Research Article

Research on Credit Algorithm of International Trade Enterprises Based on Blockchain

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Lack of trust, lack of standards, and low efficiency are the three biggest problems in China’s trade financing at present. With the development and application of new generation technologies such as big data, cloud computing, artificial intelligence, and blockchain technology, China is in the stage of financial technology 3.0 under the deep integration of finance and technology. In the field of financial technology, the most concerned is the application of blockchain technology in trade finance business. With the successive construction of various blockchain platforms and the acceleration of the internationalization process, the international trade credit risk behind it is also increasing. Among many financial services, trade finance is the most closely integrated field with blockchain technology. In this context, preventing the risks in the business process of international trade enterprises, so as to reduce the cost of financial transactions, improve the effectiveness of financial services, and better serve the real economy is not only the internal development needs of enterprises, but also the national financial strategy needs. In view of the above problems, this paper analyzes the risk factors faced by multinational trading enterprises in the transaction process through the transaction data of some multinational enterprises on mobile phones, and constructs a credit evaluation system of international trading enterprises based on blockchain, in order to enhance the trade risk resistance ability of international trading companies.

1. Introduction

In recent years, especially since 2014, China’s total foreign trade has shown a straight-line trend, with a variety of trade forms. China has become the world’s largest trading country. Since joining the World Trade Organization in 2001, China’s foreign trade volume has shown an overall upward trend [1–4]. In 2020, China’s total import and export trade was 32.16 trillion yuan, an increase of 6.6 times compared with 2001. Foreign trade activities are becoming more and more frequent, followed by the increasing demand for working capital by trade subjects, which brings great market space and drives the rapid development of financing business [5–7].

Among all financial business products, “international trade financing business” is often the easiest to expose industrial financial risks due to its short loan term [8–10]. Under the “new normal” situation of the economy, China’s foreign trade generally appear as the phenomenon of “recession and excess,” the heat of foreign trade in the market continues to be depressed, industry risks continue to gather and strengthen, and many enterprises are facing bottlenecks and crises, which urgently need a lot of financial support [8, 10–12]. However, because a large number of idle funds in China’s financial system are difficult to flow into the real economy and there are significant differences in competitive advantages at home and abroad, arbitrage financing, repeated financing, and over financing have become common problems in the international trade financing business. The “hidden reef” and “bright reef” of risk business are intertwined, which brings great financing risks to this business field [13–15].

For the risks in the process of international trade, whether at home or abroad, bad scholars have carried out research on it. Among them, Shao h believes that commercial banks should take the real trade background as the
basis when evaluating the assets and risks of credit objects, and should timely monitor the inflow and outflow of funds, so as to ensure the repayment of loans [16]. Li studied how commercial banks innovate in international trade financing and believed that only on the basis of strengthening risk management and keeping their own risks within a controllable range, can product innovation be meaningful at this time. At the same time, the author also provides effective methods for commercial banks in how to identify and prevent risks [17]. Bekhet and Eletter [18–21] believed that commercial banks should consciously bear risks and actively take various measures to reduce risks. After risk identification, hedging and other methods can effectively manage risks and improve their core competitiveness. After analyzing the background of big data, Li [22, 23] and others found that the current risk control system for international trade financing should match the era of big data. Voskuil et al. [24] based on the perspective of the government, believed that the government should promote and improve the credit guarantee system as much as possible, and improve China’s relevant laws and regulations according to international practices to help prevent possible risks in the process of international trade financing. In the development of international trade financing business, Obayemi et al. [25] divided the difficulties faced by commercial banks into external difficulties and internal difficulties. In the face of external difficulties, commercial banks should strengthen cooperation with financial institutions to share risks. At the same time, they need to build an effective credit risk assessment system and customize differentiated management schemes for different customers; in the face of internal difficulties, commercial banks on the one hand need to enhance their risk identification ability, on the other hand, they should also pay attention to improving their internal control management system.

In the field of financial technology, the most concerned is the application of blockchain technology in trade finance business. 2018 is the first year of the integration of blockchain technology and trade finance. Various blockchain platforms have been built one after another, and commercial banks, core enterprises, regulators, and other institutions have taken advantage of the trend to carry out platform pilot work one after another. Among the many financial services covered by trade finance, trade finance is the most closely integrated field with blockchain technology. In this context, commercial banks should actively comply with the development of science and technology, use blockchain technology to solve problems in international trade financing, and prevent risks in the process of international trade financing business, so as to reduce financial transaction costs, improve the effectiveness of financial services, and better serve the real economy.

