Financial Early Warning Model of Listed Companies: An Empirical Study of Y-Score Model

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Abstract: This paper is based on the experience of financial crisis of Listed Companies in China. By studying the principal component analysis method of operational research, the y-score model of early warning mode of financial recruitment of listed companies, and through the sample indicators selected in this study, it preliminarily determines the evaluation area of financial situation of enterprises and predicts financial crisis for enterprises. A scientific and feasible prediction method is provided.

1. Introduction

With the deepening of China's opening to the outside world and the reform of its economic system, especially since China's accession to the World Trade Organization, competition among enterprises has become increasingly fierce, and financial crisis has led to increasing operational difficulties. Even businesses go bankrupt or go bankrupt. There are many reasons for the emergence of financial crisis in enterprises, but financial risks gradually appear and deteriorate, and it is impossible to suddenly appear. It is the so-called "dyke of thousands of miles, collapse in ant cave". When the financial system is in normal operation, it is necessary to monitor the financial operation process of enterprises, compile and follow up the comprehensive analysis of the financial indicators data of enterprises, and put forward early warning signals. It is necessary to inform users of the potential risks that enterprises will face. In order to avoid or mitigate the damage to enterprises, appropriate means and measures are taken. Therefore, enterprises, especially listed companies, must establish an early financial early warning model.

2. Research Background and Literature Review

2.1. Research Background

With the development of marketization and internationalization of China's economic environment, enterprises are facing increasing financial risks. Due to the occurrence of financial risks, the number of problematic enterprises and bankruptcy liquidation enterprises is increasing. Enterprises, especially stakeholders of listed companies, pay more attention to financial risks and respond with several lists. Correspondingly, some individual financial indicators are used to forecast the financial crisis and to send out early warning signals. It is effective to analyze the single variable index, but its function is limited. (1) Different analysts draw different conclusions on the most important forecast indicators. (2) Long-term single-scale analysis may tell you that the company has encountered difficulties or future difficulties, but you can not more clearly prove that your company has encountered difficulties or future difficulties. (3) The conclusion drawn from the analysis of the proportion of individual indicators may be influenced by some factors such as inflation. (4) When the company's managers realize that the company is facing financial crisis, they need to modify accounting reports and financial indicators in most cases to cover up the company's actual financial situation. The main purpose of this paper is to develop a meaningful financial forecasting model[1].

2.2. Literature review

Since the 1960s, many western economists have thoroughly explored the early warning model of

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corporate financial failure. However, the Z-score model was proposed before 1968, so the number of Z-score models (66, 33 interests, 33 losses) is less. The choice of financial indicators also has great limitations (without considering cash flow indicators, etc.). As a result, many researchers have criticized this method as empiricism without any logical basis.

At home, due to the impact of the development of China's securities market, there is little research on the early warning of financial deterioration of listed companies. So far, the F-score model (Zhou Shouhua, 8 accounting research questions, 1996) modifies the Z-score model by updating the indicators and expanding the sample size: Pan Ju, Cheng Xiaoke, Zhu Chunshan, etc. Principal component analysis (PCA) in statistics is introduced into financial forecasting model by using principal component forecasting model. Although these models have certain feasibility, rationality and effectiveness, there are still many shortcomings, mainly reflected in the following aspects: First, the sample selection of listed companies is insufficient. The influence of industry factors is not taken into account. For example, they only considered ST companies of that year and chose 80 listed companies (40 ST companies and 40 non-ST companies). Secondly, the selection of financial indicators is insufficient. Considering only the financial ratio indicators in the performance evaluation system of industrial and commercial enterprises in the “Rules for the Performance Evaluation of State-owned Capital” compiled by the Ministry of Finance of China, the application of these indicators is not the case for enterprises in financial distress. Very effective, failed to highlight the financial crisis of enterprises, especially in cash flow. The purpose of this paper is to overcome these shortcomings and re-select indicators to build a new model[2].

2.3. Research ideas

The general research ideas of this paper are as follows. Firstly, a specific method is used to determine the research sample. Then choose to determine financial indicators based on this. Thirdly, SPSS statistical software is used to perform principal component analysis. Finally, I will make a model to test. As shown in Figure 1.

