Study on Incentive Mechanism of Electronic Warehouse Receipt Financing Mode in Online Supply Chain Finance

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Abstract. We take the electronic warehouse receipt business patterns of online supply chain finance as the research object, and based on the perspective of moral risk prevention and adverse selection, with the goal of maximizing the overall benefits of supply chain, we focus on the incentive mechanism between banks and B2B platform and its own logistics enterprises. By constructing the expected profit function, the optimal profit function of the bank and the B2B platform can be deduced, which can directly stimulate the B2B platform and its own logistics enterprises, so as to prevent the moral hazard of the B2B platform. The relevant parameters are assigned and some parameters are simulated and analyzed by MATLAB. Therefore, we get the variation trends of related functions and the influencing factors, and verify the incentive model has certain practical value. Through the establishment of incentive mechanism we find that it is very useful for reducing the risk of principal-agent and credit bank. Risk reduction will greatly improve the enthusiasm of B2B platforms and their own logistics enterprises.

1 Introduction

With the development of B2B e-commerce, online supply chain finance business based on B2B platform has also begun to grow and develop, and its business model has been constantly innovated, which not only broadens the financing channels of small and medium-sized enterprises, but also provides new profit growth points for banks, B2B platforms and logistics enterprises ([1]). Because banks don't know the strength and operating status of the platform when choosing the cooperative B2B platform, and B2B platform and its self-operated logistics companies have more information about the platform transaction, logistics and supply chain of financing enterprises. As an important basis for credit granting, this information is generally privately owned by B2B platform, so the information asymmetry between banks and B2B platforms will lead to moral hazard and adverse selection problems when conducting business ([2, 3]). In order to reduce the principal-agent risk of banks and solve the problem of moral hazard prevention and adverse selection, this study takes the electronic warehouse receipt business model of online supply chain finance as the research object, and studies the incentive mechanism among banks, B2B platforms and their self-operated logistics enterprises. By establishing the incentive mechanism for B2B platforms, banks urge B2B platforms and their self-operated logistics enterprises not to hide information from banks and work hard in credit review, so as to maximize the overall interests.

2 Research Design

2.1 Basic hypothesis

(i) The participating principal banks, B2B platforms and their self-operated logistics enterprises are all bounded rational decision makers, and they are all risk-neutral. In the decision-making process, they all aim at maximizing their own interests.

(ii) The logistics company that evaluates and supervises the warehouse receipt goods is the self-operated logistics company of the B2B platform. The logistics company comprehensively determines the value of the goods by analyzing the market price of the warehouse receipt goods in recent years.

(iii) The expenses incurred in the credit review of the B2B platform include the relevant expenses incurred in the supervision and assessment of goods by its own logistics company.

(iv) The credit evaluation report obtained by the B2B platform through analyzing the transaction information of the financing enterprise platform is valid and can be used as the basis for bank credit.

(v) Under the entrusted credit, if the financing enterprise repays according to the agreement, the bank and the B2B platform will distribute the profits according to the agreement. If the financing enterprise fails to repay or overdue, the bank obtains the right to dispose of the warehouse receipt goods and enjoys the full payment after disposal.

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(vi) Loans from financing enterprises are repayable with principal and interest in one lump sum. ([4, 5])

2.2 Model construction

2.2.1 Parameter settings of the model

X_0: Valuation of goods under warehouse receipt by B2B platform's self-operated logistics company.

C: Pledge rate of goods under electronic warehouse receipts of financing enterprises by banks.

B: Margin provided by a financing enterprise to a bank.

L: Total amount of loans granted by banks to financing enterprises, $L=(X_0+B)+C$.

r: The bank's lending rate (Annualized interest rate).

t: The loan term of the bank (Unit is years).

W: The realisation rate of the goods under the warehouse receipt at maturity.

S_B、S_b: The respective efforts of the banking and B2B platforms in the credit review ($S_B \in [0,1]$, $S_b \in [0,1]$, S_B *and* S_b are continuous variables, the effort of the B2B platform includes the effort of its own logistics enterprises in assessing and supervising the goods under the warehouse receipt).