However, only using blockchain technology cannot achieve the credit evaluation of international trade enterprises, which often requires the combination of some other credit evaluation systems. Grey theory is a new control theory, which can use specific methods to describe incomplete information and can be used as the basis for scientific prediction, decision-making, and control [26]. Grey correlation analysis is one of the main aspects of its theory, which is applicable to the uncertain system decision-making problems with small samples and poor information. It can make up for the shortcomings caused by the traditional evaluation methods to a certain extent, eliminate the deviation caused by people’s subjective randomness, and make the evaluation results more effective and accurate. It has been applied in many fields, such as investment decision-making, corporate governance evaluation, enterprise risk evaluation, cost consulting, construction evaluation, and so on. Based on the previous research, this paper constructs the credit evaluation model of international trade enterprises based on grey correlation model technology and blockchain technology, which provides a new idea for the research on the credit evaluation grade of international trade enterprises.

2. Risk Factors in the Process of Transnational Transactions of International Trading Enterprises

International trade refers to all kinds of trade, exchanges, and cooperation between economies in different countries or regions in order to expand their business scale and obtain economic profits, as well as the exchange of various goods and labor resources. Compared with domestic trade, international trade has both commonalities and great differences from foreign trade. The main differences include: (1) different policies and laws applicable to countries; (2) the settlement forms of trade are different; (3) the risk factors are different. At the same time, international trade will be affected by the political, economic, and some situation changes in the countries where foreign investors and others are located. International trade risks generally refer to all kinds of risks that companies in different countries or regions may encounter in their activities and business processes of cross-border commodity trade, such as credit risks between enterprises, policy risks at the national level, market risks, and international trade transaction risks.

2.1. Credit Risks. According to the relevant practical investigation and research, we can see that when carrying out international trade activities, the trading parties belong to different countries. When expanding product sales channels and seeking raw material suppliers, due to the great differences in laws and regulations, political and cultural environments, and trading systems in different countries, most of the enterprises will be afraid, unwilling to take risks, and unwilling to try. Every enterprise is fully aware that an excellent and good partner will have a positive and efficient impact on its subsequent development. Once you make friends carelessly, there may be a large amount of losses in the later economic business development process and even affect its normal operation and management. Even if the contract is set strictly, many problems will occur in the later implementation, and even lead to the bankruptcy of the enterprise in serious cases. For example, a domestic enterprise exported 20000 tons of coke to European countries and was transported by foreign charterers. In the process of
operation, foreign businessmen used local banks to issue letters of credit to enterprises. The enterprise prepares goods, delivers goods, prepares and delivers documents in full accordance with the contract. However, after the goods were sent, the enterprise applied to the bank for payment of documents, which was refused. The main reason for this phenomenon is that foreign businesses asked enterprises to reduce the price of goods, and enterprises directly rejected this request, which eventually led to the direct landing of goods in the port. Although the foreign businessmen paid the corresponding freight, for the enterprises, the goods were detained in the port, and over time, the goods were damaged. It can be seen that there are many uncontrollable factors in the trading activities entrusted by foreign investors such as shipping agents and freight forwarders in the process of international trade, and the status of goods cannot be effectively guaranteed. If domestic enterprises file lawsuits, they will face high litigation costs. In this context, many enterprises can only deal with it locally at a lower price, which affects the economic benefits of enterprises and has a great adverse impact on their sustainable development.

2.2. Policy Risks. Under the constraints of national and regional trade, economic integration and other factors, the competition and friction between international trade enterprises are becoming increasingly fierce, breeding trade barriers, anti-dumping, and other phenomena. In order to ensure their own interests and local enterprises, all countries require that trade participating countries should implement all kinds of cooperation in accordance with their national laws, and gradually strengthen the problem of international trade barriers through the restriction of national purchase authority, which will lead to policy risks in international trade cooperation.

2.3. Market Risk. In the past, China’s import and export markets were mainly concentrated in the United States, Japan, the European Union, and China’s Hong Kong and Macao regions. The import and export markets were too concentrated, resulting in excessive dependence on some markets. With the development of world trade, China’s international trade has spread to all countries and regions in the world. However, because China’s export still depends on low prices and a substantial increase in export volume, the traditional market is oversaturated, and the prices of peers in the same market are killing each other, which will only be “competing with clams and reaping benefits”.

