

Benefits balance mechanism of network finance based on e-commerce platform

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Abstract

Information asymmetry is one of the main reason which leads to the financing difficulties of small and medium enterprises (SMEs), while network financing based on e-commerce platform can reduce information asymmetry degree and provide a new approach for SMEs to solve their financing difficulties. In this article, we built some games model based on the theories and methods of game theory to analysis profit distribution and Nash Equilibrium of each participant in e-commerce financing, and we differ the finance model into accounting-based lend and network finance based on e-commerce platform. The results show that the introduction of e-commerce into financing can play a positive role in increasing the financing scales of SMEs, reducing the risks of bank, and enhancing the value-added service of e-commerce platforms. There is also an optimal solution about profit distribution, thus achieving a win-win outcome for all stakeholders.

Keywords: network finance, e-commerce platform, SMEs, game analysis

1 Introduction

Difficulties in financing is a major problem plagued the development of SMEs whom less own assets, less own funds. Besides, a longer period of receivables, slower cash flows cause much more difficulties for SMEs engaged in e-commerce. However, these SMEs engaged in e-commerce are also different from the traditional characteristics of SMEs: information is relatively transparent. E-commerce is good at mastering the static and dynamic information of the SMEs accompanied with them, including the results of operations and financial condition. The basic thought of network finance based on e-commerce platform model is: the bank control capital, e-commerce obtains information of SMEs and monitor the use of lend, combine the advantage of bank and e-commerce to supply finance service.

In this article, the differences of new network finance based on e-commerce platform and accounting-based lend were analyzed based on repeated game model, as well as the effect of network finance based on e-commerce platform on promoting banks, SMEs and e-commerce. Different from the previous article, we regard the bank and e-commerce as a separate subject and discussed the profit distribution and risk sharing between bank and e-commerce after game analysis. The remainder of this paper organized as follows. The next section explains the principle characters of network finance based on e-commerce platform, which are also the main characteristics different from the accounting-based lend, and draw the mode chart of this new finance model. Game analysis section outlines our analysis about the two different finance model based on Game Theory. Analysis of the balance of interests and risk sharing are presented in section benefits balance mechanism part. The last section concludes.

2 Principle section

2.1 THE CHARACTERISTICS OF NETWORK FINANCE BASED OF E-COMMERCE PLATFORM

Informational advantages are one of the most important superiorities in network finance. E-commerce can collect information about SMEs' operations and financial condition from e-commerce financing platform, so it plays an important role in network finance. Banks and investors can acquire more real related information form e-commerce financing platform with less time and cost, so it can improve financing efficiency greatly. Cooperated with e-commerce, the lenders can expand their financial sales quickly with less financial risks. We define the characteristics of network finance based on e-commerce platform as follows:

2.1.1 Systemic

Systemic is characterized by purpose, relevance and integrity. Meanwhile, e-commerce provide is a combination of logistics, information delivery, cash flow etc, and these constitutes are organic connected with each other. The whole system has clearly elements of input, process and output, which has the ultimate goal of improving value-added services of e-commerce and promoting the competitiveness of participants.

2.1.2 Rational participants

The utility function of enterprise depends not only on its own decision but also the others according to Game Theory; a player's optimal strategy must be the best strategy after

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thinking counterparty's best strategy. It means that bank will chose corresponding strategy according to the SMEs' strategy. Because the cooperation between SMEs and e-commerce service providers is continuously ongoing, long-time relationship should be thought carefully. Thereby the participants will be more rational.

2.1.3 Uncertainty

There are more participants of network finance based on e-commerce platform and the evaluation process is more complicated. In most cases, modeling operation analyzed by computer led to the possibility of information being artificially adjusted. Besides, insufficient quantity and low quality of information will make a negative influence on evaluation result. In addition, complex evaluation method and modeling anglicizing pattern are easily to be used by malicious borrowers. These will lead to the uncertain evaluation results.

2.2 OPERATION MODE OF NETWORK FINANCE BASED ON E-COMMERCE PLATFORM

Less information asymmetry make network finance based on e-commerce platform distinguish from the accounting-based lend. General models of network finance based on e-commerce platform are: (1) SMEs produce information during operating and apply loan to meet the needs of projects; (2) e-commerce and banks deal with applications together, banks share the information, profits and risks with e-commerce platform; (3) banks lend money to SMEs who meet the their loan obligations; (4) in the whole process, e-commerce platform play a major role in monitoring the use of loan until SMEs return it. In this game analysis, we define the bank and e-commerce as a whole, the combination of bank and e-commerce is principal, and the SME is agent. The model of the combination as the picture shows.

