

Research on Commercial Factoring Settlement Risk Based on Blockchain Technology

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Abstract: The "Regulations on Local Financial Supervision and Administration" promulgated by the People's Bank of China in 2022 emphasizes the importance of preventing risks in commercial factoring. However, due to the information asymmetry of the participants and the limited rationality of the business personnel, the default rate of commercial factoring settlement is still rising year by year, which brings huge losses to the factoring. At the same time, the advantages of blockchain technology such as on-chain data sharing and information whole-chain leaving can make up for the shortcomings of traditional settlement methods. Therefore, the research on commercial factoring settlement risk based on blockchain technology has theoretical value and practical significance. Based on the supply chain risk management theory, this paper analyzes the manifestations and causes of commercial factoring settlement risk by using the transaction cost theory, builds a commercial factoring settlement process based on blockchain technology, explores how to resolve the risk of quota approval, repayment credit risk and personnel operation risk by blockchain technology, and finally puts forward corresponding countermeasures and suggestions. The research results show that blockchain technology can optimize the existing settlement system of commercial factoring, prevent settlement risks, and improve the efficiency of settlement business.

Keywords: Blockchain Technology; Commercial Factoring; Settlement Risk; Smart Contract; Distributed Ledger

1. Introduction

At the beginning of 2021, the People's Bank of China, the China Banking and Insurance Regulatory Commission and other eight units jointly issued the Notice on the Establishment of National Supply Chain Innovation and Application Demonstration, encouraging the active development of process-based and intelligent supply chain finance business including commercial factoring, and further emphasizing the importance of developing commercial

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factoring business. According to the estimates of the Commercial Factoring Committee of the China Association of Trade in Services, in 2021, China's commercial factoring business increased by 34.7% year-on-year, and the total scale reached 2.02 trillion yuan. However, according to the statistics of China Judgment Documents Network, as of the end of May 2022, the case documents related to commercial factoring settlement disputes accounted for more than 30%; Among the commercial factoring dispute cases accepted by the Beijing Arbitration Commission in 2021, the maximum target amount of a single case reached 160 million yuan, and frequent defaults hindered the healthy development of the commercial factoring industry. At the same time, there is serious information asymmetry in the commercial factoring industry, the data required for settlement business is complicated and difficult to ensure its authenticity, it is difficult for factoring providers to achieve penetrative supervision of funds, and business personnel have high operational risks, and the overall settlement lacks technical capabilities. In 2021, The State Council promulgated the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Outline of 2035 Vision Goals, which clearly pointed out that fintech means represented by blockchain technology should be used to improve the efficiency of supply chain operation. Therefore, this paper adopts supply chain risk management theory and transaction cost theory to explore the prevention of commercial factoring settlement risk based on blockchain technology has strong theoretical value and practical significance.

2. Forms and Causes of Commercial Factoring Settlement Risk

2.1 Defective Accounts and Unclear Ratios Leading to Line Approval Risk

2.1.1 Flawed Accounts Receivable Attributes

The defects of accounts receivable are mainly manifested as prohibited transfer of accounts receivable^[1] or repeated transfer, future accounts receivable problems, etc. Among them, the prohibition of transfer of accounts receivable includes the prohibition of transfer stipulated in the sales contract; The repeated transfer of accounts receivable is manifested by the original creditor signing multiple factoring contracts on the same receivables, resulting in multiple factoring claims, resulting in settlement of the amount of compensation or sequential disputes; The existing law has not yet made explicit provisions on whether future accounts receivable can be used as claims, so that future accounts receivable still have the risk of legal effect.

2.1.2 Difficulty in Calculating the Percentage of Single Receivables Financing

After the factoring provider grants credit, it is necessary to consider the two factors of gross margin and dilution rate to determine the appropriate proportion of financing for each account receivable (formula 1), and then the factoring financing can be transferred.

$$\begin{aligned} & \text{Individual accounts receivable financing ratio} \\ & = (1 - \text{Gross profit margin}) (1 - \text{Dilution ratio}) \times 100\% \end{aligned} \quad (1)$$

Among them, the dilution rate is estimated based on the factors affecting the recovery of accounts receivable from the supplier's purchase and sales records, and the valuation limit is 80%. According to Formula 2-1, the business personnel need to approve the financial statements

of the applicant for each factoring business to determine the gross profit rate, check the records of its purchase and sales activities and other information to determine the dilution rate. On this basis, massive data is formed, which brings difficulties to the information collection of the factoring party. Moreover, it is difficult to quantify the dilution rate and other problems, resulting in difficulties in determining the financing ratio.

