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## **The Impact of Blockchain on the Credit Risk of Supply Chain Finance: A Tripartite Evolutionary Game Analysis**

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# The Impact of Blockchain on the Credit Risk of Supply Chain Finance: A Tripartite Evolutionary Game Analysis

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## 1. INTRODUCTION AND RESEARCH QUESTIONS

The supply chain finance model integrates the capital flow, information flow, and logistics of supply chain, thereby providing a viable solution to the small and medium sized enterprises (SMEs) financing problem in China. However, in the process of developing supply chain finance, credit risk issues frequently arise as a result of information asymmetries in the supply chain and the absence of repayment willingness or ability among debt repayment subjects [1]. For example, in February 2020, Hang Qian Communication Company fraudulently obtained a bank loan by allegedly forging contracts and fictitiously pledging accounts receivable with affiliated companies, involving a total amount of RMB 220 million. Moreover, due to the relevance of the supply chain, the credit risk will be transmitted in the supply chain, resulting in systemic risks [2].

The new generation of information technology especially blockchain has developed rapidly in recent years. The consensus mechanism, non-tampering, traceability, and other characteristics of blockchain technology have created a strict regulatory environment within the chain [3,4]. In addition, blockchain also increased the level of trust between supply chain financial system businesses organizations [5] and provided a viable solution to credit risk issues experienced during the development of the supply chain finance business. For example, after Baowu Group introduced blockchain technology in accounts receivable financing, it greatly alleviated the information asymmetry between the group's core enterprises and SMEs, guaranteed the authenticity of transaction information, and reduced the possibility of credit risk.

Existing research on the impact of Blockchain technology on the credit risk of supply chain finance is predominantly qualitative. Through theoretical analysis of the types and influencing factors of supply chain financial credit risk, combined with the coupling mechanism of blockchain and supply chain finance, it is concluded that blockchain can reduce the credit risk of supply chain finance [6-9]. And case studies demonstrate the benefits of blockchain technology in the field of credit risk management for supply chain finance [10]. Although the academic community has extensively acknowledged the importance of Blockchain technology in reducing the credit risk of supply chain finance, the micro-mechanism has yet to be thoroughly investigated. However, the mechanism research and quantitative analysis of blockchain to prevent the credit risk of supply chain finance are not sufficient.

Therefore, In order to quantitatively and mechanistically analyze the issue of blockchain affecting credit risk in supply chain finance from a microscopic perspective. this paper takes the factoring financing of accounts receivable in supply chain finance as the research object, constructs a credit risk evolutionary game model among a financial institution, SME and core enterprise. The impact factors of blockchain on preventing credit risk in supply chain finance are analyzed by comparing the changes in stabilization strategies of the tripartite evolutionary game in supply chain finance before and after the introduction of blockchain. This study assigns values according to different conditions in the model analysis and tests the system equilibrium strategy through numerical simulation by referencing current research on simulation and data acquisition. The influencing factors that accelerate the formation of Pareto-optimal solutions for supply chain finance participants after the introduction of blockchain are further discussed.

Our research questions are as follows: (1) What is the impact of blockchain application on credit risk in supply chain finance? By what mechanism is it impacted? (2) What is the impact of splitting and flowing receivables in a blockchain environment on supply chain finance credit risk?

## 2. RESULTS AND MAJOR FINDINGS

The following are the key findings. (1) The results reveal that whether the traditional supply chain finance business produces credit risk depends on the amount of accounts receivable, the income obtained by SME and core enterprise when maintaining the stability of the supply chain, and the default income and default cost of both. After the introduction of blockchain, a strict regulatory environment increases the default cost of enterprises in the supply chain. Therefore, the system strictly converges to the Pareto-optimal solution of financial institution accepting financing applications, core enterprise repayment, and SME compliance. (2) The blockchain environment improves the trust transfer mechanism of supply chain finance, allowing accounts receivable to be split and transferred within the alliance chain, thus reducing the amount of accounts receivable held by a single SME in the supply chain. If the core enterprise declares bankruptcy and is unable to repay the account at maturity, financial institutions can recover the loan from the SMEs that apply for financing in the supply chain by exercising the right of recourse more quickly.

## 3. CONTRIBUTIONS

The following are the major contributions of this paper: Firstly, this work develops a credit evolutionary game model of a financial institution, SME, and core enterprise, and incorporates the repayment risk of the core enterprise into the model, so making the analysis more reasonable and compensating for deficiencies in prior studies. Secondly, this paper not only identifies the decisive factors by which blockchain affects the credit risk of supply chain finance, but also verifies the impact of the amount of accounts receivable on the supply chain financial system after the introduction of blockchain, which enriches the mechanism analysis and quantitative research of blockchain in the credit risk of supply chain finance. Our research provides theoretical support for optimizing credit risk management in supply chain finance using blockchain.

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