



STUDY ON ACCOUNTS RECEIVABLE PLEDGE UNDER  
THE SUPPLY CHAIN FINANCE MODE OF SMLES



By  
Mrs. Yuqiong LI

A Thesis Submitted in Partial Fulfillment of the Requirements  
for Master of Engineering ENGINEERING MANAGEMENT  
Department of INDUSTRIAL ENGINEERING AND MANAGEMENT

Silpakorn University

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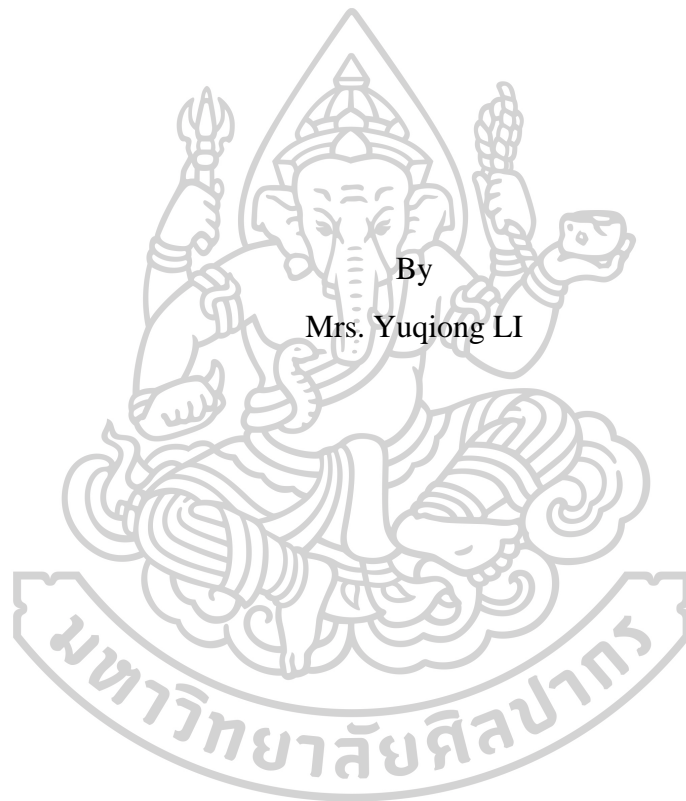
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Mrs. Yuqiong LI : STUDY ON ACCOUNTS RECEIVABLE PLEDGE UNDER THE SUPPLY CHAIN FINANCE MODE OF SMLEs Thesis advisor : Associate Professor Prachuab Klomjit, Ph.D.

Affected by internal and external factors such as the business model of small and medium-sized enterprises and the overall downturn in the overall environment, domestic small and medium-sized construction enterprises in China generally face the problem of insufficient funds in their development process. In order to capture more market share, many construction companies have adopted the competitive approach of financing construction, which has led to a sharp increase in the number of accounts receivable and exacerbated the difficulty of business operations, which is not conducive to the healthy and long-term development of enterprises. The emergence of supply chain finance provides a great platform for enterprises in the industrial supply chain to finance. Supply chain finance is divided into three financing models: accounts receivable, prepaid accounts, and inventory. Among them, the accounts receivable financing model is

The most suitable financing model for the rapid development of small and medium-sized construction companies. This article first analyzes the concept of supply chain finance, the current research status at home and abroad, and analyzes the financing models of supply chain finance; Secondly, analyze the traditional financing model of small and medium-sized logistics enterprises and construct a game model to explain the advantages of accounts receivable pledge financing compared to traditional financing models for small and medium-sized logistics enterprises; Once again, to analyze the game relationship between the subjects of accounts receivable pledge financing for small and medium-sized logistics enterprises in the context of supply chain finance, a game model is constructed to analyze the rationality of the model and the process of game equilibrium; Finally, based on the above research and analysis, the existing financing model of M logistics enterprise is introduced, the current situation of accounts receivable management is analyzed, the feasibility of accounts receivable financing is analyzed, and corresponding strategies are proposed for banks and small and medium-sized logistics enterprises to carry out supply chain finance business based on the above analysis.

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Secondly, I would like to express my deep gratitude to my family for their selfless support and dedication over the past times, which has enabled me to fully devote myself to my studies. I would like to express my highest respect to my family online.

Finally, I sincerely thank the school for creating the learning and research conditions for me, and I would like to express my sincere gratitude and best wishes!



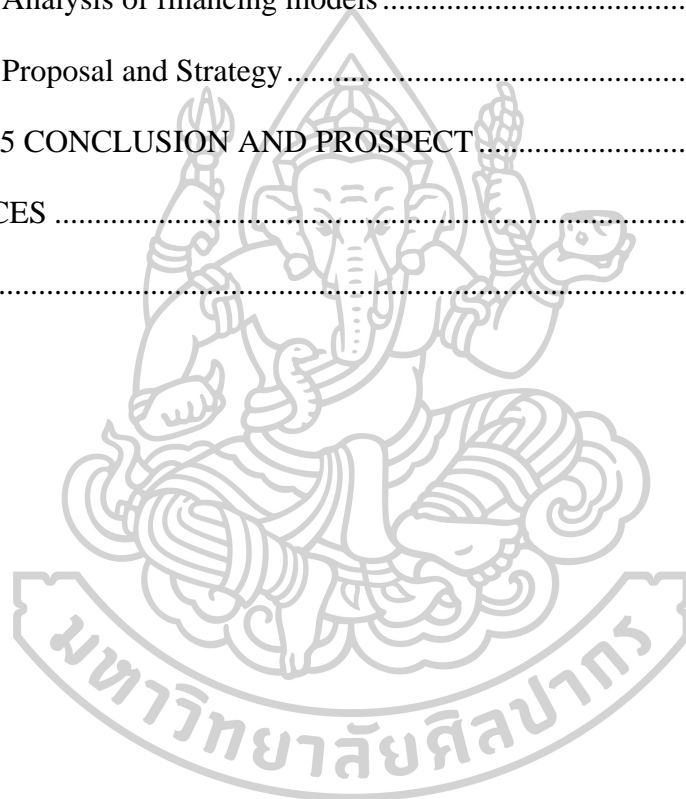
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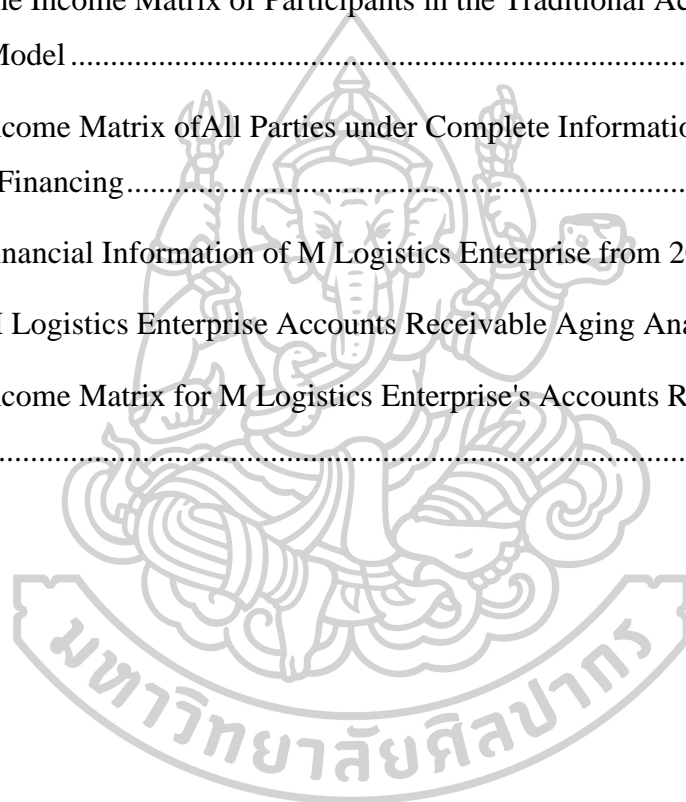
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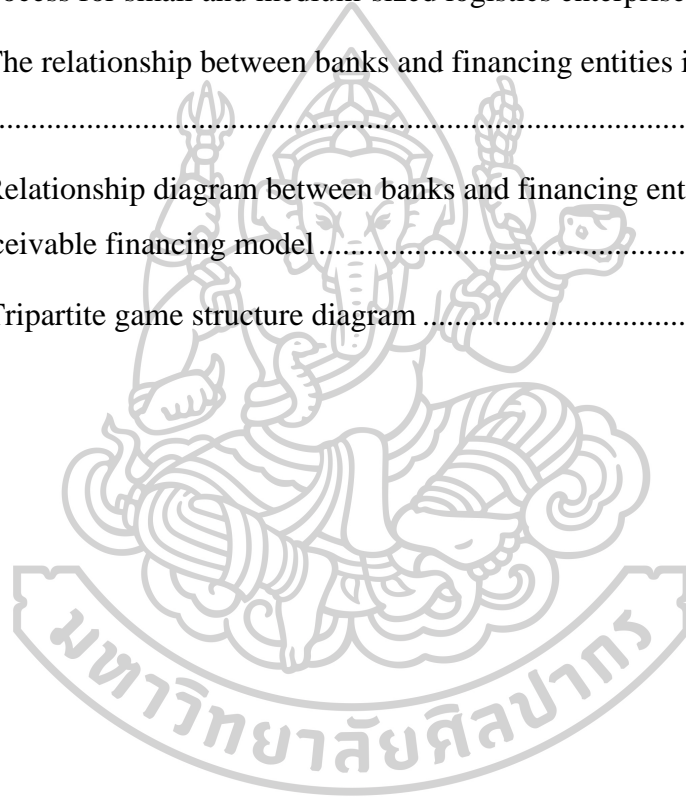
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# CHAPTER 1

## INTRODUCTION

### 1.1 Motivation

A commodity supply chain refers to starting from the procurement of raw materials to the final product and finally delivering the product to the consumer through the sales network, connecting the suppliers, manufacturers, distributors, retailers, and final customers in one overall process. The stability and efficiency of each link in the supply chain can promote the orderly development and progress of the entire supply chain. However, more often than not, performing each link in the entire supply chain is not balanced. Instead, it is the most competitive and largest in the supply chain. The symbiotic model of the entire supply chain is determined or controlled by the core links (and companies) of the entire supply chain, which will directly suppress other links or companies in the supply chain or even be subject to harsh requirements from the core links and companies, resulting in non-core links and companies facing more operating pressure, mainly reflected in funds. If things go on like this, this restrictive relationship can easily lead to imbalances in the entire supply chain and even collapse and reconstruction. On this basis, supply chain finance is gradually being valued by people and even becoming an indispensable factor in supply chain management.

Most small and medium-sized enterprises are located upstream and downstream of the supply chain of industrial enterprises above the designated size. Facing the core enterprises with large scale and strong competitiveness, the upstream and downstream small and medium-sized enterprises are often in a weak position in the negotiation and bargaining process, and the funds caused by the high accounts receivable Chain tension is a common problem faced by such enterprises in the development process. To give full play to the role of accounts receivable circulation in alleviating the financing difficulties of small and medium-sized enterprises, more and more enterprises introduce financial institutions in the supply chain to provide financial solutions to members of the supply chain promptly, which has resulted in supply chain finance. The emergence of supply chain finance is to focus on serving the supply chain, use financial means to rationalize the allocation of resources in the entire supply chain, and at the same time promote the healthy development of the supply chain. Supply chain finance is a

reasonable combination of the two major management fields of supply chain and finance. As a new financing method, supply chain finance not only broadens traditional financial thinking but also drives the liquidity of the entire supply chain, thus becoming a source of innovation in the financial sector. The supply chain financial model is a comprehensive financial service provided by financial institutions relying on the core enterprise as the dominant entity and the upstream and downstream related enterprises of the core enterprise. This is the requirement for supply chain finance—how to maximize it.

The traditional financial model focuses more on the control of risks and the flexibility of reputation. At the same time, traditional finance focuses more on starting with an independent individual and conducting multi-dimensional analysis and judgment on its business to deal with security strategies when future risks are uncontrollable. (Victor Ricciardi, 2008). In today's society, where the economy is constantly changing, financial institutions have found that they cannot simply treat individual businesses in isolation and need to seek a more efficient financial model to replace the rigid mechanisms of the traditional financial model. Through the integration of logistics, information flow and capital flow, supply chain finance forms a strategic alliance with all enterprises in the entire supply chain to solve the difficulties of financing for small and medium-sized enterprises, thereby stabilizing the supply chain and improving the overall level of the supply chain, At the same time, it also promotes the win-win demand of financial institutions for risk management and control.

According to the different needs of supply chain links, the supply chain financial model can be divided into prepaid accounts, inventory, accounts receivable, etc. The benefits and risks brought about by different supply chain financial models are actually different. At present, the accounts receivable supply chain financing model can not only help small and medium-sized enterprises obtain bank financing but also effectively reduce the risk of bank loans. It is the fastest-growing and most common supply chain financing model at home and abroad.

Supply chain accounts receivable financing means that small and medium-sized enterprises whose asset scale and profit level make it difficult to meet bank loan standards, and whose financial status and credit level do not meet the bank credit level use the receivables formed by their business transactions with core enterprises as a

guarantee to the bank applications to obtain loans (Aimin Deng, Bo Yu, 2017). Among them, the core enterprise assumes the role of reverse factoring. Once the financing enterprise has problems, such as failing to repay the bank loan on time, the core enterprise will bear the responsibility of making up for the losses of the financial institution.

