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Risk Control of Contract in Confirming Warehouse Financing for Supply Chain in the Perspective of Commercial Banks

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Abstract

This paper focus on the difficult situation of traditional financing, combine with the psychological phenomenon of credit reluctance of commercial banks and the environment for further development of logistics enterprises. In this paper, we analyze the impacts of key parameters of confirming warehouse financing model contracts on the behavioral choices of financing companies and commercial banks. And we analyze the optimal funds ratio of banks and the bank credit lines. This paper provides feasible suggestions for banks to avoid the contracts risk and develop relevant policies.

Introduction

According to the estimation of China Banking Regulatory Commission, in China, large enterprises usually get access to loans from commercial banks. The loan coverage rate of large enterprises is as high as 100% and the loan coverage rate of medium-sized enterprises is 90%, while the loan coverage rate of small and medium-sized enterprises facing the financial pressure and financing difficulties is only 20%. The loan coverage rate of small and medium-sized enterprises is only 20% to the loan coverage rate of large enterprises. (Gong, 2011) However and supply chain finance business innovation provides the hope for many small and medium-sized enterprises to solve the financing problems. According to incomplete statistics, from 2008 to 2013, China's commercial banks provided about 230 billion yuan of financial supply chain financing to more than 1250 small and medium-sized enterprises. (Tang, 2014)

However, as a new financing model, supply chain financing contains various complex financial relationships between the parties in the supply chain, and there are relatively large differences to general corporate financing. (Wuttke, 2016) So the risks of the supply chain financing and risk management have their own characteristics and difficulties. First, because one of the core values of the supply chain financing is to solve the financing difficulties of small and medium-sized enterprises in the supply chain, while the high risks of small and medium-sized enterprises cannot be avoided. Thus, how to conduct risk control is one of the key issues to the financial risk management of supply chain. Secondly, the financing service of supply chain finance relates to a variety of financial and credit products and combinations. In recent years, the theory and practice in financial field are in constant exploration; new financial products are constantly emerging. New credit products are likely to be vulnerable in the design and operations process, new credit products are likely to touch the edge of the laws and invade the bank interests. Finally, when banks provide financing services to the enterprises in supply chain, they need to determine the source of repayment, an important means of guaranteeing the repayment is to have mortgage collateral. But finance-transportation and warehouse and other modes of financing need a third party logistics enterprises to supervise goods, financing enterprises and logistics companies are easily to be hand and glove with each other to deceive banks. What is more, the mortgage collateral is very mobility; these factors make it difficult for banks to have effective supervision to mortgage collateral. (Jing, 2014)

Since the concept of supply chain finance was put forward, academia do lots of researches to the risk of innovative business. In the prior study, a lot of literatures study the mode of stock pledge financing, the risk of accounts receivable financing model and analysis of risk prevention measures, but research on the financing model of the confirming warehouse is relatively small. Even some literatures involve financing model of confirming warehouse; they mainly analyze the theoretical design and risk aversion of financing model of confirming warehouse and the roles of logistics enterprises. Currently, research on supply chain finance involving confirming warehouse model risk and risk management focus on the following aspects: (1)**Definition and characteristics of risk.** Hertzela (2008) thinks that the flexibility of confirming warehouse can reduce implementation costs and confirms that the financial supply chain warehouse model is flexible while at the same time discusses the risk aggregation characteristics of supply chain from the aspects of imperfect of market credit system, deviation of the interests of relevant main parties and lacking of the core enterprises. (2)**Risk and fund management.** Mahata (2011) believes that there are many opportunities for cost savings and value creation in the supply chain cash management, in this

regard; enterprises need to maintain high operating capital to deal with the risk of supply chain capital flow. With the progress of the payment and settlement tools and technical solutions, Enterprises can better manage the supply chain of funds flow, in order to reduce operating capital and thus gain.(3)**Risk control and management model.** Srinivasa Raghavan (2011) believes that if commercial banks want to achieve the goal of minimizing the credit risk, they need to establish an emergency handling mechanism, strengthen the cash flow control and structural credit. Yan (2016) studied the game between the core enterprise and the member enterprise, and the game between the supply chain node enterprise and the bank when Information is completely symmetrical. Research points out that: the total amount of pledge in confirming warehouse model and the cash deposit of core enterprise are the main factor affecting the probability of bank loans, the core enterprise security probability is largely affected by the impact of node enterprise default losses.

