

# Enterprise Financing Modeling Based on Information Asymmetry

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**Abstract:** Information asymmetry is the main problem restricted small and middle-sized enterprises (SMEs) financing. This paper applies fuzzy comprehensive evaluation to design the screening model of SMEs, in order to deal with the issue of information asymmetry. The classical screening theory of Stiglitz, Joseph E and the Z score method of Edward I. Altman are used in the model designing. The model originally builds multi-level screening system, integrated the financial and non-financial indicators. Finally, analysis and evaluation of the screening model indicates that it is benefit to establish new order for the Investment and financing market.

**Keywords:** Screening, Model Design, Information Asymmetry, Fuzzy Comprehensive Evaluation

## 1 Introduction

On the conditions of information asymmetric, more and more scholars had focused on the enterprises financing Since 1980s. Especially to SMEs, by size, transaction costs and other factors, the phenomenon of poor information transparency is particularly acute. In recent years, Chinese scholars had made more research in depth. They had reached a consensus in the academic community, the reason of difficulties for SMEs financing is information asymmetry. Scholars had also made a number of countermeasures, such as advocating the development of small and medium-sized financial institutions from Justin Lin in 2001 and Wang Xiao in 2003; making full use of private capital markets from Guo Bin in 2002 and Li Wei in 2005; the establishment of cooperative financial institutions from People's Bank of China on behalf of Mission in 2002; improving the capital market system from Wang Xuanyu in 2002; the development of venture capital from Chen Naixing in 2001; using the third-party credit information and credit mechanisms from Tang Jianxin in 2007, etc. . However, the diversification of financing methods had not solved the issue of information asymmetry completely. The effective implementation of these measures must be built on the basis of information symmetry and transparency.

Since 1960s, the credit assessment had become the main method to assess corporate credit rating. Estimation-analysis method had been judged as the mainstream of the international academic analysis, the representative models were Altman bankruptcy- prediction models, Chesser credit-forecasting model, Bathory credit-analysis model, the operating assets-evaluation model. However, some SMEs' accounting system and the accuracy of financial data had not been satisfactory. It was useless to apply original models mechanically. Therefore, it is benefit to establish SMEs information screening system.

## 2 Theoretical Bases and Composition of the Screening Model

### 2.1 Theoretical bases of the screening model

Stiglitz, Joseph E who had won the Nobel Prize in Economics for working on the issue of asymmetric information, had proposed "screening" originally in his representative "theory of screening, education and income distribution" (1975), which was the theoretical base for the further research.

Stiglitz believed that there were several mechanisms to make enterprises' private information become public information:

(1) Self-selection mechanism. This was an important way to access to information. In this mechanism, the enterprises had displayed the more prominent feature of their own, especially in the system of rewards and punishment.

(2) Testing mechanism. It had measured the accuracy and reliability of self-screening, in order to avoid the noise impact in the screening process.

## 2.2 Composition of the screening model

The purpose of establishing screening mechanism for SMEs financing was screening out the low-risk financier through quality index of information. In this condition, it was benefit for SMEs to extricate a predicament of "high threshold, trust discount", to provide a good quality environment for the better enterprise.

The screening system had included three levels as fig.1:

The first level was initial screening based on self-selection. The enterprises had showed themselves through the disclosure of private information. And investors could use the financial and non- financial indicators to implement systemic analysis.

The second level was the noise screening. The result of preliminary screening wouldn't be accepted arbitrarily, for the existence of noise. The enterprises were likely to make use of their information superiority in the transmission process to take accounting fraud. Consequently, evaluation of internal and external monitoring mechanism would minimize the impact of noise. And the noise screening was necessary amendments to the results of initial screening.

The third level was Characteristic screening. In recent years, the credit system had improved continued, as well as people's awareness of credit. Accordingly, we should make full use of these supplementary resources in the screening system designing.