2.2 Repayment Credit Risk Due to Insufficient Willingness and Ability to Pay

2.2.1 Insufficient Willingness to Repay

The lack of repayment willingness of core enterprises is mainly manifested in three aspects. First, if there is a need for the core company to use the funds for other purposes, it will refuse to pay; Secondly, the supplier's defective performance of the delivery obligation will lead to the buyer's refusal to repay; Moreover, the core enterprise will breach the contract due to the fraudulent motives of all parties^[2], which can be divided into two situations: first, the supplier's unilateral fraudulent acts, including fictitious basic contracts and false expansion of trade financing; The second is collusion fraud, including the core enterprise in the knowledge of the account designated by the factor, still transfer to the supplier's account, or the two sides conspired to fabricate the trade background and bills.

2.2.2 Deterioration of Repayment Capacity

Changes in the operating conditions of buyers and sellers are the dominant factor in the deterioration of the repayment ability of each repayment source in commercial factoring settlements, which is caused by the uncertainty of the market demand and the limited rationality of the enterprise's decision-making. Based on the transaction cost theory, the uncertainty of the demand in the purchase and sale market, the complexity of the environment in which the enterprise is located, coupled with the limited rationality of the decision-making layer, cannot guarantee that the buyer enterprise will continue to maintain good business conditions and correct decision-making after the confirmation of the factoring, which brings high risk to the recovery of the factoring financing.

2.3 Personnel Operational Risk Due to Lack of Due Diligence and Inefficient Settlements

2.3.1 Business supervision is not in place

First, business personnel do not carefully review the compliance or terms of the basic materials of settlement business before the loan of factoring financing^[3], for example, they do not find the existence of connected transactions between the buyer and the seller or do not identify fraudulent documents, which lays hidden dangers for commercial factoring settlement according to contract; Second, after the factoring financing loan, the business personnel did not make penetrating tracking of the use, balance, supply status of the seller and real-time credit status of the buyer of the financing funds, resulting in the failure to recover the corresponding funds on time when the financing period expires.

2.3.2 Low Efficiency of Manual Settlement

The low efficiency of manual settlement mainly includes two aspects: first, the settlement speed is slow. Commercial factoring each salesman needs to handle multiple factoring business at the same time^[1,4], and the number of operators is very limited, resulting in slow settlement speed;

Second, the settlement error rate is high. Although the existing commercial factoring business system has developed online business processing^[5], most of the data still need to be entered manually^[6], and the existence of limited rationality can easily lead to entry errors, and if the proportion of single accounts receivable financing is therefore measured incorrectly, it will bring losses to the factor.

3. Analysis of the Risk of Preventing Commercial Factoring Settlement

3.1 Analysis of the Applicability of Blockchain Technology in Commercial Factoring Settlements

First, the data required for commercial factoring settlement constitutes the basic database. A large number of basic materials need to be reviewed in the quota determination stage, and a large amount of data needs to be monitored in the payment tracking stage. The above information makes each commercial factoring business form a large original database in the settlement process, which meets the conditions that blockchain applications must be based on the database^[7].

Second, commercial factoring settlement has an urgent need for continuous data storage and multi-party verification of the authenticity of materials. The settlement business must be carried out on the basis of the truth of the data, personnel operation standards and other conditions. In order to ensure that the factoring business is based on the real transaction background, it is necessary to check whether the account is defective, and start to store the certificate from the delivery of the goods, which requires multi-party verification to reduce the error rate of a single act, and meet the applicable conditions of blockchain technology.

Third, commercial factoring needs to improve trust. In the process of commercial factoring settlement, due to the existence of information asymmetry, environmental uncertainty and other factors, as well as the speculative behavior of enterprises, the factor lacks trust in enterprise credit. Blockchain consensus mechanism and smart contract technology can realize a leap in the quality and efficiency of commercial factoring settlement by transforming the trust of the trusting subject from "human" to "machine".

Fourth, commercial factoring settlement takes real assets as the anchoring object. The essence of commercial factoring settlement business is the transfer of actual funds, which is realized by the change of real assets of all parties as the realization signal, which is in line with the applicable conditions of blockchain technology. Blockchain realizes the change of assets on the chain through the free circulation of passes in the whole chain, and based on the correspondence between passes and real assets, it can realize the payment of assets on the chain and off the chain^[8].