Although the existing results discuss the financial risk of supply chain and risk management from several perspectives, reflect the achievements and trends of the current domestic and foreign experts and scholars. However, we believe that the following two questions worth discussing in the existing literature. Firstly, there are few literatures to analyze the financial risk control of supply chain from the angle of bank. Second, the existing literature has very little focus on how to control the financial analysis of the supply chain through contract design. From the perspective of the commercial banks, this paper analyzes the contract risk management process in the confirming warehouse financing model and avoid the contract risk in confirming warehouse financing model through the key parameters of the contract. What is more, this paper analyzes the Commercial bank credit line for commercial banks to develop the optimal margin ratio and determine the line of credit to provide reference.

Research on the risk control of the key index of the confirming warehouse

The operation of the confirming warehouse financing mode is finally realized through the contract. Therefore, the design of the contract, especially the determination of the key parameters of the contract, is the key to the risk control of the financing mode of the confirming warehouse. In the process of contract design, the line of credit, loan ratio, margin ratio, regulatory fees, loan period are undoubtedly the keys control indicators of contract. Generally speaking, commercial banks have a fixed standard about loan ratio and loan period. But the standards of the margin ratio and regulatory costs are not sure. In this paper, we study the margin ratio and the determination of the credit line for the contract risk of the confirming warehouse financing model.

A. Variable symbols and basic assumptions

Relevant variable symbols are as follows.

r：	Lending rate of financing enterprises
p：	Retail price of products of financing enterprises
w：	Product wholesale price (contract price)
c：	Supplier cost
q：	Order quantity of contract
d：	Market demand
s：	Unit storage cost
b：	Margin ratio
B：	Deposit
q_1：	First delivery amount of the financing enterprise
T：	Contract period
V：	Product handling price

There are six assumption are discussed in details below.

（1）Confirming warehouse financing for the supply chain is the quartet financing. Its participants are: supply chain core enterprises (suppliers), supply chain financing enterprises (vendors), financing institutions (banks), third party logistics enterprises.

（2）The market environment faced by vendors is stochastic demand environment. Its market demand for the distribution function is F (x), the density function is f (x).

（3）The cost, price and demand distribution information are common knowledge for the quartet.

（4）Amount of lending, the wholesale price of the purchase and sale of the contract and the number of commodity transactions are determined. That the amount of lending is w×q.

（5）After the end of the contract period, the product has not yet sold, the price of the product is V, to meet the c>v>s.

（6）Financing enterprises use the initial own funds to pay for the first delivery margin B. According to the size of margin, the bank informs the logistics enterprises about the delivery quantity, and delivery quantity meets q1=B/w.

B. Establishment and analysis of model

When the funds of financing enterprise are limited, the order amount of financing enterprises is small; it is difficult to obtain a higher amount of discount from the core business. This has led to the increase in the cost of financing enterprises, it is unfavorable to the financing enterprises. Through

the advance payment mode, the mode of the confirming warehouse increases the purchasing quantity of the financing enterprise, help the financing enterprises obtain the better quantity discount, and reduces the cost of the financing enterprise. If the market demand is stable, the financing enterprise can better predict the market demand, and the confirming warehouse financing model can effectively improve the profit of the financing enterprises. However, when market demand is random, financing enterprises will face a dilemma. On the one hand, if the order quantity is too high, when the market demand is less than the amount of the order, the ordered product of financing enterprises will be remained, according to the hypothesis 5 of this chapter, the product will have a certain loss and result in a certain loss. On the other hand, if the order quantity is lower, when the market demand is greater than the order quantity, the supply problem often leads the financing enterprises to lose the potential customers. At the same time, the lower order quantity will make the financing enterprises cannot get the appropriate quantity discount. Of course, compared to the case, the second situation is more serious than the first. Therefore, financing companies are still willing to increase the order quantity. Without loss of generality, this chapter assumes that there are two kinds of behavior choice of financing enterprises, respectively, according to the provisions of the contract to pay all related costs, and do not pay second margin.