α_B、α_b: The cost factor of banks and B2B platforms during credit review can be understood as the effectiveness of the efforts made by banks and B2B platforms during credit review on the success of loan business (Smaller value of α_B *and* α_b indicates that the effort is more effective, $\alpha_B, \alpha_b \in [0,1]$). Then the effort cost functions of the two reviews can be expressed as $\frac{\alpha_B S_B^{\,2}}{2}$、$\frac{\alpha_b S_B^{\,2}}{2}$.

β_B、β_b: Work efficiency of banks, B2B platforms and their self-operated logistics enterprises in credit review(β_B、$\beta_b \in [0,1]$).

P: Probability of timely repayment by financing enterprise. It can be expressed by the effort level and work efficiency of banks, B2B platforms and their own logistics enterprises, i.e. $P = min(S_B\beta_B + S_b\beta_b, 1)$. It is assumed here that the size of *P* is only affected by the effort level and work efficiency of banks, B2B platforms and their own logistics enterprises.

λ: Percentage of revenue of banks when financing enterprises repay on schedule. The revenue ratio of B2B platform is $1-\lambda$. The B2B platform does not allocate revenue when the bank receives revenue compensation from the disposal of goods under the warehouse receipt in the event of default by the financing enterprise.

C_B: The cost incurred by the bank in disposing of the goods under the warehouse receipt after the overdue financing of the enterprise.

2.2.2 Expected Revenue Function

$$U_B = LP(rt\lambda+1)+(1-P)\cdot(X_0\cdot W+B)-L-\frac{\alpha_B S_B^{\,2}}{2}-(1-P)\cdot C_B \quad (1)$$

$$U_b = L\,Pr\,t\,(1-\lambda)-\frac{\alpha_b\cdot S_b^{\,2}}{2} \quad (2)$$

Formula (1) is a function of the expected revenue of the bank derived from interest on the loan and the realisation of the goods under the warehouse receipt if the financing enterprise defaults. Formula (2) is the expected revenue function of the B2B platform, whose revenue is mainly derived from the allocation of loan interest when the financing enterprise makes repayment on schedule, and satisfies $U_B > U_b \geq 0$.

The sum of the expected revenue of the bank and the B2B platform can be obtained from formula (1) and (2), and the sum of the revenue is greater than zero, i.e.

(i) Participation constraints for banks and B2B platforms

In formula (1), assuming that the minimum acceptable revenue for the bank is 0, let $U_B = 0$, then the minimum revenue allocation ratio λ_{min} for the bank can be obtained.

$$U_B+U_b = LP(rt+1)+(1-P)\cdot(X_0\cdot W+B)-L-(1-P)\cdot C_B-\frac{\alpha_B S_B^{\,2}}{2}-\frac{\alpha_b S_b^{\,2}}{2}>0 \quad (3)$$

$$\lambda_{min} = \frac{2(1-P)(C_B-X_0W-B)+2L+\alpha_B S_B^{\,2}-2PL}{2L\,Pr\,t} \quad (4)$$

In formula (2), assuming that the minimum revenue that the B2B platform can accept is 0, so that $U_b = 0$, the highest revenue allocation ratio λ_{max} that the B2B platform can accept the bank can be obtained.

$$\lambda_{max} = 1-\frac{\alpha_b S_b^{\,2}}{2L\,Pr\,t} \quad (5)$$

It can be obtained from formulas (4) and (5)

$$\lambda_{max}-\lambda_{min} = \frac{U_B+U_b}{4L\,Pr\,t} > 0 \quad (6)$$

That is, $\lambda_{max} > \lambda_{min}$, and satisfies $0 \leq \lambda_{min} < \lambda_{max} \leq 1$.

It can be obtained from formulas (3), (4) and (5), when $\lambda < \lambda_{min}$, $U_B < 0, U_b > 0$ does not satisfy the participation constraint of the bank, and therefore the bank will not agree to the income distribution ratio λ; when $\lambda > \lambda_{max}$, then $U_B > 0, U_b < 0$, the B2B platform will not accept the allocation ratio λ because the allocation ratio cannot meet the benefit requirements of the B2B platform; when $0 < \lambda_{min} < \lambda < \lambda_{max}$, at this time, simultaneously meets $U_B > 0, U_b < 0$, it meets the participation constraint conditions for both parties to carry out the business.