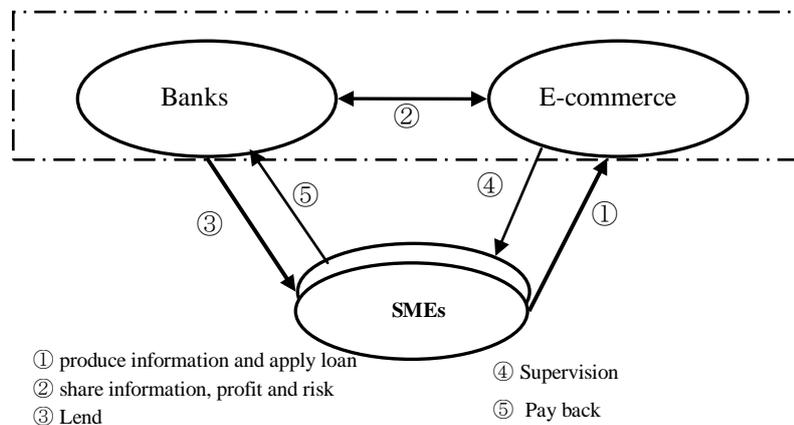


FIGURE 1 Network finance based on e-commerce platform model

3 Game analysis section

3.1 GAME ANALYSIS OF ACCOUNTING-BASED LEND

Banks cannot know exactly about the quality of the project and chance of success because information asymmetry, all they can do is making a subjective judgment. We assume that there is a project which needs capital L , and loan from bank is the only way to meet the needs of project; the success rate is P , then the probability of project failure is $1-P$; bank has to spend F accessing each loan application and earns $(R-F)$ if project succeed; while if fail, bank would loss $-(L + F)$. Fixed interest rate has no influence on different financing models. Yield of the project is β ; SMEs earn $(P\beta L-R)$.The form of accounting-based lend as follow

Table 1 Analysis of accounting-based lend

		SMEs	
		Keep word	Default
Banks	Receive	$(R - F, P\beta L - R)$	$(-L - R, P\beta L + L)$
	Refuse	$(-F, 0)$	$(0, 0)$

We can conclusion that the Nash equilibrium in this game model is $(0, 0)$, i.e. bank choose "refuse" strategy and SME is "default" strategy, which is same with real phenomenon that banks in favor of large enterprises and discrimination against SMEs; meanwhile, those SMEs who get the loan always use it not contract, what's more, many SMEs try their best to delay repaying loan.

On the basis of game theory, the bank will choose strategy according to expected rate of return, just as we analysis in another article, $P > L/(L+R)$ is the requirement of positive strategy of bank. It means that bank will receive the loan application of SME only when the success of project P over $L/(L+R)$. The Bayesian equilibrium point is $P < L/(L + R)$, it means that the bank refused loan application; besides, loan interest rate is important element which affects the bank's lending strategy, and bank always take the way of raising interest rate for SMEs to reduce losses.

3.2 GAME ANALYSIS OF NETWORK FINANCE BASED ON E-COMMERCE PLATFORM

Compared with accounting-based lend, the banks have stronger impact on SMEs' behavior in network finance

based on e-commerce platform, and we consider the extra opportunity cost in this model. The banks and e-commerce platform work as a combination to supply finance services. We ignore the access fees because it is spontaneous and continuous for e-commerce platform to gather information, and will not be affected by banks' strategy. The game analysis of network finance based on e-commerce platform is in the form 2:

Table 2 Game analysis of network finance based on e-commerce platform

		SMEs	
		Keep word	Default
United	Receive	$(R, P\beta L - R)$	$(L, P\beta L + L - S)$
	Refuse	$(0,0)$	$(0,0)$

We can infer from upon form that the opportunity cost of default will affect the solution of Nash equilibrium.

$$E_1 = P\beta L - R \quad (1)$$

$$E_2 = P\beta L + L - S \quad (2)$$

E_1 : SME's return of keep word

E_2 : SME's return of default

When $(1)-(2)=0$, each strategy of SME is the optimal strategy; if $(1)-(2)>0$, then the equation:

$$-R - L + S > 0 \quad (3)$$

The evaluation of S can be inferred from equation (3), as follows:

$$S > L + R \quad (4)$$

At this time, the return of keep word is more than default.

We conclude that there are two Nash equilibria in this game model, one is $(R, P\beta L - R)$; Another is $(0, 0)$.

