Financial Crisis Early Warning of Listed Companies Based on Information Disclosure Fraud

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Abstract: At the same time of rapid development, listed companies in China are also facing financial risk constraints at all times. The existence of financial risk not only has a negative impact on the survival and growth of Listed Companies in China, but also may cause huge economic losses to stakeholders. This paper studies the financial crisis early warning of listed companies based on information disclosure fraud, gives the theoretical analysis of financial risk early warning and information disclosure fraud of listed companies, and elaborates the specific process of financial risk early warning modeling based on information disclosure fraud. The financial risk early warning model of information disclosure fraud studied in this paper can meet the financial security requirements of enterprises.

1. Introduction

The financial status of listed companies is closely related to the survival and development of enterprises, and the management of finance is the basis of the management of enterprises. The financial status of listed companies runs through all the economic activities of enterprises. Every link of purchase, production, operation, sales, warehousing and logistics of enterprises cannot be separated from the reflection and regulation of the financial status of enterprises. The financial risks of listed companies will bring huge obstacles to the survival and development of enterprises, but also will make stakeholders bear huge losses, which will even hinder the development of our market economy. Therefore, whether managers, investors and creditors of listed companies, they are eager to pay attention to the existence of financial risks in related enterprises. However, the traditional financial analysis method is limited to a single enterprise, and cannot find rules from a large number of objective data, and provide a higher accuracy of early warning methods. This paper studies the financial crisis early warning of listed companies based on information disclosure fraud, gives the theoretical analysis of financial risk early warning and information disclosure fraud of listed companies, and elaborates the specific process of financial risk early warning modeling based on information disclosure fraud.

2. Financial Crisis Early Warning of Listed Companies Based on Information Disclosure Fraud

2.1 Financial Risk Early Warning Model Based on Information Disclosure Fraud

With the accumulation of data and the development of statistics, the idea of statistics is gradually applied to financial risk early warning. At first, based on the related research of financial risk early warning of information disclosure fraud, it used a single financial index to predict whether the listed company has bankruptcy risk. In the 1960s, American scholar Atman constructed a well-known model of information disclosure fraud by using multivariate analysis method, as shown in Formula (1):

$$IE = DataS\{D1, D2, D3, D4, D5\} \quad (1)$$

“IE-DIS” information disclosure fraud model is the earliest and widely used research results in the field of empirical research on financial risk early warning. Among them, when the calculated IE value is less than 1.8, it will indicate that listed companies have bankruptcy risk. Five variables of financial indicators are involved in the model of information disclosure fraud, among which D2, D3 and D5 are all financial indicators reflecting the profitability of listed companies. D2 is the ratio of accumulated retained earnings to total assets; D3 is the ratio of pre-interest and pre-tax profits to total assets; D5 is the ratio of sales revenue to total assets. D1 reflects the financial indicators of the short-term solvency of listed companies. The calculation method is the ratio of working capital to total assets. D4 reflects the financial indicators that measure the capital structure relationship of Listed Companies in the early stage. The calculation method is the ratio of owner's equity and market value to total liabilities. “IE-DIS” is the first method to measure the financial risk of listed companies by investigating various financial indicators. It has important theoretical and practical significance. At the same time, the accuracy of “IE-DIS” in the domestic environment can be around 65%. The theoretical model of financial risk early warning based on information disclosure fraud is shown in Figure 1.

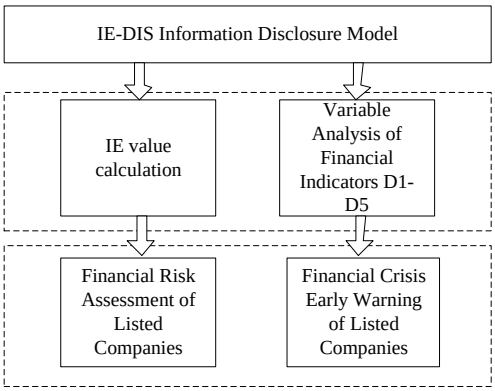

Figure 1. Financial Risk Early Warning Model Based on Information Disclosure Fraud

Compared with the fraudulent information disclosure model, the D3 in the F-score model is replaced by a financial indicator on cash flow repayment of short-term debt. The purpose is to point out that depreciation expenses of listed companies should also be classified as cash flow income of listed companies, which can also be used to repay short-term debt. D5 replaces the financial index to measure the profitability of listed companies with a financial index to measure the cash flow creation ability of listed companies. Overall, the F-score model emphasizes the solvency function of cash flow more fully, highlights the flexibility of cash, and reduces the coefficients of other relevant profitability indicators appropriately.

