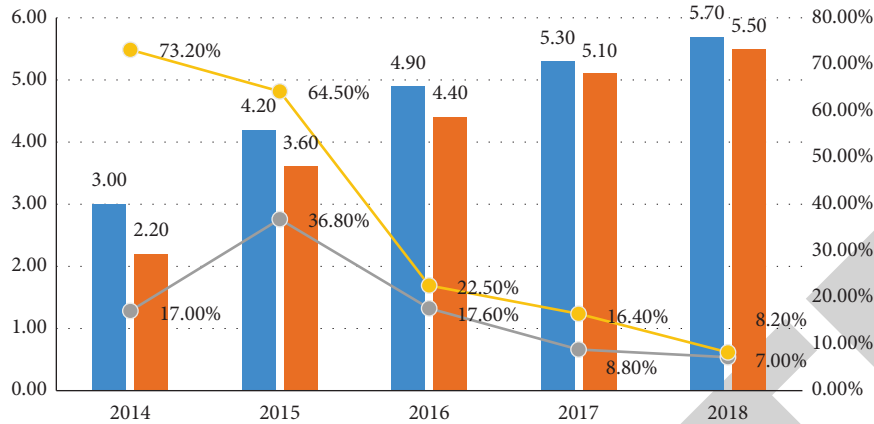
Figure 4: Size and growth of logistics supply chain from 2014 to 2018.

141 platforms closed down, accounting for 21.9%; 100 platforms are difficult to withdraw cash, accounting for 15.6%, and the rest are shown in Figure 5.

The interval distribution of interest rates can be observed from the perspective of volume and number of platforms. From the perspective of volume (Figure 6), since 2016, the transaction interest rate of most online loan orders is between 8% and 12%. The transaction interest rate of 12%–16% accounts for a small proportion, while the transaction interest rate of more than 16% declines year by year until it reaches zero. It can be seen that under the background of gradually strengthening financial supervision, online loan interest rate gradually shifts to a reasonable range, and supervision plays a significant role in regulating interest rate. In terms of the overall trend, the next highest percentage of deals was below 8%, and in early 2016 and early 2017, those below 8% squeezed even beyond the 8% to 12% range. This is closely related to macroeconomic policies and financial supervision. In the environment of deleveraging and defusing financial risks, the policy prospects of online lending industry are uncertain, and the downward pressure on interest rates is large. After 2017, the regulatory policy framework of online lending has been basically built, and market expectations have improved, and the downward pressure on interest rates has been eased.

In Figure 7, the straight line represents the distribution of the income sequence, and the scatter plot under the normal distribution curve represents the actual distribution. As can be seen from the figure, the scatter distribution on both sides of the online wave is very obvious, but the left curve near the lower end of the horizontal axis shows a scatter diagram, and the linear deviation is getting larger and larger, indicating that the production sequence has a trailing effect.

As shown in Figure 8, the overall performance from 2015 to 2019 showed a downward trend with a large fluctuation range. There were two obvious inflection points in the figure, which were divided into three stages according to the inflection points for further analysis. In the first stage, from the beginning of 2015 to the beginning of 2017, the interest rate dropped rapidly from around 14% to around 8%. Before the regulation gradually approached the reasonable range, a large number of online loan platforms implemented policies,
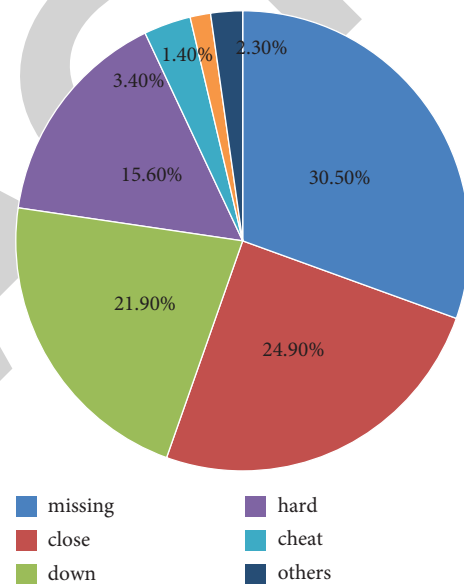

Figure 5: Composition of problem types in supply chain finance in 2020.

such as guarantee payment and high interest solicits, to expand the capital pool.