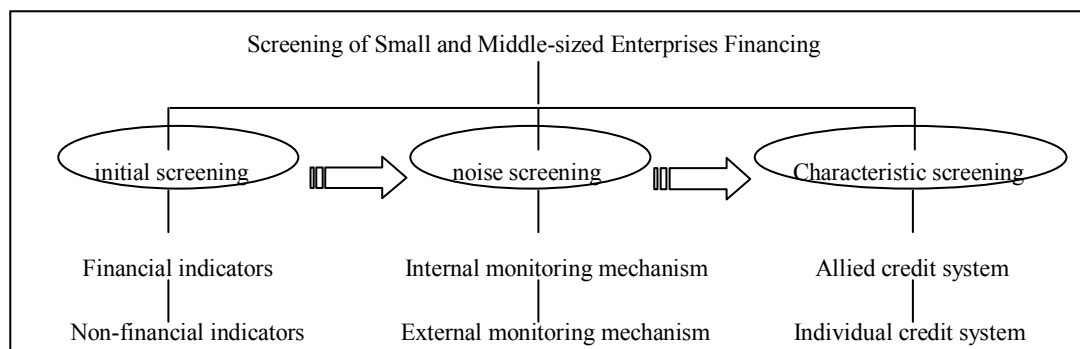


Figure 1 Multi-level screening system

## 3 Designing Steps of Screening Model

### 3.1 The basic assumptions

(1) Object grouping

Research had proved that pooling equilibrium and separate equilibrium were co-existence in the balanced environment. Pooling equilibrium could not exist in market of information asymmetry, so different investors have different investment choices. Assuming that Investment program for  $A\{I, S\}$ ,  $S$  denoted information quality index,  $I$  denoted investment probability. Supposed there were only two types of investment programs  $A_1\{I_1, S_1\}$  and  $A_2\{I_2, S_2\}$ ,  $S_1 \neq S_2$ .

(2)The selection rule (R):

① The possibility and the amount of investment had depended on information quality index.

②  $S \in \{S_1, S_2\}$

(3) Elements

The model based on the aforementioned three major levels and seven indexes. Of course, there were many other factors also have an impact on SMEs financing, such as the potential development of

enterprises, screening costs etc., we had just neglected these factors in this research.

### 3.2 Model elements

#### (1) Determining credit risk and credit limit

Preliminary screening had been adopted to identify credit risk and credit limit through the Financial and non-financial indicators. The research based on well-known value of Z score method advanced by Dr. Edward Altman in 1968. He had observed bankruptcy and non-bankrupt enterprises in the United States, and had taken 22 financial ratios for the selection of mathematical statistics. Finally, he had determined the 5 best indicators of financial ratios to calculate Z score in order to measure credit risk and credit limit.

$$Z=0.71X_1+0.847X_2+3.10X_3+0.420X_4+0.998X_5$$

$X_1$  = operation capital / total assets;

$X_2$  = retained earnings / total assets;

$X_3$  = EBIT / total assets;

$X_4$  = total stockholders' equity / total liabilities;

$X_5$  = revenue / total assets

In order to evaluate more objectively, two non-financial indicators had been added.  $X_6$  denoted the management capacity, to be subjective judgments by team spirit, management decision-making speed, ability to staff participate and enterprise culture.

$X_7$  denoted the growth of capacity.

$X_7 = g_1 * \text{the growth rate of net assets} + g_2 * \text{the growth rate of operating profit} + g_3 * \text{the growth rate of sales} + g_4 * \text{the growth rate of total wages}$

In this model, the seven variable value( $X_1$ 、 $X_2$ 、 $X_3$ 、 $X_4$ 、 $X_5$ 、 $X_6$ 、 $X_7$ ) remains unchanged, but new weights( $a_1$ 、 $a_2$ 、 $a_3$ 、 $a_4$ 、 $a_5$ 、 $a_6$ 、 $a_7$ ) would be given when necessary, the formula was:

$$Y=a_1X_1+a_2X_2+a_3X_3+a_4X_4+a_5X_5+a_6X_6+a_7X_7$$

$$= \sum_{i=1}^7 a_i X_i \quad (1)$$

#### (2) Evaluation of the internal monitoring

Internal control system was an important part of corporate governance, including Board of Supervisors, Audit Committee, and the Internal Audit Department. This system could not only maintain balance of the board and management, management and other functional departments, but also improve the financial system and change the bad habits of information disclosure through evaluation and supervision. And the internal audit reports would amend the risk degree of obtaining the investment in formula (1).