2.2 Financial Crisis Warning Process of Listed Companies Based on Information Disclosure Fraud

According to the different purposes and functions, the financial crisis early warning process of listed companies with fraudulent information disclosure can be divided into the following categories:

(1) Clustering of information disclosure fraud: Clustering of information disclosure fraud is a process of dividing the object set into several classes according to the characteristics of object data. The objects of the same class are similar to each other and have obvious differences with different objects, which can also be called “group analysis”.

(2) Information disclosure fraud classification: unlike information disclosure fraud clustering, the classification of information disclosure fraud is known to the required categories. Information disclosure fraud classification mining can distinguish a large number of data sets or objects according to established rules, and ultimately classify objects into each known category. Common classification methods of information disclosure fraud include decision tree model and Bayesian method.

(3) Financial Crisis Early Warning Association: Financial Crisis Early Warning Association Model is dedicated to discovering a specific rule relationship between data items, so it is also called Financial Crisis Early Warning Association Rule Mining. Mining association rules for financial crisis early warning was originally proposed by statistical analysis. Firstly, by searching for high frequency item groups, trusted rules are mined in high frequency item groups. Apriori and Eclat are the main methods of association rules for early warning of financial crisis caused by information disclosure fraud.

(4) Financial Crisis Early Warning and Forecasting: All kinds of methods of financial crisis early warning and forecasting ideas are an estimate of the future development trend of data. The idea of financial crisis early warning and forecasting of information disclosure fraud is to find or construct a continuous functional model in a large number of historical data, and to judge the direction of the target value.

The financial crisis warning process of listed companies based on information disclosure fraud is shown in Figure 2.

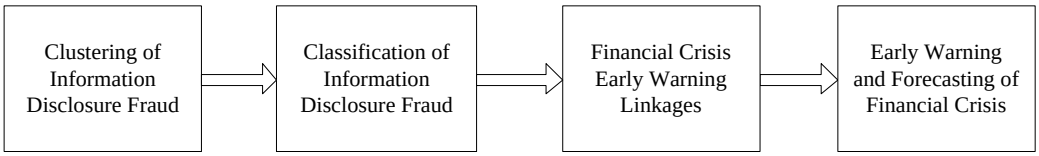

Figure 2. Financial Crisis Warning Process of Listed Companies Based on Information Disclosure Fraud

2.3 Empirical Study on Financial Risk Early Warning Based on Information Disclosure Fraud

(1) Data Selection and Processing

The sample data studied in this paper are from the relevant tables of CSMAR financial index analysis database of a securities company. The basic tables mainly include solvency table, disclosure financial index table, ratio structure table, operating ability table, profitability table, cash flow analysis table, risk level table, development ability table, etc. A total of 146 financial indicators are available. According to the needs of the experiment, all the sample data are divided into risk group and normal group, and the classification standard refers to ST information disclosure fraud classification method. Considering the lagging characteristics of financial data and the release time of actual financial statements, the rules are as follows: one year after the current accounting cycle of listed companies is marked as a listed company, and the financial indicators of the current accounting cycle of listed companies are divided into risk groups. However, listed companies published on stock exchanges mainly include two types of enterprises: the first is enterprises with negative net profit for two consecutive years; the second is special treatment caused by other special reasons.

(2) Screening steps of early warning indicators

Traditional financial risk early warning analysis is subjective in selecting early warning indicators, and it is easy to ignore potential early warning indicators. With the development and improvement of database technology, researchers can easily obtain large-scale financial indicators data, and have the conditions to screen reasonable early warning indicators from large-scale financial indicators data. In this paper, the screening of early warning indicators is carried out, including the following steps:

1) Preliminary screening of 146 financial indicators was carried out, and the indicators with 5% or more vacancies were excluded. At the same time, there are a lot of similar indicators in the index database, such as total asset return A, total asset return B, total asset return C. It can be concluded from the interpretation of data dictionary that there are only slight standard differences in the calculation formula for this kind of index, so only one can be retained.

