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The Applicability of a Financial Crisis Early Warning System for Chinese Entrepreneurial Listed Companies

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Abstract--- *The purpose of this study is to establish an early warning model for financial crises suitable for Chinese entrepreneurial listed enterprises. The study builds the model using financial indicators to analyze the financial early warning effect of Chinese entrepreneurial listed enterprises. The result shows that Chinese entrepreneurial companies can use a series of financial indicators and appropriate early warning models to predict a financial crisis, avoid bankruptcy, and help enterprises grow and develop better health. The conclusion of this study puts forward the following suggestions: First, the decision-makers of listed companies on the GEM should change their financial management methods and educate their managers on the importance of the early warnings of financial crises. Second, education should not be limited to the decision-makers and managers of GEM listed companies. The whole staff needs to be trained to form a common understanding of the early warning signs of a financial crisis. Third, the government should strongly support the effective implementation of a financial crisis early warning operating system.*

Keywords--- *Early Warning Model, Financial Crisis, GEM, Applicability, Bankruptcy*

I. INTRODUCTION

At the end of March 2009, the Measures for the Administration of Initial Public Offering and Listing on the GEM (Growth Enterprise Market) were officially announced, marking the first policy provision for the GEM.

However, because most GEM companies have only been established for a relatively short period, hold limited assets, and have unstable operating performance, their management system needs to be improved [1]. In addition, the most prominent characteristics of GEM listed companies are obvious family holding and a high concentration of ownership and management rights by few parties [2]. A variety of factors have led to the change in performance since the opening of the GEM, including the phenomenon of continuous options cashing by executives, which has occurred often amongst GEM companies. This all increases the probability of a corporate financial crisis. Therefore, in order to ensure the sustainable development of GEM listed companies and safeguard the interests of investors, strengthening the financial crisis early warning system for them is urgent.

Beaver in 1966 uses the statistical method to carry out an empirical study on the early warnings of a financial crisis using a single-variable model of a single financial index [3]. Building off this work, domestic and foreign scholars have made great achievements by continuously refining research methods and increasing the knowledge base on financial crises [4].

At the present, while researching early warnings of financial crises, Chinese scholars mainly select companies

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listed in China's main board for their sample according to the ST (Special Treatment). It is a very low priority for most scholars to study a financial crisis early warning system for the GEM listed companies that entered the capital market in 2009.

The purpose of this study is to establish an early warning model for financial crises suitable for Chinese entrepreneurial listed enterprises. The study builds this model using financial indicators to analyze the financial early warning effect of Chinese entrepreneurial listed enterprises. The model is intended to put forward policy suggestions to enterprises and the government and to assist the healthy development of entrepreneurial enterprises.

At the present, China's research on financial crisis early warning focuses mainly on the main board listed companies, and little focus is given to research on financial crisis early warnings for GEM companies. However, the impact of a financial crisis is greater in innovative or high-tech enterprises with high growth and high-risk characteristics, and most of these enterprises are listed on the GEM. Therefore, the novelty of this paper lies in its research of a financial crisis early warning model for entrepreneurial enterprises. This provides a theoretical basis for further exploration of the field of financial crisis early warning systems for Chinese enterprises.

II. Theoretical Background And Literature Review

Ohlson in 1980 believes that filing for bankruptcy means that the enterprise has experienced a financial crisis [5]. Altman in 1968 puts forward the idea that an enterprise going through a financial crisis is one that is legally bankrupt and unable to operate [6]. However, the development of the economy and the deepening of the research on financial crises has led some scholars to think that taking only enterprise bankruptcy as the criterion of judging a financial crisis is too one-sided. Beaver in 1966 extends the definition of a financial crisis from bankruptcy to include overdrafts of deposit accounts, the accumulation of debt that cannot be repaid in time, and so on [3]. Deakin in 1972 includes a lack of liquidity of funds and the inability to repay creditors in the category of financial crises [7]. Ross in 1999 defines a financial crisis using four categories: enterprise failure, legal bankruptcy, technical bankruptcy, and accounting bankruptcy [8].

In China, the market economy affects the financial operation of enterprises. Other non-market factors such as politics may also affect their operations [9]. Therefore, the one-sided view that bankruptcy is the only indicator of a financial crisis is not in accordance with the actual situation in China. A financial crisis exists when an enterprise cannot repay its debts or meet its expenses on time [10]. In addition, because domestic scholars mainly study the financial crises of A-share listed companies, the Shenzhen Stock Exchange and Shanghai Stock Exchange, as stipulated by the China Securities Regulatory Commission, deal with listed companies with abnormal operating conditions. Many domestic scholars regard listed companies who experience a financial crisis as ST companies. Chen in 1999 and other domestic scholars carry out an empirical study, with financial crisis sample data paired with non-ST listed companies [11]. In addition, some scholars use the financial ratio to define the financial crisis. Lv in 2004 believes that when the current ratio is less than 1, the company is experiencing a financial crisis [12].

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III. Research Methods

A. Selection of Samples

This paper selects sample companies who experienced a financial crisis and poor financial health in 2017 using the WIND database, the Tide information network, and DIB database.

In order to build the warning model for a financial crisis, this paper requires the year of the crisis for each sample company to be available in the data. In this paper, the year of a company's financial crisis is t, so when constructing our early warning model, we generally choose data from the year t-1. We do this because using the data of year t to construct the model will make the accuracy of the model appear falsely high. In addition, the purpose of this paper is generating an early warning. If we use the data of the year t, the year of the financial crisis, the results are no longer a prediction.

In this paper, the companies selected for the financial crisis sample and the financial health sample are matched according to industry, year, size, and other factors. The data of the year previous to the occurrence of a serious financial situation and the existence of delisting risk are selected as the data year for each sample company.

