Research Article

Enterprise Financing Risk Control of Machine Learning Combined with Blockchain Technology

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In order to scientifically and reasonably control the financing risk of supply chain enterprises and minimize the financing risk of the enterprises, this paper introduces the relevant theories of machine learning algorithm and blockchain technology, proposes an enterprise financing risk control model based on the combination of machine learning algorithm and blockchain technology, and uses system dynamics to dynamically evaluate the system risk. Finally, the specific changes of each subsystem over time are obtained. Through the risk evaluation results, it can be seen that the risk level of the blockchain system has decreased from the initial 4.3 to 0.3 after two months of transition, and the risk control effect is very significant.

1. Introduction

In recent years, with the continuous development of China’s social economy and the acceleration of industrial transformation and upgrading, the development model of the financial industry has become more and more diversified, and at the same time, enterprises are facing higher and higher financing risks in the process of development. With the continuous development of blockchain technology, there are more and more research studies on various specific scenario applications related to blockchain technology. The emergence of these applications has a positive impact on the operation mode of supply chain finance at the current stage. With its own characteristics, the emergence and development of blockchain technology can better meet the requirements of enterprise financing risk control and can better control the financial risk of supply chain. Based on the technical characteristics of the blockchain and taking enterprise financing risk control as the research direction, this paper proposes an enterprise financing risk control model based on the combination of machine learning algorithm and blockchain technology.

2. Literature Review

Domestic: some scholars summarized the impact of blockchain technology on the current operation mode of China’s financial industry and various difficulties faced in the promotion of the financial industry and advocated to improve the scenario application of the blockchain in the financial field through science and technology such as the Internet of things; it is expected that the blockchain will have a significant impact on the financial sector. By reducing operating costs and improving operational efficiency, the regulatory capacity can be further improved. Blockchain technology records all transactions in real time through a distributed ledger and can never be modified, so as to achieve the effect of self-letter of credit. According to statistics, the research proportion of blockchain technology in supply chain finance is higher than that in other financial fields. Relevant literature shows that the blockchain can optimize the operation process of supply chain financial business and can reduce the difficulty and cost of financing enterprises. Some scholars tried to apply blockchain technology to factoring business and describe the improvement in its traditional model. They believed that blockchain
technology would help supply chain finance break through
the inherent obstacles; Hernández et al. [1] summarize the
impact of the application of blockchain technology on the
participating nodes of supply chain finance, so as to describe
the economic value of blockchain technology [1]; Payedim-
marri et al. [2] believe that blockchain technology will help
enterprises maximize the value of data, make up for the
disadvantages of traditional supply chain finance, and op-
timize the risk control system of the whole supply chain
finance. By studying the characteristics of blockchain
technology, such as decentralization, nontampering, mul-
tinode consensus mechanism, and distributed accounting,
believes that blockchain technology will help traditional
supply chain finance overcome the shortcomings of poor
link transmission, lack of moral hazard constraints, low
transaction efficiency and so on [2]. Moon et al. [3] found
that the traditional supply chain finance has the problem of
“information island,” that is, it is difficult to integrate the
four streams and the information flow is not smooth, which
makes it difficult to carry out the traditional supply chain
finance business and greatly increases the risk of fraud. If
blockchain technology is adopted, such problems can be
perfectly solved because of its decentralized, data tamper
proof, and other characteristics that can ensure the inte-
gration of four flows in the supply chain finance and can
open up the information closed loop of all participants, and
provide a new solution for supply chain risk control [3].

In foreign countries, some scholars have found that
blockchain technology can greatly improve the efficiency of
the operation and can simplify the steps of transaction
through an online operation, so as to reduce labor costs;
when describing the application of blockchain technology in
the financial field, Ezzaouini et al. [4] pointed out that the
blockchain is actually a distributed database with asym-
metric encryption algorithm, which has a very important
application value in the financial field [4]. Blockchain
technology has gradually expanded from the basic field of
finance to its surrounding industries, especially through the
natural matching with the field of supply chain finance. It
uses its characteristics of data transmission and storage that
cannot be modified to increase the credit of small and
medium-sized enterprises in the chain, so as to make it easier
to obtain financing. At the same time, it uses the automatic
execution mechanism of smart contract to make up for the
disadvantages of traditional supply chain financial risk
control; Tedre et al. [5] summarized the application scenario
blueprint of blockchain technology in supply chain finance,
as well as the landing restrictions faced in this field and the
great innovation that will be brought to this field; by
studying the characteristics of blockchain technology, be-
lieves that it can effectively make up for many disadvantages
of the traditional supply chain finance and uses blockchain
technology to formulate a set of implementation strategy of
asset securitization for accounts receiving financing. Finally,
he also depicts a beautiful blueprint for the combination of
blockchain technology and supply chain finance [5].

