

Research on Credit Risk Transmission Mechanism of E-commerce Supply Chain Finance and Countermeasures to Prevent Credit Risk of Core Enterprises

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Abstract—With the rapid development of digital economy and e-commerce, the scale of supply chain finance has surged from 15 trillion in 2020 to 45.6 trillion in 2024, with an average annual growth rate of 204%, and its core driving force stems from the expansion of the financing demand of small and medium-sized micro-enterprises (SMMEs), and the supply chain integrates the core enterprises and the upstream and downstream enterprises together to form a multilateral credit collaboration network. However, its credit risk is gradually exposed as credit risk keeps growing. This study integrates the theory of cross-industry risk transmission, systematically examines the interaction and transmission route of credit risk among various stakeholders, and offers appropriate solutions for businesses' risk prevention, all based on the dynamic transmission mechanism of credit risk in supply chain finance.

Keywords— E-commerce, supply chain finance, core business, credit risk.

I. INTRODUCTION

Supply chain finance is a financing model that combines core enterprises and upstream and downstream enterprises through financial institutions and flexibly provides them with financial products and financial services. In recent years, with the development of big data, the Internet and the digital economy, e-commerce has been able to develop rapidly, and supply chain finance developed with the help of e-commerce has also continued to develop under the influence of the digital era, and according to the latest data, the scale of supply chain finance has grown from 15 trillion in 2020 to 45.6 trillion in 2024, which is about 204% higher than that of 2020, leading to this rapid growth is mainly due to the increased financing needs of MSMEs. MSMEs have become key players in the supply chain finance market as they dominate the development of the Chinese economy. In addition, core enterprises and financial institutions are also key participants in the supply chain finance market. As of 2022, the total number of core enterprises in China reached 10,816, and the number of financial institutions (including commercial banks, securities companies and insurance companies) totalled 2,139. Among them, supply chain finance, which relies on the development of Internet technology, occupies a dominant position and has an important impact on the development of the economy. In the context of the big data era, no matter how supply chains

innovate and develop, their own risks such as operational risk, market risk, credit risk and legal risk always exist, of which the most difficult to control is credit risk.

In essence, supply chain finance is a kind of credit guarantee, so it is most likely to generate a kind of credit risk represented by default in the process of development, and form a kind of basic risk in the supply chain. As the supply chain finance business continues to become more and more, the types and number of subjects of interest involved are also more and more, which will make the role of credit risk in the supply chain mechanism and contagion presents a complex trend, forming the characteristics of multi-level conduction, if an enterprise in the supply chain default, then it will make the health of the entire supply chain received impact, to enterprises and even the society to bring serious challenges. For supply chain finance, the asymmetry of information between the principal and the agent, the instability of supply chain finance business, non-truthful transactions, and the risk of depreciation and realisation of pledges may all lead to the generation and transmission of default risk. [1] When the credit quality deteriorates in a certain sector or a certain region, it will be transmitted to other enterprises, and this is not limited to the financial industry, but also in the manufacturing industry, where buyers and sellers enter into a contract, where the credit risk can be transmitted through such a trade relationship.

With the continuous development of supply chain finance, driven by this model and modern technology, the ability of enterprises to obtain profits and resources will be significantly improved, but the ensuing sudden risks will also become more and more complex, which is prone to produce the "domino effect", making the transmission of credit risk in supply chain finance more complicated. At present, most scholars focus on the source of enterprise risk and the path of risk propagation, which does not reflect the propagation law of risk in the complex network, in order to solve the problem of credit risk transmission in supply chain finance, this paper will study the risk transmission mechanism of supply chain finance, and put forward the corresponding risk prevention measures according to the transmission mechanism of supply chain finance.