3.2 Commercial Factoring Settlement Process Based on Blockchain Technology

As shown in Figure 1, the commercial factoring settlement process based on blockchain technology consists of six steps:①The core enterprise upload the basic contract, the goods delivery order and the accounts receivable transfer notice, and the supplier upload the receipt

accordingly;②The salesman approves the accounts receivable by invoking the smart contract, and calculates the financing proportion of a single account receivable respectively, and obtains the calculation result through off-chain negotiation;③After the material review is passed, the smart contract is called to issue the factoring financing;④ Regular full-chain broadcast, reminding all parties to upload relevant materials to prove the repayment ability and repayment willingness of enterprises;⑤Each participant uploads the materials after receiving the message;⑥After the material review is passed, the business personnel call the smart contract to clear the factoring funds.

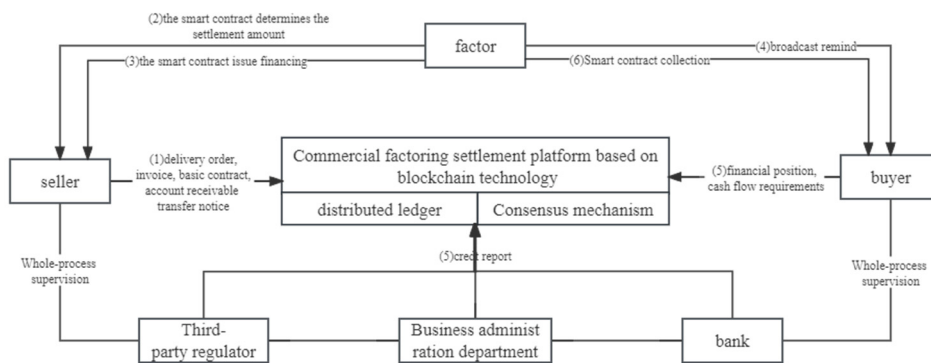


Figure 1 Commercial Factoring Settlement Process Based on Blockchain Technology

3.3 Analysis of the Use of Blockchain Technology to Prevent Commercial Factoring Settlement Risks

3.3.1 Determination of the Settlement Amount Based on Blockchain Technology to Address the Risk of Quota Approval

As shown in Figure 2, after the factor, the original creditor, the debtor, the bank (central bank, commercial bank) and the third-party regulator are incorporated into the blockchain as nodes, the factor completes the determination of the ownership relationship of the accounts receivable and the calculation of the financing ratio of a single receivable by means of the distributed ledger, the consensus mechanism and the smart contract, respectively.

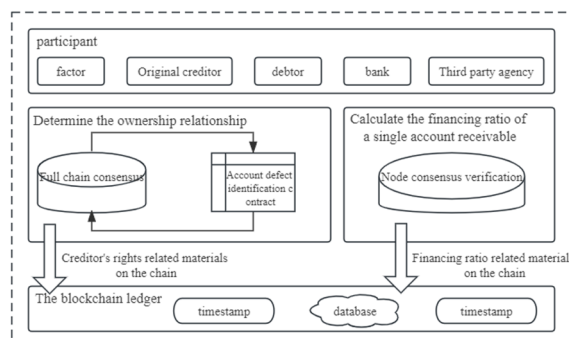


Figure 2 Process of Determining Settlement Amount Based on Blockchain Technology

(1) Blockchain Technology Clarifies Ownership of Commercial Factoring Claims

Distributed ledger stores creditor's rights-related materials to realize the implementation and verification of creditor's right transfer. As shown in Figure 3, the alliance ledger of commercial factoring settlement records all the information related to the factoring object, including the basic transaction contract, shipping documents, etc., and the content can be classified into the ownership of digital assets, balance information and contract terms. Through this infinite growth of the shared ledger^[9,10], the factor and the supervisor node can directly query and supervise all kinds of information while realizing the right confirmation, reducing the information omission and information collection cost when confirming the creditor's right relationship^[11].