China's current industrial structure is upgrading, and the core enterprises in the industrial chain has become more and more important. Small and medium-sized enterprises have also become more frequent with the industrial upgrading of the entire chain. At this time, the proportion of accounts receivable increases, and the account period elongation becomes more and more obvious. According to the data released by the National Bureau of Statistics of China, it can be seen that the notes receivable and accounts receivable of industrial enterprises above the designated size are 16.41 trillion yuan at the end of 2020, 18.87 trillion yuan in 2021, and 21.65 trillion yuan in 2022, increasing year by year. The accounts receivable not only reflect that many small and medium-sized enterprises sell too much on credit during the sales process, the bargaining power of enterprises is not strong, and they are in a relatively weak position in the supply chain link. availability, thus affecting the normal business activities of small and medium-sized enterprises and restricting the vitality of business development.

The operation process for accounts receivable financing is shown in Figure 1.1 We can divide the whole process into the following steps:

1. Small and medium-sized enterprises reach a goods transaction with core enterprises;
2. The core enterprise issues an account receivable document to the small and medium-sized enterprise, and agrees to become the debtor in the goods relationship;
3. Small and medium-sized enterprises apply for pledge loans from financial institutions with accounts receivable documents;
4. The core enterprise issues a certificate of accounts receivable to the financial institution as well as a payment commitment letter;
5. Financial institutions lend to small and medium-sized enterprises, and small and medium-sized enterprises become financing enterprises;

6. After financing, small and medium-sized enterprises use loans to purchase raw materials and other production factors to continue production;
7. The core enterprise sells products and receives payment;
8. The core enterprise pays the prepaid account amount to the account number designated by the financing enterprise in the financial institution;
9. Cancellation of the accounts receivable pledge contract

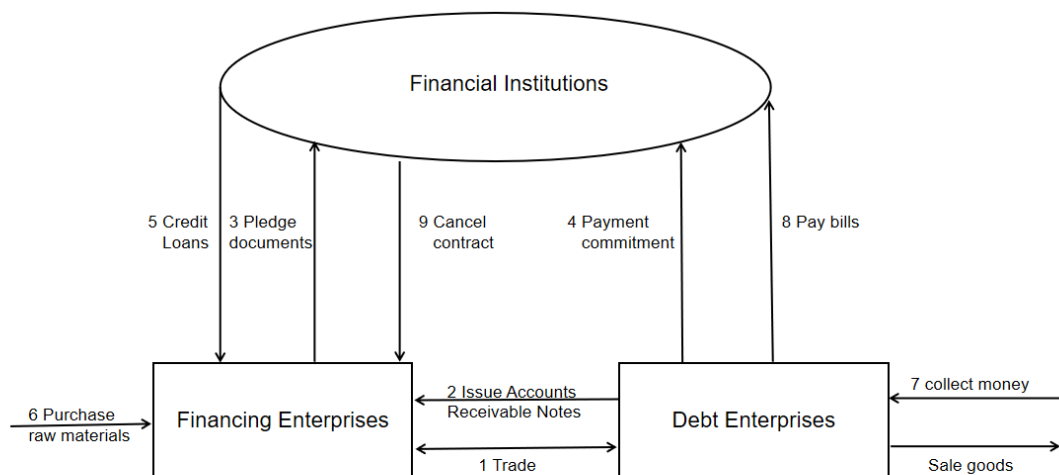


Figure 1.1 **Supply chain accounts receivable financing transaction process**

Accounts receivable financing under supply chain finance also faces many uncertainties and difficulties. For example, accounts receivable in the supply chain are generated based on transactions, and the transactions are scattered across time and amount, resulting in accounts receivable in the financing process. It needs to be processed multiple times. If financial institutions cannot regularly check with financing companies, it is easy to make omissions and mistakes, and repeated pledges occur at the same time. The vast majority of accounts receivable financing uses a circular transaction model to support long-term financing. Most of the accounts receivable in the supply chain are initiated by the weaker enterprises in the supply chain, and the ability to coordinate core enterprises to confirm rights and change the repayment path is weak and difficult to realize. At the same time, once the accounts receivable financing is carried out, it will require the core enterprise and the financing enterprise to have a

long-term and stable trade relationship, so as not to lead to the uncertainty of the accounts receivable financing and become bad debt, which requires trade between the two parties. There are clear acceptance criteria and delivery basis. Considering the diversity of accounts receivable models in supply chain finance, we need to further innovate the accounts receivable financing model to enhance the stability of all links in the supply chain.

### 1.2 Research Objectives

1. To analyze the operating mode principles and application methods currently adopted by financial institutions in the financing of accounts receivable for enterprises.
2. To find the decision-making for the receivables financing model.
3. To establishing a two party game for accounts receivable financing in small and medium-sized logistics enterprises to determine the best quality decision.

### 1.3 Contributions of the Research

1. Through this study, we can see more clearly the operation of financial institutions on accounts receivable financing.
2. According to the research, it can provide more guiding directions and operational strategies for future accounts receivable financing.

### 1.4 Definition of Terms

This study touches on a large number of terms in supply chain finance.

**Accounts Receivable Financing:** It is the conditional assignment of accounts receivable formed by a company on credit to a specialized financing institution so that the company can receive the required funds and enhance its liquidity.

**Advance Money Financing:** Prepayment financing is a short-term financing facility provided by a bank to a buyer on the basis of prepayments arising from a genuine trade contract between the buyer and the seller, with the sales proceeds as the first source of repayment.

**Inventory financing** is where the exporter uses goods stored in a warehouse (usually designated by the bank) as security and relies on payment from the importer as

a source of repayment. Unlike receivables financing, the goods have not yet been shipped when the exporter finances them.

**bank's credit rating:** a comprehensive examination and analysis of a customer's financial situation, production and operation, loan usage, ability to repay the loan and loan proceeds before the bank grants credit to the customer.

**Pledged loan:** a loan granted against movable property or rights of the borrower or a third party as collateral.

**Contract of pledge:** a written security contract between the pledge and the pledge on the basis of the principal debt contract in respect of the matters secured by the pledge.

**Credit loan** is a loan granted on the creditworthiness of the borrower and does not require the borrower to provide security.

**Duplicate pledge** is where the debtor (or third party) pledges all of its property as the subject of a pledge to more than two separate creditors at the same time.

**Accounts receivable turnover days:** the time it takes for a business to acquire the rights to accounts receivable and to collect the money and convert it to cash.

**Trust scheme** is a capital trust business activity in which a trust company acts as trustee to centrally manage, apply or dispose of funds delivered by two or more (including two) principals for the benefit of the beneficiaries in accordance with the principals' wishes.

**The term of the trust project** refers to the duration of the trust.

### 1.5 Research process

This research methodology is divided into 4 steps as follows;

Firstly, a complete information static game is used to analyze the financing of accounts receivable for small and medium-sized logistics enterprises under the traditional model.

Then compare and analyze accounts receivable financing with small and medium-sized logistics enterprises under the supply chain finance model, and discuss the advantages of developing supply chain finance.

The third step is to construct a model for accounts receivable financing for small and medium-sized logistics enterprises under the supply chain finance model, and analyze the game relationship among the three parties.

Finally, based on the aforementioned theoretical analysis, conduct a case study.



## **CHAPTER 2**

### **LITERATURE REVIEW**

Turning on the enterprise and simultaneously ensuring the smooth development of other enterprises in the entire supply chain is a crucial task in today's business environment. As the supply chain faces unprecedented changes and challenges, companies must promptly adapt to enhance their competitive advantages and ensure survival in the market. Capital supply chain management has emerged as a crucial component of supply chain operations because it involves managing the constant flow of capital and information to achieve sustainable development goals. By manipulating a company's capital structure, risk level, operating costs, and profitability, the supply chain can influence the creation of final market value. This prompts the integration of financial theory into supply chain management to optimise capital flow, enhance the ability of all supply chain links to handle risks and ultimately improve overall performance. Supply chain finance serves as the perfect intersection of supply chain collaboration and financial theory, generating new forms of cross-intelligence and cross-organization that lead to enhanced efficiency and innovation. Many enterprises in the supply chain, particularly small and medium-sized enterprises, often struggle with a lack of funds that hinders their growth potential due to operational constraints. By implementing credit finance and maintaining cash flow, these companies can mitigate the impact of credit crunches or economic downturns on their businesses while ensuring smooth operations for other enterprises across the entire supply chain. Addressing these challenges has made supply chain finance a crucial tool for enhancing overall performance, risk management, and sustainable growth.

#### **2.1 Problem Statement**

Swift economic growth also stimulates the supply chain, compelling enterprises to seek a financing model better suited to their needs to cope with the financial constraints of this rapid expansion. As the core companies in the supply chain enhance their production capacity, their upstream and downstream enterprises are also compelled to increase their production capacity. Simultaneously, when core enterprises transfer capital risks to their upstream and downstream enterprises, they can seize the

most crucial commercial competition opportunities in the market. Consequently, the supply chain can be better preserved. Previous studies have observed that the supply chain financing model primarily focuses on risk and control in the decision-making process of both parties within the supply chain; however, seldom do we witness the process control of the entire supply chain financial financing for each link of the supply chain. This scarcity of information makes it challenging to achieve a more accurate evaluation of the operational efficiency of supply chain finance (Qihui Lu et al., 2012).

The current business environment enables upstream and downstream enterprises to leverage the core enterprise's business reputation in negotiating with financial institutions, facilitating timely access to required capital injections, and facilitating growth in tandem with economic development. Simultaneously, this approach can also influence their respective customer bases, resulting in more secure economic benefits. Supply chain finance fosters fair collaboration among supply chain members and establishes long-term strategic relationships to share substantial profits in the rapidly evolving economic landscape while rectifying imbalanced resource allocation under such conditions. Although supply chain financing benefits all departments within the supply chain, it is crucial to note that inappropriate methods can result in financiers becoming overly reliant on the financed party, leading to instability within the supply chain and increased potential for control-related risks on the provider platform. To rapidly acquire market share, core enterprises within the supply chain engage in a series of inventory reduction, cost control, and quality performance management strategies for their upstream and downstream counterparts (David A. Wuttke et al., 2017). Consequently, supply chain financial financing poses higher risk control requirements for financial institutions. Efficiently maintaining the supply chain under financial theory is a critical aspect that necessitates a balance between control and risk management in supply chain finance. Surprisingly, many literature sources overlook the role of financial institutions in supply chain finance, which represents an integral yet challenging aspect to control under stringent risk management protocols. Consequently, it has become increasingly important to clearly define the various components of supply chain finance.

To gain a deeper understanding of the role of financial institutions in supply chain finance, it is crucial to first clarify their position in the supply chain financing process. As crucial stakeholders in the supply chain, financial institutions offer a comprehensive suite of services for the entire supply chain management process, including financing, payment, investment, risk management, and other financial services. Their involvement not only provides liquidity support and risk control for the entire supply chain but also enables them to share risks and returns with enterprises throughout the operational process.

Supply chain financial institutions should initially establish their role within the supply chain, encompassing various possibilities such as being a creditor, supplier, bank, or agent. Their specific positions in the supply chain significantly influence their risk management strategies and decision-making processes. For instance, if a financial institution assumes the role of a creditor, it will prioritise credit risk control concerning enterprises involved in the supply chain. Conversely, if it operates as a supplier, emphasis will be placed on efficient inventory management and the operational effectiveness of these enterprises. In the case of functioning as a bank, considerations must include optimising resource allocation and cost control while effectively managing credit risks. Finally, when acting as an agent within the supply chain framework, attention should be directed towards enhancing service efficiency and reducing costs through optimisation techniques.

Second, financial institutions should also prioritise maintaining a dynamic equilibrium between risk and return. Enterprises within the supply chain typically face higher risks to achieve greater returns. Consequently, when providing services to these enterprises, financial institutions must consider the associated risks and make decisions based on their own risk tolerance and resource allocation capabilities.

Finally, financial institutions should also prioritize the symbiotic relationship they share with enterprises in the supply chain. While it is essential for financial institutions to consider their own interests when providing services to these enterprises, they must also diligently focus on fostering long-term development and maintaining strategic alliances. By doing so, not only will this facilitate enhanced growth for enterprises within the supply chain, but it will also mitigate the inherent risks faced by financial institutions themselves.

Therefore, it is imperative to establish a precise delineation of the role that financial institutions play in supply chain finance, thereby enhancing our comprehension of their functions and strategic behaviours within this process. This will enable financial institutions to exercise superior risk management and foster economic development more effectively.

## **2.2 Advantage of Supply Chain Finance Accounts Receivable**

"Accounts receivable financing presents suppliers with a range of benefits that can significantly enhance their operations and overall growth. We can summarise this innovative financing method as follows: rapid access to funds, no need for collateral, and more. Suppliers have the flexibility to choose which invoices they want to submit to the accounts receivable financing company for financing. This allows them to prioritize invoices that best suit their cash flow needs, providing a much-needed injection of cash. This feature is particularly beneficial for small- and medium-sized enterprises (SMEs) that often face cash flow challenges due to long payment cycles.

One of the key advantages of accounts receivable financing is that it does not affect collateral. When applying for a traditional bank loan, lenders usually require collateral as a security measure. However, in accounts receivable financing, the invoices themselves serve as security, eliminating the need for additional documentation. This arrangement ensures that neither your personal assets nor any company assets are at risk, providing you with peace of mind.

Moreover, accounts receivable financing offers a higher degree of transparency and control. Suppliers can track the status of their invoices and the funds they have accessed in real-time, allowing them to make informed decisions about their financial operations. This level of visibility and control is not always available in traditional financing methods, making accounts receivable financing a preferred choice for many suppliers.