When the financing enterprises comply with the contract and pay all the relevant costs, the final profit of the financing enterprise is:

$$\pi(x) = p \times \min\{x, q\} + v \times \max\{0, q - x\} - w \times q - w \times q \times r - s \times q \quad (2.1)$$

Here, X is the market demand. Cash flows of the financing enterprise are mainly sales of products, and may include buy back (when the order is greater than demand). Cash payments include three parts, namely, wholesale costs, warehousing costs and loan costs.

When financing enterprises do not comply with the provisions of the contract, do not pay the second margin, the profit of the financing enterprise is:

$$\pi'(x) = p \times \min\{x, q_1\} + v \times \max\{0, q_1 - x\} - w \times q_1 - s \times q_1 \quad (2.2)$$

The first delivery is according to the size of the first deposit, and meets the hypothesis 6. At this time, the cost of financing enterprise mainly consists of two parts, margin expenditures B=wq1, and the payment for warehousing costs when taking delivery of goods from logistics enterprises SQ1.

Obviously, the behavior choice of the financing enterprise is influenced by the demand of the commodity market, and the following are divided into three kinds of situations.

When x>q, if the financing business comply with the provisions of the contract, the final profit of financing enterprises:

$$\pi(x) = p \times q - w \times q - w \times q \times r - s \times q \quad (2.3)$$

On the contrary, the final profit of financing enterprises is:

$$\pi'(x) = p \times q_1 - w \times q_1 - s \times q_1 \quad (2.4)$$

If and only if (2.3) ≥ (2.4), the financing enterprise keep its agreement in business, we can know that

$$q_1 \le \left(1 - \frac{wr}{p - w - s}\right) \cdot q \quad (2.5)$$

Thus, when the market demand is higher than the amount of the order, regardless of the size of margin ratio, the financing companies are willing to perform the contract.

When Q1 = x = q, if the financing enterprises comply with the provisions of the contract, the final profit of the financing enterprise:

$$\pi(x) = p \times x + v(q - x) - w \times q - w \times q \times r - s \times q \quad (2.6)$$

At this point, the default profit for the financing enterprise:

$$\pi'(x) = p \times q_1 - w \times q_1 - s \times q_1 \quad (2.7)$$

If and only if (2.6) ≥ (2.7), the financing enterprise keep its agreement in business, we can know that

$$x \ge \frac{w(1+r) + s - v}{p - v} \cdot q + \frac{p - w - s}{p - v} q_1 = x_0 \quad (2.8)$$

At the same time, from the conditions, we know that

$$\frac{w(1+r) + s - v}{p - v} \cdot q + \frac{p - w - s}{p - v} q_1 \le q \quad (2.9)$$

Then

$$q_1 \le \left(1 - \frac{wr}{p - w - s}\right) \cdot q \quad (2.10)$$

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It is not difficult to get that, when it meets (2.10). When the market demand satisfy Q1 < x < Q , if market demand x≥ $x_{0,}$ financing enterprises will comply with the contract.

when the $x \le q_1$, if the financing enterprise comply with the provisions of the contract, the final profit of the financing enterprise is:

$$\pi(x) = p \times x + v(q - x) - w \times q - w \times q \times r - s \times q \quad (2.11)$$

If the financing enterprises do not follow the contract, the final profit of the financing enterprise:

$$\pi'(x) = p \times x + v \times (q_1 - x) - w \times q_1 - s \times q_1 \quad (2.12)$$

If and only if (2.11) ≥ (2.12), the financing enterprise keep its agreement in business, we can know that

$$q_1 \ge (1 + \frac{wr}{w + s - v})q \quad (2.13)$$

Thus, when the goods are in low demand, financing companies will default.