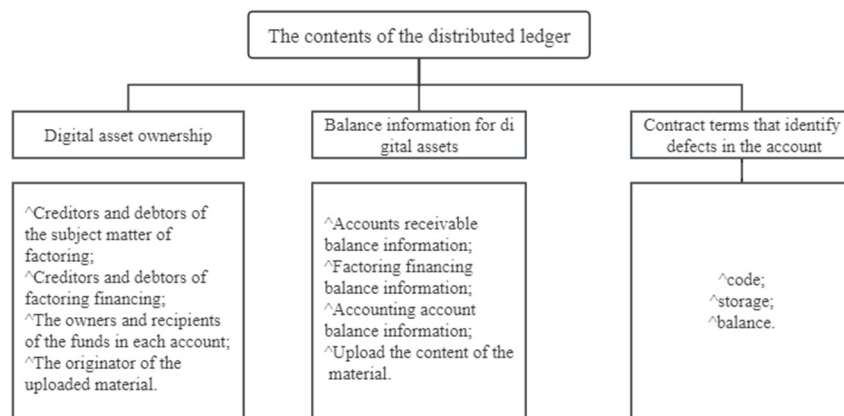


Figure 3 Contents of Distributed Ledger Records

The consensus mechanism forms multi-party transaction verification to avoid defective accounts. Based on the self-trust mechanism of blockchain, the debt information can only be released to the blockchain by the "bookkeeper" after all the nodes with privileges have verified and passed^[12], and the supplier needs to sign the material while uploading the material, and the nodes will jointly check and sign the material, so as to reduce the error rate of the traditional settlement process which is only verified by a single node, which is favorable to avoid the factor's business development on defective receivables. Avoiding the factoring of defective accounts receivable.

Smart contracts automatically identify defects in accounts receivable. The complete deployment process of an account approval contract consists of three stages: creation, release, and execution^[13]. After setting up infrastructure such as EVM and Geth consoles, the professionals convert the terms drafted by the factoring into a code language, and after formal verification, publish it on the blockchain. The data related to the linked claim triggers a specified state, and the return value automatically determines whether to continue or terminate the process. The use of smart contract technology to automatically identify defects in accounts greatly improves the efficiency of determining creditor's rights in commercial factoring settlement and reduces the manual error rate.

(2) Blockchain Technology Determines the Financing Proportion of a Single Account Receivable

The distributed ledger centrally stores the financing ratio information so that it can be shared among designated nodes. Suppliers upload financial statements and transaction statements within the agreed period, and each salesman determines the appropriate gross profit margin and dilution rate respectively on the chain, and obtains the final result through off-chain negotiation. This kind of distributed storage is conducive to improving the convenience and science of determining the financing proportion of a single account receivable, and reducing the cost and error rate of data acquisition.

3.3.2 Guarantee Financing Return Based on Blockchain Technology and Resolve Repayment Credit Risk

(1) Blockchain Technology Warns Businesses of Lack of Willingness to Pay

The distributed ledger comprehensively stores supply information and credit status, and comprehensively reflects the payment willingness of enterprises. The supplier shall upload the goods delivery record and other materials to prove the timely delivery; Core enterprises upload records of the use of funds to facilitate the determination of the possibility of changes in their repayment intentions; The third-party institution shall regularly upload the credit records and litigation situation of the enterprises of both parties, and inquire whether the enterprises have illegal marks to estimate their repayment willingness. All the above information is stored in a distributed database for real time checking by factoring.

The consensus mechanism effectively restricts the authority of enterprises on the chain. In the alliance chain, after the factor is selected as the "bookkeeping" node based on the size of the rights and interests, the factoring party is solely responsible for the block packaging, while the purchasing and selling enterprises only bear the obligations of uploading materials and confirming the invocation of the smart contract, which can help to avoid enterprise fraud, breach of contract and other behaviors.

Smart contracts are conditionally triggered to automatically transfer money ^[11]. when "date(today) = CF_date (due date of factoring financing)", if "balance of factor account [] ≥value", sendTransaction () is used to directly transfer the amount from the core enterprise account to the account of the factoring party. The core enterprise will confirm the contract call request after receiving it, and each node will automatically update the account balance of each party locally, which is conducive to avoiding the problem of insufficient repayment willingness of both buyers and sellers.