In conclusion, accounts receivable financing offers suppliers a flexible and convenient financing solution that can help them grow their businesses without worrying about collateral or asset risk. With its numerous advantages, it is no surprise that this innovative financing method is gaining popularity among suppliers across various industries."

### **2.3 Supply Chain Finance accounts receivable Modal**

Financing action can achieve better integration between physical goods and financial flows. Meanwhile, more factors will be considered in the supply chain, such as market and book value, liquidity ratio, capital structure ratio, equity-to-security ratio, profit on sales, and return on equity (Jafar Yazdimoghaddam, 2020). It can help us realise the importance of the supply chain finance model. Different models can facilitate and encourage the relationship between buyers and suppliers and enhance supply chain management. Buyers' strong creditworthiness and supply financial demand can be reviewed using supply chain finance. A good finance program can meet the demand for a win-win situation. Clarity and demonstration of the procedure processes from payment and orders until cash receipt is the ultimate goal of supply chain finance.

The imbalance of trade leads to the emergence of accounts receivable, and the misalignment of credit prolongs the accounts receivable. Trade imbalances lead to accounts receivable, while credit misalignment prolongs accounts receivable. When the customer pays the account, the account receivable has the corresponding cash. If the account cannot be paid or the account is cancelled, it will result in bad debt (JEL Klasifikacija, 2013). The biggest basis for the establishment of the accounts receivable financing model is whether the accounts receivable can be paid in a timely manner, that is, from a sufficient flow of funds from customers, so that the entire accounts receivable model can be better promoted and continued. Shehzad Mian and Clifford W. Smith presented that accounts receivable have more advantages in cost advantage, market power, and taxes, and they thought that the policy to accomplish accounts receivable was the benefit for trade credit in 2017.

The supply chain accounts receivable financing decision model was built through suppliers providing products, services, or raw materials to their buyers, and orders from the buyers were confirmed according to market feedback. The buyer (core enterprises and industries) plays the role of "counter-guarantee", and once the financing enterprises cannot pay the loan interest when due, the bank has the right to demand the loan losses from the core enterprises. The following section describes the transaction process and decision model for supply chain accounts receivable financing.

Supply chain accounts receivable financing can provide more SMEs enterprises with more convenient financing on capital and cash, and the supplier can benefit from

the financing funds to perform continuous production and achieve optimal output in a short period of time. When the initial cash scale of the supplier is larger, the supplier can meet market demand more quickly.

Scholars such as Yang Y and Chen X (2019) have established a theoretical framework to illustrate how information structure plays a role in strategic interactions between banks and enterprises in the supply chain, and why transaction information in the supply chain may help reduce information asymmetry and improve opportunities for small and medium-sized enterprises to obtain external financing.

The timely payment of accounts receivables is the most important factor in establishing an accounts receivable financing model. If customers cannot pay their accounts or cancel their accounts, it will result in bad debts, which will have a negative impact on the company's finances. Therefore, timely payment of accounts receivable is crucial for the success of the entire accounts receivable financing model.

Shehzad Mian and Clifford W. Smith mentioned in 2017 that accounts receivable have advantages in terms of cost advantage, market power, and taxes. They believed that the implementation of policies to accomplish accounts receivable is beneficial for trade credit.

Scholars such as Huff J Rogers DS (2016) conducted an empirical study on the cash flow efficiency of enterprises using inventory theory. The results showed that changes in inventory strategies had the greatest impact on the financial performance of enterprises, with the longest duration. Based on this, suggestions were made for future research on supply chain finance.

Scholars such as Mabula J B and Ping H D (2018) have found that the acquisition of financial services has a significant positive direct impact on the actual use of financial services, and the use of financial services has a significant positive impact on firm performance. Financing accounts receivable under the supply chain finance model can reduce information asymmetry for enterprises.

Supply chain accounts receivable financing is a decision-making model that allows suppliers to provide products, services, or raw materials to their buyers, and the orders from the buyer are confirmed according to market feedback. The buyer plays the role of "counter-guarantee", and if the financing enterprise cannot pay the loan interest when due, the bank has the right to demand loan losses from the core enterprise.

The transaction process of supply chain accounts receivable financing involves suppliers providing products, services, or raw materials to their buyers, and the buyers confirming their orders according to market feedback. If the financing enterprise cannot pay the loan interest when it is due, the bank has the right to demand loan losses from the core enterprise. This decision model allows more SMEs enterprises to obtain more convenient financing in terms of capital and cash, and allows suppliers to benefit from the financing funds to perform continuous production and achieve optimal output in a short period. When the initial cash scale of the supplier is larger, the supplier can meet market demand more quickly. Accounts receivable financing can help suppliers obtain more financing funds and better meet market demand, which is beneficial for both enterprises and banks.

#### **2.4 Research on Game Theory in Supply Chain Finance**

Koch AR analyzed the economic issues related to accounts receivable and inventory financing in the United States and identified the significance of supply chain finance financing models for successful financing(Koch A R, 1948). Scholars such as Xiao T and Yu G established an evolutionary game model to study the evolutionary stability strategies of duopoly retailers with homogeneous goods and quantity, and analyzed the impact of monopolies on the average profit of market channels(Xiao T et al.,2006). Scholars such as Long Y and Wei G established an evolutionary stability model for the cooperation preference of supply chain partnership systems and introduced penalty mechanisms to analyze evolutionary stability strategies(Long Y et al.,2008). Scholars such as Li X and Shouguo W (2009) introduced the concept of a supply chain financing model based on accounts receivable and proposed a mathematical model for calculating loan amount, loan term, pledge rate, and loan interest rate(Li X et al.,2009). Scholars such as Liqun M and Yuxiao L analyzed the financing strategies of three parties in the supply chain based on the dual Stackelberg model(Liqun M et al.,2015). Scholars such as Nina Y and Bowen S designed a supply chain finance system consisting of retailers, manufacturers, and commercial banks, constructed a double-layer Stackelberg game model with bank interest rate decision-making, designed credit guarantee contracts, and analyzed the supply chain finance activities of enterprises(Nina Y et al.,2016).

## CHAPTER 3

### RESEARCH METHODOLOGY

#### **3.1 Overview of accounts receivable financing models from the perspective of supply chain finance**

(1) Literature method. By reading and sorting out relevant literature on supply chain finance and accounts receivable financing under supply chain finance models both domestically and internationally, as well as game theory in supply chain finance, this paper summarizes the concept of supply chain finance, elaborates on relevant theories, and briefly discusses the financing models of accounts receivable.

(2) Comparative analysis method. Compare accounts receivable financing under the traditional mode of small and medium-sized logistics enterprises with accounts receivable financing under the background of supply chain finance, analyze the characteristics of supply chain finance mode, and the advantages of resolving financing difficulties for small and medium-sized logistics enterprises.

(3) Game theory. This article uses complete information static game analysis to analyze the accounts receivable financing of small and medium-sized logistics enterprises under the traditional mode, and compares it with accounts receivable financing of small and medium-sized logistics enterprises under the supply chain finance mode, discussing the advantages of developing supply chain finance. And construct a model for accounts receivable financing for small and medium-sized logistics enterprises under the supply chain finance model, and analyze the game relationship among the three parties.

The supply chain accounts receivable financing model refers to the financing business provided by enterprises to the seller based on the accounts receivable generated from the genuine trade contract signed between the seller and the buyer in order to obtain operating funds, and using the accounts receivable under the contract as the repayment source. Enterprises can also use accounts receivable for financing in their daily business activities, monetize accounts receivable in a timely manner, meet their funding needs, and reduce the cost of using these funds. In this process, the core enterprise plays a role of counter guarantee. Once the financing enterprise is unable to

pay the loan interest upon maturity, the bank has the right to demand loan losses from the core enterprise.

At present, accounts receivable financing can be divided into three types based on different business requirements or different entities participating in accounts receivable financing: accounts receivable factoring financing, accounts receivable pledge financing, and accounts receivable asset securitization financing.

### **3.1.1 Accounts receivable factoring financing**

Accounts receivable factoring is the process in which a company sells the accounts receivable generated from credit sales to commercial banks and other factoring firms, in order to obtain financial support from banks and provide financial support for the company's normal production and operation activities. There are many classification criteria for accounts receivable factoring financing, which can be divided into non recourse factoring and recourse factoring based on the presence or absence of recourse. The non recourse factoring business means that all accounts receivable and related risks of the enterprise are transferred to financial institutions, and the related risks and returns are borne by the financial institutions, while the transferor does not have to bear them. Moreover, the cost generated by this method in the financing process is often higher than that of the recourse factoring business. Factoring with recourse refers to the situation where a company sells accounts receivable to a factoring company. If the debtor is unable to repay the accounts receivable within the repayment date, the factoring company has the right to exercise recourse against the company, and the company must repay this portion of the funds. The overall operational process can be seen in Figure 3.1.

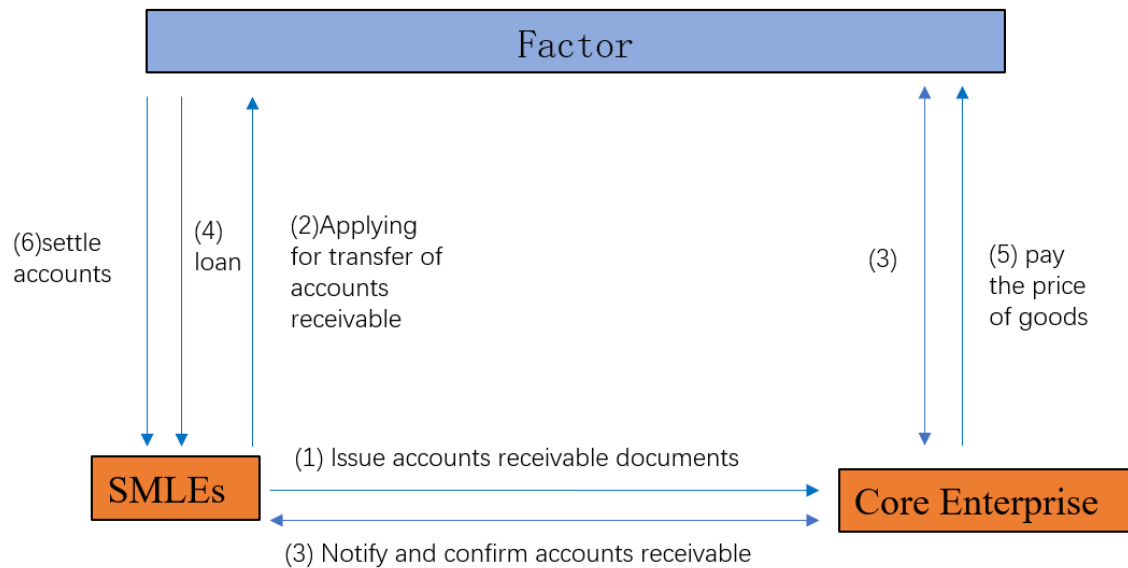


Figure 3.1 Accounts receivable factoring financing process

### 3.1.2 Accounts receivable pledge financing

A loan secured by accounts receivable is a short-term financing method, which refers to the signing of contracts between enterprises and financial institutions such as banks with financing needs. This approach requires the company to pledge its outstanding and unexpired accounts receivable as collateral to another party as collateral. In this financing method, the actual control of the company's accounts receivable is not transferred, and the maturity date of the accounts receivable must be earlier than the final deadline of the pledge financing, allowing the financing company to receive the relevant accounts receivable before the final deadline of the pledge financing is reached, and then return the funds to the financing party. This financing model is relatively effective in helping enterprises alleviate the shortage of working capital in the short term, but it is not suitable for long-term financing. The overall operational process can be seen in Figure 3.1.

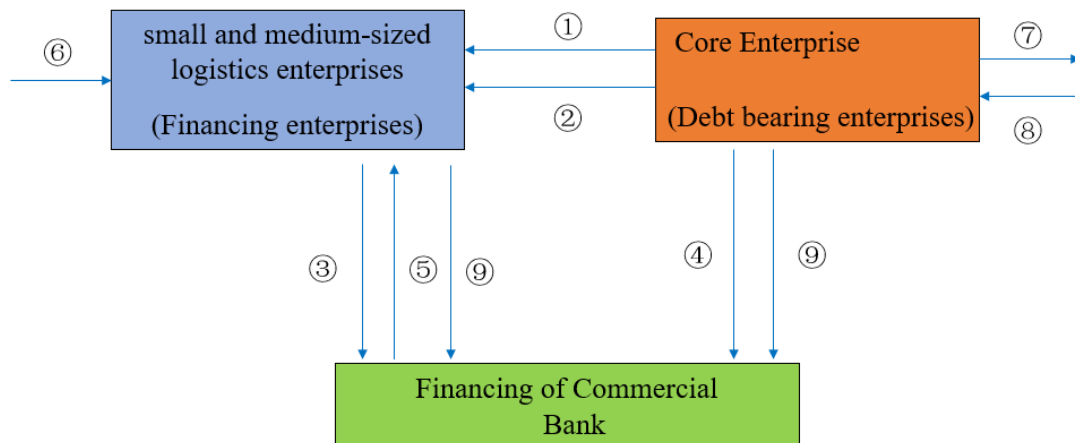


Figure 3.2 Schematic diagram of supply chain finance accounts receivable pledge financing process for small and medium-sized logistics enterprise

① Logistics services ; ② Accounts receivable voucher ; ③ Accounts receivable pledge ; ④ Transaction is true and payment is promised ; ⑤ grant a loan ⑥ Put financing funds into operation ; ⑦ sales ; ⑧ Payment collection ; ⑨ Repayment and interest payment termination of contract

### 3.1.3 Securitization financing of accounts receivable asset

Accounts receivable asset securitization financing is a relatively special asset securitization financing method, which requires the conversion of the company's acquired but not yet due accounts receivable into securities that can be traded in the secondary capital market and refinancing. However, due to the high requirements for accounts receivable in this financing method, only accounts receivable of large companies can be securitized for financing.