If there are two and just two ways of loan, i.e. accounting-based lend and network finance based on e-commerce platform, the bad SMEs; then, we divide enterprises into "good" companies and "bad" companies, and "good" companies choose to repay the loan, "bad" companies choose "default" strategy, the distinction between "good" companies and "bad" companies lies in the operating history and financial condition of SMEs. "bad" companies always choose

the first way, just as our analysis in another analysis. Meanwhile, it is easier to acquire a loan for "good" companies in the second way.

If $S < L + R$, there is only one Nash equilibrium $(0, 0)$. It shows that SMEs will be more careful when they choose the way of network finance based on e-commerce platform because of the great opportunity cost of default. Meanwhile, if $P\beta L - R - S > 0$, i.e., the opportunity cost of "default" strategy: $S < P\beta L - R$, the "bad" company will participate in the network finance based on e-commerce platform.

3 Benefits balance discussion section

Compared with counting-based lending, information model based on the analysis of large data belongs to network finance based on e-commerce platform model. The basic thought of this model: the bank controls capital, e-commerce obtains information of SMEs and monitors the use of lending, combines the advantages of banks and e-commerce to supply finance services. In this model, banks and e-commerce are principals, and SMEs are agents.

As we analyzed previously, banks and e-commerce were analyzed as a whole, and we concluded that network finance based on e-commerce platform expands the scope of services of banks, raises the competitiveness of e-commerce, and increases the SMEs' rate of meeting the standards of banks. In actuality, e-commerce and banks are two independent subjects, which cannot be simple as a whole, one participant would never support another without price. Therefore, there is an important problem in network finance based on e-commerce platform model, which is how to share profits and risks between banks and e-commerce.

There are two common ways to share profits and risks: based on proportion of profits or pay a fixed fee. Based on proportion of profits means the profits were divided based on the proportion of contract, risks do the same way; pay a fixed fee means that banks pay the fixed fee to acquire the applicant's information, and then e-commerce won't undertake any risks.

In the article, we will analyze the first way only. Assume that e-commerce obtains αR , R is the earnings of lenders. The possibility of default is ρ , then $(1-\rho)$ will keep the contracts. We can assume the function relation between α and ρ , as in figure 2.

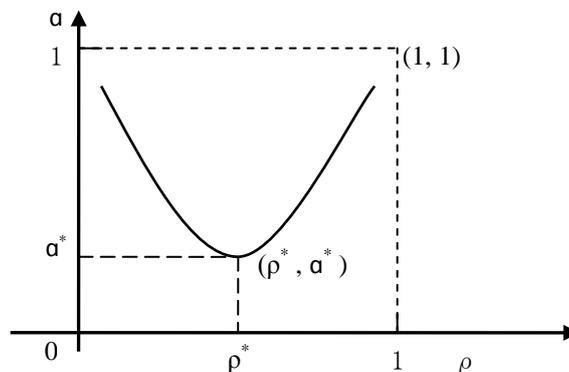


FIGURE 2 The curve of α and ρ

The picture shows that when $\rho < \rho^*$, α will decrease with the increase of ρ ; however, when ρ over the ρ^* , α will increase with the increase of ρ . The reason is high quality related information lead to the results of more good SMEs pass the test, so that less the default loss of banks. However, if ρ bigger and bigger, profit will less and loss will increase, and e-commerce should undertake more responsibility because e-commerce make a negative impact on the evaluation.

In order to simplify the calculation, we assume the function relation between α and ρ :

$$F(\rho) = a\rho^2 + b\rho + c, 0 < \rho < 1; a > 0; a, b, c \in C. \quad (5)$$

In network finance based on e-commerce platform model, borrowers repay principal and interest, so the return of bank is $(1-\alpha)R$; and loss $(1-\alpha)L$ because e-commerce share the risks. We know the total profit of bank is:

$$E(\alpha, \rho) = (1-\rho)(1-\alpha)R - \rho(1-\alpha)L. \quad (6)$$

On both sides of ρ derivative:

$$E'_\rho(\alpha, \rho) = -(2a\rho + b)[(1-\rho)R - \rho L] - (1 - a\rho^2 - b\rho - c)(R + L). \quad (7)$$

Equation (7) can be transferred as follow:

$$E'_\rho(\alpha, \rho) = (aR + aL)\rho^2 - 2aR\rho - [bR + (1+c)(R+L)] \quad (8)$$