2.1 Typical models of e-commerce supply volume finance

Accounts receivable financing

Accounts receivable financing refers to the accounts receivable generated from the transactions between suppliers (generally SMEs) on the e-commerce platform and their core enterprises' (a large e-commerce platform), which are transferred to financial institutions or other supply chain finance platforms, so as to obtain advance financing, further alleviate the capital pressure of enterprises, reduce the cost of financing, and optimise the financial statements of enterprises. In this financing activity, the financial institution becomes the main provider of funds, which is the key to maintaining the entire amount of funds, due to the information disclosure system of SMEs is not sound, and the information transparency of the enterprise is low, which leads to the bank's difficulty in judging the use of funds by the enterprise, coupled with the influence of the external environment of the supply chain, these factors increase the probability of the generation of confidence risk. According to the data of Jingdong Finance, Jingdong's supply chain finance "Jingbao" has exceeded 200 billion yuan in cumulative financing scale in 2024, successfully connecting more than 100,000 suppliers, and covering more than 1,000 categories of services.

Inventory financing

Inventory financing is a financing method in which an e-commerce enterprise takes inventory goods as a pledge and applies for a loan from a financial institution to further obtain short-term financial support. This financing method can provide real-time inventory data, further reducing the risk control costs of financial institutions. Jingdong Logistics warehouse receipt pledge is the use of intelligent warehousing data to assess the value of inventory and dynamically adjust the amount of financing. According to the relevant data in 2024, the Jingdong Logistics warehouse receipt pledge financing business covers 85% of the intelligent warehousing centres in the country, and the value of pledged commodities grows by an average of 35% per year. The goods credit in Jingdong Finance supports a number of fast-consuming goods enterprises, and at the same time cooperates with a number of leading logistics and warehousing enterprises, of which more than 2,000 warehouses, with a total supervisory area of more than 5,000 square meters, and the number of pledged commodities is more than 100 million, and it has cumulatively provided Customers to provide more than 40 billion yuan of financial support.

advance financing

Advance payment financing refers to the situation where a downstream buyer, when purchasing goods from a supplier, lacks the funds to pay the advance payment and applies to a financial institution (e.g., a bank) for financing to pay the supplier in order to obtain the goods. The financial institution provides financing support to the purchaser based on real transaction information between the purchaser and the supplier. In 2024, Jingdong Procurement Financing helped SMEs finance a record 247% year-on-year increase in financing and 102% year-on-year increase in the number of companies served.

2.2 Advantages of e-commerce supply chain

E-commerce supply chain finance has a greater advantage over traditional ones, and under the technological empowerment of big data, regional chains and AI risk warning, the flow of funds and related data can be monitored in real time, reducing the asymmetry of information. The annual report of Netcommerce Bank 2022 shows that the cumulative service of e-commerce supply chain finance has served more than 49 million small and micro merchants (including upstream and downstream of the supply chain), 70% of which are small and micro enterprises with an annual operating income of less than 5 million, and the data of the CBRC 2021 shows that the traditional supply chain finance covers less than 30% of SMEs and most of them are first-tier suppliers, which can be seen that e-commerce supply chain finance can improve the coverage of micro and small enterprises; according to Jingdong Technology's "2022 County Economy Supply Chain Finance Report", for the financing of county suppliers the penetration rate can reach 41%, an increase of 18% year-on-year, and the coverage rate of traditional county supply chain finance is only 12.7% in the same period; the data of KPMG's "2023 China Supply Chain Fintech Whitepaper" shows that the disbursement time of e-commerce supply chain finance is <4 hours, and the automated approval rate is as high as 92%, while under the traditional supply chain, the average disbursement time is 5-15 working days, and the automated approval rate is 35%, which greatly reduces the efficiency of the work; under the model of e-commerce supply chain finance, the transaction risk can be further reduced by establishing a risk assessment model, and the Ali Research Institute's "2022 Digital Supply Chain Finance Development Report Data show that Alibaba supply chain finance uses more than 1,000 kinds of risk control variables, including real-time transaction flow, logistics timeliness, buyer evaluation and other non-financial indicators, which improves risk accuracy by up to 27% compared with the traditional model; according to the First Financial "Supply Chain Finance Changes under the Epidemic", during the Shanghai epidemic in 2022, the Jingdong Supply Chain Finance provided relevant financing services for suppliers in the Yangtze River Delta region, and the single-month The number of disbursements increased by 240% sequentially, and the traditional disbursements decreased by 32% during the same period; data from the China Federation of Logistics and Purchasing's "2022 Digital Supply Chain Casebook" shows that the inventory turnover cycle of small and medium-sized suppliers entering e-commerce supply chain finance dropped from 62 to 39 days, and the efficiency of the use of funds increased by 58%, and the above data is sufficient to illustrate the advantages of e-commerce supply chain finance.