Enterprises transfer ownership of accounts receivable to SPVs (Special Purpose Vehicles), a specialized agency, to form an "asset pool". Special purpose vehicles issue tradable securities to the financial market based on the expected income from their acquired assets, which is called accounts receivable securitization. Under this model, the financing enterprise may generate future profits from transferring accounts receivable to investors in the capital market, thereby obtaining transfer income. The advantages of securitization financing are reflected in its contribution to

improving the quality of accounts receivable, accelerating the turnover rate of accounts receivable, effectively reducing the management cost of accounts receivable, and promoting the optimization of corporate financial structure and investment portfolio. However, the implementation of this model requires a mature capital market and strong capabilities from investment institutions. However, based on the current situation in our country, the scale and number of investment institutions are relatively small, the development of the capital market is not yet mature, individual investors have insufficient financial knowledge reserves, and investment skills, which to some extent limits the development of accounts receivable securitization financing in our country.

### 3.1.4 Main differences

Based on the above analysis, the ownership, reputation requirements, financing enterprise size, and financing costs of the three types of accounts receivable financing methods are analyzed, as shown in Table 3-1.

Table 3.1 Analysis of the main differences in accounts receivable financing

<b>Mode</b>	<b>Ownership</b>	<b>Reputation requirements</b>	<b>Financing scale</b>	<b>Financing costs</b>
Pledge	Not transferring accounts receivable, risk borne by small and medium-sized enterprises	High demand for reputation	relatively small	low
Factoring	Transfer of accounts receivable, risk borne by financial institutions	High demand for reputation	relatively small	high
Securitization	Transfer of ownership of accounts receivable requires separate agreement	none	relatively high	low

For accounts receivable factoring business, small and medium-sized enterprises need to have a high reputation and good financial condition to carry out, and most small and medium-sized enterprises cannot meet their requirements and cannot carry out factoring business. Although there are no requirements for credit qualifications and financial status for accounts receivable securitization, and the risk is transferred to financial institutions, its financing cost is high and not suitable for most small and medium-sized enterprises.

### **3.2 Game Theory of Complete Information**

The complete information game is divided into complete information static game and complete information dynamic game according to the order in which both parties make choices. Complete information static game refers to the situation where both parties in the game make choices without a sequential order, or the player who makes the decision later is unaware of the strategy of the player who makes the decision first. In short, it is a type of game in which the players involved in the game act simultaneously and their profit function is shared knowledge. Complete information dynamic game refers to the sequential selection of strategies by players participating in the game, where both sides make decisions in a sequential order, and the player who makes the decision later knows the strategy of the player who makes the decision first.

In a complete information static game, complete information refers to the fact that the feasible strategy set and profit set of each player are the common knowledge of all players, while "static" refers to each player not knowing the strategies of others when choosing their own strategy, that is, acting simultaneously. Therefore, a complete information static game requires the following conditions:

- (1) At least two players in the game;
- (2) All players in the game know the set of their and others' actions, the set of profit functions, and how their actions affect the outcome;
- (3) All players in the game are rational and aware of their own and other players' preferences for the outcome.

### 3.3 Theory of Information Asymmetry

Asymmetric information is commonly present in social business activities, and there are differences in the amount of information held by different subjects. This information difference can lead to different decision-making among subjects, resulting in different economic consequences and leading to game play among various subjects. This theory suggests that in general, the seller has more information than the buyer, and can benefit from the information being transmitted by the party lacking the information source. The party lacking the information will also find ways to obtain more information to make favorable decisions. As the target entity for investors to invest, enterprises belong to those with more information. The investment of investors is to expand their investment capital, and mastering more information about the enterprise can make their investments more stable. This theory provides an explanation for many market phenomena. In normal financing business, there is also information asymmetry between the credit and loan parties. The deliberate concealment of information by either the credit or one of the parties can increase the lending risk of commercial banks.

Generally speaking, there are three main reasons for information asymmetry: first, restrictions on professional division of labor. The professional division of labor in a market economy results in people's limited understanding of their work scope, which is limited to their own work scope. Therefore, there is less understanding of other products and less information compared to participants in other products; Secondly, each market participant has limited knowledge. Everyone has differences in computing and decision-making abilities, which leads to limited information and resources being available for disposal; Thirdly, collecting information requires costs. When the information is poor, it will be compared with the cost after collecting the information.

In the context of market information asymmetry, people often face moral hazard issues and adverse selection in order to protect their own interests. Moral hazard refers to a selfish behavior that is carried out in the process of engaging in economic activities with the goal of maximizing one's own interests, even if it harms the interests of others. Reverse selection refers to the phenomenon of distorted resource allocation and reduced market efficiency caused by information asymmetry in a market economy.

The existence of information asymmetry is not conducive to the stable and orderly development of the capital market. In corporate governance, as a collective

entity relying on contracts, the division of rights and responsibilities and conflicts of interest among all parties are inevitable. There is an issue of information asymmetry in the formulation and execution of contracts. Enterprises can only establish and continuously improve supervision and reward mechanisms, and formulate a series of systems to promote the reduction of information asymmetry.

When adopting the supply chain accounts receivable financing model, there are the following information asymmetry situations:

(1) Information asymmetry between financial institutions and lending enterprises

Small and medium-sized enterprises lack sound management systems, and their own information often cannot be sufficiently disclosed and transparent. So when financing for small and medium-sized enterprises, banks have a disadvantage in information, and it is difficult for financial institutions such as banks to comprehensively analyze the operation and financial situation of small and medium-sized enterprises themselves. Banks may not have sufficient understanding of the quality information of accounts receivable of financing enterprises, and the transaction records of small and medium-sized suppliers may be fictitious, with no corresponding accounts receivable. It is also possible that the accounts receivable of small and medium-sized enterprises have already been pledged, and the accounts receivable may be repeatedly pledged. Such situations may lead to the occurrence of a breach of contract.

(2) Information asymmetry among participating parties in the supply chain

Because core enterprises are in an absolute dominant position in the supply chain, and their information is often relatively public, small and medium-sized enterprises are at a disadvantage in understanding their financial payment ability, repayment willingness, and information on goods and services. Small and medium-sized enterprises may not understand the financial capacity of their core enterprises at a certain stage, which may lead to delayed repayment and result in greater financial turnover pressure on them. Meanwhile, the information asymmetry between small and medium-sized construction enterprises and other related enterprises can also bring risks to them.

**CHAPTER 4**  
**PROCESS ANALYSIS OF ACCOUNTS RECEIVABLE**  
**FINANCING MODEL FOR SMLEs**

**4.1 Analysis of operational entities**

For the convenience of specific analysis and model construction, this article assumes that the operating entities are small and medium-sized logistics enterprises (financing enterprises), core enterprises, and banks (third-party financial institutions). The small and medium-sized logistics industry provides regular logistics services to the core enterprises, and both parties have a continuous and targeted cooperative relationship. Due to the inability of downstream enterprises to timely pay service fees in the payment cycle, the core enterprises generate a large amount of accounts receivable. The sales collection of core enterprises requires a fixed time, therefore, there will also be a certain cycle limit for the realization of accounts receivable. How to convert the restricted working capital into a win-win profit for the operating entity will be the reason for in-depth exploration of this accounts receivable financing model.

The main participants in accounts receivable financing are three parties, namely: buyers, sellers, banks, and other financial institutions.

The core enterprise, i.e. the buyer, is the party with absolute say in the supply chain. Therefore, they often pass on their own financial pressure by extending the payment cycle, which leads to the seller generating more accounts receivable, causing them to fall into financial difficulties and limiting the development of small and medium-sized enterprises. In this mode, the seller is the disadvantaged party. If the buyer, the core enterprise, cannot pay off the outstanding debts in a timely manner, it will cause the seller enterprise to generate accounts receivable. The seller, in order to maintain a long-term cooperative relationship between the two parties, cannot but accept such conditions, thus being in a very disadvantageous position for themselves.

If small and medium-sized enterprises adopt this financing model, they can leverage the good credit of their core enterprises and secure repayment sources to strengthen their credit level, meet the loan qualifications of banks and other financial institutions, and obtain loans, thereby solving their own financial problems.

## **4.2 Demand analysis of participant**

### **4.2.1 Demand analysis for SMLEs**

Large logistics enterprises can leverage their own advantages to play a role in the financing process of supply chain finance, providing logistics services to enterprises on the supply chain while also collaborating with financial institutions. Compared to large logistics enterprises, small and medium-sized logistics enterprises lack strong financial strength, shorter operation time, less experience in logistics transportation and warehousing supervision, advanced supporting equipment and logistics information management systems, and cannot obtain recognition from financial institutions. We can only continue to struggle to maintain business operations under the pressure of large logistics enterprises. In daily operations, small and medium-sized logistics enterprises, as small and medium-sized enterprises in the supply chain, have a direct relationship between their financial situation and the speed of fund recovery of core enterprises. During the cycle of fund recovery, the turnover of funds for small and medium-sized logistics enterprises may encounter problems. Although a large amount of accounts receivable can bring a certain amount of business to enterprises, as a small and medium-sized enterprise, facing the situation of oversupply in the logistics service market, insufficient effective market demand, and insufficient funds in the capital market, accounts receivable are also a challenge for itself.

The financing channels for small and medium-sized logistics enterprises are narrow. Faced with traditional financing models, small and medium-sized logistics enterprises are unable to obtain further financing. In order to promote their own development, how to cleverly utilize the development of supply chain finance and transform the challenge of accounts receivable into an opportunity is an urgent problem that small and medium-sized logistics enterprises need to solve.

### **4.2.2 Demand analysis for Core enterprise**

The phenomenon where core enterprises rely on their dominant position to squeeze member enterprises in the supply chain. Mainly manifested in squeezing the cash flow of member enterprises in terms of capital flow. The financing problem of member enterprises has always been a major obstacle to the further development of the supply chain. The transaction model of credit sales has made the relationships between enterprises that should have been in a cooperative relationship on the supply chain

increasingly tense, and even affected the overall competitiveness of the supply chain. Core enterprises are usually large in scale and strong in strength, and can play a dominant role in the funding and logistics of the entire supply chain. Due to the obvious advantages of core enterprises, they usually have strong financing capabilities. For the supply chain financing model, the core enterprise is the main provider of credit resources. The core enterprise can extend its own credit resources to small and medium-sized enterprises upstream and downstream of the supply chain, so that small and medium-sized enterprises can use this credit resource to obtain support from bank loan funds, which helps further optimize payment conditions, extend payment cycles, strengthen cooperation between enterprises, increase capital flow returns, strengthen risk control, promote supply chain system stability, and enhance the overall competitiveness of the supply chain.

#### **4.2.3 Demand analysis for bank**

With the deepening of financial marketization, China's financial market is becoming increasingly active, presenting a diverse situation. The market share of joint-stock banks, foreign-funded banks, and urban commercial banks has been increasing year by year. From the perspective of operational details, the businesses of various banks have a high degree of similarity and no obvious competitive advantage. In order to avoid risks, banks prefer to finance large customers, with 80% of financing loan business provided to large state-owned enterprises and 20% provided to small and medium-sized enterprises. This risk control method has seriously squeezed the business space of the bank and worsened the market competition environment. Under the impact of Internet finance, the interest margin of the bank has narrowed. In the face of the depressed market environment, the bank must adjust its business policy to achieve business transformation. Banks are facing serious challenges - "financial disintermediation". Financial disintermediation refers to the continuous decrease in the proportion of savings funds in total social financial funds, and the proportion of direct and indirect financing methods in social financing methods tends to be the same. With the advancement of interest rate marketization and financial marketization, the medium for providing funds is no longer dominated by banks alone, and new financing institutions are rapidly occupying the market. In the face of enormous challenges, banks need to accelerate business innovation, differentiate operations, and increase their core

competitiveness. Supply chain finance financing can serve as a breakthrough point for banks, refining and segmenting enterprises on the supply chain, providing different financing services for core enterprises and small and medium-sized enterprises, upgrading financial needs for core enterprises, and developing new financing models for small and medium-sized enterprises. Under the premise of controllable risks and costs, Promote the coordinated development of the entire supply chain. As a core force in the rapidly developing logistics industry, accounts receivable financing for small and medium-sized logistics enterprises can clearly serve as the starting point for banks to carry out new business. By relying on professional and high-quality financing services, they can win the trust of small and medium-sized logistics enterprises, consolidate the relationship between banks and enterprises, and achieve a win-win effect.

#### **4.3 Benefits and risks of accounts receivable financing**

##### **4.3.1 Benefits of supply chain participants**

###### **(1) Income of small and medium-sized logistics enterprises**

There are many financing obstacles faced by small and medium-sized logistics enterprises, both subjective and objective factors hindering their steady development in the overall environment. Under the background of supply chain finance, the accounts receivable financing model starts from reality, based on the problem of accounts receivable accumulation in small and medium-sized logistics enterprises, with the core enterprise as the center, and based on the overall credit level and real transaction background, allowing small and medium-sized logistics enterprises to leverage the good reputation of the core enterprise on the supply chain, and reduce bank restrictions on lending to small and medium-sized logistics enterprises through forms such as accounts receivable pledge, Thus, small and medium-sized logistics enterprises can join the loan services of banks and other financial institutions, obtain low interest loans, effectively alleviate the pressure of high accounts receivable, insufficient working capital, and difficult capital turnover within small and medium-sized logistics enterprises, reduce their financing costs, increase their own financing amount, and promote the development and transformation of small and medium-sized logistics enterprises.

