An Empirical Study on Financial Early Warning of Chinese Petrochemical and Plastic Manufacturing Listed Companies

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Abstract: The petrochemical and plastic manufacturing listed companies were took as the research objects and the Logit model was adopted in the paper, the five years' data before these companies' special treatments were analyzed. Putting the cash flow index and the traditional financial index in the same position, the research has a good effect. Moreover, the accuracy of forecasting doesn't increase as the special treating year approaching, but it has a decreasing tendency in the previous four years.

Key Words: Manufacture; Financial early warning; Empirical analysis; Logit model

1 Introduction

Up to the end of the third quarter of 2010, there are a total of 2166 listed companies in China. Among them, 232 listed companies have special treated. It is obviously that one over ten of the listed companies in the position of the financial difficult in China. This undoubtedly will bring loss for the investors, creditors, employees and other stakeholders. It also will bring tremendous obstacles for social economy development. Therefore, the research for the financial crisis warning attracted many scholars and they made many useful results. But most previous researches didn't consider the characteristics of various industries and took all listed companies for sample to analyze. Moreover, many past researches selected the traditional finance indicators and cash flows indicators respectively.

In the former research on financial crisis, most studies selected sample companies from the overall the listed company, and constructed finance early warning model by traditional financial indexes. These traditional indexes which can directly respond debt paying ability, operating capacity, profitability and development capability mainly generate according to the balance sheet and profit statement. The earliest research about financial distress can be traced back in the early 1930s.Fitzpatric (1932) carry on a research of 19 companies by using financial ratios respectively, and discovered that the ratio of net profit/shareholders' equity and shareholders' equity/Liabilities have highest discriminative capability[4]. Beaver (1966) investigated the anticipation capability of 30 traditional financial ratios in the first one to five years before Enterprise sinking into the financial distress and discovered that the accuracy of the ratio of working capital / total liabilities respectively reach 87%, 79%, 77%, 76% and 78% five years before the distress[3]. Altman (1968) chose five marked variables form 22 traditional Financial Indicators, and construct multiple discriminate models[1]. Ohlson (1980) set up a conditional probability model by traditional variables and got good results, the accuracy of anticipation reached to 96.12% [5]. With further research, some scholars added cash flow indexes to analysis the financial distress based on the traditional indicators and they usually selected the sample companies from industry-wide. Aziz and Lawson (1989) put cash flow indicators into early-warning pattern and discovered that cash flow variables could predicted most bankruptcy case two to three years before bankrupting[2].

In China, the research about financial distress began in the late 1980s. Wu Shi Nong and Huang Shi Zhong (1986) once introduced the variables for bankrupt analysis and anticipation pattern of financial distress[8].Chen Jing(1999) studied 27 pairs ST company with the same size and industry, chose traditional indicators such as asset-liability ratio to discriminate analysis by unit and multivariate variable, and obtained accuracy rate of 100% and 85% one year before the announcement of special treatment [7].Wu Shi Nong and Lu Xian Yi(2001) took 70 pairs listed companies as objects and selected 21 traditional financial indicators to carry on univariate analysis, multivariate analysis, and logit regression analysis respectively. Discovered that logit prediction model has lowest error rate. The false positives of previous year before special treatment is only 6.47%.Identification of the first five years are higher, respectively 93.53％,84.29％,76.26％,73.17％,55.56％[9].There are also some researches took the target of other financial indicators or particular industry for empirical analysis. On the basis of the traditional indicators ,Zhou Sou Hua and Yang Ji Hua(1996) added cash flow index of (net income - depreciation) / total liabilities, expanded the sample size , modified the Z model and built F score model[6]. Zhang Ming (2005) tried to add two cash flows indicators on the base of traditional financial indicators, but the cash flow didn't enter in the model[10]. By selecting financial indicators ,Zhou Yong

Mei (2008) built model Z to pass the authentication of the stage characteristics of manufacturing companies which were verified to have financial crisis[11]. Zhou Yun (2009) used cash flow indicators to analyze the financial position of listed company, and found that indicators of cash flow have better identification advantage than traditional indicators[14].

This paper put the cash flow indexes and the traditional financial indexes in the same position to analyze the data .We expect to set an early-warning pattern matching the characters of petrochemical and plastic manufacturing industry.