3. Machine Learning Algorithm

3.1. Logistic Regression. Logical regression is often used to
deal with classification problems, which has evolved through
linear regression. Linear regression is used to find the linear
relationship between the output eigenvector \( h(x) \) and the
input sample matrix \( X \), and the coefficient \( W \) satisfies
\( h(x) = WX \). However, when the output eigenvector \( h(x) \) is
discrete, the linear regression method fails. In order to solve
this problem, the solution that scholars think of is that when
the output eigenvector is a discrete value, \( h(x) \) is trans-
formed into \( g(h(x)) \) again. If the value of \( g(h(x)) \) is cat-
egory \( A \) in a real interval and category \( B \) in another real
interval, and so on, a classification model will be obtained.
When there are only two categories of results, it is a binary
classification model. The goal of linear regression is to fit
the distribution of samples in space with the linear combina-
tion of features. The independent variable \( X \) is the feature, \( h(x) \) is
the label, and \( W \) represents the weight corresponding to the
feature. Thus, the linear regression formula can be expressed as

\[
 h(x) = w_0 + w_1 x_1 + w_2 x_2 + \cdots + w_n x_n = W^T x. \quad (1)
\]

On the basis of linear regression, the Sigmoid function is
introduced to map all its output values between [0,1]. The
formula of the Sigmoid function is as follows:

\[
 g(z) = \frac{1}{1 + e^{-z}}. \quad (2)
\]

The Sigmoid function image is shown in Figure 1 and its
value range \([0, 1]\) can be found.

\[
 g(z) = g(W^T x). \quad (3)
\]

The objective function of logistic regression is shown in
the following formula:

\[
 h_w(x) = g(W^T x) = \frac{1}{1 + e^{-W^T x}}. \quad (4)
\]

From the objective function of logistic regression in
formula (4), it can be found that no matter what value \( x \) takes,
it value range stays within the interval of \([0, 1]\). Generally,
for a binary classification problem, the result is
only 0 or 1, where 0 corresponds to “no” and 1 corresponds
to “yes.” For the output results between \((0, 1)\), you can set the
threshold to classify the output results greater than 0.5 as 1
classification and those less than 0.5 as 0 classification, so as
to achieve the purpose of secondary classification. The
maximum likelihood probability is constructed as shown in
the following formula:
the goal of the next iteration is to find a decision tree, represented as shown in the following formulas:

\[
F(x; \rho_m, a_m) = \sum_{m=0}^{M} \rho_m h(x; a_m). \tag{9}
\]

For the estimation of \(g_m(x)\), the decision tree is used to approximate \(g_m(x)\), so that the distance between the two is as close as possible, and there are many ways to measure the distance, such as logarithmic error and so on. The following derivation will be based on the logarithmic error loss function, as shown in the formula:

\[
L(y, F) = \log(1 + \exp(-2yF)), \quad y \in [-1, 1]. \tag{10}
\]

First, solve \(F_0\) so that its partial derivative is 0, as shown in formulas (11)–(14):

\[
F_0 = \arg \min \sum_{i=1}^{N} L(y_i, F), \tag{11}
\]

\[
\frac{\partial \sum_{i=1}^{N} L(y_i, F)}{\partial F} = 0, \tag{12}
\]

\[
\sum_{i=1}^{N} \frac{\exp(p - y_i 2F)}{1 + \exp(p - y_i 2F)} = 0, \tag{13}
\]

\[
F_0(x) = \frac{1}{2} \log \frac{1 + y}{1 - y} \tag{14}
\]

Then, estimate \(g_m(x)\) as follows:

\[
g_m(x_i) = \frac{\partial F(y_i, F)}{\partial F}_{F=F_{m-1}} = \frac{2y_i \exp(-2y_i F_{m-1}(x_i))}{1 + \exp(-2y_i F_{m-1}(x_i))} \tag{15}
\]