###### **(2) Core enterprise revenue**

The core enterprises in the supply chain hold a high level of credit and, with their strong financial strength, occupy a dominant position in the entire supply chain operation. Core enterprises often take advantage of their scale advantages and adopt methods such as deferred payment or credit for a long time, which will make small and medium-sized logistics enterprises bear liquidity risks and affect the stability of the entire supply chain through the chain structure of the supply chain. The accounts receivable financing model under supply chain finance not only solves the funding gap of small and medium-sized logistics enterprises, but also does not increase the financial costs of core enterprises. Core enterprises reduce the transfer of cost pressure to small and medium-sized logistics enterprises, but actually indirectly supports the development of core enterprises, making their production and operation more smooth. As a result, it strengthens the overall strength of the supply chain that is self-centered, and ultimately improves their advantages in market competition.

### (3) Income from banks and other financial institutions

Firstly, banks can increase intermediary business revenue and optimize their business structure. With the development and updating of the industry, the phenomenon of homogenization of business between commercial banks is quite serious, and competition is becoming increasingly fierce. Major banks are seeking new development points by innovating their business. Banks provide financing services to small and medium-sized logistics enterprises. Due to the special nature of the logistics industry, their financing terms are generally short, and the frequency is high. The service fees are relatively high. Banks can not only increase their intermediary business income, but also attract deposits from small and medium-sized logistics enterprises, expand their business scope, and optimize their business structure.

Secondly, banks can reduce financing credit risk. If banks provide financing to small and medium-sized logistics enterprises separately, they will undoubtedly face higher credit risks. Once a small and medium-sized logistics enterprise defaults, the bank can only bear all the risks alone. In the accounts receivable financing model, core enterprises with strong financial strength provide strong guarantees for small and medium-sized enterprises, becoming the first repayment source of supply chain financing, thereby reducing the credit risk of banks.

## **4.4 Financing mode risk**

### **4.4.1 Legal risk**

Each country's laws and regulations undergo a gradual and continuous process of improvement, and changes in laws and regulations can bring certain risks to supply chain operations. The main sources of legal risk first come from the uncertainty, relative ineffectiveness, and differences in enforcement areas of legal provisions, and secondly from the ineffective legal actions of banks and staff. In the context of the supply chain, accounts receivable pledge financing refers to small and medium-sized enterprises using their accounts receivable as collateral to apply for loans from banks, using their future cash receipts to repay the loan principal and interest. Therefore, banks first need to confirm that the accounts receivable of small and medium-sized enterprises are qualified, legally eligible for pledge, and have pledgeability or transferability. If the bank pledges illegal and flawed accounts receivable, once the loan defaults, the bank will not be able to enjoy the rights of the pledgee, and there will be huge risks in this business.

### **4.4.2 Operational risk**

The operational risks of accounts receivable pledge financing business involve the loan investigation stage before credit granting, the business process operation mode design stage during the credit granting process, the loan credit reporting and approval stage, and the post loan risk management stage.

(1) In the loan investigation stage, the main operational risk is the risk caused by personnel factors. In the accounts receivable pledge business under supply chain finance, banks introduce core enterprise credit, use the accounts receivable of core enterprises and small and medium-sized enterprises as collateral, and use the future cash flow of the borrowing enterprise as the repayment source. This type of business not only needs to consider the financial ability, credit level, and debt repayment ability of small and medium-sized enterprises (financing enterprises), but also evaluates the operational status of the core enterprises on the supply chain and the entire supply chain, and measures the essence of the transaction background between the core enterprises and small and medium-sized enterprises, as well as the quality of accounts receivable. Therefore, during the loan investigation phase of this business, banks have extremely high requirements for the professionalism of their staff. If the customer manager or risk

manager lacks experience, any misjudgments or omissions may lead to huge losses for commercial banks.

(2) The main operational risk during the operation mode design phase is the risk of process design. The accounts receivable pledge business under supply chain finance is based on accounts receivable as credit support assets, and banks must dynamically monitor it. In order to achieve the purpose of dynamic control, it is necessary to ensure the operability of its business process design, and eliminate obvious loopholes such as incomplete contracts, contracts not protected by law, and overly complex processes, so as not to leave opportunities for fraudulent behavior.

(3) The operational risks involved in the loan credit approval stage mainly include two aspects: one is the risks caused by unreasonable approval processes, improper authorization, and internal control systems; the other is the risks caused by objective reasons such as internal fraud, overstepping authority, and loss of key personnel in internal approval personnel.

(4) The post loan management stage is the core of fund flow and logistics in supply chain financing, and is the most critical stage of operational risk. The accounts receivable pledge business under supply chain finance belongs to self compensating short-term financing. When conducting such business, banks and other financial institutions need to monitor the collection and entry of accounts receivable in real time. If accounts receivable cannot be monitored and warned in real time, it may cause great losses to the bank.

#### **4.4.3 credit risks**

Credit risk is widely present in all credit businesses. In the context of supply chain finance, any credit crisis between core enterprises and small and medium-sized enterprises can cause the stability of the entire supply chain. Therefore, the credit risk of accounts receivable pledge business in the context of supply chain finance covers a wide range, mainly including the credit risk of core enterprises, systemic risks brought about by industry and policy changes, and credit risks of credit applicants.

##### **1) Credit risk of core enterprises (buyers)**

As the center of the entire supply chain, core enterprises are the first guarantee and repayment source for banks to recover debts under the supply chain finance accounts receivable financing model. The prominent characteristics of core

enterprises (buyers) are their large scale and high credit level. They are the coordinators and managers of the entire supply chain. Banks need to verify the credit status of core enterprises when conducting accounts receivable pledge financing business based on the background of supply chain finance. Once the credit status of the core enterprise in this business encounters problems, it will bring devastating disasters to the operation of the entire supply chain. The credit of core enterprises is the foundation of the operation of supply chain finance. Generally speaking, core enterprises have strong performance capabilities and grasp information on the flow of funds and logistics in the supply chain. Banks can use the functions of the core enterprise information platform to reduce information asymmetry, and grasp the relevant operational status of small and medium-sized enterprises providing supporting services in the supply chain, as well as the latest information on upstream and downstream transactions. Banks make judgments on whether to provide loan support to small and medium-sized enterprises in the supply chain based on the information they have. As the debtor of accounts receivable, the ability of core enterprises to fulfill commercial contracts with borrowers (small and medium-sized enterprises) in accordance with the agreement directly affects their willingness and ability to repay. After obtaining financing for small and medium-sized logistics enterprises with their high credit level, core enterprises have further extended their repayment periods. If the core enterprise is a risk averse person, the probability of moral hazard increases, which may lead to the behavior of being unable to repay when due. This may have a negative impact on banks, small and medium-sized logistics enterprises, and the entire supply chain.

Therefore, the credit status of core enterprises is a key factor in credit risk control. Core enterprises have good industry prospects, strong product competitiveness, large market share, smooth production and sales operations, and small and medium-sized enterprises are guaranteed to receive payments; If the core enterprise is poorly managed, has chaotic internal management, or experiences a credit crisis, it will affect the credit of all enterprises in the supply chain.

## (2) Risks of changes in industry policies or macro environment

The major external environmental changes and industry policies of the country affect the supply chain environment and the strategic direction of core enterprises. If the industry is regulated by major national industry policies, the

foundation of supply chain finance will disappear. If banks do not respond to this risk in a timely manner, it will bring huge losses to the banks. Therefore, when banks consider core enterprises in the supply chain, they should fully consider the impact of national macro environment and industry policies on core enterprises, and avoid entering the non main business of the two high and one leftover industries and core enterprises.

### (3) Logistics credit risk for small and medium-sized enterprises

Due to their disadvantaged position in the entire supply chain, small and medium-sized logistics enterprises, in order to alleviate financial pressure and alleviate financial conflicts with core enterprises, even if they adopt the financing model of accounts receivable, still need to pay certain service fees and deposits to banks, which brings them a certain financing cost. If small and medium-sized logistics enterprises have low revenue or logistics service errors in actual operation, resulting in settlement disputes or even transaction interruptions, and the final profit is lower than the cost, the bank cannot recover the loan, but instead worsens its subsequent financing conditions, making financing for small and medium-sized logistics enterprises more difficult.

When considering accounts receivable pledge financing business under supply chain finance, banks should not only evaluate the core enterprise and the overall business situation of the supply chain, but also measure the business situation, financial status, debt repayment ability, credit status, credit level, financial strength, and risk resistance ability of small and medium-sized enterprises in the supply chain. For example, if suppliers (small and medium-sized enterprises) use bank loans for investment or speculative activities with high returns and risks (such as real estate and stocks) instead of for designated purposes, it will bring huge risks to the bank's normal recovery of loan principal and interest.

## **4.5 Comparative analysis of financing models with traditional SMLEs**

Traditional financing for small and medium-sized logistics enterprises generally starts from the perspective of a single enterprise, and evaluates the credit of the main body of a single small and medium-sized logistics enterprise. When financing, it often requires a single small and medium-sized logistics enterprise to provide collateral or third-party guarantees as the basic condition for its financing credit. However, due to

the lack of conditions, the individual itself does not have the ability to do so, Therefore, financing difficulties often arise. Even if financing can be obtained, it often requires a higher financing cost. Compared to traditional finance, supply chain finance has differences in terms of credit subjects, credit ratings, credit structure, financing costs, etc., mainly reflected in the following aspects (comparison in Table 4.1): In terms of credit subjects, compared to the traditional financing model of single enterprise credit review, The supply chain finance accounts receivable financing model focuses on examining the joint credit of multiple enterprises; In terms of credit rating methods, supply chain finance has a wider selection of accounts receivable financing models, which can rate individual entities or all supply chain enterprises; In terms of evaluation content, the supply chain finance accounts receivable financing model no longer focuses on the financial status, credit level, operational risks and other factors of small and medium-sized logistics enterprises, but focuses on the competitiveness, operational stability, and market risks faced by the entire supply chain Assess factors such as the credit rating and repayment ability of core enterprises, as well as the degree of close cooperation between core enterprises and small and medium-sized logistics enterprises.

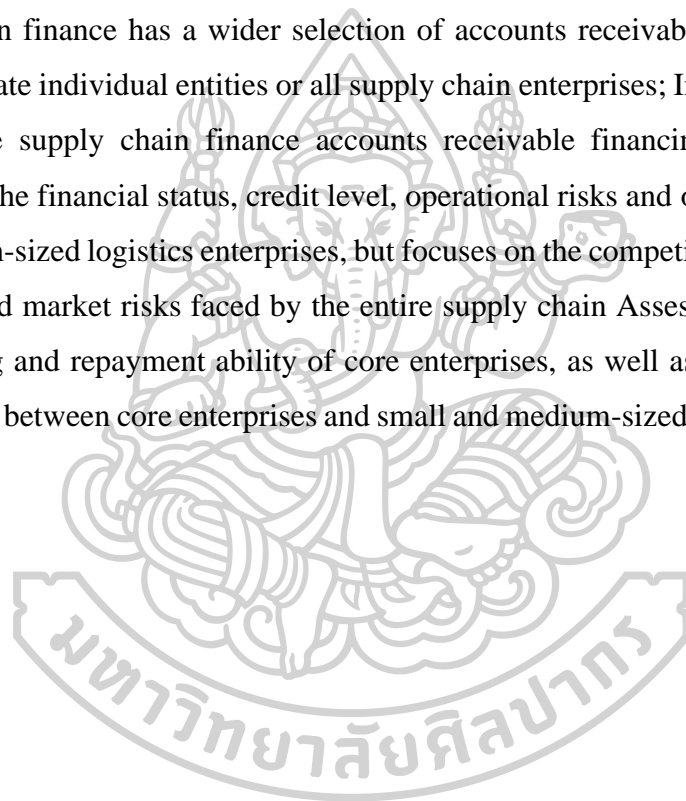


Table 4.1 Comparison between accounts receivable financing model and traditional financing model

<b>difference</b>	<b>Financing for traditional small and medium-sized logistics enterprises</b>	<b>Accounts receivable financing model financing</b>
Credit subject	Individual small and medium-sized logistics enterprises	Multiple affiliated enterprise groups
Credit rating	Individual entity enterprise	Rating of small and medium-sized logistics enterprises and related core enterprises
Credit structure	Mortgage, third-party guarantee	Structured financing credit
Financing costs	High cost	Increased credit and relatively low costs
Function	Relieve financial difficulties for small and medium-sized logistics enterprises	Relieve pressure on logistics enterprises and improve supply chain competitiveness
Risk	High risk	Guaranteed repayment source with low risk

The relationship between banks and participating financing enterprises in traditional financing models is relatively single, as shown in Figure 4.1.

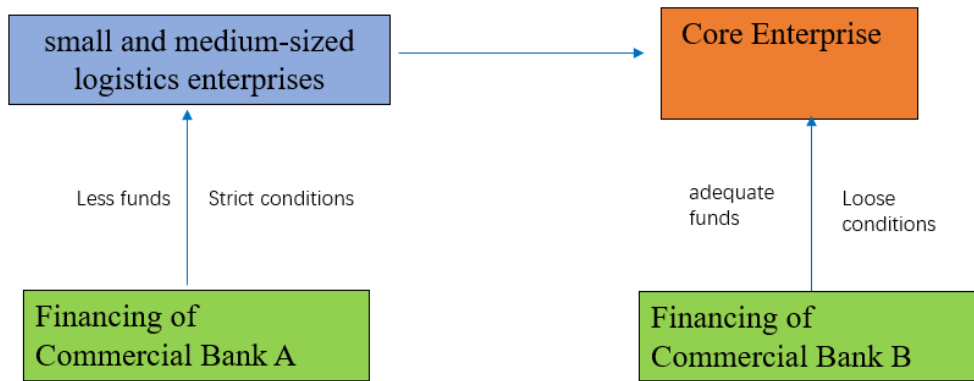


Figure 4.1 The relationship between banks and financing entities in traditional financing

The relationship between banks and financing enterprises in the accounts receivable financing model is closer, as shown in the figure, as shown in 4.2.