#### (3) Evaluation of the external monitoring

The research of risk degree in investment was based on the evaluation of financial indicators. So the authenticity and accuracy of the financial indicators was essential. Due to the relatively objective position of external audit, what kind of conclusion that the external audit made was significant to reduce the noise effect in the financial evaluation. In addition, the credibility of external audit should also be taken into account.

#### (4) Monitoring of allied credit system

The multi-information-sharing system could provide the integrated credibility of the enterprises, which was very useful for the investors to evaluate the financing and operation status. Meanwhile, it was necessary to link to personal credit system, because the credit record of managers was an important supplement to SMEs credit.

### 3.3 Model frame

Fuzzy comprehensive evaluation method was the method using the idea of fuzzy mathematics to make an overall evaluation of the multi-factor restricted object. Screening model on SMEs financing was

based on the fuzzy comprehensive evaluation method, combined with financial and non-financial indicators, used internal and external monitoring system to amend the evaluation factors, and taken the allied credit system and the credit rating index as the necessary supplement. The model as follows:

$$S=(b_iB+c_iC) Y + d_1M_i + d_2M_j$$

Combined with formula (1), the model can be defined as follows:

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$$S=(b_iB + c_iC)(\sum_{i=1}^n a_iX_i) + d_1M_i + d_2M_j$$

Assumptions:

- (1) Selecting a different value to B in accordance with the integrity of internal control system and internal audit opinions.  $B \in [0,1]$  ( $B=1$ , when the monitoring system was sound and internal audit issued the unqualified opinion;  $B=0$ , when the regulatory system was inadequate or internal audit issued the negative opinion).
- (2) Selecting a different value to C according to the external audit opinion,  $C \in [0,1]$  ( $C=1$ , when the external auditors issued the unqualified opinion;  $C=0$ , when of the external auditors issued negative opinion).
- (3)  $\text{Max}\{b_i+c_i, 1\}=1$ ,  $b_i$  and  $c_i$  for weights;
- (4) Determining the values of  $M_i$  by the score of allied credit system,  $M_i \in (0,1)$ ;
- (5) Determining the values of  $M_j$  by the score of individual credit system,  $M_j \in (0,1)$ ;
- (6)  $d_1, d_2$  respectively denoted the weight to the quality index of allied credit system and individual credit system.

## 4 Analysis and Evaluation of the Screening Model

### 4.1 Model Analysis

According to the basic assumptions, the research had only focused on two types of investment programs,  $A_1 \{I_1, S_1\}$  and  $A_2 \{I_2, S_2\}$ . Supposed  $A_1, A_2$  were particular,  $S_1$  denoted the maximum to the index of information quality,  $S_2$  denoted the minimum to the index of information quality.

(1) If  $W_1$  denoted a SME, and the corresponding investment program for  $A_1 \{I_1, S_1\}$ , the process of screening was as follows:

With the private information of  $W_1$ , in the step of Initial Screening, the calculated value of  $Y_1$  was greater than the threshold, indicating that the enterprise had operated properly. The noise screening had showed that the enterprise's internal and external monitoring mechanisms were efficient, and the information was authentic and fair ( $B=1, C=1$ ). Few noises represented that the results of first step was more believable. Meanwhile, credit rating system also had shown a higher level of credibility to  $W_1$ .

Therefore, the three parts of the screening results had proved that  $W_1$  was the best quality of the information, so that the probability of investment acquisition ( $I_1$ ) was the highest.

(2) If  $W_2$  denoted another SME, and the corresponding investment program for  $A_2 \{I_2, S_2\}$ , the process of screening was as follows:

In Initial Screening, the calculated value of  $Y_2$  was less than the threshold, indicating that the operating result was dissatisfied. The external monitoring mechanism had found that the existence of a more serious distortion of information and ineffective oversight of the problem ( $B=0, C=0$ ). In addition, credit rating system had shown a lower level of credibility to  $W_2$ .