Then, the Newton iterative method is used to approximate the step size in the descending direction. This step is omitted in the process of algorithm implementation because different values can be assigned to the parameters according to the shrink strategy to achieve the effect of setting the step size, as shown in the following formulas:

\[
f(r) = \sum_{x_i \in D_m} \log[1 + \exp(-2y_i(F_m(x) + r))], \tag{16}
\]

\[
f'(r) = \sum_{x_i \in D_m} \frac{-2y_i}{1 + \exp(-2y_i(F_m(x) + r))} \tag{17}
\]

\[
f''(r) = \sum_{x_i \in D_m} \frac{2y_i \exp[2y_i(F_m(x) + r)]}{[1 + \exp(-2y_i(F_m(x) + r))]^2} \tag{18}
\]
4. Construction of Enterprise Financing
Financial Risk Evaluation System Based on
Machine Learning and
Blockchain Technology

4.1. Types of Enterprise Financing Risks. When a company receives all of its financial assets fairly, operational risk is the total risk of the transaction and is borne entirely by the shareholders. Corporate financial risk 2 includes the liquidity of assets. Principal loans and interest are usually paid in cash. Therefore, even if the entity’s profits are good, its ability to pay its financial loans and interest on time in accordance with the terms of the agreement depends on the entity’s adequate financial timeliness and total capital investment. Cash flow indicates solvency and liquidity indicates the solvency of assets. If a company does not know when its investment is wrong, its lending policy is too high, and it will face many financial problems, such as needing a lot of cash and paying high interest. In particular, business financial risk consists of the following four factors [6].

4.1.1. Enterprise Financing Risk I: Enterprise Operation Risk. Business risk is the risk of production, operations, and activities that directly affect the uncertainty of an entity’s pre-tax and interest income. Operational risk is different from financial risk but it affects financial risk. When a company receives all of its financial assets fairly, operational risk is the total risk of the transaction and is borne entirely by the shareholders. As companies expand their access to equity and credit costs, investor returns will increase and the risks will outweigh operational risks. The difference is financial risk. If the company is mismanaged and operating costs are not enough to pay the interest, members’ income will decline and interest will be paid along with the investment. In extreme cases, the company will have to make a decision and promote its business [7].

4.1.2. Enterprise Financing Risk II: Capital Liquidity. The principal and interest on the debt are usually repaid in cash (cash capital). Therefore, even if the entity’s profits are good, its ability to pay its financial loans and interest on time in accordance with the terms of the agreement depends on the entity’s adequate financial timeliness and total capital investment. Cash flow indicates solvency and liquidity indicates the solvency of assets. If a company thinks its investment is wrong, or if its lending policy is too high, or if it does not know what income it is earning when it pays its principal and interest, it will face financial difficulties. During this period, the market is able to recognize its assets in order not to incur losses but the volatility of different assets varies. Of these, the liquidity of the cash cell is the strongest, while the liquidity of fixed assets is the weakest. The total liquidity of an entity’s assets is different, i.e., the proportion of different assets in total assets varies due to financial adequacy. The total liquidity of an entity’s assets is high and there are many high liquid assets, but the financial risk is low; conversely, the financial risk is higher when the total capitalization of goods is weak and there are many low assets. Many businesses lose money not because they do not have it but because they cannot finish it in the short term. As a result, they are forced to pay their debts on time and have to declare their business [8].

4.1.3. Enterprise Financing Risk III: Volatility Risk of Financial Market. The financial market is a place of financing. Trading costs are affected by financial markets. For example, interest rates depend on capital and demand in the financial markets after a loan is obtained, and changes in the financial system, such as changes in access to the exchange rates, can increase the risk of financial transactions. Companies often use it to finance short-term loans, while hard financing and spending lead to higher and lower interest rates when short-term loans increase. Also, some companies lose their business and trade because they cannot pay the interest on the loan [9].

