

Financing Difficulties of Small and Medium-sized Enterprises: Analysis Based on Game Theory Model

Jie Mu

Wuhan Technology and Business University, School of Management.

Wuhan 430065, Hubei, China

290963100@qq.com

Keywords: Financing Dilemma, Game Theory Model, Small and medium-sized enterprises.

Abstract. Small and medium-sized enterprises (SMEs) are relatively small in scale, irregular in operation, poor in risk resistance and weak in repayment of bank loans. It is common for enterprises to use short loans for a long time and repay old loans for new ones. Many small and medium-sized enterprises set up false financial information to deceive a large number of investors and financing banks, resulting in the misinvestment and loss of a large amount of capital in society. The low performance rate of SMEs has resulted in a large number of bad debts and bad debts in banks. The non-performing loans of SMEs in financing banks are still high. For banks that pay attention to economic benefits, they are not inclined to provide loans for SMEs. In short, SMEs are in a disadvantageous position in the financing process. This paper uses game theory in economics to analyze SMEs' financing behavior, so as to find out the solutions and measures to SMEs' financing.

1. Introduction

Since the reform and opening up, the development of small and medium-sized enterprises in China has received unprecedented attention, and has achieved considerable development. Some unique functions of small and medium-sized enterprises in economic operation, such as acting as the engine of economic growth, creating employment opportunities and optimizing and adjusting industrial structure, are recognized by all walks of life in China. According to relevant statistical data, in 2005, China's small and medium-sized enterprises accounted for 50% of GDP, 46% of tax revenue and 62% of exports. More than 90 enterprises in China are small and medium-sized enterprises, but due to various factors, small and medium-sized enterprises have encountered many difficulties and obstacles in the development process, among which financing difficulties have become the primary bottleneck restricting the development of small and medium-sized enterprises.

At present, the prominent problems in the development of small and medium-sized enterprises are lack of funds and poor financing channels. Financial institutions are the main financing channels for SMEs. Because of their weak foundation, small and medium-sized enterprises have few funds, and private financing channels are not smooth. The main source of funds is still loans from financial institutions. In addition, mortgage and guaranteed loans are also the main ways of SME loans [2,3]. At the same time, the credit difference between SMEs is becoming more and more obvious. Banks pay more attention to SMEs with good operation results. For SMEs with development potential, but the current situation is not ideal, they lack the identification ability, which makes such enterprises neglected. As for those small and medium-sized enterprises with poor efficiency, even if they apply to banks for loans, they will not be able to obtain loans because they do not meet the conditions. This paper uses game theory in economics to analyze SMEs' financing behavior, so as to find out the solutions and measures to SMEs' financing.

2. Game Analysis of Financing Difficulties

2.1 Complete Information Static Game

This game means that there is no information asymmetry between the players in the game. Everyone has a complete understanding of the information of the other party in the game. In this

game, each player of the game chooses his own action when he knows the other party's action (Table 1).

Table 1 Complete Information Static Game

		Small and medium-sized enterprises		Small and medium-sized enterprises			
		Keep promise (T)	Break faith (F)	Keep promise (T)	Break faith (F)		
Bank	Loan (Y)	(I,C)	(-I,I)	Bank	Loan (Y)	(I,C)	(-I,I)
	No loan(N)	(-L,0)	(0,0)		No loan(N)	(-I,R)	(0,0)

In the static game of complete information, when SMEs learn that banks agree to lend to themselves and choose to lend (Y), they will make a decision of dishonesty (F) in order to gain more benefits (I) for the sake of maximizing utility ($I > C$). However, due to the symmetry of information, banks fully understand the information of SMEs, so they choose not to lend (N) to avoid losses (I). The Nash equilibrium of the game is (N, F), and the profit is (0, 0).