According to the above analysis, we can get the following propositions:

Proposition 1: whether the financing enterprises comply with the provisions of the contract, mainly depends on two factors: first, the market demand situation, second, the first margin ratio. When the market demand $x \ge x_0$, and the first deposit ratio is lower than 1-wr/ (p-w-s), the financing enterprise comply with contract. According to the hypothesis (2), the probability of financing enterprises to comply with contract is 1-F(x_0). When $x < x_{0,}$ the financing business will not perform the contract, the probability of breach of contract of financing enterprise is F(x_0).

Confirming warehouse financing model has greatly eased the financing difficulties of small and medium enterprises in the supply chain, while helping small and medium-sized enterprises to get more quantity discount from the core enterprises. For commercial banks, the models of the confirming warehouse further develop the intermediate business of the banks and broaden the scope of the bank's business. In the confirming warehouse financing, whether the financing enterprises can strictly implement the purchase and sale contracts, extract all the goods is the main contract risk of the confirming warehouse financing model. This is because, if the financing enterprises in the contract period only to pay margin one time, the disposal price of remaining goods can only be processed by the v<w to buy back. In theory, the bank can require the core enterprises in accordance with the wholesale price of w to buy back the rest of the goods. There is no risk of capital loss at this time. But in the actual operation, if the demand risks are borne by the core enterprises, the core enterprises often have not the power to guarantee the financing business, which is often unable to carry out the confirming warehouse financing model. May wish to believe that the bank provides the core enterprises of the proportion of the remaining commoditiesα in accordance with the wholesale price to repurchase, 1-αproportion is repurchased by the disposal price. The bank's expected profit is:

$$E\pi_B(x) = wrq \cdot (1 - F(x_0)) - (1-\alpha) \cdot (w - v) \cdot (q - q_1) \cdot F(x_0) \quad (2.14)$$

By first order condition, we can get q_1^*. When other parameter values are known, it can be solved.

Proposition 2: the actual line of credit for banks is $w(q - q_1^*)$, the specified deposit ratio of bank is $\frac{q_1^*}{q}$.

Simulation analysis

For commercial banks, the key parameters of confirming warehouse contract are the margin ratio and the amount of credit. This section respectively simulates the changes in the wholesale price and the market demand fluctuations, the relationship between bank profits and q_1. The simulation program code can be seen in Appendix 1. Here, the function of the simulation is:

$$E\pi_B(x) = wrq \cdot (1 - F(x_0)) - (1-\alpha) \cdot (w - v) \cdot (q - q_1) \cdot F(x_0) \quad (2.14)$$

Among it, $x_0 = \frac{w(1+r) + s - v}{p - v} \cdot q + \frac{p - w - s}{p - v} q_1$ 。

In this simulation, we set the parameters as shown in the following table.

Table 1 values of each variable

Variable symbol	Variable value	Variable symbol	Variable value
p(Market retail price)	200	v （ Unit product value）	50
w(wholesale price)	125	q（Contract order quantity）	1000
S （ Inventory cost）	15	r（Lending rate）	10%

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If market demand follows the normal distribution, the mean value is 1000 as the contract order quantity, the standard deviation is 100,150,200,300, the relationship between the expected profit of commercial bank and the first delivery quantity of financing enterprises is shown in Figure 3.1.

As can be seen from Figure 3.1, when the fluctuations of commodity market demand is constant, the expected profit of commercial banks will be different as the first delivery amount increasing. As a whole, when the number of first delivery of financing enterprises remains unchanged, the expected profit of commercial banks will be decreased along with the increase of demand fluctuation value. When other conditions remain unchanged, there is an inverse relationship between expected profit of commercial banks and demand fluctuation. The more the demand fluctuates, the greater the maximum expected profit of commercial banks is. On the other hand, when the demand fluctuation is small, the first delivery amount required by the commercial bank is relatively small, when the demand fluctuation increases, the first delivery amount required by the commercial bank is increasing. Such as when the standard deviation for 100, the optimal first delivery amount booked by the commercial banks is about 200, and standard deviation of 150, the optimal first delivery volume is about 400, and standard deviation of 200, the optimal first delivery volume is about 600, and the standard deviation is 300, the optimal first delivery volume is about 800. Thus, in combination with Proposition 2, we get the following conclusion:

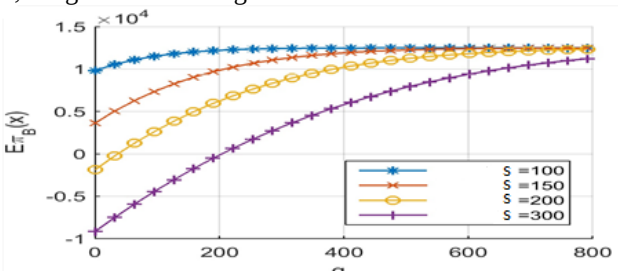

Figure 1 The relationship between the expected profit of commercial banks and the number of the first delivery of financing enterprises

Corollary 1: The credit line of banks and the determination of the margin ratio is related to the fluctuation of market demand. The credit line is in inverse proportion to the fluctuation of market demand, and the margin ratio is proportional to the degree of fluctuation of market demand.

We also simulated, in the case of different wholesale prices as 75, 100, 125, 150, 175, the relationship between the expect profits of commercial banks $E\pi_B(x)$ and the first delivery amount of financing enterprises q_1 is shown in figure 2.3. Here, the market demand is subject to N（1000，100^2）.

From figure 2, we can know that the optimal first delivery is not related to the size of the wholesale price. As the wholesale price increases, the bank's profits are increasing.

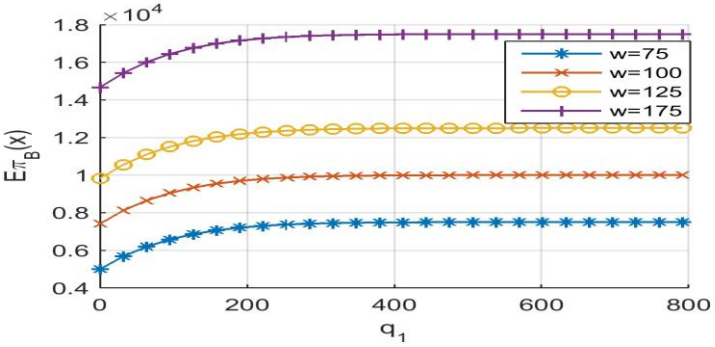

Figure 2 the relationship between the expect profits of commercial banks and the first delivery amount of financing enterprises.

Conclusions

The following conclusions are drawn from the above analysis:

In the quartet confirming warehouse, if commercial banks and logistics companies are just simple principal-agent relationship, commercial banks do not need to pay for supervision to logistics enterprises, the source of logistics enterprises' income is not from commercial banks, the income is paying cost when financing enterprises extract commodities. Whether the financing enterprises comply with the contract depends on two factors: the demand factors of commodity market involved in the contract, initial margin ratio factor. When the market demand is higher than the commercial order, regardless of the size of the margin ratio settings, financing enterprise will comply with contract and pay all the related costs. When $q_1 \le (1-\frac{wr}{p-w-s})\cdot q$, and the commodity market demand meet $q_1 \le x \le q$, in the condition of $x \ge x_0$, financing enterprises comply with the contract. When the commodity is in the low demand state, the financing enterprise must breach the contract.

The actual credit line and the initial margin ratio specified by the commercial banks are affected by the following factors: the wholesale price of its products, product processing price, retail prices, costs for storage unit, the contract order quantity, loan interest rates, repurchase ratio of core enterprise, the default probability of financing enterprise, the density function of the market.

When the wholesale price of a product is certain, the expected profit of commercial banks will increase with the

increase of the number of delivery, but there is limitation to increase. When the number of the delivery of goods is certain, the expected profit of commercial banks will increase with the increase in the wholesale price of products, and the expected profit of commercial banks will decrease as the fluctuation of market demand increase. Therefore, when other conditions remain unchanged, commercial banks should pay attention to the wholesale price of products, market volatility. High product prices mean high expected profit for commercial banks; high volatility means low expected profit of commercial banks.

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