4.1.4. Enterprise Financing Risk: A Trap in the Process of Enterprise Financing. The emergence of various financial instruments such as investment, fairness, and private investment has led to many financial and economic developments for businesses, but they are always dealing with problems, and some incorrect financial information can lead to big losses for businesses. For example, in the current financial market, some fraud in the name of investment occurs one after another. They will first attract businesses with better circumstances and then ask the companies to develop business plans or attorneys to inspire. First, they will pay a part of the cost, and then pay for the inspection, research, and reception [10].

4.2. Analysis of Financial Business System Based on Blockchain Technology

4.2.1. System Architecture. The general architecture of the system is shown in Figure 2. In terms of blockchain network architecture and blockchain module connection, the network section is responsible for connecting the service interface module, which must link the financial service history of the supply network to the blockchain service. Blockchain networks typically include member management, blockchain services, data distribution, and code networking services. Among them, blockchain service mainly realizes the communication management function of P2P and the underlying consensus mechanism; member management mainly includes member registration, member audit, member authentication, and
other functions; the distributed ledger stores the transaction data on the chain; the chain code implements the functions of chain code container and chain code deployment. The service interface includes four modules, namely, scheduling control, authority management, certificate management, and fiiric SDK. The interaction between the four modules and the supply chain financial background is realized by relevant interfaces, so that certificates and authorities can be well managed [11].

4.3. System Business Module

4.3.1. Supplier Management Process. First, after the supplier enters the supply chain financial system, it calls the enterprise information writing interface of the service platform to write the enterprise information into the blockchain ledger; the core enterprise can then call the interface for querying enterprise information on the service platform, query the supplier list, select the supplier with transaction, and write the transaction information into the blockchain through a series of steps after the transaction [12]. The management process is shown in Figure 3.

4.3.2. Order Transaction Process. After the supplier delivers goods, it calls the relevant interface to write the information about the shipment into the blockchain. After receiving the goods, the core enterprise calls the relevant interface to confirm the completion of the transaction on the blockchain, as shown in Figure 4.

4.3.3. Capital Flow Process. When there is a financing demand, the supplier, that is, the financing enterprise, will put forward a loan demand to the bank because of the shortage of funds. The bank will query the enterprise information and transaction information on the chain through the relevant interface and review it to decide whether to finance. If so, the financing enterprise will get the funds and this round of transaction will be completed. After the financing period expires, the core enterprise will transfer this round of financing payment to the bank, and all information at this stage will be recorded in the blockchain [13]. The business flow chart of capital flow is shown in Figure 5.

4.4. Construction of Supply Chain Financial Risk Evaluation System on Blockchain. In order to clarify the risks of supply chain finance in the block, the risk analysis process of this paper is shown in Figure 6.

This set of evaluation system is based on the principles of comprehensiveness, scientificity, legitimacy, or operability, pertinence, quantitative, and qualitative combination. Among them, scientificity refers to the scientific selection of the indicators and scientific classification and sorting, so that the indicators do not repeat each other, and the theory should be practical [14].

In each dimension, the part related to the blockchain is black and bold.

First, the selection of indicators for the construction of macro and industrial risk evaluation system is shown in Table 1.

Second, the selection of indicators for the construction of credit risk evaluation system is shown in Table 2.

Third, the selection of indicators for the construction of supply chain relationship risk evaluation system is shown in Table 3.

Fourth, the selection of indicators for the construction of pledge risk evaluation system is shown in Table 4.

Fifth, the selection of indicators for the construction of operational risk assessment system is shown in Table 5.

Sixth, selection of indicators for the construction of blockchain system risk evaluation system is shown in Table 6.

5. Enterprise Financing Risk Evaluation on Blockchain Based on System Dynamics

5.1. Applicability of System Dynamics. The fuzzy comprehensive evaluation method and the analytic hierarchy process are static evaluation of the financial risk of the supply chain on the blockchain, and their evaluation basis can only reflect the risk of the supply chain finance at a certain time. The supply chain financial system on the blockchain is a mobile system. Various transactions are going on continuously, and the values of relevant indicators and parameters are constantly changing. Therefore, the static evaluation system can make an initial value for the risk in a certain period of time but cannot reflect the risk value of supply chain finance on the blockchain in real time. Based on this, this paper uses system dynamics to further dynamically analyze the supply chain finance on the blockchain, so as to achieve real-time risk control [15].