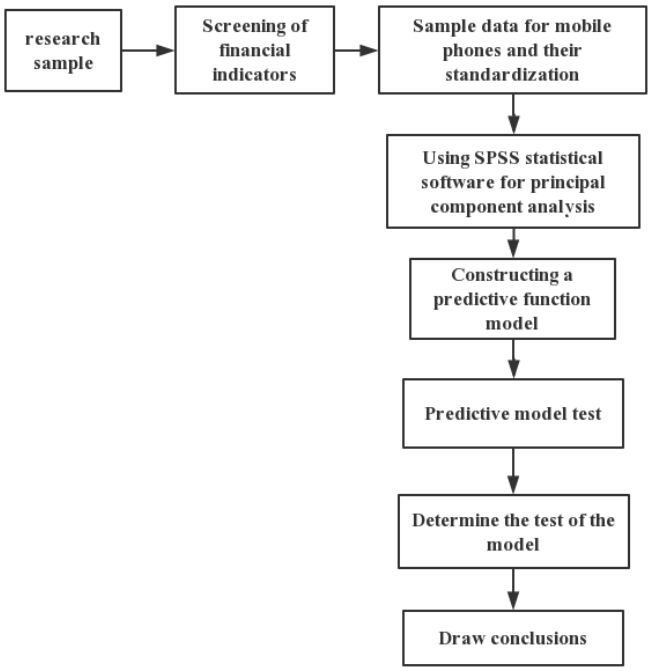

Fig.1. General research idea

3. Selection of Research Samples

The sample data in this paper are mainly from the Guangda database Daguan 2000 published by

Beijing Huizhi Excellent Development Co., Ltd. in May 2000. Other supplementary data are from the CD-ROM database of Beijing Huizhi Science and Technology Daquan 1997-1999. Because of the limitation of data source and reliability, the research sample can only come from listed companies. Due to the insufficient development of China's securities market and the scarcity of bankrupt companies, we can only define ST companies in listed companies as “financial crisis” or “financial failure” for the time being. Here, the selection criteria of 67 financial crisis sample companies are: 1. In 1999, ST companies (41 families); 2. Non-ST companies in 1999, but in 2000, they became ST companies (26). Non-financial crisis, i.e. financial “health” company, is selected according to the corresponding industry departments of ST company. Considering the good situation of financial indicators and experts'opinions, 67 sample companies are selected. The measurement data of the sample in the model are all the financial indicators (abbreviated stock names and codes) of 1999. Among them, 39 ST companies belong to the industrial sector (25 ST companies in 1999 and 14 ST companies in 2000); 4 public utilities (2 in 1999 and 2 in 2000); 9 integrated sectors (6 in 1999 and 3 in 2000); 4 real estate sectors (2 in 1999 and 2 in 2000); and 10 commercial sectors (5 in 1999). According to the same industry distribution quantity standard, 67 non-ST companies were selected. The distribution of selected sample companies is basically in line with the distribution of Listed Companies in China, with industry as the leading factor, covering all listed companies except the financial industry, which has strong representativeness[3].

4. Determination of Financial Ratio Index

Based on the references in previous studies, this paper will study the salient characteristics of insolvent enterprises (debt can not be paid). Considering the actual situation of China's listed companies, 12 financial ratio indicators are selected as the starting point of the survey, such as solvency, profitability, cash flow ability and development ability. Specific indicators such as F::

(1) Quick ratio: (2) Profit ratio: (3) Interest guarantee ratio: (4) Debt guarantee ratio: (5) Total cash/liabilities of project activities: (6) Total asset profit ratio: (7) Sales cost ratio: (8) Accounts receivable turnover ratio: (9) Inventory turnover ratio: Growth rate of major undertakings. (1) Capital maintenance rate: (2) cumulative profitability.