2.4. Transaction Risk. There are high transaction risks in international trade. Due to the long distance between the two parties in international trade, the current trade practices are not familiar, and the trade methods are complex. In addition, trade settlement and delivery are also different from domestic trade. The completion of an international trade often involves many departments, such as customs, banking, insurance, commodity inspection, and transportation, and there are complex relationships between various departments, which undoubtedly increases the transaction risk of enterprises in international trade. For China’s small- and medium-sized enterprises, especially those who have just come into contact with international trade, the neglect of transaction risks often brings immeasurable losses to enterprises. China’s small- and medium-sized enterprises either adopt the practice of domestic trade and adopt the transaction method of “payment to delivery,” requiring the other party to pay first and then deliver goods to the party, missing international trade opportunities, or they blindly accept unreasonable transaction methods and accept unreasonable payment methods and other conditions under the pressure of the international trade market, so that illegal foreign businessmen can exploit loopholes.

3. Overview of Blockchain Technology

Blockchain technology is an innovative technology that integrates a variety of traditional technologies, including but not limited to cryptography, distributed systems, consensus mechanisms, etc., It realizes the distributed storage of data on different nodes, and the generation and update of data can also be synchronized. Among them, the technology related to cryptography is used to generate and record data on the block, so that each node can store the same data, drawing on the idea of distributed system, while the synchronized update data adopts the consensus mechanism. The core of transaction is trust, and the core of blockchain is to help solve the trust problem of multiple parties.

3.1. Working Principle of Blockchain. From a technical perspective, blockchain is a data structure. A blockchain contains multiple blocks. The important content stored in the current block involves transaction information, the hash value of this block, and the hash value of the previous block. The transaction information stores the basic data of a transaction, including the transaction subject, the number of transactions, and the transaction signature information. Each block contains two kinds of hash values. Since the hash value cannot be forged, the hash value of this block is equivalent to “fingerprint,” which is the unique feature of this block. The hash value of the previous block is recorded, so the “page number” is arranged, so that the transaction information can form a complete chain in chronological order. If the hash value of a potential block is calculated, the right to account on the newly generated block can be obtained, and the newly generated block will also be added to the blockchain.

In essence, blockchain is a decentralized distributed ledger. In this “account book,” there is no centralized organization. Every node has equal rights and obligations and has bookkeeping rights. The transaction data on the blockchain is maintained and updated by all nodes. Without the participation of a third party, it means that each node on the blockchain can realize point-to-point transactions. Using this account book can be used to record and update the transaction information carried out in the chain and help the parties in the transaction to track the source and
whereabouts of a fund. For each transaction, each node will verify the transaction information and store them after reaching a consensus. With the continuous addition of new nodes, the chain structure has become longer and longer, and each admitted node in the chain records the same and complete information.

3.2. Technical Characteristics of Blockchain. The cost of modifying information in the blockchain is very high, and a single node cannot tamper with the data. Because such tampering is not recognized, 51% of the nodes in the whole network must be controlled to modify the data on the blockchain, which is almost impossible to achieve. Therefore, once the data on the blockchain is online, the subsequent transaction information is authentic. In fact, the core of blockchain technology is to help people solve trust problems with relatively low cost. The foundation of transaction is trust. In traditional transactions, the completion of the transaction will depend on the trust of financial institutions and third-party intermediaries, while in blockchain, all parties to the transaction rely on the trust of calculation and use a large number of calculations to confirm the completion of the transaction.

Blockchain adopts distributed storage, which means that there is no centralized management organization in the whole network, and the rights and obligations of each node in the structure are equal. Therefore, if some node information is deliberately destroyed externally, the whole blockchain system can still operate normally, and it will not affect other nodes to process and update information. In addition, when more nodes participate in the blockchain, the possibility of blockchain damage will be smaller and the security will be higher.

Blockchain technology can realize data sharing, but it can also realize anonymity and trust. Blockchain technology is based on asymmetric encryption algorithm, that is, the decryption process and encryption process cannot be mutually inverse. Information sharing depends on “public key” and “private key.” Participating nodes can decrypt node information through “public key” and encrypt private information through “private key.” The “public key” is open to everyone, but the public can only know the existence of the transaction, and does not know who completed the transaction. The “private key” holder can control the information locked on the “public key” address, and the corresponding private key cannot be deduced from the public key.