2.3 Supply chain credit risk transmission mechanism

2.3.1 Analysis of direct business relationship transmission mechanisms

Transaction linkage

Transaction linkage refers to the basic relationship between upstream and downstream enterprises in the supply

chain, in which the transmission of credit risk may occur in each link in the supply chain [2]. There are two main ways of transmitting credit risk in trading association, one is downward transmission by upstream enterprises due to the lack of competitive advantage of goods or technology, and the other is upward transmission by downstream enterprises due to the market downturn. It is relatively difficult for upstream enterprises to transmit risk downward because downstream enterprises usually choose two or more suppliers, and products provided by upstream enterprises can also find substitutes on the shopping malls; and upstream enterprises can also find substitutes on the shopping malls. shopping malls can also find substitutes; and downstream enterprises due to the lower market demand, resulting in a reduction in the order volume of the upstream enterprise, the enterprise's goods pile up a lot, the capital is occupied, which will lead to a reduction in profits or even losses. Its specific transmission mechanism: the market competitiveness of the downstream enterprise is reduced - the order quantity of the upstream enterprise is reduced - the profit of the enterprise decreases - the outbreak of credit risk - the default rate of the enterprise increases. 2022, Evergrande real estate mine, leading to the cooperation of the renovation of the company can't be carried out to settle the bill, which further led to the cancellation of the orders of the Tmall home sellers, and finally affected the reduction of the income of the logistics company, according to the related data Statistics, Evergrande commercial paper overdue rate of more than 90%, Sophia and other home furnishing companies bad debt accruals increased by 1.2 billion yuan, Tmall home furnishing category GMV fell by 25% year-on-year, resulting in a 37% reduction in the volume of home furnishing transport business of Deppon Logistics.

Asset linkage

There are two types of asset linkages: investment asset linkages and debt asset linkages. Investment asset linkage is usually established in the upstream and downstream enterprises have close and long-term co-operation relationship, the main forms of linkage are: through shareholding, investment to form an alliance system associated with shares; through the establishment of subsidiaries or joint ventures to form a system of equity ownership as the linkage system relationship. In order to prevent the occurrence of credit risk, the core enterprise adopts the mode of "vertical integration" to carry out control, for raw materials, various types of parts and components by taking the form of investment in self-built, investment holdings, etc., which makes the supply chain in the enterprise's capital transactions more closely, once any one of them default, then the credit risk will be carried out along the equity structure. Credit risk will be passed along the equity structure, which will lead to the whole supply chain of enterprises affected. According to a report by Avery Consulting, the proportion of bad debts in the supply chain due to connected investments in e-commerce platforms has risen from 12% of the whole industry in 2019 to 27% in 2021. Debt investment refers to the problem of small and medium-sized enterprises (SMEs) incurring a shortage of funds, and reputable enterprises in the supply chain will give him a guarantee in order to obtain financing, and once the SME

defaults, the guarantee company will have to bear the corresponding joint and several liability, and the huge payout may cause the guarantee company to fall into a financial crisis, and default may occur, and the credit risk will be transmitted along the affiliated enterprises, which will have an impact on the entire supply chain. In 2020, Haier's financing platform Hailongyi provided guarantees to banks for small and medium-sized suppliers to obtain financing, and the foundry raised 80 million yuan through the platform, but Hailongyi was forced to repay 62 million yuan due to Haier's delayed payment of the loan, which triggered the default of 11 enterprises in Haier's supply chain, with bad debts amounting to 320 million yuan.

2.3.2 Analysis of the transmission mechanism of indirect business relationships information effect

The news effect refers to the information asymmetry between enterprises and the information does not flow caused by the existence of information asymmetry, it will make it difficult for creditors to make accurate judgements on the enterprise, even if the debtor has no direct contact with their own enterprises, when the debtor defaults, it will be judged that other enterprises may also be in default, which will lead to the debtor to make the wrong investment judgement. When the solvency of the core enterprise declines or the capital chain is tightened by creditors or investors, then the core enterprise or even the entire supply chain will be reassessed, the bank may let the enterprise repay early because of the transmission of this information, but this will lead to other enterprises in healthy condition to be affected, and it will accelerate the transmission of credit risk.

