Big Data Enabling Risk Management in Supply Chain Finance

Yuanchen Wang*

School of Business Administration, Jiangxi University of Finance and Economics, Nanchang, 330032, China

*wangyuanchen@jcrl37.wecom.work

Abstract. The article delves deeply into how big data technology is applied in managing financial risks within the supply chain of commercial banks. Through the examination of various supply chain financial risks and their integration with real-world commercial bank scenarios, the study details the role of big data in refining risk management, boosting early warning capabilities, and refining the credit evaluation system. The study's findings indicate that the application of big data technology markedly enhances the effectiveness and precision of financial risk management in the supply chain of commercial banks, offering robust backing for their robust growth in the evolving and intricate financial landscape.

Keywords: Big data; Supply chain finance; Risk management; Commercial bank

1 Introduction

With the acceleration of economic globalisation and intensification of market competition, supply chain finance, as an innovative financial service model, has solved the financing problems of small and medium-sized enterprises (SMEs) and brought new business growth points for commercial banks.

It has solved the financing problems for SMEs and also brought new business growth points for commercial banks. However, the complexity and riskiness of supply chain finance business also put forward higher requirements for risk management of commercial banks. In recent years, the rise of big data technology has provided new ideas and methods for commercial banks' supply chain finance risk management. This paper discusses how big data empowers supply chain finance risk management by reviewing relevant literature and analysing commercial bank cases.

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2 Theoretical Foundations

2.1 Big Data Technologies

Big data technologies are methods and techniques for collecting, storing, managing and analysing large and diverse data collections from various types of data sources [5].These data collections are usually characterised by high speed, high capacity and high complexity, and need to be processed and analysed with the help of advanced technological tools. Utilizing big data technologies enables businesses to gain a deeper insight into market patterns, consumer requirements, and operational procedures, thereby facilitating better decision-making [5][8]. For instance, these technologies allow businesses to track market trends instantly, swiftly address customer needs, refine their business operations, and enhance operational effectiveness.

2.2 Supply Chain Finance

Supply chain finance, a structured financial service, is offered by banks and financial bodies to key players in the supply chain and their associated businesses, grounded in the actual transactional context of the supply chain [5]. It facilitates the distribution and management of risks by amalgamating logistics, information exchange, and capital movement within the supply chain, thereby converting the risks of an individual enterprise into those of the entire supply chain. A key aspect of supply chain finance lies in depending on the core enterprise's credit to offer adaptable financial options for both upstream and downstream businesses, assisting small and medium enterprises (SMEs) in resolving financial issues, and fostering the overall stability and growth of the supply chain. As an illustration, via supply chain finance, small and medium-sized enterprises (SMEs) can leverage the credit from their main companies to secure funding, reduce financial strain, and enhance their operational effectiveness [5].

3 Characteristics and Types of Supply Chain Finance Risks

3.1 Risk Characterisation

3.1.1 Information Asymmetry Risk.

The supply chain involves multiple links and participating subjects, and there are barriers to information exchange between the subjects, making it difficult for financial institutions to comprehensively and accurately grasp the real operation of the supply chain, leading to increased difficulty in credit assessment and a significant increase in credit risk [1].

3.1.2 Core Business Risk.

The core enterprise occupies a key position in the supply chain, and its business condition directly affects the stability of the whole supply chain and the financial security of upstream and downstream enterprises [1].The risk of the collapse of the core enterprise will trigger a chain reaction, leading to the risk of capital rupture of multiple enterprises and the supply chain.

3.1.3 Note Fraud Risk.

Counterfeiting of bills and collusive lending by enterprises in the upper and lower reaches of the supply chain are more prominent, posing huge credit risks to banks [1].Bill fraud not only involves a huge amount of money, but also a variety of means, difficult to prevent[4].

3.1.4 Amplification and Lengthening Risks.

The complexity and extensiveness of supply chains make risks more likely and holistic and systemic. Supply chains are infinitely elongated, involving multiple enterprises, and once a risk occurs, it can have a wide range of impacts and huge losses [1].

3.2 Types of Risk

3.2.1 Systemic Risk.

Risks caused by the macroeconomic environment, policy changes, and other factors that affect the entire supply chain financial system [2,7].For example, economic recession and policy adjustments can have a significant impact on supply chain finance business.

3.2.2 Credit Risk.

The credit default risk, including that of core and upstream and downstream firms, is one of the risks that commercial banks are most concerned about [2].The occurrence of credit risk may be associated with the enterprise's asset size, operating conditions and changes in the value of collateral and pledges.

3.2.3 Business Process Risk.

Risks due to poorly designed business processes, information asymmetry and other issues [2].For example, unreasonable design of bank authorisation, credit approval and other links, as well as lack of process due to information asymmetry, can increase business process risk.

3.2.4 Market Risk.

Risks caused by fluctuations in financial asset prices and commodity prices that affect the returns of supply chain finance operations [2].For example, fluctuations in

pledge prices and changes in market interest rates can bring market risk to supply chain finance business.