4. Design of International Trade Credit Evaluation Algorithm

In order to establish a sound online international trade credit evaluation system, ensure that users’ privacy data will not be maliciously tampered with by attackers, and ensure that users can modify their evaluation information, we propose a modifiable international trade credit evaluation system based on blockchain, and give two specific schemes: complete anonymity and traitor tracking. In the completely anonymous scheme, the user first generates the evaluation information locally, stores the pre-calculated ring signature and group signature parameters locally, and then, executes the smart contract to transfer the evaluation information and its signature to the blockchain. After receiving these transactions, block-link first verifies the effectiveness of the message, and then, carries out consensus algorithm to publicize the evaluation information. In the traitor tracking scheme, we can find out the users with malicious comments by asking the group administrator to open the group signature. We have replaced the traditional third party to ensure that the user evaluation information cannot be tampered with, which greatly ensures the user’s identity privacy.

4.1. Framework of International Trade Credit Evaluation System Based on Blockchain Technology. In our evaluation system, when an evaluation transaction starts, the user first generates the evaluation information $m$, then generates the ring signature $\delta$ for the message $m$, and then sends the evaluation information $m$, the signature $\delta$, and the transaction receipt $m_R$ to the blockchain node. After receiving the data, the blockchain node verifies the receipt $m_R$ and the user’s ring signature $\delta$. If the verification algorithm passes, the evaluation information consensus will be recorded in the blockchain, otherwise the evaluation will be terminated.

According to different needs, users can choose group signature or ring signature to sign the evaluation information $m$ in order to achieve different security purposes. The modifiable evaluation system scheme is divided into two operations: the first is to generate a new evaluation, and the other is to modify the evaluation information. The modifiable reputation evaluation system designed in this paper can not only ensure the anonymity of users, but also ensure that malicious attackers cannot tamper with the evaluation information. The blockchain system thus formed is shown in Figure 1.

4.2. Joint Learning Model Based on Blockchain and Grey Correlation Model. In the credit evaluation of international trade enterprises, most of the traditional credit evaluation methods require large samples and a large amount of data, and the distribution of these samples is required to have a certain regularity. However, due to the difficulty of information data collection, incomplete information, and the interference of human factors, it is difficult to find a typical distribution law in the process of credit evaluation. Therefore, using traditional methods for credit evaluation is often not of practical significance, and its implementation is also difficult. Therefore, on this basis, this paper introduces the grey correlation model, which integrates the blockchain technology to realize the fuzzy evaluation of the credit of international trade enterprises [34–35]. Its basic principle and construction steps are as follows:

(1) determine the credit evaluation comment set of international trade enterprises.
Determine the set of international trade enterprise credit evaluation comments: $X = (x_1, x_2, \ldots, x_n)$, where: $n$ represents the number of comments.

(2) Determine the primary index weight $W = (W_1, W_2, \ldots, W_N)$. In this paper, there are three primary index weights, so $N = 3$. The three first-class indicators are the enterprise characteristics, enterprise credit, and financial situation of the international trade enterprise.

(3) Determine the secondary index weight $W = (W_{i1}, W_{i2}, \ldots, W_{in})$.

Since the primary indicators are not unique, the number of secondary indicators is not unique. In this paper, there are 12 secondary indicators, as shown in Table 1 in Section 4.2.

(4) Establish secondary index evaluation matrix.

Evaluate the secondary indicators under the primary indicators in the index system according to the comment set, so that:

$$P_j \in \{W_{i1}, W_{i2}, \ldots, W_{iN}\}. \quad (1)$$

Get the corresponding evaluation vector according to the vector comment set:

$$e_i = (e_{i1}, e_{i2}, \ldots, e_{in}). \quad (2)$$

Form a secondary index evaluation matrix $E$:

$$E = \begin{bmatrix}
e_{11} & e_{12} & \cdots & e_{1n} \\
e_{21} & e_{22} & \cdots & e_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
e_{m1} & e_{m2} & \cdots & e_{mn}
\end{bmatrix}. \quad (3)$$

(5) Standardize the evaluation matrix.