The operation steps of system dynamics are as follows:

(1) Find out the problem
(2) Analyze the causes of the problem and put forward assumptions
(3) Establish computer simulation model
(4) Conduct model testing to ensure that the model can simulate the behavior in the real world

Figure 2: General system architecture.
(5) Multischeme test to find out the local optimal scheme of the problem

(6) Implementation of the scheme

As the risk of supply chain finance on the blockchain is multidimensional and dynamic, when the environment of any participant changes, the overall risk level will also change. The sources of each risk are different. Each source point can be regarded as a subsystem. Each subsystem is not only dynamic internally but also dynamic in the interaction between systems. Therefore, this chapter uses the system power to simulate the supply chain financial risk on the blockchain and will establish a more effective supply chain financial risk control mechanism according to the simulation results.

5.2 Causality Diagram of Each Subsystem. The supply chain financial risk on the blockchain is mainly affected by six factors (see Figure 7). These six dimensions are the macro and industrial risk, credit risk, supply chain relationship risk, pledge risk, operational risk, and the blockchain system risk [16].

| Supplier Management Process |
|-----------------------------|
| Stage | Core business | Supplier | Service interface | Block connection |
| Stage | Supplier registration | The registration information is written into the blockchain | Provide information |
| Get a list of suppliers | | | |
| Affiliated Suppliers | Get a list of suppliers | | Provide information |
| | Write associated information to the blockchain | | |

Figure 3: Supplier management process.

| Order transaction process |
|---------------------------|
| Stage | Core business | Supplier | Service interface | Blockchain |
| Stage | Place an order | Record order data | Write order data to the blockchain | Record Wenyi information |
| Confirm Order | Record order confirmation status | Update order status to the blockchain | Document information |
| | Record shipping information | Shipping information is written to the blockchain | Cargo information |
| | Record charge information | The receipt information is written into the blockchain | |
| | Record financing application information | The financing application information is written into the blockchain | Credit information |

Figure 4: Order transaction process.
## Cash Flow Process

| Stage | Bank | Core Business | Supplier | Service Interface | Blockchain |
|-------|------|---------------|----------|-------------------|------------|
| Stage 1 | No financing | Payment due | Update order information | Write order payment data to the blockchain | Order data |
| Stage 2 | Financing | Payment confirmation | Update order information | Update order payment data into the blockchain | Exchange information |
| Stage 3 | Financing | Write order payment data to the blockchain | Financing application, sign supplier's tripartite agreement | Authorize the bank to view transaction records | Get order transaction data |
| Stage 4 | Financing | Order data | Submit financing order associated order | Get order transaction data | Update the financing status to the blockchain |
| Stage 5 | Financing | Update the financing status to the blockchain | Allow viewing of transaction history | Financing payment data is written into the blockchain | Update financing payment data into the blockchain |

**Figure 5:** Capital flow process.

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## Risk Analysis Flow Chart

- **Key Risk Factors**
- **Characteristics of Supply Chain Financial Risk on Blockchain**
- **Identification of Risk Factors**
- **Key Risks of Supply Chain Finance on Blockchain**
- **Analysis of Risk Occurrence Mechanism**

**Figure 6:** Risk analysis flow chart.
**Table 1: Construction indicators of the macro and industrial risk evaluation system.**

| Primary index | Macro and industry risks                  |
|---------------|------------------------------------------|
| Secondary index | Macro environment Industry development prospect |
| Tertiary indicators | Macroeconomic conditions and blockchain policies Industry competition intensity |

**Table 2: Indicators of the credit risk evaluation system.**

| Primary index | Macro and industry risks                  |
|---------------|------------------------------------------|
| Secondary index | Financing enterprise quality Solvency of financing enterprises |
| Tertiary indicators | Employees’ understanding of blockchain Management quality Enterprise scale, and financial disclosure quality |
| | Sales profit margin Return on net assets Current ratio Quick ratio |
| | Enterprise operating capacity cash Current to current mobilization debt ratio Interest cover Fixed fee reimbursement ratio Asset liability ratio Long-term asset suitability ratio |

| Primary index | Macro and industry risks                  |
|---------------|------------------------------------------|
| Secondary index | Counterparty profitability Development potential of financing enterprises Counterparty credit status |
| Tertiary indicators | Industry status Counterparty sales profit margin Return on net assets of counterparties Counterparty quick ratio Counterparty fixed fee reimbursement |
| | Growth rate of total assets Net profit growth rate Sales revenue growth rate |
| | Previous performance Credit rating External guarantee |