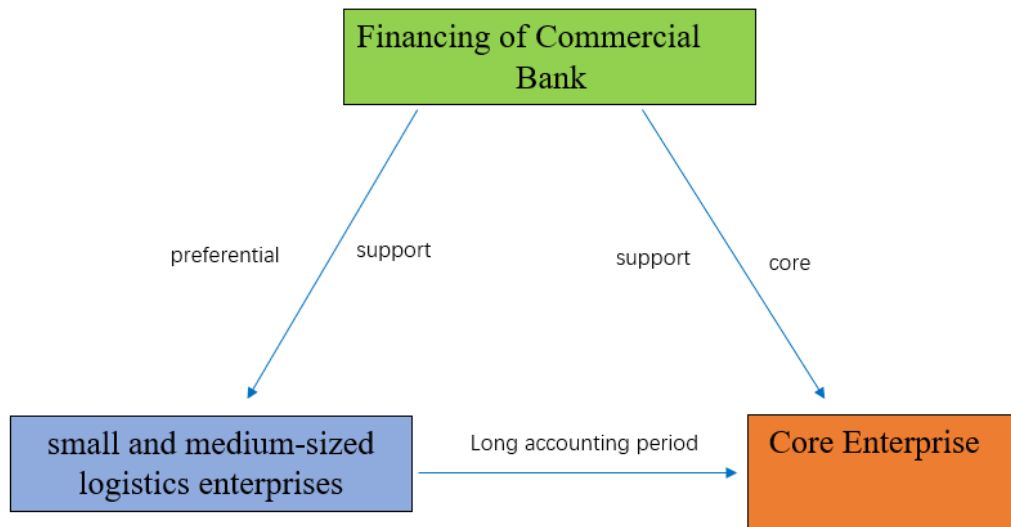


Figure 4.2 Relationship diagram between banks and financing enterprises under accounts receivable financing model

#### 4.6 A game model for financing accounts receivable in SMLEs

##### 4.6.1 Traditional accounts receivable financing Game Model and Analysis

Under the traditional model, the financing of accounts receivable pledge between small and medium-sized logistics enterprises and banks only involves two participants, namely small and medium-sized logistics enterprise banks, and the game is only played between these two participants. The income matrix of participants in the traditional accounts receivable financing model is shown in the table 4.2.

Table 4.2 The Income Matrix of Participants in the Traditional Accounts Receivable Financing Model

		Small and medium-sized logistics enterprises	
		keeping promises	Not keeping promises
Bank	No loan	$\lambda_1 B(r_{01} - r_0) - C_1, \lambda_1 B(r_1 - r_{01})$	$-\lambda_1 B(1 + r_0) - C_1, \lambda_1 B(1 + r_1)$
	Loan	$-\lambda_1 B r_0, 0$	$0, 0$

In the above table, the accounts receivable of core enterprises are  $B$ ; The interest rate for banks to absorb deposits from the outside world is  $r_0$ ; Under the traditional financing model and the supply chain finance model, the fees paid by banks to obtain small and medium-sized enterprises and transaction information are  $C_1$  and  $C_2$ , respectively, and the lending rates are  $\lambda_1$  and  $\lambda_2$ . If the loan interest rates are  $r_{01}$  and  $r_{02}$  ( $r_{01}, r_{02} > r_0$ ), the loan amount is respectively  $\lambda_1 B$  and  $\lambda_2 B$ ; After obtaining loans, small and medium-sized enterprises can engage in reproduction and generate profits. Assuming that the rate of return for small and medium-sized enterprises to engage in reproduction is  $r_1$ , enterprises will only take out loans for production when the income from reproduction exceeds the loan interest rate. Therefore,  $r_1 > r_{01}, r_1 > r_{02}$ . The rate of return that core enterprises can obtain by utilizing accounts receivable during the accounts receivable period is  $r_2$ ;

##### 4.6.2 Complete Information Static Game

If the bank does not provide loans, small and medium-sized enterprises will receive zero returns regardless of whether they repay or not. When applying for bank loans,  $\lambda_1 B(r_1 - r_{01}) < \lambda_1 B(1 + r_1)$ , small and medium-sized enterprises may have

higher returns if they do not repay the loan. According to the principle of maximizing individual interests, regardless of whether the bank provides loans or not, small and medium-sized enterprises have an advantageous strategy of not repaying. At this point, banks can only choose not to lend in order to minimize their losses. So at this point, the Nash equilibrium is (no loan, no repayment), and the profits for both parties are (0, 0). However, there are clearly better strategies (loans, repayments) in this game, which are better than the current Nash equilibrium.

In the long run, if small and medium-sized enterprises continue to operate, this game is a repeated game. If small and medium-sized enterprises do not repay the loan the first time, and in the next game, the banking industry will not lend, then the game ends. If the enterprise repays, the bank can predict that the enterprise will continue to repay next time, and the bank chooses to take out a loan.

#### 4.6.3 Incomplete information game

Due to the unstable operating environment and limited assets, small and medium-sized enterprises often default due to insufficient repayment ability. So, while small and medium-sized enterprises have repayment intentions, banks need to determine whether the risks and benefits of small and medium-sized enterprises not being able to comply with the agreement are within an acceptable range. Banks can analyze the creditworthiness of enterprises through information analysis. Assuming the bank knows the probability of default caused by insufficient repayment ability of small and medium-sized enterprises.

The expected return of a bank loan is:

$$E(1) = P_s(\lambda_1 B(r_{01} - r_0) - C_1) + (1 - P_s)(-\lambda_1 B(1 + r_0) - C_1) \quad (4-1)$$

The expected return of a bank when it does not lend is:

$$E(2) = P_s * 0 + (1 - P_s) * 0 \quad (4-2)$$

If  $E(1) = E(2)$ , so

$$r_{01} = \frac{\lambda_1 B(1 + r_0) - C_1}{P_s \lambda_1 B} - 1 \quad (4-3)$$

$$P_s = \frac{\lambda_1 B(1 + r_0) - C_1}{\lambda_1 B(1 + r_{01})} \quad (4-4)$$

It can be seen that the loan interest rate is inversely proportional to the probability of small and medium-sized enterprises keeping their promises. The smaller  $P_s$ , the higher the loan interest rate.  $P_s$  is the critical point between bank loans and non loans.

So when  $P_s > \frac{\lambda_1 B(1+r_0) - C_1}{\lambda_1 B(1+r_{01})}$ , bank chooses loan.

What's more, at this point, banks will also increase loan interest rates to compensate for their own risks. The high requirements for credit level make it difficult for small and medium-sized enterprises with low credit to obtain loans. Moreover, high interest rates have narrowed the profit margins of small and medium-sized enterprises. When small and medium-sized enterprises operate stably, they will choose to repay. But once there are operational issues, there is no ability to repay. This will encourage banks to further improve the credit level and loan interest rates of lending enterprises, leading to adverse selection and both parties being unable to obtain financing benefits.

From this, it can be concluded that in the game between small and medium-sized enterprises and banks, due to the lack of strong constraints, unstable operations, limited fixed assets, and low credit levels, it is difficult for small and medium-sized enterprises to obtain loans. Even with bank loans, loan interest rates are generally higher.

## **4.7 Game Model under Supply Chain Finance Model**

### **4.7.1 Definition of game subjects**

Game theory is the study of decision-making and equilibrium problems when the behavior of decision-makers directly interacts, that is, when the choice of one subject is influenced by the choices of other subjects and in turn affects the choices of other subjects. The proposal and development of game theory have opened up a new research approach for disciplines such as management and economics, and provided a good method for analyzing individual behavior.

The main participants in accounts receivable financing for small and medium-sized logistics enterprises under the supply chain finance model are small and medium-sized logistics enterprises, banks, and core enterprises. And each entity in the supply chain is an independent individual, with their interests influencing and

constraining each other, but they are different. There is both cooperation and game between the various entities. When financing accounts receivable under the supply chain finance model, all three parties involved have the goal of maximizing their own interests. In order to make decisions to maximize their own interests, the decisions of each party will affect each other. The decisions of one party will affect the interests of other parties. In order to maintain their own interests, other parties will change their own strategies accordingly to avoid damaging their own interests, At this point, the subjects will guess each other's behavioral decisions so that they can react in a timely manner. Based on the above, the game relationship between the three behavioral subjects arises. At this point, there is a game relationship between the three parties, and the mutual game between the parties affects their decision-making behavior. Therefore, it is necessary to analyze the game relationship between the three parties. The tripartite game structure diagram is shown in Figure 4.3.

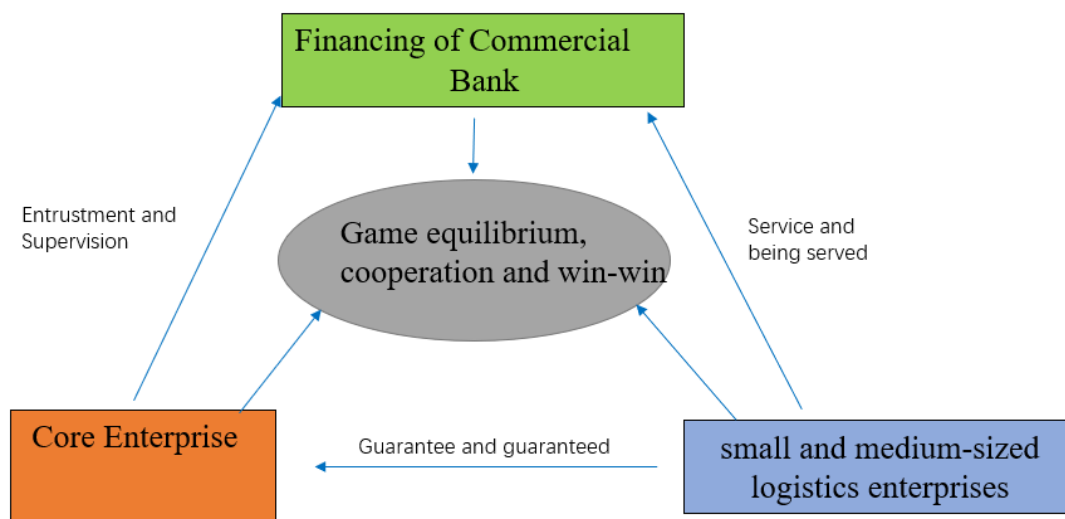


Figure 4.3 Tripartite game structure diagram

#### 4.7.2 Model Assumptions

Assuming that there are only banks as financial institutions in the credit market. Most small and medium-sized enterprises in China are unlisted, so they can only obtain loans from banks and rely on borrowing for financing without any other means of access.

Assumption 2: Rational economic man hypothesis, that is, when small and medium-sized logistics enterprises engage in accounts receivable pledge financing under the supply chain finance model, the three parties of small and medium-sized logistics enterprises, core enterprises, and banks are all rational economic men, and their decisions are based on their own interests, pursuing maximum self-interest; X represents banks, core enterprises are represented by Z, and Y represents small and medium-sized logistics enterprises.

Assumption 3: Without considering the joint loan fraud behavior of small and medium-sized logistics enterprises and core enterprises, core enterprises are strong and large-scale enterprises in the supply chain. After providing logistics services to core enterprises, small and medium-sized logistics enterprises will have settlement periods ranging from 3 to 4 months, causing them to form accounts receivable.

Assumption 4: In order to obtain financing, small and medium-sized logistics enterprises use their core corporate reputation to pledge accounts receivable to banks and obtain loans with interest rates lower than traditional financing models.

Assuming 5, based on the bank's credit rating of the enterprise (mainly repayment ability), considering only repayment ability, let the probability of compliance for small and medium-sized enterprises be  $P_s$ , and the probability of default be  $1-P_s$ ; The probability of core enterprises complying with the contract is  $P_c$ , and the probability of default is  $1-P_c$ . And the default of small and medium-sized enterprises and the default of core enterprises are independent of each other. In addition, it is stipulated that the default caused by insufficient repayment ability is not equal to the default caused by the borrower's willingness to repay.

Assumption 6: In the game process, the bills of small and medium-sized logistics enterprises are based on the real transaction background;

### 4.7.3 Model building

Regardless of whether the bank issues a loan or not, interest should be paid to the depositor, and the bank's deposit interest rate is  $r_0$ ; After obtaining funds from banks, small and medium-sized enterprises use loans to reproduce logistics services and generate profits, with a reproduction yield of  $r_1$ ; The loan interest rate of a bank is  $r_c$ , and only when the loan interest rate is less than the reproduction yield, will the enterprise choose to borrow, that is,  $r_c < r_1$ ; The rate of return that core enterprises can obtain by utilizing accounts receivable during the accounts receivable period is  $r_2$ ;

The accounts receivable generated by small and medium-sized logistics enterprises after providing logistics services to core enterprises is  $B$ , and the bank's loan amount is  $C$ . After lending funds, they will face the risk of debt default. Assuming that the probability of core enterprises complying with the contract is  $p_z$ , and the probability of default is  $1 - p_z$ . The probability of small and medium-sized logistics enterprises choosing the "default" strategy is  $p_y$ , and the probability of default is  $1 - p_y$ .