2) Testing the variance of the remaining indicators to find out the indicators with significant differences between the risk group and the normal group. This paper argues that if there is no

significant difference between the risk group and the normal group, the financial risk has no impact on the index, so it is not suitable for early warning indicators.

3) The purpose of the correlation test of the remaining indicators is to keep only one financial indicator with strong correlation, such as asset-liability ratio and equity ratio with strict positive correlation, or other potential indicators with strong correlation. According to the results of correlation analysis, a reservation will be selected between any two indicators whose absolute value of correlation is greater than 0.8.

After the screening process of the above indicators, 25 early warning indicators suitable for the construction of financial risk early warning model are finally obtained. The number of indicators after each part of the screening is shown in Table 1.

Table 1 Indicators in the screening process

Source table	Original value scale	Preliminary screening index	Variance analysis index	Relevance test index
Profitability table	32	15	12	5
Management capability table	34	5	2	2
Solvency statement table	13	2	3	2
Development capability table	28	3	3	2
Cash flow analysis table	15	6	3	2
Ratio structure table	17	13	8	9
Risk level table	2	1	4	2
Disclosure of financial indicators	5	2	3	1
Total	146	47	38	25

Secondly, the reasonable early warning indicators obtained by the three-step screening work have different emphasis in different aspects. From the perspective of financial analysis, profitability indicators represent the profitability of a listed company. Since the ST system in China directly depends on the profitability of listed companies, the factors of whether listed companies are profitable should account for a large proportion. The ratio structure mainly involves the distribution of assets of listed companies, involving a wide range of directions. At the same time, it also involves profit distribution, cash flow and other important aspects, which should also occupy a larger proportion in financial risk analysis. Previous literature on the selection of early warning indicators is more balanced in different aspects, but does not reflect the key aspects. Finally, after three steps of screening work, the reasonable early warning indicators obtained in this paper have some overlaps compared with the previous literature. For example: total assets profit margin, operating profit margin, total cash recovery rate, property rights to liabilities ratio, fixed expenditure repayment multiple and so on, are often selected as early warning indicators in the previous literature.

(3) Financial Crisis Analysis of Listed Companies with Fraudulent Disclosure of Industry Information

According to the above steps of information disclosure fraud clustering analysis, all sample data are clustered to analyze information disclosure fraud. When the number of information disclosure fraud clustering is 2, the financial crisis warning effect of listed companies is the best. Three different aspects of financial indicators are selected for observation. As shown in Figure 3, there are obvious differences between the two types of listed companies under the financial indicators of assets operation (cash turnover), debt risk (property rights to liabilities ratio) and profitability (total net asset interest rate).

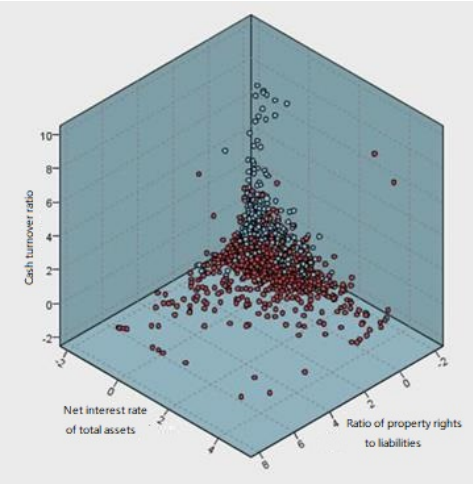

Figure 3. Financial Crisis analyses of Listed Companies with Fraudulent Information Disclosure in Industry

The first type of listed companies have low profitability, but the speed of capital turnover is faster and the degree of debt is lower, so it can be referred to as the operation industry. The second kind of listed companies have higher profitability, but the speed of capital turnover is slow, and the degree of debt is high. The financial crisis analysis results of listed companies with information disclosure fraud verify the effectiveness of this method.

3. Conclusion

By using the financial data of Listed Companies in China as the research sample, taking information disclosure fraud technology as the research method, this paper constructs a financial risk early warning model based on information disclosure fraud through the process of index screening, industry information disclosure fraud clustering analysis and so on. And financial data are used to test and analyze them. This paper gives the theoretical analysis of financial risk early warning and information disclosure fraud of listed companies, expounds the specific process of financial risk early warning modeling based on information disclosure fraud. Cluster analysis of information disclosure fraud using all sample data shows the early warning effect of financial crisis of listed companies, which proves the effectiveness of this method.

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