**Table 3: Risk evaluation index of supply chain relationship.**

| Primary index | Supply chain relationship risk | Financing enterprise status |
|---------------|--------------------------------|-----------------------------|
| Secondary index | Closeness of supply chain and blockchain |
| Tertiary indicators | Supply chain time Transaction frequency on blockchain Default |
| | Product price advantage Product substitutability Throughput |

**Table 4: Risk evaluation index of the pledge.**

| Primary index | Risk of pledge | Operational risk |
|---------------|----------------|------------------|
| Secondary index | Sales risk Logistics warehousing risk | Stability of sales channels Vulnerability and perishability of goods |
| Tertiary indicators | Stability of sales customers; Degree of commodity standardization on blockchain |
| | Scope of sales area; Logistics enterprise level |
| | Market bulk density; Supporting storage conditions |
| | Sales accounting period; Commercial insurance of pledge |

**Table 5: Indicators of the operational risk assessment system.**

| Primary index | Operational risk |
|---------------|------------------|
| Secondary index | Process risk Personnel risk Technical risk |
| Tertiary indicators | Maturity of blockchain process design Standardization degree of blockchain process |
| | Standardization degree of blockchain Information Abnormal trading system Abnormal financing system Abnormal payment system Abnormal logistics system |
| | Personnel fraud Human operation Proficiency |
| | Net abnormality Blockchain transaction history data exception |
| | Network security Blockchain transaction history data exception |

| Primary index | Operational risk |
|---------------|------------------|
| Secondary index | Financing approval risk Payment risk Warehouse supervision risk |
| Tertiary indicators | Smart contract vulnerability Bank approval Bank audit Blockchain platform audit |
| | Payment data Out of account Payment collection |
| | Take delivery of goods Deliver goods Warehouse receipt error |
Table 6: Indicators of blockchain system evaluation system.

| First-level indicator | New technology is risky | Security risk | Stability and reliability |
|-----------------------|-------------------------|--------------|--------------------------|
| Secondary indicators  | Investment failure      | Data security| Ecosystem matures        |
| Three-level indicator | Market mismatch         | Wrong implementation | Extensibility |

Figure 7: Financial risk dimensions of supply chain on the blockchain.

Figure 8: Causality diagram of macro and industrial risks.

Figure 9: Causality diagram of supply chain risk.
The following describes the system relationship of the four main modules:

(1) Macro and industry risk subsystem (see Figure 8)
(2) Supply chain relationship risk subsystem (see Figure 9)
(3) Collateral risk subsystem (see Figure 10)
(4) Blockchain system risk subsystem (see Figure 11)

5.3. Variable Set of the System Dynamics Model. Assign values to various variable types, including the horizontal variable (represented by box), rate variable, auxiliary variable (storing intermediate process), and constant variable [17].

5.3.1. Horizontal Variable Set. Level variable can be called integral variable in mathematics. The general solution is to integrate other variables in time [18], as shown in Table 7:

Table 7: Financial level variables of supply chain on the blockchain.

| Variable scene name                          | Variable code | Variable star description                                                                 |
|---------------------------------------------|---------------|------------------------------------------------------------------------------------------|
| Macro and industry risks                    | $L_1$         | The unit is dimensionless. The higher the score, the higher the risk level                |
| Credit risks                                | $L_2$         | Dimensionless. The greater the score, the higher the risk                                 |
| Supply chain relationship risk               | $L_3$         | Dimensionless. The greater the score, the higher the risk                                 |
| Risk of pledge                              | $L_4$         | Dimensionless. The greater the score, the higher the risk                                 |
| Operational risk                            | $L_5$         | Dimensionless. The greater the score, the higher the risk                                 |
| Blockchain system risk                      | $L_6$         | Dimensionless. The greater the score, the higher the risk                                 |
5.3.2. Rate Variable Set. Rate variable (Rite Viriille) is the amount of change in unit time. It is generally the inflow rate and outflow rate set for the source and the drain of horizontal variable, as shown in Table 8.