After the issuance of regulatory policies in 2015, the irregular behaviors of online lending platforms have been gradually controlled, and the artificially high interest rates have returned to a reasonable level. In addition, due to the uncertain industry outlook caused by regulation and the lack of investor confidence, the performance fluctuated greatly during this period. In the second stage, from the first quarter of 2017 to the second quarter of 2018, the performance rebounded slowly. During this period, the supervision system of the online loan industry has been basically established and the supervision goal is to promote the healthy development of the industry. In the third stage, from the third quarter of 2018 to the end of 2019, the performance fell back again. Previous regulations curbed the irregular development of online loans but failed to resolve the accumulation of risks, which showed the difficulty of reforming the financial logistics industry.
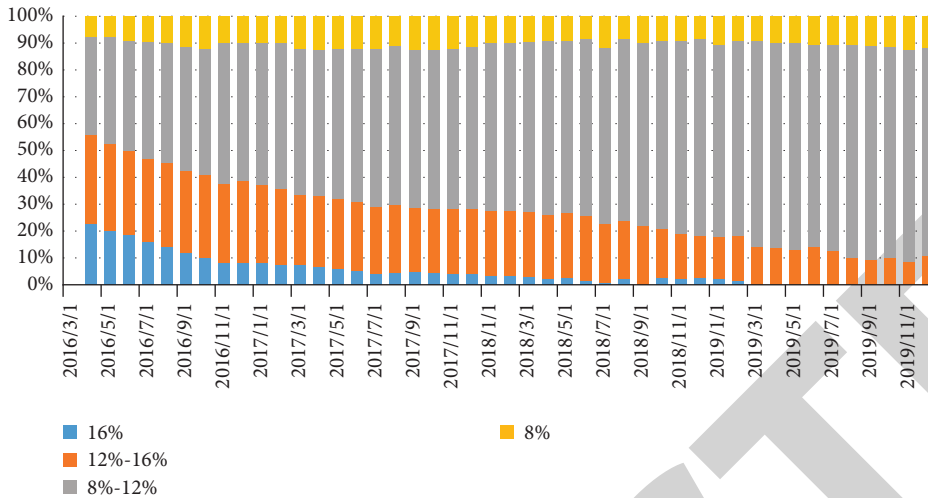
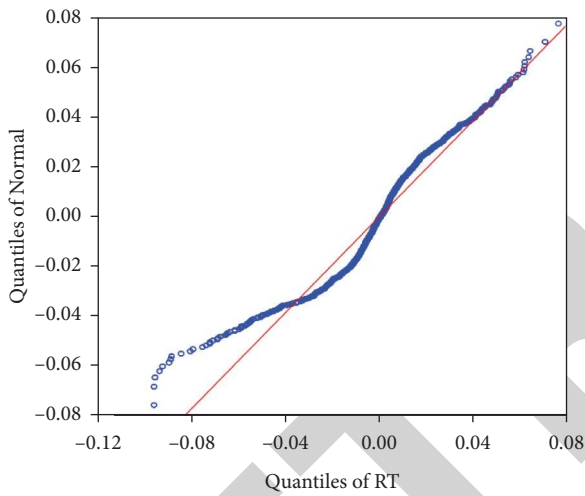Figure 6: Logistics enterprise comprehensive performance evaluation grading.

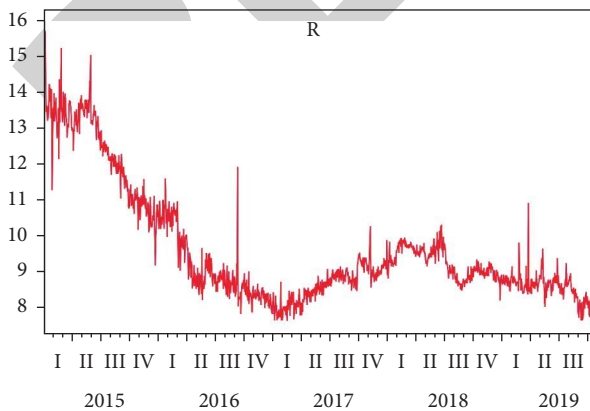Figure 7: Supply chain finance logistics enterprise performance index QQ chart.

Figure 8: Performance trends of financial enterprises.

5. Conclusions

Supply chain finance, as an emerging financing method, provides a good solution to the problems of capital turnover of all parties in the supply chain, which is conducive to solving the financing difficulties of small- and medium-sized enterprises. As a key node in the supply chain, warehousing and logistics enterprises enjoy a special position. Therefore, it is necessary to study the performance of supply chain finance of warehousing and logistics enterprises, and it is of great significance to study the performance of supply chain finance of enterprises to promote better and faster development of supply chain finance of enterprises.

On the basis of literature retrieval and analysis by domestic and foreign scholars in the early stage, the research topic of supply chain financial performance evaluation of logistics enterprises is determined, and risk analysis is carried out through relevant basic theories and the operation process of supply chain financial mode of warehousing logistics enterprises. This paper innovatively takes the GARCH-VAR model as the supply chain financial performance analysis model and tries to construct a complete index system through analytic hierarchy process. The fuzzy comprehensive evaluation method is used to empirically evaluate the financial performance of the supply chain of warehousing and logistics enterprises, so as to test its applicability and operability, then analyze the problems existing in the evaluation score of the supply chain financial performance of warehousing and logistics enterprises, and put forward corresponding improvement suggestions for the problems and shortcomings of enterprises.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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