As can be seen from Table 1, when banks choose not to lend (N), if SMEs choose to keep their promises (T), the benefits will be zero, which seriously hampers the enthusiasm of the trustworthy enterprises and tends to lose their promises. In view of this situation, the government should take certain incentives to enable SMEs with good credit records to obtain certain income even if they have not received enterprise loans. We will record this part of the income as (R), and then get a new game matrix table.

2.2 Complete Information Dynamic Game

Table 2 Complete Information Dynamic Game

		Small and medium-sized enterprises		Small and medium-sized enterprises			
		Keep promise (T)	Break faith (F)	Keep promise (T)	Break faith (F)		
Bank	Loan (Y)	(I,C)	(-I,I)	Bank	Loan (Y)	(I,C)	(-I,I)
	No loan(N)	(-L,0)	(0,0)		No loan(N)	(-L, R)	(0,0)

Complete information dynamic game means that the actions of both players are successive, and the latter actor can observe the actions of the first actor before acting (Table 2):

One is that SMEs act first, choose to keep their promises (T) or fail to keep their promises (F), and then banks act. If SMEs choose to be trustworthy (T), under the condition of symmetrical information, banks will choose to lend (Y), and they will not give up the chance of profit (L). If SMEs choose to lose faith (F), banks will choose not to lend (N), thus avoiding losses (I), SMEs will lose financing opportunities. Therefore, SMEs will choose to be trustworthy (T) when their information is complete. At this time, the Nash equilibrium of both sides is (T, Y), and the income is (C, L).

Another case is that banks take action first, choose to lend (Y) or not to lend (N), and small and medium-sized enterprises take action again. If banks take action first, SMEs will take actions to maximize their own interests according to the bank's decision. When banks choose (Y), small and medium-sized enterprises (SMEs) will choose (F) from their own interests ($I > C$), and (T) to gain (R) when banks choose (N). In the game, we can see that small and medium-sized enterprises have "speculative mentality" and incentives to break faith, and may still break faith. The Nash equilibrium of this matrix is (N, T), and the return of both sides is (-L, R).

2.3 Incomplete Information Game

Under the condition of information asymmetry, banks do not know the credit situation of SMEs, and can only judge the compliance and default probability of SMEs according to their past credit records and credit status. The default rate of enterprises with high credit standing is lower, and that of enterprises with low credit standing is higher. Banks do not know the exact type of credit of SMEs, but they know that the probability of enterprises with high credit standing is (P) and that of enterprises with low credit standing is (1-P). If SMEs belong to enterprises with high reputation, when the enterprise is in compliance with the contract, the net income of the bank is assumed to be (L), the net income of the enterprise is (C), and when the enterprise defaults, the net income of the bank is assumed to be (-I), and the net income of the enterprise is (I).

At this time, the expected return of the bank's choice of loan (Y) is:

$$P L + (-I) (1 - P) = (L + I) P - I \quad (1)$$

The expected return of the bank's choice of non-loan (N) is:

$$P (-L) + 0 (1 - P) = -PL \quad (2)$$

If $(L + I) P - I > -PL$, i. e. $P > I / (2L + I)$, then the bank chooses (Y) to make a profit. On the contrary, choose (N).

From the above game analysis, we can see that:

In the case of complete information, it is unwise for small and medium-sized enterprises to seek the best interests through dishonesty (F). Once small and medium-sized enterprises choose (F), banks will choose (N) according to the enterprise's behavior, so neither side will be profitable. Therefore, in the case of information symmetry, win-win decision-making is enterprise choice (T), bank choice (Y). However, in real life, due to the trader's egoistic psychology and the high cost of information, it is difficult for both parties to achieve complete symmetry of information. Banks do not know about the credit situation of SMEs and have no relevant credit records. Driven by information asymmetry and speculative psychology of SMEs, SMEs either evade bank loans or default on bank loans, thus forming a vicious circle of bank loan reluctance and corporate dishonesty.