5.3.3. Auxiliary Variable Set. Auxiliary variables are the intermediate products of the horizontal variables, speed variables and other types of variables. The existence of auxiliary variables can effectively reflect some delay and nonlinear changes in the feedback system, which plays an important role in the simulation of real activities, as shown in Table 9.

5.3.4. Constant Set. The constant set in the model is the amount that does not change with time in the process of model simulation. If the constant changes, it will automatically change to another simulation. Changing the constant value can get many different simulations, and each simulation result set can be compared. The constants are divided into general constants and ratio constants. General constants are set objectively and are reasonably analyzed according to the actual survey data. The ratio constant is the ratio of the two variables in the system [19].

5.4. System Simulation Operation

5.4.1. Purpose

(1) Verify the impact intensity of different primary indicators on the financial risk of the supply chain on the blockchain, so as to determine the change of the total risk with the change of each primary indicator risk [20].

(2) By changing different initial values for simulation, the different trends of system risk with different initial values are obtained, which provides a basis for the preliminary preparation of the blockchain system.

(3) Observing the risk development of each subsystem and the development trend of supply chain finance on the blockchain can well control the total risk.

5.4.2. Determination of Initial Value of Simulation Operation. In order to test the feasibility of the simulation system, it is necessary to simulate the simulation system. The risk evaluation value comes from the reference of relevant references, and the initial value of system risk evaluation can be obtained by referring to the previous theoretical research and analysis [21]. This simulation sets the financing period as two months, as shown in Tables 10 and 11.

### Table 8: Financial risk flow of supply chain on blockchain.

| Variable scene name                        | Variable code | Variable star description                          |
|--------------------------------------------|---------------|---------------------------------------------------|
| Macro and industry risk reduction scenario | R1            | Reduction of macro and industrial risks per unit time |
| Credit risk reduction                      | R2            | Reduction of credit risk level per unit time       |
| Supply chain relationship risk reduction   | R3            | Reduction of relationship level reduction per unit time |
| Increased risk of pledge                   | R4            | Increase of collateral risk per unit time          |
| Increase in operational risk               | R5            | Increase in operational risk per unit time         |
| Increase in blockchain system              | R6            | Increase in blockchain system risk per unit time   |
| Reduction in blockchain system             | R7            | Reduction in blockchain system risk per unit time  |

### Table 9: Auxiliary variables of supply chain financial risk system on the blockchain.

| Variable scene name                        | Variable code | Variable star description                          |
|--------------------------------------------|---------------|---------------------------------------------------|
| Solvency of financing enterprises          | 11            | The unit is dimensionless. The greater the score, the higher the solvency |
| Financing enterprise status                | 12            | Dimensionless. The higher the score, the higher the status |
| Sales risk                                 | 13            | Dimensionless. The higher the score, the higher the sales risk |
| Technical risk                             | 14            | Dimensionless. The greater the score, the higher the technical risk |
| Financing approval risk                    | 15            | Dimensionless. The higher the score, the higher the approval risk |
| Bank status                                | 16            | Dimensionless. The higher the score, the higher the bank status |
| Supply chain financial risk on blockchain  | 17            | Dimensionless. The higher the score, the higher the risk |

### Table 10: Initial value of subordinate index.

| Primary index | Relative weight | Y1     | y2     | y3     | y4     | y5     | y6     | y7     |
|---------------|-----------------|--------|--------|--------|--------|--------|--------|--------|
| I1            | 0.058           | 0.000  | 0.000  | 0.000  | 0.075  | 0.375  | 0.241  | 0.308  |
| I2            | 0.200           | 0.007  | 0.171  | 0.235  | 0.368  | 0.193  | 0.003  | 0.020  |
| I3            | 0.221           | 0.000  | 0.184  | 0.296  | 0.239  | 0.217  | 0.053  | 0.007  |
| I4            | 0.102           | 0.000  | 0.149  | 0.302  | 0.272  | 0.204  | 0.068  | 0.005  |
| I6            | 0.149           | 0.022  | 0.098  | 0.236  | 0.383  | 0.198  | 0.054  | 0.006  |
| I7            | 0.270           | 0.007  | 0.171  | 0.235  | 0.368  | 0.193  | 0.003  | 0.020  |

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Since there are too many three-level indicators, they will not be listed one by one here.