(2) Blockchain Technology Warns Companies of Deteriorating Repayment Capacity

Distributed ledger collectively stores materials reflecting the business status of enterprises, so that the factor can determine the repayment ability of enterprises. Suppliers and core enterprises regularly upload all the materials that can reflect the dynamic operating ability of enterprises, such as financial statements, utility bill payments, tax payment data, etc. The distributed ledger stores the above information in a distributed manner, saving the time for offline material collection, and the information on the chain cannot be tampered with and is supervised and audited by each node, which enables the factor to monitor the operating condition of the debtor and the cash flow in real time whether it meets the actual needs directly on the blockchain. Once

the first signs of mismanagement are found, the factoring business will be stopped immediately to avoid the payment risk.

3.3.3 Based on Blockchain Technology to Regulate the Operation of Business Personnel, to Prevent Personnel Operation Risk

(1) Consensus Mechanism Enables Multi-Party Validation Transactions

The consensus mechanism can ensure that all materials to be uploaded, their digital signatures, and the invocation and execution of smart contracts are verified and passed by each node at the same time, which further guarantees the truthfulness and comprehensiveness of the material review, restricts the speculative behaviors of purchasing and selling enterprises, reduces the risks arising from the loopholes of the smart contracts, and improves the correct settlement rate.

(2) Smart Contracts Automate the Settlement Process

Based on Solidity language, code contracts are written according to the traditional contract logic, and after completing the deployment of the contract, the corresponding state is triggered, and the execution results specified in the script can be obtained, which can complete the automatic identification and calculation of the commercial factoring settlement business^[14], reduce the risk of human operation, and contribute to the improvement of the efficiency and quality of the commercial factoring settlement business.

4. Countermeasures and Recommendations to Prevent Commercial Factoring Settlement Risks Based on Blockchain Technology

4.1 Countermeasures and Recommendations for Blockchain Technology to Protect Against the Risk of Quota Approval

Strengthening Pre-Chain Data Supervision and Improving On-Chain Data Quality. It is difficult for blockchain technology to guarantee the authenticity of pre-chain data sources, and it is necessary to strengthen the supervision of pre-chain original data^[15]. Specifically, the business administration department needs to regularly review the enterprise's documents, the format of contracts and the compliance of official seals. Audit institutions need to analyze the financial status of enterprises on a regular basis to verify the accuracy of financial statements; The credit information system of the People's Bank of China needs to check whether the enterprise registration information is perfect and true. Relevant departments cooperate with each other on this basis in order to truly avoid the problem of pre-chain data fraud.

4.2 Countermeasures and Recommendations on Blockchain Technology to Prevent Repayment Credit Risk

"Blockchain + Big Data" Enriches the Verification Dimension and Comprehensively Evaluates the Credit of Enterprises. Factors' supervision of enterprises' repayment ability is mainly based on structured data such as their financial data and transaction data, which are subject to falsification and are one-sided in reflecting their real repayment ability^[16]. In this regard, it should combine with big data methods to mine unstructured data and all other data that cannot be conveniently presented in two-dimensional logical tables of databases to supplement the

database for checking the repayment ability of enterprises, so as to comprehensively evaluate the creditworthiness of enterprises and improve the repayment ability of enterprises. Highly scientific and effective repayment monitoring.

4.3 Countermeasures and Recommendations on Blockchain Technology to Prevent Personnel Operational Risks

Developing Blockchain Factoring Settlement Audit Standards to Reduce Audit Difficulty. Although the distributed ledger breaks the restrictions of pure manual settlement, it still requires human participation. In order to effectively improve labor efficiency and give full play to the synergies among settlement departments, relevant departments need to develop a unified standard for commercial factoring settlement combined with blockchain, which is conducive to business personnel to carry out batch business^[17]. At the same time, the "blockchain + commercial factoring settlement" mode needs to have the compatibility of purchasing and marketing enterprises, and requires the competent department of commercial factoring to improve the relevant standards in combination with the application characteristics of blockchain under the existing standards.

5. Conclusion

In order to prevent commercial factoring settlement risk and improve the current situation of commercial factoring default, based on the supply chain risk management theory, this paper uses the transaction cost theory to explore the main manifestations of commercial factoring settlement risk as quota approval risk, repayment credit risk and personnel operation risk. Based on the applicability of blockchain technology in commercial factoring settlement, the blockchain commercial factoring settlement process is constructed, and the blockchain technology is used to prevent the risk of quota approval, repayment credit risk and personnel operation risk. The commercial factoring settlement process embedded with blockchain technology can improve business quality and efficiency, effectively prevent settlement risks, and promote the healthy development of the commercial factoring industry.

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