$\lambda$ : Compare and analyze the benefits and risks generated by banks after lending to small and medium-sized logistics enterprises, determine whether to lend to small and medium-sized logistics enterprises. When the bank chooses a loan strategy, based on past experience, it corresponds to the loan collateral ratio in accounts receivable pledge financing contracts, where  $0 < \lambda < 1$ ;

$q$ : The proportion of accounts receivable that core enterprises repay to banks;

$S$ : Maintaining stable cooperative relationships between small and medium-sized logistics enterprises and core enterprises, and the credit benefits that enterprises in the supply chain can obtain;

After small and medium-sized logistics enterprises apply for loans from the bank, the bank verifies the authenticity of their transactions with the core enterprise, and decides whether to lend to small and medium-sized logistics enterprises and the loan amount based on the stability of the supply chain where the small and medium-sized logistics enterprises and the core enterprise are located, as well as the credit status of both parties. After investigation, if the bank believes that small and medium-sized logistics enterprises meet their loan conditions and chooses the "loan" strategy, the game will continue. Conversely, if the bank chooses the "no loan" strategy, the game

will end directly. After the bank chooses the "loan" strategy, the strategies that small and medium-sized logistics enterprises and core enterprises can choose are (compliance, breach of contract).

Assuming that small and medium-sized logistics enterprise Y provides logistics services to core enterprise Z, completing this logistics service can earn profits for small and medium-sized logistics enterprise Y. Due to the disadvantaged position of small and medium-sized logistics enterprise Y in transaction activities with core enterprise Z, core enterprise Z makes payment to small and medium-sized logistics enterprise Y in the form of accounts receivable, with the amount of accounts receivable being B. Due to a shortage of funds, small and medium-sized logistics enterprises need to apply for a loan from Bank X. At this time, the loan amount that small and medium-sized logistics enterprises can obtain is  $\lambda B$ . The repayment ratio of the core enterprise to accounts receivable is  $q$ , so the repayment amount received by the bank is  $qB$ . At this time, as long as  $qB$  is greater than  $\lambda B(1 + r_0)$ , the bank can ensure no losses. Ignoring the supervision cost C of the bank and the credit income S brought by the supply chain finance perspective, the income matrix of the bank, small and medium-sized logistics enterprises, and core enterprises can be established as shown in Table 4.3.

Table 4.3 Income Matrix of All Parties under Complete Information for Accounts Receivable Financing

	$0 \leq p < \lambda(1+r_0)$	$\lambda(1+r_0) \leq p \leq 1$
Bank	$\lambda B(rc - r_0) - (\lambda - p)B(1+r_0) - C$	$\lambda B(rc - r_0) - C$
small and medium-sized logistics enterprises	$\lambda B(r_1 - rc) - B$	$\lambda B(r_1 - rc) - B + (\lambda - p)B$
Core Enterprise	$B r_2 + (1-p) B - (1-p) T$	$B r_2 + (1-p) B - (1-p) T$

#### 4.7.4 Game Analysis of Supply Chain Enterprises and Banks

In the process of accounts receivable financing game, first small and medium-sized enterprises apply for loans, then the core enterprise decides whether to provide guarantees, and finally the bank decides whether to issue loans. Whether small and medium-sized enterprises can obtain loans depends on the bank's decision. After the introduction of guarantees from the core enterprise, the core enterprise and small and medium-sized enterprises are connected to form a whole, playing a game with the bank for the benefit of the entire supply chain. Under the assumption of "rational economic agents", core enterprises may not provide guarantees for every loan of small and medium-sized enterprises due to considerations of their own interests. The reputation and guarantee of core enterprises are the key to whether small and medium-sized enterprises can obtain bank loans, and banks decide their strategies based on the choices of core enterprises. After the expiration of the accounts receivable pledge contract between small and medium-sized logistics enterprises and banks, the core enterprise serves as the first repayment source to repay to the bank. In the case of small and medium-sized logistics enterprises choosing the "compliance" strategy to repay interest on time, whether the bank can recover the loan depends on the repayment ability of the core enterprise.

Income from bank loans:

$$E(x) = \lambda B(r_c - r_0) - (\lambda - p)B(1 + r_0), 0 \leq p < \lambda(1 + r_0) \quad (4-5)$$

$$E(x) = \lambda B(r_c - r_0), \lambda(1 + r_0) \leq p \leq 1 \quad (4-6)$$

Expected return on bank loans:

$$E(x) = \int_0^{\lambda(1+r_0)} [\lambda B(r_c - r_0) - (\lambda - p)B(1 + r_0)] d\lambda + \int_{\lambda(1+r_0)}^1 \lambda B(r_c - r_0) d\lambda \quad (4-7)$$

$$E(x) = -\frac{1}{2}(1 + r_0)^3 B\lambda^2 + pB(1 + r_0)^2 \lambda + \frac{1}{2}B(r_c - r_0) \quad (4-8)$$

$$\frac{\delta E(x)}{\delta \lambda} = -(1 + r_0)^3 B\lambda + pB(1 + r_0)^2 \quad (4-9)$$

$$\frac{1}{-(1 + r_0)^3 B\lambda + pB(1 + r_0)^2} = 0 \quad (4-10)$$

The pledge rate  $\lambda^*$  that maximizes bank profits can be obtained

$$\lambda_1^* = \frac{P}{1+r_0} \quad (4-11)$$

From equations 4-11, it can be seen that the bank collateral ratio  $\lambda^*$  is directly proportional to the repayment ratio of the core enterprise, negatively correlated with the bank's basic interest rate of  $r_0$ , and not related to the bank's loan interest rate  $r_c$ . So banks are more inclined to lend to enterprises with higher credit levels, and a higher credit level means that the business scale of the enterprise is larger and the financial situation is better. Based on this, the quality of accounts receivable of the enterprise is correspondingly higher, and the loan pledge rate provided by the bank will also be higher.

In summary, the higher the repayment ratio of core enterprises, the higher the loan collateral ratio of banks, and the corresponding expected return of banks will increase. This also proves the rationality of the model.

#### 4.7.5 Game analysis between SMLEs and core enterprises

Assuming that the sum of the profits of small and medium-sized logistics enterprises and core enterprises is  $X$ , as shown in Table 4.3.

$$X = \lambda B(r_1 - r_c) + Br_2 + (1-p)B - (1-p)\lambda - B, 0 \leq p < \lambda(1+r_0) \quad (4-12)$$

$$X = \lambda B(r_1 - r_c) - \lambda B + Br_2 - (1-p)\lambda, \lambda(1+r_0) \leq p \leq 1 \quad (4-13)$$

According to formulas 4-12 and 4-13, the sum of expected returns for small and medium-sized logistics enterprises and core enterprises is:

$$\begin{aligned} E(x) &= \int_0^{\lambda(1+r_0)} [\lambda B(r_1 - r_c) + Br_2 + (1-p)B - (1-p)\lambda - B] d\lambda \\ &+ \int_{\lambda(1+r_0)}^1 [\lambda B(r_1 - r_c) - \lambda B + Br_2 - (1-p)\lambda] d\lambda \end{aligned} \quad (4-14)$$

$$\begin{aligned} E(x) &= \frac{1}{2}(1+r_0)^2 B\lambda^2 - pB(1+r_0)\lambda + \frac{1}{2}B(r_1 - r_c - 1) \\ &+ Br_2 - (1-p)\lambda \end{aligned} \quad (4-15)$$

$$\frac{\delta E(x)}{\delta \lambda} = (1+r_0)^2 B\lambda - pB(1+r_0) = 0 \quad (4-16)$$

$$\lambda_2^* = \frac{P}{2(1+r_0)} \quad (4-17)$$

In equations 4-10  $\lambda_2^*$  is the minimum pledge ratio for the overall income of small and medium-sized logistics enterprises and core enterprises. Banks can maximize the overall income of small and medium-sized logistics enterprises and core enterprises while ensuring their own interests.

## **4.8 CASE STUDY**

### **4.8.1 Background Introduction**

#### **4.8.1.1 General situation of logistics enterprises M**

M Logistics Enterprise was established at the end of September 2001. The company mainly operates traditional logistics businesses such as mechanical equipment freight, warehousing, and road transportation. In addition, M Logistics Enterprise also sells various specifications of mechanical equipment, building materials, coal, and other businesses. The main revenue of M logistics enterprise is to provide traditional logistics services such as mechanical freight, warehousing, and road transportation for B Mining Machinery Group. B Mining Machinery Group was founded in 1956, covering an area of 326 square kilometers with total assets of 10.13 billion yuan. The company has 18966 employees and more than 8700 sets of various equipment. It has a total of 19 functional departments, research and technology units, and 41 member units. After nearly 70 years of development, the company has acquired capabilities in casting and forging, heat treatment, mechanical processing, and final assembly and debugging. It has strong technical strength, complete scientific research methods, and strong comprehensive processing capabilities, and has a national level enterprise technology center.

With the development of the economy, competition in the logistics industry has become increasingly fierce, and the threshold for the logistics industry has gradually decreased without unified standards, resulting in lower profits for M logistics enterprise. The main business of M logistics enterprise is the mechanical freight, warehousing, transportation and other services provided by B Mining Machinery Group, which has strong dependency and dependence on B Mining Machinery Group and is often at a disadvantage. In addition, it is difficult to achieve cash on delivery in the transportation process of M logistics enterprise, which leads to B Mining Machinery Group extending the payment term to transfer financial pressure to M logistics

enterprise. The payment term is mostly 6-8 months, with the longest reaching one year. For M logistics enterprise, the lack of operational working capital is inseparable from the employment of personnel, purchase of equipment, and rental of premises. Capital has become a key factor limiting the development and growth of logistics enterprises. To solve the financial problems in the operation and development process of logistics enterprises, it is required that they must have strong financing capabilities in the operation and development process.

#### **4.8.1.2 Financing methods for M logistics enterprises**

Since 2010, M Logistics Enterprise has attempted three financing models: bank loans, private lending, and warehouse receipt pledging. Bank loans require corresponding guarantees to be provided, and only after being reviewed by the bank can corresponding loans be granted. Logistics enterprises have fewer fixed assets, so the difficulty of loans is relatively high and the cost of loans is relatively high. Although the process of bank loans is relatively complex, and corresponding collateral or guarantees need to be provided to the bank during the loan process, bank loans are still a relatively economical financing method for logistics enterprises. Seeking bank loan support is the core strategy of most logistics enterprise financing plans. Compared to the loan process of banks, private lending does not require layers of review, and only requires logistics service enterprises to use their own credit guarantees. The difficulty of obtaining financing is relatively low, but the interest rate of private lending is 2-5 times higher than that of general banks during the same period. In addition, the legal risk of private lending is relatively high, and many enterprises are unable to accurately distinguish the boundary between private lending and illegal fundraising in the process of private lending.

Warehouse receipt pledge is a collaboration between banks and logistics companies to provide loans to enterprises with ownership of warehouse receipt goods, using their own inventory as collateral to obtain cash, thereby solving the shortage of operating funds and activating inventory. Carrying out warehouse receipt pledge business, as using warehouse receipts for pledge can not only solve the problem of insufficient working capital for shippers, but also reduce bank lending risks, stabilize the customer source of third-party logistics enterprises, and improve efficiency.

The development of logistics finance has expanded the development space of M logistics enterprise. As a third-party regulatory role, the development of logistics finance has promoted the development of small and medium-sized enterprises and solved the problem of financing difficulties for small and medium-sized enterprises. However, it has not solved the problem of financing difficulties for small and medium-sized logistics enterprises. At present, although M Logistics Company participates in warehouse receipt pledge business for small and medium-sized enterprises as a third-party regulatory agency, the risks associated with warehouse receipt pledge cannot be underestimated. Moreover, warehouse receipt pledge business mainly focuses on warehousing business, while M Logistics Company has a large amount of accounts receivable in transportation business. Table 4.4 shows the financial information of M Logistics Company from 2020 to 2022.

Table 4.4 Financial Information of M Logistics Enterprise from 2020 to 2022

	<b>2020</b>	<b>2021</b>	<b>2022</b>
Total assets at the end of the period	16520	17860	20140
Current assets at the end of the period	8125	9856	12550
Accounts receivable limit	803	1321	1780
Accounts receivable ratio	9.88%	13.40%	14.18%

From Table 4.4, it can be seen that in 2020, the total assets of M Logistics Enterprise at the end of the year were 165.2 million yuan, and the current assets at the end of the year were 81.25 million yuan, of which the accounts receivable amount was 8.03 million yuan, accounting for 9.88% of all current assets. In 2021, the total assets of M Logistics Enterprise at the end of the year were 178.6 million yuan, with current assets of 98.56 million yuan and accounts receivable of 13.21 million yuan, accounting for 13.40% of all current assets. In 2022, M Logistics Enterprise's total

assets at the end of the year were 2014 million yuan, with current assets of 125.5 million yuan and accounts receivable of 17.8 million yuan, accounting for 14.18% of all current assets.

From Table 4.4, it can be seen that although the year-end current assets of M Logistics Company are increasing year by year, the amount and proportion of its accounts receivable are also increasing year by year. Therefore, how to monetize accounts receivable is particularly important for the sustainable development of M Logistics Company.

#### **4.8.2 Analysis of accounts receivable financing model for M logistics enterprise**

1. According to the accounts receivable data provided by M Logistics Company, its accounts receivable aging can be divided into three levels: within 1 year, 1-2 years, and more than 3 years.