2 The Selection of the Sample Source and Research Methods.
2.1 Data source
Since each industry has the characteristics of each industry, there are not the same characteristics of the possibility of financial crisis. There is little research of manufacturing industry such as petrochemicals, plastics, plastic and so on, which are the most important raw materials industrial. So far, no scholar researched these aspects of financial early warning of such enterprises. Considering that this industry is very important for national economy, so it is very necessary to research this industry. According to the category of SFC, petroleum, chemical, plastic manufacturing industries are selected in this article as the research objects. Sample Companies are selected from the listed companies of the first ST and operating more than five years. And the recent consecutive five years were not special treated. The number of relevant data is from the National Tai-financial database. In the selective process, exclusion the companies less than 5 years and the financial indicators data are incomplete. Finally we get 25 special treated companies and 117 pairs listed companies with normal financial status. It is equivalent to study the total of all sectors eligible, so it could avoid the result of the randomness of sampling from matching.
2.2 Indicators selection
Traditional indicators measure the financial situation of enterprises from the perspective of accrual basis. While cash flow indicator examine the actual situation of the enterprises financial from the angle of cash basis. In the aspect of measure the business situation of enterprises, they are both indispensable, and also complementary to each other. Therefore, the two financial indicators should combine to be examined in the financial early warning system. In the aspect of selects of indexes, authors directly selected from the traditional financial indicators to emerging financial indicators. Among them, Zhou Sou Hua, Yang Ji Ping (1996) building F model is based on traditional financial indicators and added the cash flow targets of (net profit after tax - depreciation) / average total debt. But he did not take the indicators of cash flow as the same status of traditional indicators. With the development research of the financial early warning, authors gradually used cash flow indexes instead of the traditional indicators .And the traditional indicators gradually began to be ignored. This paper based on comprehensive study of traditional indicators and cash flow indicators. We selected the financial indicators that are suitable to predict the companies of petrochemical, plastic manufacturing companies in financial crisis. On the basis of previous literature, we chose these financial indexes as follows: dependent variable Y(If ST, Y=1,Otherwise Y=0), cash flows ratio(X1), rate debt security(X2), recovery rate of all the asset cash(X4), Net cash flow from operating activities per share(X5), Net Cash Flow Per Share(X6), Cash Ratio(X7), Asset-Liability Ratio(X8), Interest Coverage Ratio(X9), Ratio of Debt to Equity Market(X10), Current Assets Turnover rate(X11), Fixed Asset Turnover(X12), Operating Margin(X13), Ratio of EBIT to Assets(X15), ROE(X16), The Operating Cost Ratio(X17), Capital Maintenance and Appreciation(X18), Total Assets Rate of Growth(X19), Growth in the Net Assets(X20), The Growth of Operating Receipt rate(X21).
2.3 The pattern
A lot of methods in the former searches mainly include qualitative analysis and quantitative analysis. And the quantitative analysis has the unit factor model and multiple discriminant analysis models. Multivariate model include multiple linear function, artificial neural network, Lambda index method, Logit model. Previous studies show that the multivariate model is superior to single-variable model.

Logit model does not require variables to the multivariate normal distribution, and so the premise of covariance and the forecasts are high accuracy. So the author choices Logit model as research methods, according to Logit method, set up of the pattern is as follows:

$$Ln[(1 - P_i) / P_i] = \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + C$$

Among them, Pi Means the probability of company i enter to the finance predicament, the value of the companies in financial distress is 1,others the value is 0.X is financial indicators in the table, The C is a constant in the model ,also is the model intercept column.

3 The empirical analysis and result

After picking and getting rid of the company, we chose the companies like petroleum, petrochemical and plastic industry to comprehensively analyze. As some companies still have some missing values in different years, it causes the number of subjects still slightly different in each year. Under the study, we put cash flow indexes into the model firstly. Then we gradually add the traditional financial indicators into model and use backward selection method .The results in this way are much better than other methods. Finally we get finance pattern of each year in the following Table 1, and results of discrimination in the Table 2.

Table 1 Empirical Analysis and Result

Year	Model
T-1	$L \, n[(1 - P_i)/P_i] = -93.242 X_1 + 168.110 X_3 - 2.694 X_6 + 18.991 X_8 - 0.897 X_9$ $+5.496 X_{10} + 1.634 X_{11} + 0.916 X_{12} + 0.230 X_{20} - 25.656$
T-2	$L \, n[(1 - P_i)/P_i] = -27.865 X_3 + 3.894 X_4 - 0.535 X_9 + 388.034 X_{14}$ $-355.694 X_{15} - 5.288 X_{18} + 6.052 X_{19} - 0.375 X_{20} + 2.809$
T-3	$L \, n[(1 - P_i)/P_i] = -2.924 X_5 + 2.942 X_{10} + 18.920 X_{13} - 101.958 X_{14}$ $+26.084 X_{16} + 3.135 X_{18} - 8.250 X_{19} - 2.307$
T-4	$L \, n[(1 - P_i)/P_i] = -5.024 X_1 + 4.407 X_7 + 15.274 X_8 - 2.366 X_{10} - 0.801 X_{12}$ $-47.824 X_{13} + 220.745 X_{14} - 215.373 X_{15} + 11.205 X_{16} + 8.001 X_{19} - 6.007$
T-5	$L \, n[(1 - P_i)/P_i] = -47.239 X_2 + 77.995 X_3 + 6.094 X_7 + 15.808 X_8 - 0.251 X_9$ $-5.278 X_{10} - 2.035 X_{12} + 14.059 X_{13} + 22.945 X_{17} - 4.771 X_{18} + 3.089 X_{21} - 16.556$