Macroeconomic factors

When macro factors such as interest rates, exchange rates, policies and other macro factors change, the economic impact faced by all enterprises is the same, much so that when the impact of changes in macroeconomic factors is unavoidable, the scope of the spread is usually very large, and when it is serious, almost all the industries will suffer from severe impacts, once the changes in macroeconomic factors are unfavourable to a particular enterprise in the supply chain, the enterprise may generate a financial crisis, which further creates credit risk and may finally lead to the break of the entire supply chain. In 2020, the global cross-border e-commerce supply chain finance default rate soared to 6.8% in 2020 from 1.5% in 2019 due to the impact of the epidemic, and its main risk transmission mechanism: epidemic - logistics disruption --Seller order cancellations --Uncollectible accounts receivable --Supplier defaults.

Asset price volatility

Asset prices for enterprises will affect the value of enterprise capital and its liquidity, affecting the scale of bank lending, which further leads to credit risk in the supply chain. When the economic situation shows an upward trend, enterprises in order to develop, will be a large number of borrowing from the bank, if this situation continues to develop, it will lead to the enterprise's debt risk is too large, it will form the situation of over-indebtedness, at this time the bank in order not to bear too much risk, it will urge the enterprise to pay back the loan in advance, the enterprise in

order to pay back the loan as soon as possible, will be a large number of sales of enterprise assets, the price of the asset at this time The price of assets will fall sharply, the difficulty of enterprises to obtain direct financing greatly increased, and then reduce the investment or even default. On the contrary, when the price of capital falls, the value of the net assets of the enterprise will be reduced, the enterprise may face the risk of creditors to collect debts, at this time, the enterprise has to reduce other expenditures, including investment, to pay off the debts, which will lead to a reduction in the investment of the enterprise, and the low investment means low income, such a vicious circle will make the enterprise's solvency and credit quality, and the ability to finance the enterprise continues to decline, which may lead to the occurrence of credit risk of the enterprise. This may lead to the occurrence of credit risk.

II. DRIVERS OF CREDIT RISK TRANSMISSION

3.1 Endogenous drivers

(1) Credit risk of the core business

The core enterprise is the source of credit risk of the whole supply chain finance, and to pay attention to the credit risk of the core enterprise is to control the risk of supply chain finance from the source. The risk control of the core enterprise is similar to that of the financing enterprise, but the difference is that the core enterprise has higher requirements. In a supply chain, the core enterprise is generally a stronger company, and the position it occupies is also very critical, and no matter what reasons lead to the occurrence of the credit risk of the core enterprise, it may lead to the occurrence of the payment risk of the other SMEs around the core enterprise, which will result in a systematic outbreak of the risk of the whole supply chain. Systematic outbreak. When the enterprise itself has financial problems, it may default on loans to other suppliers. According to the statistics of the China General Chamber of Commerce, about 65% of the suppliers are facing short-term funding gaps due to delayed payment by the core enterprise; in supply chain finance, the core enterprise has certain control over the SMEs, and some of the core enterprises use their bargaining power to extend the billing period, depress the purchasing price, and compress the SMEs' profit.

(2) Default risk for upstream and downstream companies

In e-commerce supply chain finance, most of them are small and medium-sized enterprises (SMEs), which are less risk-resistant and susceptible to fluctuations in market demand. Some SMEs have insufficient production capacity and are unable to cope with unforeseen situations. According to the statistics of China Association of Small and Medium-sized Enterprises, about 42% of suppliers default on orders due to production capacity problems, with an average loss of 15% of annual revenue; SMEs misjudge the market demand, which may lead to a large amount of funds being occupied, and the research of Ai Rui Consulting shows that about 37% of small and medium-sized suppliers freeze their funds due to the accumulation of inventory. Therefore, before financing, the capital provider needs to assess the risk of the financing enterprise, and only by minimising the credit risk of the financing enterprise, the probability of the entire supply chain

incurring credit risk events will be reduced, and the likelihood of serious consequences can be reduced.