(ii) Incentive constraints of banks and B2B platform

Incentive constraint means that both banks and B2B platforms will choose actions or make efforts to maximize their own interests in the process of joint credit review, so as to maximize their expected revenue. In this paper, S_B *and* S_b are mainly used to express the effort level of banks and B2B platforms respectively. Therefore, through studying the effort level of banks and B2B platforms, this paper analyzes the incentive related factors of both parties.

Knowing $P = min(S_B\beta_B + S_b\beta_b, 1)$, when $S_B\beta_B + S_b\beta_b \geq 1$, the value of *P* is always equal to 1. This indicates that the financing enterprise will definitely repay the loan on schedule, and its revenue will decrease when the banks and B2B platforms improve their efforts. Obviously, this is not the optimal effort level of both

parties. Therefore, solving the optimal effort level of both parties needs to meet $S_B\beta_B + S_b\beta_b < 1$, i.e. $P = S_B\beta_B + S_b\beta_b$, at this time, the best effort level $S_B{}^*$ *and* $S_b{}^*$ should satisfy

$$max_{S_B{}^*}(U_B) \tag{7}$$

$$max_{S_b{}^*}(U_b) \tag{8}$$

By substituting $P = S_B\beta_B + S_b\beta_b$ into formulas (1) and (2) and calculating the first derivative of S_B *and* S_b respectively, the optimal effort level of banks and B2B platforms can be obtained. The specific calculation process is as follows:

$$\frac{dU_B}{dS_B} = L\beta_B(rt\lambda + 1) - \beta_B(X_0W + B) - \alpha_B S_B + C_B\beta_B \tag{9}$$

$$\frac{dU_b}{dS_b} = L\beta_b rt(1-\lambda) - \alpha_b S_b \tag{10}$$

Make the formulas (9) and (10) equal to 0 to obtain:

$$S_B{}^* = \frac{L\beta_B(rt\lambda+1) - \beta_B(X_0W+B) + C_B\beta_B}{\alpha_B} \tag{11}$$

$$S_b{}^* = \frac{L\beta_b rt(1-\lambda)}{\alpha_b} \tag{12}$$

2.2.3 Joint revenue model

Under the joint credit model, whether the bank can successfully recover the loan depends on the joint efforts of the bank, the B2B platform and its own logistics enterprises. In order to reduce the possibility that either party to the cost may make no effort. Therefore, a joint revenue incentive model can be established to solve the optimal revenue allocation ratio between the bank and the B2B platform, so as to maximize the joint revenue. And analyzing it according to the changing trend, the joint revenue model can be expressed as follows:

$$max_\lambda(U_B + U_b)$$

$$s.t.(PC): 0 < g_{min} < g < g_{max} \tag{13}$$

$$(IC): max_{S_B{}^*}(U_B), max_{S_b{}^*}(U_b) \tag{14}$$

Under the joint credit model, banks and B2B platforms are satisfied with:(1) Both sides reached the best level of effort S_B^*、S_h^*; (2) $0 < g_{min} < g^* < g_{max}$, $0 \le S_B^* \le 1, 0 \le S_b^* \le 1, 0 < S_B^*\beta_B + S_b^*\beta_b < 1$, the above constraints maximize the respective revenue and joint revenue. At this time, the optimal distribution ratio can be obtained:

$$\lambda^* = \frac{Lrt\frac{\beta_B{}^2}{\alpha_B} + (X_0W - L + B - C_B)\cdot\frac{\beta_b{}^2}{\alpha_b}}{Lrt(\frac{\beta_B{}^2}{\alpha_B} + \frac{\beta_b{}^2}{\alpha_h})} \tag{15}$$