From the above analysis, it can be seen that the coexistence of information asymmetry between bank-enterprise game and credit deficiency of small and medium-sized enterprises has caused the financing difficulties of small and medium-sized enterprises, which makes banks too cautious in lending to small and medium-sized enterprises, so that they are unwilling to lend to small and medium-sized enterprises [5]. Therefore, in order to solve the problem of small and medium-sized enterprises loans, we can start from two aspects.

3. Game Analysis of Credit of Small and Medium-sized Enterprises

From the perspective of their own interests, enterprises can choose to be honest and trustworthy after obtaining loans, that is, repay the principal and interest of loans on time, or choose not to be trustworthy and default on loans. If the probability of honesty is p, the probability of dishonesty is 1-p. It is generally believed that the larger the scale of the enterprise, the better the reputation of the enterprise, that is, the greater the probability of honesty P. Therefore, for large enterprises, P is larger, and for small enterprises, P is smaller. This also reflects the serious credit deficiency of small and medium-sized enterprises in our country at this stage. Before providing loans to enterprises, banks should check the target enterprises, and the cost is C. Assuming that the amount of investment required by SMEs is I, and the equity capital of enterprises is W, $W < I$, so enterprises need to borrow money from banks $A = I - W$. Assuming that the profit margin is r when the project succeeds, 0 when the project fails, and the probability of the project succeeds is p1, the expected profit of enterprises investing in the project is $\pi = p1Ar$, and the loan income of banks is R, and $R > c$, $\pi > R$.

3.1 Bank-enterprise game without penalty mechanism

For an enterprise, when a bank accepts an application for enterprise loan, when $p \geq \frac{A}{p_1Ar-R+1-p_A}$, i.e. $p \geq \frac{A}{p_1Ar-R+A}$, the enterprise will choose honesty as its dominant strategy, so $p_0 = \frac{A}{p_1Ar-R+A}$ is a critical value. As compared with large enterprises, the probability of honesty of small and medium-sized enterprises is smaller, often less than p_0 . Only when $p \geq \frac{A}{p_1Ar-R+A}$, enterprises choose honesty, and banks choose to accept is the Nash equilibrium of this game, which is also the result we would like to see. But in real life, we often can not guarantee that enterprises are honest and trustworthy. Therefore, we must introduce some punishment mechanism to make the profits of enterprises' dishonesty far less than the losses of enterprises' dishonesty. In this way, enterprises will automatically choose honesty and trustworthiness in the game with banks, so that enterprises and banks can maximize their own interests.

3.2 Bank-enterprise game with penalty mechanism

Let S be the present value of a series of future losses caused by dishonesty of an enterprise. It includes that an enterprise is isolated because of a dishonesty, and can not obtain loans in future economic transactions, so that it can not engage in production, investment and the reduction of future earnings. So S should be much larger than A , $A-S < 0$. For enterprises, when banks accept enterprise loan applications, because $p \geq \frac{A}{p_1Ar-R_0}$, $1-p_A-S_0$, it is a dominant strategy for small and medium-sized enterprises to be honest and trustworthy, and no one is willing to pay such a large cost for dishonesty. For banks, when enterprises choose honesty, the bank's dominant strategy is to accept corporate loan applications. Therefore, Nash equilibrium exists in this game, that is, enterprises choose honesty, banks choose acceptance and maximize their respective interests.

References

- [1] Zhang Weiyang. Game Theory and Information Economics [M]. Shanghai: Shanghai People's Publishing House, Shanghai Triple Publishing House, 1996.
- [2] Wang Shuzhen. Financing Analysis of SMEs from the Perspective of Bank-Enterprise Game [J]. Journal of Nanjing University, 2007 (06).
- [3] Xu Jibin. Game analysis of SME financing [J]. Enterprise Management, 2011 (08).
- [4] Wang Zhe-ru. Research on the Financing Situation of Small and Medium-sized Enterprises [J]. Securities Investment, 2011 (05).
- [5] Liu Jing. From the perspective of game theory, the financing difficulties of small and medium-sized enterprises [J]. China Market, 2013 (13).