4 Application Strategies of Big Data in Supply Chain Finance Risk Management

4.1 Optimising Information-Sharing Models to Reduce Data Acquisition and Processing Costs

By strengthening the combination of supply chain finance and social networks, it breaks the boundary limitations of data sources, promotes information sharing, and reduces the cost of acquiring big data [2].At the same time, improve the core processing capacity of big data, adopt professional big data analysis tools, transform raw data into valuable information assets, and improve the efficiency of data application.

4.2 Use of Blockchain Technology to Improve Data Authenticity

The traceability and immutability of blockchain technology can ensure the authenticity and reliability of supply chain finance data. By integrating the elements of financial contracts, designing fully intelligent contracts, and encrypting and storing all contractual transactions, it reduces the risk of contract fraud and false transactions [2, 5].

4.3 Strengthening Risk Early Warning and Monitoring

Employing big data technology for creating an early risk alert system, along with real-time surveillance of diverse risk metrics in the supply chain finance sector [3], enables prompt identification of atypical transactions and potential hazards through extensive data analysis and mining, facilitating preemptive actions for risk prevention and resolution.

4.4 Improving the Credit Assessment System

Utilizing big data analysis, we develop a scientifically sound and logical model for credit evaluation, aiming to thoroughly examine the credit standing of key businesses and both upstream and downstream entities. Improve the accuracy and reliability of credit assessment by integrating multi-dimensional data, such as enterprise tax records, utility bill payments, and fund flows [2].

4.5 Optimising Business Processes and Internal Controls

Comprehensive sorting and optimisation of supply chain finance business processes with the help of big data technology to improve the standardisation and efficiency of

business operations. Concurrently, enhance internal governance, refine the risk management framework, and guarantee the successful execution of risk management strategies [3].

4.6 Effectiveness and Challenges in the Implementation of the Application Strategy

4.6.1 Implementation Effects.

Through the application of big data technology, supply chain financial institutions have achieved significant results in risk management. For example, the Lianyungang branch of Bank of Jiangsu has improved its risk management efficiency by 30 per cent and its risk warning accuracy by 25 per cent through the application of big data technology [1].These results show that big data technology has an important role in supply chain financial risk management and can significantly improve the risk management ability and business efficiency of financial institutions.

4.6.2 Challenges Faced.

Even though big data technology holds considerable benefits in managing risks in supply chain finance, it continues to encounter obstacles during its practical implementation. First, the cost of data acquisition and processing is high, and a large amount of resources need to be invested in data collection, storage and analysis. Second, the authenticity and reliability of data are difficult to ensure, and effective measures need to be taken for data verification and cleaning. In addition, user privacy protection is also an important issue, requiring strict compliance with relevant laws and regulations in the process of data use and the protection of users' private information.

5 Commercial Bank Case Studies

5.1 Practice of Bank of Jiangsu Lianyungang Branch

The Jiangsu Lianyungang Branch of the Bank has enhanced its supply chain finance's risk management through digital supply chain development, the creation of a finance platform for the supply chain, the ongoing growth of manageable data sources, the integration of blockchain technology in billing, and the efficient utilization of financial technology [5,6].

5.1.1 Digital Supply Chain Building.

Promote supply chain enterprises to carry out digital management, build a system management platform, realise information and digital sharing, and improve the transparency and controllability of the supply chain [1].Through digital management, enterprises are able to monitor the information flow, logistics and capital flow in the supply chain in real time, and discover and solve potential problems in a timely manner.

5.1.2 Supply Chain Finance Platform Development.

Create a supply chain finance system that aligns with the bank's ethos of risk management, integrate blockchain and smart contracts, tap into complex data, and enhance the early alert system to achieve comprehensive process management in supply chain finance [1]. This platform development enables banks to streamline their supply chain finance operations and refine risk control precision.

5.1.3 Expansion of Data Sources.

Actively introduce diversified data, do a good job of data cleansing, ensure the relevance, antecedence and timeliness of data, and improve the accuracy of risk identification and early warning. By expanding data sources, banks are able to obtain more comprehensive and accurate information, providing strong support for risk management.

5.1.4 Blockchain Applications.

The introduction of blockchain principles in the note business improves the reliability and authenticity of note transactions through the creation of blockchain scenarios and the all-round disclosure of inter-enterprise payments, credit, transactions and economic activities. The application of blockchain technology effectively prevents the risk of bill fraud and safeguards the security of bill business.

5.1.5 FinTech Applications.

Utilizing financial technology proficiently in the decision-making process of supply chain finance, developing models for risk assessment, gathering extensive business data on supply chains, identifying potential risk sources and points, devising early warning and preventive strategies, conducting stress tests, and enhancing scientific and efficient risk management. Utilizing fintech enables banks to pinpoint and control risks with greater precision, enhancing their risk management capabilities.