Prove: Substituting formulas (11), (12) and $P = S_B\beta_B + S_b\beta_b$ into formula (3) of the joint objective income function, and then deriving B, you can get:

$$\frac{\partial(U_B+U_b)}{\partial_\lambda} = Lrt\cdot\frac{\beta_B{}^2\alpha_b - \beta_b{}^2\alpha_B}{\alpha_B\alpha_b} + L\cdot\frac{\beta_B{}^2\alpha_b - \beta_b{}^2\alpha_B}{\alpha_B\alpha_b} - (X_0W + B - C_B)\cdot\frac{\beta_B{}^2\alpha_b - \beta_b{}^2\alpha_B}{\alpha_B\alpha_b}$$
$$- \frac{[L\beta_B(rt\lambda+1) - \beta_B(X_0W+B) + C_B\beta_B]\cdot\beta_B}{\alpha_B} + \frac{Lrt\beta_b(1-\lambda)\beta_b}{\alpha_b}$$

Make it equal to 0 to get $\lambda^* = \frac{Lrt\frac{\beta_B{}^2}{\alpha_B} + (X_0W - L + B - C_B)\cdot\frac{\beta_b{}^2}{\alpha_b}}{Lrt(\frac{\beta_B{}^2}{\alpha_B} + \frac{\beta_b{}^2}{\alpha_b})}$, and the certificate is completed.

Through the analysis of the optimal allocation ratio, it can be concluded that the influencing factors mainly include the bank's credit line L, loan interest rate r, loan term t, value of goods under electronic warehouse receipt X_0, margin provided by financing enterprises B, bank's cost of disposing goods C_B, and the ratio $\frac{\beta_B{}^2}{\alpha_B}$ and $\frac{\beta_b{}^2}{\alpha_b}$ between the sum of squares of work efficiency of banks, B2B platforms and their own logistics enterprises. When carrying out the online supply chain finance electronic warehouse receipt financing business based on the B2B platform, the B2B platform and its own logistics enterprises hold electronic credit information such as transaction information, logistics, capital flow and supply chain relationship of financing enterprises, which can provide banks with more comprehensive and targeted credit information. In addition, each of them has a relatively mature big data technology, which greatly improves the work efficiency and effectiveness of banks, B2B platforms and their own logistics enterprises, i.e. the values of variables $\frac{\beta_B{}^2}{\alpha_B}$ and $\frac{\beta_b{}^2}{\alpha_b}$ are constantly increasing, while the change range of other conventional influencing factors is relatively small. Therefore, the research on the respective work efficiency and work effectiveness of banks and B2B platforms is of great significance to the impact on the optimal allocation ratio.

Find the partial derivative of λ^* to $\frac{\beta_B{}^2}{\alpha_B}$ and $\frac{\beta_b{}^2}{\alpha_h}$ to get

$$\frac{\partial\lambda^*}{\partial\frac{\beta_b{}^2}{\alpha_b}} = \frac{(X_0W + B - L - C_B - Lrt)\cdot\frac{\beta_B{}^2}{\alpha_B}}{Lrt(\frac{\beta_B{}^2}{\alpha_B} + \frac{\beta_b{}^2}{\alpha_b})^2} \tag{16}$$

$$\frac{\partial\lambda^*}{\partial\frac{\beta_B{}^2}{\alpha_B}} = \frac{(Lrt + L + C_B - X_0W - B)\cdot\frac{\beta_B{}^2}{\alpha_B}}{Lrt(\frac{\beta_B{}^2}{\alpha_B} + \frac{\beta_b{}^2}{\alpha_b})^2} \tag{17}$$