It can be inferred from the equation above that the density function of bank's profit is a parabolic curve about ρ . Then we calculate the second derivative of equation (6).

$$E''_\rho(\alpha, \rho) = 2(aR + aL)\rho - 2aR. \quad (9)$$

Define $E''_\rho(\alpha, \rho) = 0$, then:

$$0 = 2(aR + aL)\rho - 2aR, \quad (10)$$

$$\rho = \frac{R}{L + R}. \quad (11)$$

If $\rho_1 < R/(L+R)$, $E'_\rho(\alpha, \rho)$ is a decreasing function of ρ , and vice, $E'_\rho(\alpha, \rho)$ is an increasing function of ρ_1 . Besides, we get the evaluation of ρ^* from equation (8) that:

$$\rho^* = \frac{aR + \sqrt{a^2R^2 + (aR + aL)[bR + (1+c)(R+L)]}}{aR + aL}. \quad (12)$$

Another solution of equation (6) is:

$$\rho = \frac{aR - \sqrt{a^2R^2 + (aR + aL)[bR + (1+c)(R+L)]}}{aR + aL} < 0. \quad (13)$$

We confirmed that the equation (12) is the only reasonable solution and $0 < \rho^* < 1$.

We analysis the solutions about those equations, a diagram of density function $E'_\rho(\alpha, \rho)$ can be described as follow:

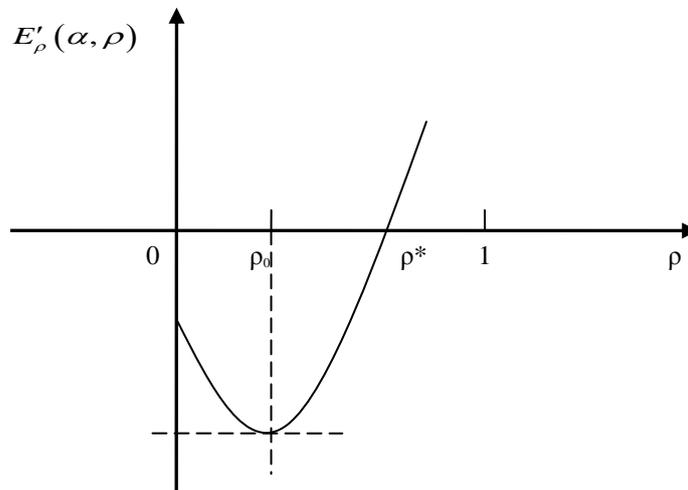


FIGURE 3 Diagram of density function $E'_\rho(\alpha, \rho)$

Then a conclusion can be inferred from the figure3 that $\rho^* > \rho_0 = R/(L+R)$, i.e. banks can receive the rate of default over $R/(L+R)$, and we infer the answer of equation (5) is α^* . Therefore, existing the optimal solution which maximize the return of banks, which is (α^*, ρ^*) , meanwhile, the evaluation of ρ is impacted by the function relation between α and ρ . Similarly with accounting-based lend, the return and strategy of bank also affected by interest income R in network finance based on e-commerce platform.

4 Conclusion

E-commerce normal development and bank's flexibility credit system is the key to network finance based on e-commerce platform. The opportunity cost of default plays an important role in decreasing the motivation of default in network finance based on e-commerce platform and decided by the relationship between e-commerce platform and SMEs. Therefore, e-commerce should improve the compe-

titiveness of the platform, and enhance bonding capacity with SMEs. Meanwhile, e-commerce should develop an appropriate loan supervision and punishment mechanism to protect the safety of loan without influencing the continued viability of SMEs. As to banks, under the network finance based on e-commerce platform model, banks expand their size of loans with less risk, however, they should also actively develop new lending model to improve the flexibility of the loan and take advantage of a variety of third-party advantage to develop appropriate financial services. Besides, the profit distribution and risk sharing between banks and e-commerce platform should be analysis careful to less loan loss and strengthen the cooperation of bank and e-commerce platform.

E-commerce and SMEs reflects the coordinated development of the two sides, interrelated, mutual benefit, mutual adjustment, co-evolution of symbiotic state, banks and e-commerce also do so. All participants are pursuing their

own profit maximization, whether e-commerce or SMEs, or banks. In this paper, different models of finance were analyzed to study the impact of the e-commerce for lending between banks and SMEs, the risk sharing and profit distribution also were discussed. The results proved that way of network finance based on e-commerce platform is an important way to solve the financing difficulties and there is an optimal solution of profit distribution between banks and e-commerce, which also the solution of risk sharing.

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