(3) High-tech risk

E-commerce supply chain finance needs to rely on high technology in the process of operation, but if the establishment of risk assessment model is a misjudgement (such as over-reliance on historical data to ignore unexpected risks) will lead to underestimation of risk, which may result in credit risk, Tsinghua University research shows that the default prediction error rate of the AI model can be up to 4-6 times of the conventional in the case of an extreme event; the e-commerce platform relies on the transaction flow, logistics data, and other unstructured data modelling, but there are problems of data forgery (such as brushing orders, false evaluations). The e-commerce platform relies on transaction flow, logistics data and other unstructured data modelling, but there is the problem of data forgery (such as brushing single, false evaluation), the "e-commerce anti-fraud white paper book" data show that in 2021 there is an e-commerce platform due to merchants brushing single led to a supply chain finance bad debt rate surged 3.2%; e-commerce supply chain of the upstream and downstream enterprises are mostly small and medium-sized enterprises, the digital level is low, there may be a technological chasm, and can't satisfy the core enterprise's technological requirements. requirements, and according to relevant statistics from the China Academy of Information and Communications Technology, only 31 per cent of small and medium-sized enterprises have ERP systems, leading to insufficient data coverage in supply chain finance.

III. COUNTERMEASURES AGAINST CREDIT RISK

4.1 Risk Identification

The establishment of risk management system starts from the identification of risks, accurate, efficient, identification of potential risks, and then take reasonable and effective measures to prevent and deal with risks, is the basis of the real role of risk management system. ^[3]In e-commerce supply chain finance, the more enterprises involved, it is necessary for entrepreneurs in all links to have a sense of risk prevention, and an effective risk identification mechanism can help to help enterprises find risks and control risks in a timely manner, so as to minimise the loss of enterprises. Thus providing a better future for the enterprise. In the past, there will always be a sudden closure of the enterprise, in the final analysis, or because the enterprise did not do a good job of risk identification, so that when the risk of a real impact, the enterprise will be in a passive state, unable to make timely and appropriate risk prevention measures, may lead to irreversible situation. With the rapid development of high technology in recent years, e-commerce supply chain finance mode of operation are online operations, which requires the supply chain of enterprises to establish a comprehensive risk identification mechanism, regular risk assessment of enterprises, once the risk of timely to other nodes to seek help, so that the risk of bringing the impact of the minimum, and effectively reduce the loss of other related enterprises.

4.2 Risk assessment

Risk assessment is to quantitatively assess the impact of risk on the economy and society after the occurrence of the risk event and the whole process. [4]With the arrival of the digital era, all kinds of high and new technology continue to develop, enterprises should improve their own information technology level, improve the enterprise risk assessment system. Regional chain technology has the characteristic of tampering, this characteristic ensures the authenticity of the data, so that financial institutions can more accurately assess the real situation of the enterprise, and at the same time, the use of this technology can ensure that the information and data of the transaction is updated in real time, so as to avoid the risk caused by information asymmetry.

4.3 Risk control

Risk control aims to minimize or eradicate the occurrence of risk events, or to implement strategies or measures to mitigate the losses faced by enterprises following the emergence of risks. Improve the cooperation mechanism of supply chain stakeholders, and promote the establishment of a risk control model that brings together various types of financial market information, business flow, logistics and data flow cross-validation. For the e-commerce supply chain, involving more enterprises, it is necessary to control the probability of risk occurrence from the root, so as to reduce the losses caused by credit risk.

4.3.1 Criteria for controlling the entry of financing companies into the e-commerce supply chain

Financing enterprises can influence the whole supply chain, control the admission standard of financing enterprises is to control the risk from the source, which can be controlled from the following aspects: Firstly, it is necessary to ensure that the operation direction of financing enterprises and the operation direction of the supply quantity are roughly in line with each other, if the difference between the two operation directions is large, it will be unfavourable to the development of the supply chain; Secondly, it is necessary to ensure that the enterprises have certain repayment ability, only by ensuring that the enterprises can have stable Secondly, it is necessary to ensure that the enterprise has a certain repayment ability, only to ensure that the enterprise can have a stable income, in order to reduce the risk of default caused by insufficient funds; thirdly, it is necessary to ensure that the enterprise can formulate the corresponding development strategy, only to ensure that the enterprise has a certain degree of foresight to ensure that the sustained and good operation.