Let $e_{dj} = \max_{1 \leq k \leq m} e_{kj}$, $e_{xj} = \min_{1 \leq k \leq m} e_{kj}$ ($1 \leq k \leq m$, $1 \leq j \leq n$), and standardize all indicators. The normalized indicators are the relatively optimal indicators $e_{6j}$:

$$e_0 = (e_{01}, e_{02}, \ldots, e_{0n}). \quad (4)$$

(6) Establish grey correlation evaluation matrix

The grey correlation degree between the standardized evaluation value $\bar{e}_{ij}$ of the secondary index $P_j$ and the relative expected optimal value $\bar{e}_{0j}$ is:

$$r(\bar{e}_{ij}, \bar{e}_{0j}) = \frac{\min_{i} \Delta_{io} + \rho \max_{i} \Delta_{io}}{\Delta_{io} + \rho \max_{i} \Delta_{io}}, \quad (5)$$

where: $i = 1, 2, \ldots, m; j = 1, 2, \ldots, n$, $\Delta_{io} = |\bar{e}_{ij} - \bar{e}_{0j}|$, $\rho \in (0, 1]$.

Let $r_{ij} = r(\bar{e}_{ij}, \bar{e}_{0j})$, then, the grey correlation evaluation matrix is:

$$R = \begin{bmatrix}r_{11} & r_{12} & \cdots & r_{1n} \\
r_{21} & r_{22} & \cdots & r_{2n} \\
\vdots & \vdots & \ddots & \vdots \\
r_{m1} & r_{m2} & \cdots & r_{mn}\end{bmatrix}. \quad (6)$$

(7) Calculate the index weight vector of the secondary index.

From this calculation, the group grey correlation degree between the secondary indicators $P_j$ and $P_j$ in the international trade enterprise credit evaluation index system is:

$$r^*(P_j, \bar{P}_j) = \frac{1}{n-1} \sum_{k=1}^{n} r(P_j, P_k). \quad (7)$$

(8) Determine the judgment vector of primary indicators

The weight vector $W = (w_1', w_2', \ldots, w_m')$ ($j = 1, 2, \ldots, m$) can be calculated from equation (7). Through calculation, the evaluation vector of the corresponding primary index $W_k$ is $C_k = W_{1:m}R_{mxn} = (c_1, c_2, \ldots, c_n)$, thus forming a grey matrix for evaluating the primary index:

$$C = \begin{bmatrix}c_1^T, c_2^T, \ldots, c_n^T\end{bmatrix}^T (n = 3). \quad (8)$$

(10) Normalize the judgment vector of the comprehensive evaluation of corporate governance, namely:

$$Z^* = \left\{ \frac{z_1}{\sum_{i=1}^{n} z_i}, \frac{z_2}{\sum_{i=1}^{n} z_i}, \ldots, \frac{z_n}{\sum_{i=1}^{n} z_i} \right\}. \quad (9)$$

(11) Evaluation and analysis: according to the principle of maximum degree of membership, the corresponding comments with $\max_{1 \leq k \leq n} [z_i/\sum_{i=1}^{n} z_i]$ (i.e., the maximum degree of membership) are the credit evaluation results of engineering supervision enterprises.
In order to improve the security of international trade enterprises, a distributed framework for privacy protection and security is established, and blockchain technology is introduced into the decentralized structure. The framework of joint learning model based on blockchain is shown in Figure 2.

Select the model station with the lowest error rate as the initial model to share. Other sites download the model from the blockchain and use it to train their local data. Then, calculate the error rate of each site and upload it to the blockchain. Due to the concept of boosting framework algorithm, sites that contain data that cannot be accurately predicted by the current local model are likely to contain more information than other sites, which is of great significance for the improvement of the model [18–20]. Therefore, priority should be given to the station with the highest error rate.

Select the model station with the highest error rate and use the model with the lowest error rate to train its local data. The objective function is:

$$J(w) = \frac{1}{N} \sum_{i=1}^{n} \phi(h(w; x_i), y_i),$$  \hspace{1cm} (10)

where: $w$ is the model station; $x_i, y_i$ are the data used for the training model; $N$ is the amount of data.

Using the small batch gradient descent algorithm (MBGD) as the optimization algorithm, the gradient of the model station $w_t$ is formed as:

$$\nabla J(w_t) = \frac{1}{N} \sum_{i=1}^{N} \frac{d}{d w_t} \phi(h(w; x_i), y_i).$$  \hspace{1cm} (11)

Update $w_t$ on blockchain as

$$w_{t+1} = w_t + \eta \nabla J(w_t).$$  \hspace{1cm} (12)

The above iterations continue until the error rate of the training model is lower than the pre-set value, or the number of iterations exceeds the set value.