From the formulas (16) and (17), it can be seen that the positive and negative of $\frac{\partial\lambda^*}{\partial\frac{\beta_b{}^2}{\alpha_h}}$ and $\frac{\partial\lambda^*}{\partial\frac{\beta_B{}^2}{\alpha_B}}$ depend on the positive and negative of their molecules $X_0W + B - L - C_B - Lrt$ and $Lrt + L + C_B - X_0W - B$. When $X_0W + B < L + C_B + Lrt$, $\frac{\partial\lambda^*}{\partial\frac{\beta_b{}^2}{\alpha_b}} < 0$ and $\frac{\partial\lambda^*}{\partial\frac{\beta_B{}^2}{\alpha_B}} > 0$, it can be concluded that λ^* decreases with the increase of $\frac{\beta_b{}^2}{\alpha_b}$ and increases with the increase of $\frac{\beta_B{}^2}{\alpha_B}$. When $X_0W + B > L + C_B + Lrt$, $\frac{\partial\lambda^*}{\partial\frac{\beta_b{}^2}{\alpha_b}} > 0$ and $\frac{\partial\lambda^*}{\partial\frac{\beta_B{}^2}{\alpha_B}} < 0$, it can be concluded that λ^* increases with the increase of $\frac{\beta_b{}^2}{\alpha_b}$ and decreases with the increase of $\frac{\beta_B{}^2}{\alpha_B}$.

3 Empirical Analysis

In order to better study the impact of model parameters changes on the model parameters established under the joint credit model, we use MATLAB simulation software to carry out numerical analysis on some parameters, and can more intuitively observe the change trend of the corresponding parameters. The parameters are now assigned based on work experience and research results([6]).

At present, the annual interest rate of loans provided by banks to enterprises is generally between 6% and 7%, where r=6.5%. The loan term is generally 3 months to 1 year, with value t=1. In order to reduce the risk, the bank will control the pledge rate to be low, generally at 50%-70%, with value C=60%. Since the realisation rates of goods will vary, the value here is W=70%. Assuming that the total loan amount is L=100, the margin is generally 10%-20% of the loan amount, which is calculated as 12%, and the value is B=12. $X_0 \approx 154.67$ can be calculated by formula $L = (X_0 + B) \times C$. In combination with the logistics costs, taxes and management fees incurred by enterprises in selling goods, the bank's disposal costs of goods when the financing enterprises are overdue are calculated here according to 10% of the goods value, $C_B = X_0 \times 10\% \approx 15.47$. As the effectiveness, effort level and work efficiency of banks, B2B platforms and their own logistics enterprises cannot be directly obtained, set $\beta_B = 0.7, \beta_b = 0.6$, $S_B = 0.7, S_b = 0.6$, $\alpha_B = 0.7, \alpha_b = 0.6$, and after all the parameter values are set, study the impact on other parameters according to the change of one parameter, and the following relationship charts can be obtained:

(i) The dynamic relationship between the optimal distribution ratio λ^* with $\frac{\beta_B{}^2}{\alpha_B}$ *and* $\frac{\beta_b{}^2}{\alpha_b}$ of banks

Substituting the set parameter value into formula (15) to obtain:

$$\lambda^* = \frac{6.5\cdot\frac{\beta_B{}^2}{\alpha_B}+2.88}{6.5\cdot\frac{\beta_B{}^2}{\alpha_B}+3.9}, \lambda^* = \frac{4.55+4.8\frac{\beta_b{}^2}{\alpha_b}}{4.55+6.5\frac{\beta_b{}^2}{\alpha_b}}$$

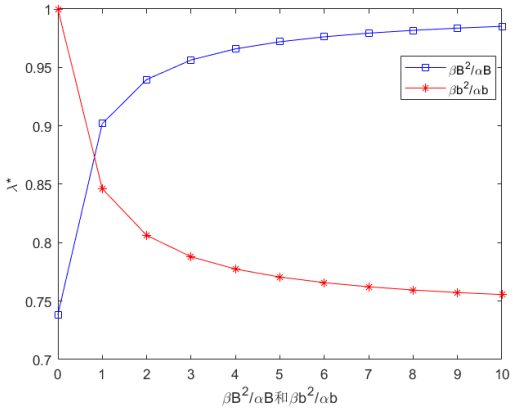

Fig.1. Dynamic graph of λ^* and $\frac{\beta_B{}^2}{\alpha_B}$、$\frac{\beta_b{}^2}{\alpha_b}$.