Table 2 Original Value and Prediction

Original value		Predictions		
		Whether ST		Percentage Correct
		No ST	ST	
T-1	No ST	101	0	100
	ST	1	21	95.5
	Overall percentage			99.2
T-2	No ST	101	5	95.3
	ST	10	15	60
	Overall percentage			88.5
T-3	No ST	107	4	96.4
	ST	11	14	56.0
	Overall percentage			89.0
T-4	No ST	108	3	97.3
	ST	12	13	52.0
	Overall percentage			89.0
T-5	No ST	106	3	97.2
	ST	6	17	73.9
	Overall percentage			93.2

4 Conclusions

From table1, we can see that the anticipation accuracy of the pattern is different. This shows that the financial crisis in the first five years, ever year has its own application model. We can also see the accuracy of high pattern come to a 99.2%; the lowest accuracy also reaches to 88.5% and explains the total effect of pattern is very good. From table 3-1, we can also find that X_3 (all the assets of the cash recovery rate), X_8 (asset-liability ratio), X_9 (interest coverage), X_{10} (debt and equity market ratio), X_{12} (fixed asset turnover), X_{13} (operating margin), X_{14} (EBIT to assets ratio), X_{19} (total asset turnover) all appeared three times, indicating that these indicators have more discrimination capability than other indicators.

We can see from the table 2, the year before of finance crisis, discrimination effect reaches 99.2%. This can be explained in financial difficulties based on the previous financial situation. Can also explain that, the indicators and methods we chose are highly desirable, error rate is only 0.08%.

Moreover we can discover, for the fifth year, the discrimination effect up to 93.2% ,while the forecast results of fifth year ,the fourth year, the third year and the second year is a decreasing trend, Which just opposite to other literature. I guess this reason may be these companies have been aware of the condition of some distress and take actions in the fifth year of the financial trouble. Such as business efforts, and even modified baking in the financial statements, these are worthy of further study.

Because of the history of the establishment of listed companies of China is short, this paper selected only five years of data to periodically analyze. So it is less comprehensive in terms of periodic characteristics. In addition, in the aspect of the last four years, the conclusion effects is not increasing but decreasing. It is contrary to other literature. This paper just analyzed the reasons from the qualitative aspects, but did not have systematic study. This paper also only considered the financial indicators and it didn't take non-financial indicators into account, such as macroeconomic indicators, market share index, the indicators of corporate governance etc.

Reference

[1] Altman E. Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy[J]. Journal of Finance, September 1968:589-609

[2] Aziz A., D. Emanuel and G. Lawson. Bank Prediction: An Investigation of Cash Flow Based Models[J]. Jouma1 of Management Studies.1988 (25):419—437

[3] Beaver W. H. Financial Ratios as Predictors of Failure[J]. Journal of Accounting Research, 1966:71-111

[4] Fizpatrick P.J. A Comparison of Ratios of Successful Industrial Enterprises with Those of Failed Firms [J]. Certified Public Accountant, 1932

[5] Ohlson J. A. Financial Ratios and the Probabilistic Prediction of Bankruptcy [J]. Journal of Accounting Research, 1980 (Spring): 109-131

[6]Zhou Sou Hua, Yang Ji Hua. Early Warning Analysis of Financial Crisis— F Fraction mode [J].Accounting Study, 1996 (08):8-11 (In Chinese)

[7] Chen Jing. Empirical Analysis of Listed Companies for the Anticipation of Financial Deterioration [J]. Accounting Research, 1999:(04)31-38 (In Chinese)

[8] Wu Shi Nong, Huang Shi Zhong. The Analysis Indicators and Forecast Indexes of Bankruptcy of the Enterprise[J]. Economic Issues in China 1986, (6) (In Chinese)

[9] Wu Shi Nong, Lu Xian Yi. The Forecast Model of Financial Distress of the Listed Companies in China [J]. Economic Research Journal, 2001, (6) (In Chinese)

[10]Zhang Ming, Chen Tao. Dynamic Finance Distress Prediction for Listed Companies in China [J]. Journa1 of Finance and Economy, 2005, (01):62-70 (In Chinese)

[11] Zhou Yong Mei, Zhao Kai Long. The Empirical Research on the Characteristics of the Financial Crisis Phase in Listed Companies [J]. Journal of Shandong Institute of Business and Technology, 2008, (02):58-61 (In Chinese)

[12] Zhang Hua Lun, Sun Yi. Financial Precaution Analysis for Listed Company--An Empirical Study Based on Cash Flow [J]. Business Economics and Administration, 2005, (12):58-63 (In Chinese)

[13] Dong Xin. On Financial Crisis Alarm of Chinese Mechanical Manufacturing Enterprises Based on Cash Flow [J]. Business Economy, 2008, (7):65-67 (In Chinese)

[14]Zhou Yun. Empirical Study of the Financial Early Warning Based on Cash Flow Index and Factor Analysis [J]. Communication of Finance and Accounting, 2009, (12):65-66 (In Chinese)