5.2 Research at the Business School of Guilin University of Technology

A study by Guilin University of Technology Business School pointed out that commercial banks face challenges in supply chain finance risk management such as systemic risk, credit risk, business process risk and market risk [2].To cope with these risks, the following strategies are proposed :

5.2.1 Enhanced Digital Management Transformation.

We use big data technology to accumulate and analyse user data, track the flow of funds in real time, optimise customer experience and prevent credit risk. Through digital management, banks are able to manage customer information more efficiently and improve the accuracy of risk management.

5.2.2 Establishment of Professional Teams.

Strengthen training on risk warning and prevention, improve the business level and professional ethics of account managers, and enhance risk awareness. Through the construction of professional teams, banks are better able to cope with various risk challenges and improve risk management.

5.2.3 Improvement of the Information Disclosure System.

Increased openness and transparency of information enables commercial banks to effectively weigh risk and profitability and to prevent and avoid risk. By improving the information disclosure system, banks are able to better understand customer information and improve the science and effectiveness of risk management.

5.2.4 Practices of Other Commercial Banks.

Additional business banks are vigorously investigating how big data can be utilized in managing risks associated with supply chain finance. For example, some banks achieve truthfulness of information, data sharing and transaction transparency of all parties by establishing a big data supply chain finance information sharing platform; some banks use big data in combination with blockchain technology to establish smart contracts and reduce contractual risks[7]; and others develop an effective model for credit risk evaluation using big data analysis to enhance the effectiveness and caliber of lending [1,5].

6 Benefits of Utilizing Big Data Technology in Managing Risk in Supply Chain Finance

6.1 Improved Efficiency of Risk Management

Big data technology can quickly process and analyse huge amounts of data, discover potential risks in a timely manner and improve the efficiency of risk management. Through big data technology, banks are able to manage supply chain finance business more efficiently and reduce the probability of risk and the degree of loss. For instance, Advantages of Employing Big Data Technology for Risk Management in Supply Chain Finance Research indicates that the Lianyungang branch of the Bank of Jiangsu has seen a 30% enhancement in risk management efficiency and a 25% rise in the precision of risk warnings, as evidenced by studies (Zhao Yinan, 2020)[1].

6.2 Enhancing Risk Early Warning Capacity

The risk early warning system established by using big data technology can monitor all kinds of risk indicators in the supply chain finance business in real time, discover abnormal transactions and potential risks in a timely manner, and take measures in advance for risk prevention and resolution. Through the establishment of the risk early

warning system, banks can better cope with various risk challenges and improve the level of risk management [5].

6.3 Improving the Credit Assessment System

Based on big data analysis, a more scientific and reasonable credit assessment model is constructed to comprehensively assess the credit status of core enterprises and upstream and downstream enterprises. Improve the accuracy and reliability of credit assessment by integrating multi-dimensional data, such as enterprise tax records, utility bill payments, and fund flows [2].Through the improvement of the credit assessment system, banks are able to identify and manage risks more accurately and improve the level of risk management.

6.4 Optimisation of Business Processes and Internal Controls

With the help of big data technology, the supply chain finance business process is comprehensively sorted out and optimised to improve the normality and efficiency of business operations [3]. Concurrently, enhance internal governance, refine the risk management framework, and guarantee the successful execution of risk management strategies. Through the optimisation of business processes and the strengthening of internal control, banks are able to better manage supply chain finance business and reduce the probability of risk and the degree of loss.

7 Conclusion

Big data technology provides strong support and empowerment for commercial banks' supply chain finance risk management. By optimising the information sharing model, applying blockchain technology, strengthening risk early warning and monitoring, improving the credit assessment system and optimising the business process and internal control and other strategies, commercial banks are able to effectively improve the level of supply chain financial risk management and reduce the probability of risk occurrence and the degree of loss. Concurrently, the instances involving certain commercial banks have demonstrated the tangible benefits and practicality of big data technology in managing financial risks within supply chains. In the future, with the continuous development and improvement of big data technology, commercial banks should further deepen the application of big data in the field of supply chain finance, and continuously innovate the risk management mode and method, so as to adapt to the increasingly complex market environment and risk challenges, and achieve the sustainable development of supply chain finance business. This study is mainly based on the current status quo of the application of big data technology, and the data sources mainly focus on the public information and case studies of some commercial banks. The scope of the study is relatively limited and fails to cover all types of supply chain financial institutions and business models [5].In addition, due to the limitations of data availability and confidentiality, some of the data may have certain limitations, affecting the comprehensiveness

and reliability of the research results. Future research can further expand data sources and add more empirical data to improve the comprehensiveness and reliability of the study. In addition, with the rapid development of emerging technologies such as artificial intelligence and the Internet of Things, future research can explore the application of the combination of these technologies and big data technology in supply chain finance risk management to provide more comprehensive and efficient risk management solutions for commercial banks. For example, the accuracy of risk prediction and the automation of risk management can be further improved through the application of artificial intelligence technology; the logistics and information flow in the supply chain can be better monitored through the application of IoT technology to improve the real-time and accuracy of risk management.

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