5. Case Analysis of Credit Evaluation of International Trade Enterprises

5.1. Data Sample Selection. In international trade, banks play the most important and critical role. Therefore, in the analysis, take bank credit as an example, refer to the relevant news of blockchain in recent years, record the commercial banks that have used blockchain technology or joined blockchain platform, and have a relatively large proportion of international trade financing business. Finally, this paper screened five qualified commercial banks, including a large wholly state-owned bank, one joint-stock commercial bank, and three urban commercial banks, and analyzed the data of these five commercial banks from 2009 to 2018. According to the wind financial database, these five commercial banks account for a large share of the market and can be studied as a whole.

5.2. Establish Evaluation Index System. Based on the actual situation of international trade enterprises, a set of credit evaluation index system of international trade enterprises including six aspects was constructed to realize the purpose of credit evaluation of international trade enterprises. The specific evaluation indexes are shown in Table 1.

| Primary index          | Secondary indicators                        | Evaluation objectives                                      |
|------------------------|---------------------------------------------|-----------------------------------------------------------|
| 1. Enterprise characteristics | Enterprise qualification 1.1                | Assess the qualification level of the enterprise           |
|                        | Business scale 1.2                           | Evaluate the total assets and net annual profit of the enterprise |
|                        | Number of employees 1.3                      | Assess enterprise size                                    |
|                        | System construction 1.4                      | Evaluate the humanization degree of the enterprise         |
| 2. Enterprise credit   | Degree of contract performance 2.1          | Assess the performance of the contract by the enterprise  |
|                        | Bad credit record 2.2                        | Measure the rationality of enterprise charging standards   |
|                        | Business condition of the enterprise 2.3     | Honors of nuclear enterprises                             |
|                        | Enterprise violations 2.4                    | Show the bad behavior of the enterprise                   |
| 3. Corporate finance   | Asset liability ratio 3.1                    | Reflect the debt risk of the enterprise                    |
|                        | Quick ratio 3.2                              | Reflect the debt risk of the enterprise                    |
|                        | Profit margin of main business 3.3           | Reflect the profitability of the enterprise                |
|                        | Return on net assets 3.4                     | Reflect the profitability of the enterprise                |

![Figure 2: Decentralized joint learning framework based on blockchain.](image)
5.3. Model Construction. This paper sets up an individual effect model with full consideration of the heterogeneity of commercial banks. This model allows each individual to have the same slope of the regression equation, while the intercept terms are different from each other. Through the combination of blockchain technology and grey correlation model, an international trade credit evaluation system based on blockchain and grey correlation model is constructed. The overall credit bottle original price prediction process of the model is shown in Figure 3.

5.4. Example Analysis. According to the international trade enterprise credit evaluation index system and the improved grey correlation model constructed in this paper, the credit evaluation of the above five banks was carried out.

(1) Determine the set of vector comments.

\[ X = (X_1, X_2, X_3, X_4, X_5) = \text{(Best grade, Excellent grade, Good grade, Average grade, Common grade)} \]

(2) Determine primary indicators and weights.

From the above operation steps, as shown in Figure 4.
Similarly, the secondary index weights of these five banks were analyzed and calculated, and the results are shown in Figure 5.

The comprehensive credit evaluation values of five multinational enterprise banks were calculated as shown in Figure 6:

At the same time, in order to reflect the excellence of the international trade enterprise credit evaluation system based on the combination of blockchain and grey correlation model constructed in this paper, and the data with the traditional grey correlation model was compared. The comprehensive credit evaluation value of international trade enterprises using the traditional grey correlation model is shown in Figure 7.

Comparing the above Figures 6 and 7, it can be seen that the ranking results of the two methods are completely consistent, but the difference is that the overall evaluation of the comprehensive evaluation value of the credit of international trade enterprises using the traditional grey correlation model tends to be consistent, and there is no significant difference, which shows that when using the traditional grey correlation model for credit evaluation, it cannot better identify and extract the characteristics in the business process of enterprises. As a result, there is no great difference in various evaluation values. Therefore, when evaluating the credit of some multinational trading enterprises, there is no great difference in using this kind of method, so it is impossible to distinguish the multinational trading enterprises. However, using the improved grey correlation method, that is, using the comprehensive evaluation method based on the combination of blockchain technology and grey correlation model, the credit evaluation results of international trade enterprises are very differentiated, with the highest score close to 35 and the lowest score less than 10. There is a large gap between the two, which can more intuitively reflect the credit difference between different international trade enterprises. The relevant evaluation system can also better reflect the integrity of the system and make the evaluation results more reliable.