Through a series of analysis and testing, we find that these indicators can effectively reflect the financial crisis faced by enterprises. 1. “Interest Guarantee Ratio” is a good indicator to identify financial crisis enterprises in mature capital markets. However, the time of capital market development is relatively short, many businesses are not very long: many norms, listed companies frequently distribute stocks, most bank deposits and financial costs become negative, the impact of this indicator, therefore, these listed companies formulate; and, some ST enterprises because interest and tax are negative, so there are many. Loans will also lower the index. Therefore, since the index of the sample company does not go in the same direction, it is not used. 2. “Receivable turnover rate” and “inventory turnover rate”. In the case of imperfect capital market in China, there are many related transactions between parent company and subsidiary company, which have a serious impact on the credibility of these two indicators. At the same time, there are great differences between the two indicators in the industrial and commercial sectors, such as the two indicators do not have these two indicators. Because of the possibility of comparison, let go. 3. “Capital Maintenance Rate”, an indicator of state-owned enterprises, I think it is impossible to emphasize the financial crisis faced by enterprises. Now, in order to improve the vitality of China's stock market, China has implemented the strategy of reducing state-owned shares, but this is not suitable for development. 4. The remaining eight indicators are used in the following analysis because of their excellent recognition ability.

These eight indicators are as follows.(1) Fast Ratio (F), also known as acid test rate, is an effective indicator to measure the short-term hydrochloric acid test rate of enterprises. It is important to pay attention to the important indicators of creditors, especially short-term creditors. (2) Self-capital ratio (F2): This is an important indicator reflecting the long-term financial situation of enterprises. (3) Debt Guarantee Ratio (F:): This is the Cash Flow Rate Index, which is hardly used in China at present. Baber is one of the most effective data for financial experts to predict financial

crisis in the United States. Measuring cash flow generated by enterprises is an important indicator of debt repayment. This is a very convincing index. At the same time[4], excessive accounts receivable will have an impact on the financial situation of enterprises. If this index is applicable to the original database of the model, it will show a very good illustrative effect. (4) Cash/Total Liability Ratio (F4) of Business Activities: This is also an aspect of cash flow. The ratio index of main business capability of listed companies is tested. Considering the short history of China's securities market, the authenticity of corporate cash flow has a great impact. An index can solve this problem well and persuasively. (5) Rate of return on total assets (F): a proportional index reflecting profitability. (6) Cost management ability and management level of enterprises can also be measured, so it has strong persuasion. (7) The growth rate of major business (F): belongs to the growth capacity of enterprises. This shows the ability of enterprises to withstand market risks and the possibility of major business growth. (8) Accumulated Benefit (F:): It reflects the proportion of profit surplus to the total assets of an enterprise. This index is applicable to the original sample, because the margin of profit surplus can represent the credit record of the enterprise, and its explanatory ability is very remarkable. Empirical research in this paper proves that these eight indicators reflect the economic difficulties of enterprises and have strong discrimination ability.

5. Results and Analysis of Empirical Research

5.1. Principal component analysis

The following is a sample group of enterprises (134fmm) using SPSS statistical software to analyze the 1999 financial proportion data of major components[5].

Table 1 Financial ratio correlation coefficient

	F1	F2	F3	F4	F5	F6	F7	F8
F1	1.00	0.55	0.18	0.06	0.36	0.22	0.09	0.48
F2	0.55	1.00	0.01	0.04	0.58	0.30	0.12	0.89
F3	0.18	0.01	1.00	0.54	0.14	-0.01	0.02	0.05
F4	0.07	0.04	0.54	1.00	0.13	0.07	0.02	0.07
F5	0.36	0.58	0.14	0.13	1.00	0.24	0.30	0.72
F6	0.22	0.30	-0.01	0.07	0.24	1.00	0.03	0.25
F7	0.09	0.12	0.02	0.02	0.30	0.06	1.00	0.19
F8	0.49	0.90	0.05	0.07	0.72	0.25	0.19	1.00

The following conclusion can be deduced from frontal 1. (1) All eight financial indicators show positive correlation. Except for the case that the correlation coefficient between debt guarantee and profit margin of sales cost is 0.001, the correlation coefficient between other indicators is greater than 0, and the above eight financial ratios are basically the same trend. (2) From the point of view of correlation coefficient, the correlation between self-capital ratio and cumulative profitability is relatively high, and the correlation coefficient is 0.889. The correlation coefficient between total assets profit margin and cumulative profit margin is 0.721, which indicates that the past earnings, long-term debt solvency and current earnings are highly correlated. The correlation coefficient of other financial indicators is less than 0.5.