Fig.1. shows the change of the optimal allocation ratio λ^* of the bank under the joint credit line with $\frac{\beta_B{}^2}{\alpha_B}$、$\frac{\beta_b{}^2}{\alpha_b}$. It can be seen from fig.1. that λ^* decreases with the increase of $\frac{\beta_b{}^2}{\alpha_b}$ and increases with the increase of $\frac{\beta_B{}^2}{\alpha_B}$. Therefore, the bank can reduce its own revenue allocation proportion, give more credit review and decision-making power to the B2B platform and its own logistics enterprises, and further improve the enthusiasm of the B2B platform and its own logistics enterprises and the accuracy of credit review, and increase the probability of repayment due from financing enterprises, which is consistent with Conclusion 2.

(ii) Dynamic relationship between optimal distribution ratio λ^* and B2B platform $\frac{\beta_b{}^2}{\alpha_b}$ under different goods realization rate W.

Substituting the set parameter values and W=0.69, 0.70, 0.71 into the formula (15) respectively to obtain:

When W=0.69, $\lambda^* = \frac{4.55+3.25\cdot\frac{\beta_b{}^2}{\alpha_b}}{4.55+6.5\cdot\frac{\beta_b{}^2}{\alpha_b}}$; when W=0.70,$\lambda^* = \frac{4.55+4.8\cdot\frac{\beta_b{}^2}{\alpha_b}}{4.55+6.5\cdot\frac{\beta_b{}^2}{\alpha_b}}$; when W=0.71, $\lambda^* = \frac{4.55+6.35\cdot\frac{\beta_b{}^2}{\alpha_b}}{4.55+6.5\cdot\frac{\beta_b{}^2}{\alpha_b}}$.

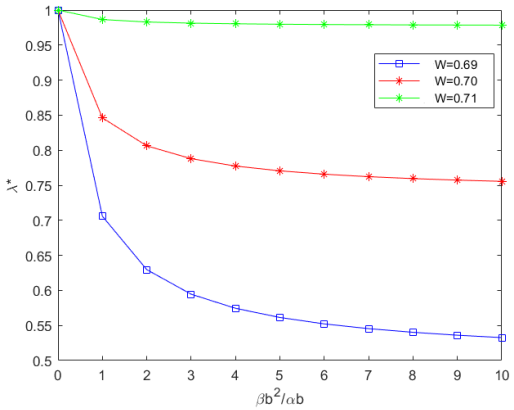

Fig.2. Dynamic relation diagram of optimal allocation ratio λ^* and $\frac{\beta_b{}^2}{\alpha_b}$ under different goods realization rate W.

Fig.2. shows the change trend of the optimal allocation proportion λ^* with $\frac{\beta_b{}^2}{\alpha_b}$ under different goods realisation rates W. It can be seen that the change trend of the optimal allocation ratio λ^* with $\frac{\beta_b{}^2}{\alpha_b}$ will be different when the goods realization rate W takes different values. The changing range of the value of λ^* is sensitive to the influence of the value of W. Improving the goods realization rate W under the warehouse receipt can win more dominant power for the bank in cooperation, reduce the risk and improve the revenue. Therefore, the banks can put forward higher requirements for the goods under the warehouse receipt, allowing the self-operated logistics enterprises of the B2B platform to select some goods with the characteristics of value preservation, easy preservation, good circulation and low price fluctuation.

(iii) Dynamic relationship between optimal allocation ratio λ^* and B2B platform $\frac{\beta_b{}^2}{\alpha_b}$ under different margin B

Substituting the set parameter values and B=10, 13, 16 into the formula (15) respectively to obtain:

When B=10, $\lambda^* = \frac{6\cdot\frac{\beta_b{}^2}{\alpha_b}+4.55}{6.5\cdot\frac{\beta_b{}^2}{\alpha_b}+4.55}$; when B=13, $\lambda^* = \frac{4.55+5.8\cdot\frac{\beta_b{}^2}{\alpha_b}}{6.5\cdot\frac{\beta_b{}^2}{\alpha_b}+4.55}$; when B=16,$\lambda^* = \frac{4.55+6.4\cdot\frac{\beta_b{}^2}{\alpha_b}}{4.55+6.5\cdot\frac{\beta_b{}^2}{\alpha_b}}$.