6. Conclusion

In the case that the existing credit index system of international trade enterprises cannot meet the rapid changes in the construction market, we should prevent the risks in the business handling process of international trade enterprises, so as to reduce the cost of financial transactions, improve the effectiveness of financial services, and better serve the real economy. Therefore, according to the development needs of the international trade industry, combined with the research results of previous scholars, this paper makes an in-depth study of relevant issues, and draws the following conclusions:

(1) on the basis of previous studies, by simplifying the analysis steps, in-depth research methods, using blockchain technology and grey correlation model, this paper constructs a credit evaluation system of international trade enterprises, which covers three primary indicators and 12 secondary indicators, for the credit evaluation of international trade enterprises.

(2) Through the empirical analysis of the credit level of international trade enterprises by constructing a grey correlation model based on blockchain, it is found that the model constructed in this paper has high reliability for the credit evaluation of international trade enterprises, and the relevant research can provide a new idea for the research on the credit evaluation grade of international trade enterprises. Different from previous studies, the grey correlation model constructed in this paper is based on the
supremacy of blockchain technology, and takes dynamic values for the resolution coefficient, thus reducing the deviation of evaluation results caused by human factors.

(3) Comparing the joint model based on blockchain and grey correlation model constructed in this paper with the traditional grey correlation model, it is found that the evaluation results of the improved grey correlation analysis model based on this paper are basically consistent with the tradition, which proves the accuracy of the international trade enterprise credit evaluation system built on blockchain technology and grey correlation analysis model constructed in this paper, and by comparing the results of the two models at the same time, it was found that the credit evaluation system of international trade enterprises based on blockchain technology and grey correlation analysis model constructed in this paper was superior to the traditional grey correlation model in terms of evaluation results, had a higher degree of identification, had more differentiated evaluation of enterprise credit, and could improve the accuracy of evaluation results. [27–32].

Data Availability

The dataset used in this paper can be obtained from the corresponding author upon request.

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

References

[1] B. Lin and C. Sun, “Evaluating carbon dioxide emissions in international trade of China,” Energy Policy, vol. 38, no. 1, pp. 613–621, 2010.

[2] Y. Qiao, “Capital investment, international trade and economic growth in China: evidence in the 1980-1990s],” China Economic Review, vol. 9, no. 1, pp. 73–84, 1998.

[3] B. Jacobs, “A dragon and a dove? A comparative overview of Chinese and European trade relations with sub-saharan africa,” Journal of Current China Affairs, vol. 40, no. 4, pp. 17–60, 2011.

[4] F. Lemoine and D. Unalkesenci, China and India in International Trade: From Laggards to Leaders?, CEPII research center, Princeton, New Jersey, USA, 2008.

[5] K. Fukao, K. Kiyota, and X. Yue, “China’s long-term international trade statistics: by commodity, 1952-1964 and 1981-2000]],” Hi-Stat Discussion Paper Series, vol. 20, no. 4, pp. 561-562, 2006.

[6] C. E. Montenegro, M. Pereira, and I. Solaoga, “China’s effect on Latin America’s international trade]],” Estudios de Economia, vol. 38, no. 2, 2010.

[7] T. Xu, B. Zhang, L. Feng, and S. Snowden, “Net oil exports embodied in China’s international trade: an input-output analysis,” ENERGY - OXFORD, vol. 48, pp. 464–471, 2012.

[8] J. Hantula, M. M. Müller, and J. Uusivuori, “International plant trade associated risks: laissez-faire or novel solutions,” Environmental Science & Policy, vol. 37, no. 1, pp. 158–160, 2014.

[9] M. G. Bondad-Reantaso, A. Lem, and R. P. Subasinghe, “International trade in aquatic animals and aquatic animal health: what lessons have we learned so far in managing the risks?” Fish Pathology, vol. 44, no. 3, pp. 107–114, 2009.

[10] J. H. Reichman, “Intellectual property in international trade: opportunities and risks of a GATT connection,” vand.j.-transnat, vol. 22, 1989.

[11] H. Nasheri, “Global risks of economic espionage, industrial spying and international trade secrets,” Transnational Crime A Global Perspective, 2009.