Considering the results of three screening completely, the index of information quality to  $W_2$  was the minimum, so that the probability of investment acquisition ( $I_1$ ) was the lowest. The unsatisfactory index was probably due to inefficient fund management, inadequate governance structures, poor reputation etc.

(3) It was worth noting that the actual situation was not as simple as the assumptions. In reality, the

financiers' situation would be more intricate, value of  $S$  was between the range of  $S_1$  and  $S_2$ , and leading to more investment programs.

Using 0-1 mode to reflect the results of several screening,  $A_1$  was the ideal program, for all the scores of three-step screening were excellent. And  $A_2$  was the most unsatisfactory program, for its poor performance in all aspects. In actual practice, more situations were between the ranges, which could be summarized into eight major cases in the table 1.

**Table 1 Eight Major Cases of Screening in 0-1 Mode**

Program	Initial screening	Noise screening	Characteristic screening	Composite Index
$A_1$	1	1	1	3
$A_3$	0	1	1	2
$A_4$	1	1	0	2
$A_5$	1	0	1	2
$A_6$	1	0	0	1
$A_7$	0	0	1	1
$A_8$	0	1	0	1
$A_2$	0	0	0	0

Note: Initial screening: 1 - good financial condition, 0 - poor financial situation

Noise screening: 1 - little effect of the noise, 0 - serious effect of the noise

Characteristic screening: 1 - better credit standing, 0 - worse credit standing

For these cases, the former model was still applicable, and the elements and steps of screening were unchanged. To the investors, the model could help determine whether to invest and the amount of investment. To the financiers, the model could be useful to find their own deficiencies and prescribe the right remedy, in order to make improvements and enhance the competitiveness of financing.

#### 4.2 Model evaluation

Although the SMEs investment and financing market was in the booming, some SMEs still could not get away from the financing difficulties. The reason was the selection mechanism of mutual-trust and mutual-benefit hadn't established. The information screening model had built a bridge for the investors and financiers. It was great benefit to solve the problem of asymmetric information.

(1) For the SMEs of higher index, the screening model was a "rights" model.

First, the financing costs had reduced. In the screening mechanism, SMEs of the higher index could try to avoid adverse selection, and would not have to raise interest rates for financing as the lower ones. It was not only a return for the symmetry, but also reduced the financing costs.

Second, credibility had been reflected objectively. Most people had the stereotypes to SMEs that the small scale companies would be poor credibility and low index. In fact, plenty of SMEs were not lack of good business reputation. Therefore, the information screening mechanisms would safeguard the rights of those enterprises.

(2) For the SMEs of lower index, the screening model was a "relief" model. Under the screening model, chances would be no place, all the SMEs had to find their own deficiencies and make improvements.

For the favor of investors, on one hand, they should enhance the credibility and reduce the default risk. On the other hand, they should improve the corporate governance structure, and make the necessary disclosure to avoid reverse choice.

(3) For investors, the screening model was a "dialectical" model.

First, choose transparent. The reason that the investors had taken adverse selection was they faced with

the unknown groups. While under the screening model, information of different enterprises could be quantified and compared. For the more transparency information, investors could make a positive choice, according to their own needs and characteristics of the financing.

Second, risk minimization. With the transparency of information, the choice of investors would be much objective and fair. Generally, the SMEs of higher index would win the favor of investors. If the financiers were competing to improve the quality of the information, the probability of moral hazard would decline rapidly. In addition, the performance capacities of higher index enterprises were satisfactory, and the default risk would also be maintained at a lower level.

In conclusion, application of the screening model would change the original "lemon market". For the financiers' accurate and timely disclosure of private information, investors could better grasp the market and make an objective choice. Due to the improvement of Symmetric information, the original adverse selection and moral hazard had been reduced probability. In conclusion, the financing of SMEs would enter into virtuous circle.

## 5 Conclusion

In this paper, the Model on Screening of SMEs Financing was much operational and innovative. It had not only selected the financial and non-financial indicators, but also brought Noise Screening and Characteristic Screening to the model. However, due to the restrictions of industry characteristics and supervision standards, it is necessary to promote a wider-depth research to obtain more detailed information, what will be the future research work.

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