Characteristic values and contribution tables of each principal component can also be obtained from the results of principal component analysis (Table 2)[6].

Table 2 Main component eigenvalues and contribution rates

main ingredient	Contribution rate (%)	Eigenvalues	Cumulative contribution rate (%)
1	38.46	3.07	38.46
2	19.07	1.52	57.54
3	12.50	1.00	70.04
4	10.87	0.87	80.92
5	8.23	0.66	89.20
6	5.58	0.44	64.79
7	4.26	0.34	99.05
8	0.97	0.23	100.00

The cumulative contribution rate is 89.207%, and the principal component factor M = 5. That is to say, five principal components are used to replace the original eight financial ratio indicators, which contain 89.207% of the original information. To explain these five factors, we need to obtain eight original financial ratio indicators for these five main components. Factor loading a (i.e. the correlation coefficient between the original index and the principal component factor).

The following conclusions can be derived from the factor load matrix. 1. The main component X is mainly composed of F2, Fs and F. These three financial ratios and exchange rate indicators, factor load and other indicators of these three indicators. Now and in history, it shows the ability to pay and the profitability of enterprises[7].

5.2. Major component x

It is mainly explained by two financial ratio indicators F and F. Because the factor load of these two indicators is much larger than that of other indicators. This represents the ability to repay the cash flow of debt.

Because the main component X is mainly explained by the financial proportional index F, the factor load of the index is much larger than that of other indicators. This shows the development potential and growth ability of enterprises.

The main component X is mainly composed of F. Because this financial ratio index is explained, the factor load of the index is much larger than that of other indexes. This represents the profitability of an enterprise expressed by the profit margin of sales cost.

Principal Component X; because it is mainly explained by the financial proportional index F, the factor load of the index will be much larger than other indicators. This is the short-term solvency of the enterprise.

5.3. Establishment and analysis of prediction model and evaluation area

According to the contribution rate of the main components in Table 2, financial crisis prediction can be made for listed companies.

$$Y = 0.3847X + 0.1908X2 + 0.1251X + 0.1088 \text{ x } 0.0828Xs \quad (1)$$

The model is used to classify 134 original samples. When the forecast value Y = 0.5, 59 non-ST companies exceeded this value, accounting for 88% of 67 companies in this category: 57 ST companies were below this value, accounting for 85% of the total 67 companies in this category. The results are not 100% satisfactory, but considering that non-ST companies are arbitrarily selected according to the same sector of ST companies: at the same time, ST companies are not all “financial failure” companies, some ST companies are restructuring and restructuring, and the financial indicators of these companies are unstable, that is, the sample companies we choose merge with each other. This is not a typical bipolar company, so we come to these conclusions[8].

Y > 1. Areas that are very safe for financial situation

1 > Y > 0.5 is the area of financial security.

0.3 is the grey area of financial situation

0.3 > Y > 0 is the area of financial failure.

0 > Y. Areas with severe deterioration of financial situation

6. Conclusion

According to the above analysis of the main components, on the basis of forecasting whether the financial crisis will occur in listed companies, we can draw the conclusion that the Y-score model has strong reliability. If you use this model to predict the financial proportions of listed companies continuously and dynamically, then pay attention to the direct trend of analysis and prediction, development and change. It has a stronger love for the field[9].

Establishment of model and summary analysis of sample testing process. The model has the following advantages.

The sample selected is reasonable and general, basically representing the overall situation of

China's stock market, and the choice of non-ST and ST enterprises is the same.

The original financial ratio index selected in the model has strong explanatory ability, and can better distinguish between financial crisis companies and non-financial crisis companies. Especially the current flow rate (debt guarantee ratio and cash/total liability ratio of commercial activities) and the selected ratio of cumulative profitability indicators are not concerned by previous researchers.

The selection method is scientific and can also be implemented. Principal component analysis (PCA) is a scientific statistical method. With the help of SPSS and other statistical analysis software, the prediction becomes simple and feasible, and has strong operability.

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