[12] R. Pettler, “International trade settlements and negotiations : leading lawyers on performing due diligence, assessing risks, and adding client value[]],” Circulation Journal Official Journal of the Japanese Circulation Society, vol. 67, no. 1, pp. 521-522, 2003.

[13] R. W. Fraser, D. C. Cook, and J. Haddock-Fraser, “Evaluating International Trade Proposals in the Context of Ecosystem Services Risks: Case Studies,” World Scientific Book Chapters, 2019.

[14] C. Brandi, A. Berger, and D. Bruhn, “Between Minilateralism and Multilateralism: Opportunities and Risks of pioneer Alliances in International Trade and Climate politics,” Briefing Papers, 2015.

[15] H. Lin, Q. Sun, and S. Q. Chen, “Reducing exchange rate risks in international trade: a hybrid forecasting approach of ceesdn and multilayer lstm,” Sustainability, vol. 12, no. 6, p. 2451, 2020.

[16] N. Kirk, “Trade Relations with China: An Overview,” Australia Points of View Trade Relations with China, 2010.

[17] Z.-X. Li, “A New Method of Credit Risk Assessment of Commercial Banks,” in Proceedings of the 2016 International Conference on Robots & Intelligent System (ICRIS), August 2016.

[18] H. A. Bekhet and S. F. K. Eletter, “Credit risk assessment model for Jordanian commercial banks: neural scoring approach,” Review of Development Finance, vol. 4, no. 1, pp. 20–28, 2014.

[19] Y. Ping, W. Chong, and M. Yao, “Credit Risk Assessment Model of Commercial Banks Based on Fuzzy Neural Network,” International Symposium on Neural Networks on Advances in Neural Networks, Springer-Verlag, Berlin, Heidelberg, 2009.

[20] N. M. Das and J. Deb, “A Statistical Re-assessment of Capital Adequacy and Insolvency Risk in Commercial Banks of India,” Springer Proceedings in Business and Economics, Springer, Salmon Tower Building NY USA, 2018.

[21] L. Tao, Z. Z. Hua, and S. Xin, “International commercial bank in China,” Energy Procedia, vol. 4, no. 1, pp. 745–749, 2012.

[22] W. . Li, “Study on the development of the international trade financing of the commercial bank in China,” Energy Procedia, vol. 17, pp. 573–579, 2012.

[23] N . Hovhannisyan, Comment on Capturing International Re-D Trade and Financing Flows: What Do Available Sources Reveal about the Structure of Knowledge-Based Global Production?, University of Chicago Press, Chicago, IL USA, 2018.

[24] E. Voskuil, Z. Para ´c, and J. A. Wade, “Hague-Zagreb Essays6: On the Law of International Trade : Credit and Guarantee Financing Transfer of technology,” BRILL, vol. 6, 1987.

[25] O. K. Obayemi, O. S. Alaka, and C. A. Nnabuife, “Documentary Credit on International Trade Financing: Its Nature and the Legal Implications,” IKSP, vol. 6, 2015.
[26] B. J. Butijn, D. A. Tamburri, and W. Heuvel, “Blockchains: A Systematic Multivocal Literature Review,” *ACM Computing Surveys (CSUR)*, vol. 53, 2019.

[27] A. Lezgovko and A. Jakovlev, “The evaluation of trade credit insurance in Lithuanian business market as a credit risk management tool,” *Economics and Culture*, vol. 14, no. 1, pp. 5–20, 2017.

[28] M. Shohag, *Internship Report Evaluation of General Banking Activities of Uttara Bank Limited: A Study on Elephant Road Branch*, Dhaka, 2015.

[29] G. Seyfang, “Working for the fenland dollar: an evaluation of local exchange trading schemes as an informal employment strategy to tackle social exclusion,” *Work, Employment & Society*, vol. 15, no. 3, pp. 581–593, 2001.

[30] J. Education and N. York, “Study materials for economic education in the schools. Reports of materials evaluation committees to the joint council on economic education,” *Joint Council on Economic Education*, 1212 Avenue of the Americas, New York, New York, 1969.

[31] K. Manova, “Credit constraints, heterogeneous firms, and international trade,” *The Review of Economic Studies*, 2013.

[32] C. Y. Fan, W. Y. Qian, Q. S. Li, and C. Wang, “Topsis based on grey correlation method and it’s application,” in *Proceedings of the Grey Systems and Intelligent Services 2013 IEEE International Conference on*, November 2013.