5.4.3. Analysis of Simulation Operation Results. In terms of the change curve of supply chain financial risk level on the block, it can be seen from Figure 12 and Table 12 that the supply financial risk on the block chain first decreases significantly and then increases slowly [22]. From the change of macro and industrial risk level, it can be seen that the macro and industrial risk value increases slowly with time, as shown in Figure 13.

In terms of the change in the credit risk level, the credit risk decreases with the growth of time, because in the long-
term cooperation, the credit score of all parties in the blockchain will be higher and higher, and the credit risk will be lower and lower [23], as shown in Figures 14 and 15 and Table 13.

After obtaining the above results and changing the initial of each parameter, it is found that the obtained graph has no change in the trend, and the original or upward or downward trend of each risk has not changed. Macro and industry risks: the performance of macro and industrial risks is relatively gentle because the simulation period is two months and the time is relatively short. In such a short time, the possibility of drastic changes in the macro environment is less. As reflected in the system risk, the fluctuation range of macro and industrial risks is less. Credit risks: the credit risk decreases rapidly with the passage of time because the credit transmission function of the blockchain system greatly reduces the credit uncertainty. The relevant algorithms and unique mechanisms of the blockchain minimize the credit problems in the financing process, thus reducing the credit risk; Supply chain relationship risk [24]: it can be seen that the relationship risk of the supply chain also decreases rapidly, because with the continuous occurrence of

| Time       | 0/8 months | 1/8 months | 2/8 months | 3/8 months | 4/8 months | 5/8 months | 6/8 months | 7/8 months | 8/8 months |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Value at risk | 3.670      | 2.615      | 1.853      | 1.037      | 0.917      | 0.655      | 0.455      | 0.332      | 0.228      |
| Decrease value | 4.218      | 3.059      | 2.186      | 1.546      | 1.089      | 0.767      | 0.538      | 0.377      | 0.266      |
| Impact value  | 1.101      | 0.785      | 0.555      | 0.392      | 0.278      | 0.194      | 0.146      | 0.088      | 0.077      |
transactions, the reliability of the blockchain system ensures the reliability of transactions between the trading partners, making the relationship between the partners in the supply chain more reliable, thus reducing the relationship risks accordingly. Risk of pledge: the information of the blockchain is traceable, so that the cargo information and historical information can be queried conveniently and quickly, ensuring the accuracy of the pledge information and reducing the risk of the pledge; Operational risk level: the rise in the operational risk level is due to the lack of knowledge in people who do not fully understand the concept of blockchain, the lack of professionals, and the lack of relevant personnel training in enterprises. Over time, the number of operational errors will increase, resulting in an increase in operational risk; Blockchain system risk [25]: the risk reduction of the blockchain system is due to the continuous development and maturity of blockchain technology, and its own algorithm and mechanism are relatively mature, which ensures the reliability of the system. Therefore, the risk will be gradually reduced with the growth of time.

6. Conclusion

The addition of blockchain technology to the product market not only affects the scope of analytical measurement of key financial risk management products but also the impact on the value of instruments identified in the market. The integration of blockchain technology will change the measurement value of the key symbols. It has always been possible to introduce product sector blockchain to improve the timing of the industrial development, reduce the overall operating costs of the network, improve the investment capacity of the chain, and improve the operation of the financial network to meet the need for efficient technology and to be aware of the new developments in the financial equipment. This paper is intended to provide a comprehensive set of measurement measures for financial risk management chain in blockchain technology and leads to the following studies:

(1) The common behaviors of participants in supply chain finance under various financing modes are analyzed. Combined with the 5C factor analysis method, supply chain risk evaluation system and the operational risk measurement theory, the supply chain financial risk on the blockchain is identified, and the unique risk points of the supply chain system on the blockchain are effectively identified.

(2) According to the weight of each level of financial indicators in the block chain, the weight of each level of financial indicators is calculated by using the fuzzy evaluation method, and the final value of each level of financial indicators is calculated according to the weight of each level of financial indicators.

(3) Using system dynamics, this paper makes a detailed analysis of each subsystem of supply chain financial risk on the blockchain, draws the causality diagram and flow diagram of each subsystem, and explores the risk change trend of each subsystem and the change trend of the total risk system with time, so as to provide the basis of risk control for the introduction of blockchain technology in the supply chain financial industry.

Data Availability

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

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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