4.3.2 Criteria for controlling supplier firms' entry into the e-commerce supply chain

The development of supplier enterprises also affects the operation of the supply chain. Enterprises entering the supply chain should fulfil the following conditions: firstly, they should ensure the quality of the commodities they provide, not be miserably mixed with any counterfeit commodities, and be able to safeguard the interests of all consumers; secondly, they should set up a commodity quality traceability system to ensure that the commodities they provide meet the needs of consumers.

4.4 Risk management

4.4.1 Risk management in the accounts receivable financing model

The financing risk associated with accounts receivable primarily arises from the legitimacy of these receivables. Before carrying out financing, it is necessary to carry out the relevant background investigation of the transaction, verify the basic transaction contract, invoice, logistics documents, acceptance vouchers and other documents to ensure that the transaction really exists, and track the process of the transaction through high-tech, such as big data and regional chain. The use of digital tools for real-time monitoring of accounts receivable account period, debtor operating conditions and industry dynamics, the risk management of accounts receivable financing needs to carry out the whole process of monitoring, which includes pre-lending audit, lending monitoring, post-lending disposal, combined with high technology and financial tools, etc., to form a multi-level risk control system, so as to reduce the losses brought about by the risk.

4.4.2 Risk management in inventory financing models

The risk of inventory financing mainly comes from the change of the value of inventory commodities and the authenticity of inventory commodities, in order to avoid this risk, we can carry out a real-time monitoring of inventory commodities through electronic labelling, video monitoring, etc., and establish an information-sharing platform jointly with the core enterprises of the supply chain and logistics service providers to synchronise the inventory data in real time, so as to reduce the risk.

4.4.3 Risk management in the advance payment financing model

Under the prepaid accounts financing model, it is necessary to supervise the credit of the core enterprise, establish a sound risk assessment mechanism, combined with the enterprise's data to assess the enterprise, [6]At the same time, it is necessary to establish a multi-dimensional dynamic management mechanism, and to establish a multi-dimensional risk mitigation system according to the actual situation of the supply chain. First of all, the establishment of the supplier enterprise access assessment mechanism, for the supplier's credit risk, performance ability, etc. to assess, give preference to establish long-term cooperation with the core enterprise enterprise, and at the same time the introduction of the third-party guarantor so as to play the role of risk-sharing. In the process of supply chain financing, due to the uncontrollable amount of orders, the risk is relatively large, at this time can be adjusted through the interest rate to reduce the risk of downward adjustment of the quota, with the gradual stabilisation of production, you can adjust the interest rate downward adjustment of the quota. Through the Internet of Things and other technologies for the production of goods, transport, warehousing and other aspects of a real-time monitoring, to ensure that the right to control and information sharing, and thus achieve the overall ability to collaborate and improve efficiency.

IV. CONCLUSION

In summary, the following suggestions are put forward for the risk management and control of e-commerce supply chain finance: firstly, strengthen the risk supervision of the core enterprises in the supply chain, establish a dynamic risk assessment model, and prevent them from taking advantage of their strong position to excessively squeeze the profits of small and medium-sized enterprises; secondly, improve the informatisation of e-commerce supply chain, and apply high and new technology to realise the multi-dimensional cross-validation of transaction flow, logistics and capital flow, and solve the problem of asymmetric information; finally, strengthen the mechanism of credit risk management in e-commerce supply chain, and buffer the sudden external shocks by means of risk reserve and supply chain insurance. Ultimately, it is essential to enhance the credit risk management framework within the e-commerce supply chain, utilizing risk reserves and supply chain insurance to cushion against unexpected external disruptions. In the future, it is necessary to further explore the application of artificial intelligence and big data in risk early warning to improve the resilience ecology of e-commerce supply chain finance.

ACKNOWLEDGMENT

Thank you for the support of the Undergraduate Research and Innovation Fund Project at Anhui University of Finance and Economics (XSKY24013ZD).

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