Table 4.5 M Logistics Enterprise Accounts Receivable Aging Analysis Table

	2020		2021		2022	
	quota	proportion	quota	proportion	quota	proportion
Within 1 year	640	79.70%	1050	79.48%	1350	75.84%
1-2 years	118	14.69%	187	14.16%	325	18.26%
Over 2 years	45	5.60%	84	6.36%	105	5.90%
Total	803	100%	1321	100%	1780	100%

Note: 1. The data is sourced from M Company's internal financial annual report.

2. The main operating income of M Logistics Enterprise is to provide traditional logistics services to B Mining Machinery Group.

Among them, the accounts receivable of M Logistics Enterprise in 2022 were 13.5 million yuan, accounting for 75.84% of the total accounts receivable amount, while the accounts receivable between B Mining Machinery Group and M Logistics Enterprise were 6.5 million yuan, accounting for 48.15% of the total accounts receivable amount. The total accounts receivable amount of other customers was 700 yuan, accounting for 51.85% of the total accounts receivable amount. According to the data, the accounts receivable period between M Logistics Enterprise and B Mining Machinery Group is relatively short, and as a core enterprise, B Mining Machinery Group has strong scale and strength, relatively good accounts receivable quality, and controllable risks. Therefore, in order to promote the development of the enterprise and activate idle accounts receivable into usable cash flow, M logistics enterprise can use existing high-quality accounts receivable to initiate accounts receivable financing applications with the enterprise.

According to the above data, it can be seen that the current amount of accounts receivable bills between M Logistics Enterprise and B Mining Machinery Group (core enterprise) is 6.5 million yuan. The bank is investigating and understanding the authenticity of the transaction between M Logistics Enterprise and B Mining Machinery Group (core enterprise), and has signed a accounts receivable pledge financing contract for financing, with a pledge rate of 70% and a payment term of 1 year. Based on past experience, the interest rate for short-term loans within one year is between 5% and 10%. In addition, banks need to charge additional regulatory costs and other expenses incurred in the accounts receivable financing process, which is approximately 200,000 yuan.

In the end, M Logistics Enterprise applied for a loan from the bank with 6.5 million yuan of accounts receivable bills, and the bank's financing pledge rate was 70%, which means M Logistics Enterprise can obtain a financing amount of 4.55 million yuan. In addition to the interest rate of 5% -10% for financing fees, the bank also needs to pay an additional 200000 yuan in regulatory fees and other expenses. In addition, M Logistics Enterprise does not need to pay a deposit to the bank, and its

credit guarantee method is to provide credit guarantee for B Mining Machinery Group (core enterprise).

### 4.8.3 Analysis of financing models

Based on the above analysis, the income matrix between the bank and M logistics enterprise after financing accounts receivable is shown in Table 4.6.

Table 4.6 Income Matrix for M Logistics Enterprise's Accounts Receivable Financing

		Logistics Enterprise M	
		keeping promises	Not keeping promises
Bank	No loan	$455*r_c-20,455(r_l-r_c)$	$-475,455+455 r_l$
	Loan	0, 0	0, 0

From Table 4.6, it can be seen that the bank interest rate  $r_c$  ranges from 5% to 10%, which means that when the bank adopts a "loan" strategy and M logistics enterprise chooses a "compliance" strategy, the bank's income range is between 10-240,000 yuan, and the logistics enterprise's income range is between  $455 r_l-1$  and  $455 r_l-24$ . When the bank chooses the "loan" strategy and Y logistics enterprise chooses the "default" strategy not to repay, the bank will lose a loan amount of 4.55 million yuan and an additional 200,000 yuan in regulatory and other expenses, that is, the bank will lose 4.75 million yuan, and the logistics enterprise's income will be  $455+455 r_l$ . When the bank chooses the "no loan" strategy, both the bank and M logistics enterprise have zero returns. Taking into account the profits generated by M logistics enterprise when it has different initial funds, when M logistics enterprise obtains accounts receivable financing and uses it for a series of logistics activities such as purchasing equipment or leasing venues to generate a reproduction rate  $r_l > r_c$ , M logistics enterprise can consider accounts receivable financing.

### 4.8.4 Proposal and Strategy

#### 4.8.4.1 Development Strategy for Logistics Enterprises to Carry out Accounts Receivable Financing Business

(1) Improve the credit level of logistics enterprises themselves

Credit risk is widely present in credit business. In the context of supply chain finance, any trust crisis in the financing process of accounts receivable,

whether it is a core enterprise or a small and medium-sized logistics enterprise, has a profound impact on the overall supply chain.

Logistics companies need to understand the importance of improving their own credit level and enhance their own corporate reputation. A credit evaluation system can be introduced, which can develop a dedicated credit evaluation system based on the development status of the enterprise and improve its credit rating. A dedicated credit department can also be established to plan and manage all issues related to corporate credit from a professional perspective on how to improve the credit rating of the enterprise.

Under the background of supply chain finance, accounts receivable financing relies on the good reputation level of the core enterprise. If there are problems with the reputation of the core enterprise, it cannot be ignored for the entire supply chain and will have a significant impact. Banks understand small and medium-sized logistics enterprises through core enterprises, obtain information and operational status of small and medium-sized logistics enterprises, and try to avoid negative impacts caused by information asymmetry, in order to evaluate whether to provide loan services to small and medium-sized logistics enterprises.

#### (2) Improving the quality of accounts receivable

The quality of accounts receivable determines the likelihood of banks conducting accounts receivable financing. The higher the quality of accounts receivable, the greater the likelihood of banks conducting accounts receivable financing, and vice versa. For logistics enterprises, their internal rules and regulations are not sound, and the management of accounts receivable is not standardized enough. Logistics enterprises should establish a dedicated accounts receivable management department, provide relevant personnel training, and standardize accounts receivable management. Classify accounts receivable between different enterprises, assign dedicated personnel to understand and supervise accounts receivable during the reconciliation period, promptly identify potential issues, closely monitor their accounting periods, remind customers to make payments before the end of the accounting period, and prepare other departments of the company for payment. Take targeted measures for expected customers and try to avoid the possibility of bad debts.

(3) Enhance the punishment for breach of contract by logistics enterprises

The reason why it is difficult for logistics enterprises to carry out accounts receivable financing business under the traditional mode is that the benefits generated by logistics enterprises when choosing the "default" strategy are much greater than the benefits generated when choosing the "compliance" strategy. In the supply chain finance model, logistics companies choose a higher "compliance" strategy when conducting accounts receivable financing business because they want to maintain a long-term and stable cooperative relationship with core enterprises, and thus obtain higher profits, rather than just focusing on immediate vested interests. However, there is currently no clear regulation in China on the punishment measures for dishonesty of enterprises. Based on this, legislation related to the punishment of dishonesty by enterprises in financial activities in China should be put on the agenda as soon as possible, and punishment should be imposed on dishonest enterprises from the national legal level, limiting the possibility of dishonesty by enterprises at the legal level. At present, for untrustworthy enterprises, China can also imitate the existing experiences at home and abroad in the past, exert pressure on untrustworthy enterprises at the public opinion level, and make other enterprises in the supply chain refuse to cooperate with them, or restrict their orders or raw materials, or refuse to provide raw materials and orders.

(4) Enhance the core competitiveness of enterprises and break free from the control of core enterprise interests

Small and medium-sized logistics enterprises, due to their weak core competitiveness and a high proportion of the total business volume signed with the core enterprise, are in a weak position in bargaining power regarding various businesses with the core enterprise. In order to obtain the right to order, they adopt a cooperative strategy in various contracts to prevent losing the core enterprise as a major customer, such as accounts receivable with excessively long accounts receivable, interest subsidies in exchange for bank loans to support enterprise development, etc. If the harsh winter of the macro environment leads to increased investment risks, lower investment returns, or even losses, then the interest generated from accounts receivable financing will make it difficult for small and medium-sized logistics enterprises to make

progress. Therefore, small and medium-sized logistics enterprises must enhance their core competitiveness from various dimensions such as core business, brand, channel, culture, etc., and enhance their bargaining power throughout the entire supply chain in order to break free from the control of core enterprise interests.

#### **4.8.4.2 Suggestions for the development of accounts receivable financing business by banks**

(1) Strengthen the management of accounts receivable financing business processes

Before conducting accounts receivable financing business under the supply chain finance model, banks need to prepare for loans and investigate the credit level, business scale, and financial status of small and medium-sized logistics enterprises. During this process, banks need to pay high costs. At the same time, after the bank issues loans to logistics enterprises, the bank still needs to supervise the subsequent operation of logistics enterprises, such as the purpose of borrowing. Simultaneously investigate the authenticity of business between core enterprises and small and medium-sized logistics enterprises. Banks can establish a standard risk assessment system to uniformly assess the risks of enterprises in the supply chain, with core enterprises as the main focus. This simplifies the loan process for banks while reducing their regulatory costs.

In addition, banks should hire professionals to establish relevant departments to manage accounts receivable financing business, establish reasonable reward and punishment mechanisms, and avoid moral risks that may arise from relevant personnel engaging in accounts receivable financing business.

(2) Conduct an investigation into the industries in which small and medium-sized logistics enterprises operate

Banks need to investigate the current industry situation of small and medium-sized logistics enterprises when conducting accounts receivable financing business from the perspective of supply chain finance, and analyze the current development stage of logistics enterprises. At present, the development of China's logistics industry is at its peak, with a good momentum. In the era of information explosion, the development of various industries directly and indirectly promotes the development of the logistics industry. Although the credit level and business scale of

the logistics industry are relatively small, the operating conditions and environment are relatively good, Therefore, the probability of banks engaging in accounts receivable financing business with logistics enterprises will correspondingly increase. For some enterprises that are already in operational difficulties, considering the current situation of their industries, although some enterprises have relatively good business scale and capabilities, banks still need to conduct more inspections for these types of enterprises.

### (3) Promote cooperation with core enterprises

The core enterprise is the key to conducting accounts receivable financing business. In logistics enterprises, they need to rely on the credit of the core enterprise to carry out accounts receivable financing business. Not only logistics enterprises, but also other enterprises in the supply chain mainly composed of core enterprises. Therefore, banks should actively carry out financial business with core enterprises, promote cooperation between both parties, and increase customer stickiness, To reduce the risk of logistics companies defaulting. Banks also need to sign relevant written contracts with core enterprises to apply for loans for financing business of accounts receivable generated from logistics transactions, whether the core enterprise is aware of it. In addition, it is necessary to supervise the operational status of core enterprises. As the primary repayment source for accounts receivable financing business, the operational status of core enterprises is related to the recovery of bank loans. Once there are problems with the operation of core enterprises, the loan risk of banks will correspondingly increase.

## CHAPTER 5

### CONCLUSION AND PROSPECT

This article analyzes the financing models of supply chain finance and constructs a game model for the traditional financing models of small and medium-sized logistics enterprises. It elaborates on the advantages of accounts receivable pledge financing for small and medium-sized logistics enterprises in the context of supply chain finance compared to traditional financing models; Determine the game relationship between subjects and construct a game model, analyze the rationality of the model and the process of game equilibrium; Finally, based on the above research analysis, taking M Logistics Enterprise as a case study, this paper introduces its financing model, analyzes its current situation of accounts receivable management, and analyzes the feasibility of accounts receivable financing. The following conclusions have been drawn through research:

(1) Under the supply chain finance model, accounts receivable pledge financing provides a new financing approach for small and medium-sized logistics enterprises.

(2) When small and medium-sized logistics enterprises face sufficient punishment when choosing the "default" strategy, and when the credit benefits brought by the supply chain system when choosing the "compliance" strategy for small and medium-sized logistics enterprises are large enough, a game equilibrium state can be achieved, and small and medium-sized logistics enterprises can improve their own credit level and competitiveness through cooperation with core enterprises.

(3) Supply chain finance has unique advantages in solving the financing difficulties of small and medium-sized enterprises. By introducing the credit of core enterprises and monitoring of third-party logistics enterprises, it can effectively weaken the information asymmetry between banks and small and medium-sized enterprises, and increase the possibility of banks granting credit to small and medium-sized enterprises; Revitalizing the idle current assets of small and medium-sized enterprises in the production and operation process, providing loan support for small and medium-sized enterprises, and improving the efficiency of capital utilization; Banks have gained profits while effectively reducing business risks and operating costs by grasping the

real trade situation between small and medium-sized enterprises and core enterprises in the supply chain when conducting supply chain finance business.

(4) Supply chain finance has multiple financing models, including accounts receivable financing model, confirmed warehouse financing model, and financing warehouse financing model. These financing models have their own characteristics, implementation mechanisms, and business processes, and are suitable for small and medium-sized enterprises at different nodes in the supply chain. When small and medium-sized enterprises use supply chain finance financing models for financing, they should combine their own characteristics with the characteristics of one or more supply chain finance financing models to achieve the goal of maximizing the improvement of their production and operation situation.

(5) By conducting credit risk assessments on specific cases, it is demonstrated that supply chain finance accounts receivable financing can provide credit support to small and medium-sized enterprises with insufficient credit qualifications through changes in financing models, thereby quantitatively proving the advantages of supply chain finance accounts receivable financing. To provide scientific and objective judgment basis for the development of supply chain finance accounts receivable financing financial products in the banking industry.

The above research conclusions are expected to provide theoretical and practical support for the financing problems of small and medium-sized logistics enterprises, but current research is still far from sufficient. Based on this article, the subsequent research directions are:

(1) There is still insufficient research on accounts receivable pledge financing under the supply chain finance model. In the future, other financing methods under the supply chain finance model can be studied.

(2) In real companies, the payment terms are often multiple, and future research can focus on non single repayment cycles, considering the financing problem of multiple payment terms.

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