Fig.3. reveals the changing trend of the optimal distribution ratio λ^* with $\frac{\beta_b{}^2}{\alpha_b}$ under different margins. It can be seen that when the margin provided by the financing enterprise is different, the change trend of the optimal allocation ratio λ^* with $\frac{\beta_b{}^2}{\alpha_b}$ will also be different, and the change range of λ^* value is sensitive to the amount of margin. Therefore, when negotiating with the financing enterprises, the banks should allow the financing enterprises to provide higher security deposit or lower goods pledge rate to reduce the risks. At the same time, the banks can also reduce the dependence on the B2B platform and its own logistics enterprises for credit, and can also play a role in preventing the moral risks of the B2B platform and its own logistics enterprises.

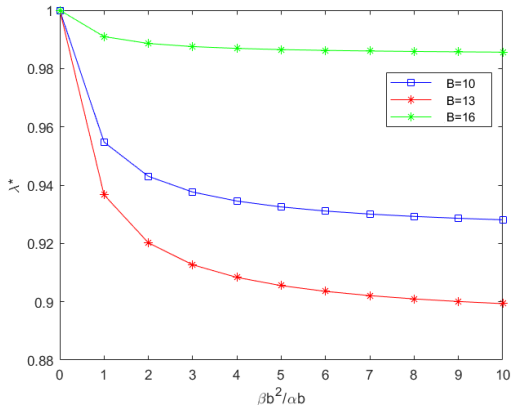

Fig.3. Dynamic relationship between optimal allocation ratio λ^* and $\frac{\beta_b{}^2}{\alpha_b}$ under different margin *B*.

4 Conclusion

Conclusion 1: Under the joint credit review model, in the process of online supply chain finance electronic warehouse receipt financing business between banks and B2B platforms, the bank's optimal effort level is directly proportional to the total loan revenue, the bank's revenue allocation ratio and the bank's cost of disposing the goods under the warehouse receipt, and inversely proportional to the value of the goods under the warehouse receipt, the margin level and the realized rate of the goods. The optimal effort level of the B2B platform is directly proportional to the total revenue of the loan and inversely proportional to the revenue allocation ratio of the bank.

Conclusion 2: In the actual process of doing business, it actually exists under the condition of $X_0W + B < L + C_B + Lrt$. Because if $X_0W + B > L + C_B + Lrt$, even if the financing enterprise fails to repay when due, the bank can cover the loss of bank loans, disposal fees and capital costs through the income and security obtained from disposing the goods under the warehouse receipt, and the banks, B2B platforms and their own logistics enterprises do not need to review and supervise the financing enterprise, so this situation generally does not exist in reality. Therefore, it can be concluded that λ^* decreases with the increase of $\frac{\beta_b{}^2}{\alpha_b}$ and increases with the increase of $\frac{\beta_B{}^2}{\alpha_B}$. The improvement in the efficiency and effectiveness of the bank credit review will increase the value of $\frac{\beta_B{}^2}{\alpha_B}$, and the value of λ^* will increase. The increase in the value of λ^* will reduce the revenue of the B2B platform, which will result in the B2B platform and its own logistics enterprises not willing to pay more efforts, and ultimately reduce the probability of successful recovery of bank loans.

Similarly, the improvement in the efficiency and effectiveness of credit review work of the B2B platform and its own logistics enterprises will lead to an increase in the value of $\frac{\beta_b{}^2}{\alpha_b}$, and the value of λ^* will decrease. The decrease in the value of λ^* indicates that the revenue distribution ratio of the B2B platform will be increased, which can mobilize the enthusiasm of the B2B platform and its own logistics enterprises and further improve the level of effort.

With the rapid development of big data and cloud computing, the value of $\frac{\beta_b{}^2}{\alpha_b}$ will be further increased, and the B2B platform and its own logistics enterprises will have more say and decision in the process of credit review to obtain more benefits. Therefore, banks can reduce their own revenue allocation ratio to motivate the B2B platform to pay more efforts, thus reducing their own credit risk.

Acknowledgement

This work is supported by the project of Liaoning Province Educational Department(2021JDW005) and Liaoning Provincial Federation Social Science Circles (023lslybkt-022).

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