B. Variables and Models

In this paper, the early warning variables of financial indicators are divided into four categories: solvency (cash capacity), development capacity (total asset growth rate), operating capacity (total asset turnover rate), and cash flow capacity (operating income cash ratio).

Table 1 Method Of Calculation Of Financial Indicators

Classification	*Variable Name and Calculation Formula*
Debt Paying Ability	Cash Ratio = Cash/Current Liabilities
Development Ability	Total Assets Growth Rate = (End-of-end Total Assets-Opening Total Assets)/Opening Total Assets
Operational Capacity	Total Asset Turnover = Sales Revenue/Average Asset
Cash Flow	Operating Income Cash Ratio = Net Cash Flow from Operating Activities/Operating Income

In this paper, the Logistic model is used to construct the early warning model of the financial crisis of listed companies on GEM. The financial crisis of a company is expressed as 1, and the healthy state of a company is expressed by 0.

In general, assuming that the probability of a financial crisis is P (0 < P < 1), the Logistic model can be expressed as follows:

$$P(Y=1|X_1,X_2,...,\ X_m)=\frac{\exp(\beta_0+\beta_1X_1+\beta_2X_2+...+\beta_mX_m)}{1+\exp(\beta_0+\beta_1X_1+\beta_2X_2+...+\beta_mX_m)} \quad (1)$$

Wherein Y is 0 or 1, and is expressed in the arguments X1, X2, ..., and the probability of the value of Y is (0 <P <1). The independent variable X is the financial index. The probability P of a financial crisis for the company is

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considered as a function of the financial crisis early warning index X. When P is greater than 0.5, the Y value is 1, which is the financial crisis company. When P is less than 0.5, the Y value is 0, which is the financial health company.

C. Results

TABLE 2 STATISTICAL ANALYSIS OF FINANCIAL INDICATORS

Variable	*Co.*	*Sd*	*Wald*	*Dof*	*Sig value*	*Exp.*
Debt Paying Ability	-4.2347	1.4287	8.3721	1.0000	0.0038	0.013
Development Ability	-4.2835	1.4293	7.3656	1.0000	0.0049	0.0191
Operational Capacity	-2.8374	0.9263	5.2376	1.0000	0.0162	0.0932
Cash Flow	-0.1284	0.0639	3.3829	1.0000	0.0632	0.8714
Constant	3.2742	0.8367	12.8372	1.0000	0.0003	23.1432

TABLE 3 PREDICTIVE REST RESULTS

Value Ranking	*Stock Code*	*Trade*	*Registered Address*	*Total Points*	*Probability*	*Prediction Type*
1	300296.SZ	electron	Beijing	611.3209	0.2452	normal type
2	300244.SZ	medical biology	Zhejiang	587.8180	0.1523	normal type
3	300202.SZ	computer	Liaoning	587.1265	0.0038	normal type
4	300104.SZ	media	Beijing	583.1630	0.0549	dangerous model
5	300003.SZ	medical biology	Beijing	561.4433	0.0162	normal type
6	300049.SZ	medical biology	Neimenggu	553.6349	0.0232	normal type
7	300323.SZ	electron	Hubei	549.0100	0.0003	normal type
8	300271.SZ	computer	Beijing	548.7640	0.0172	normal type
9	300015.SZ	medical biology	Hunan	544.4225	0.0256	normal type
10	300373.SZ	electron	Jiangsu	541.3834	0.0083	normal type
11	300128.SZ	electron	Jiangsu	541.0967	0.0940	normal type
12	300349.SZ	mechanical equipment	Zhejiang	540.7217	0.0256	normal type
13	300315.SZ	media	Beijing	540.0246	0.0168	normal type
14	300269.SZ	electron	Guangdong	539.1335	0.0279	normal type
15	300059.SZ	media	Shanghai	538.7873	0.0286	normal type
16	300084.SZ	excavate	Gansu	537.8692	0.0662	normal type
17	300295.SZ	media	Jiangsu	536.6620	0.0120	normal type
18	300351.SZ	mechanical equipment	Zhejiang	535.5106	0.0353	normal type
19	300232.SZ	electron	Guangdong	535.0288	0.0307	normal type
20	300043.SZ	media	Guangdong	534.9175	0.0429	normal type
21	300065.SZ	computer	Beijing	534.7257	0.0452	normal type
22	300130.SZ	computer	Guangdong	533.3231	0.0240	normal type

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23	300017.SZ	communication	Shanghai	533.0011	0.0196	normal type

24	300134.SZ	communication	Guangdong	532.9925	0.0172	normal type
25	300303.SZ	electron	Guangdong	532.0607	0.0256	normal type
26	300052.SZ	media	Guangdong	530.8085	0.0083	normal type
27	300066.SZ	mechanical equipment	Jiangxi	530.5773	0.0940	normal type
28	300144.SZ	leisure service	Zhejiang	530.1475	0.0256	normal type
29	300367.SZ	computer	Beijing	529.0388	0.0168	normal type
30	300058.SZ	media	Beijing	528.9243	0.0279	normal type
31	300234.SZ	construction material	Zhejiang	528.7693	0.0286	normal type
32	300322.SZ	electron	Guangdong	528.2940	0.0662	normal type
33	300044.SZ	computer	Guangdong	527.4268	0.0120	normal type
34	300207.SZ	electron	Guangdong	526.8713	0.0172	normal type
35	300222.SZ	electric accessory	Shanghai	524.1848	0.0172	normal type
36	300226.SZ	media	Shanghai	523.4554	0.0256	normal type
37	300166.SZ	computer	Beijing	522.7827	0.0083	normal type
38	300190.SZ	public utility	Jiangsu	519.5947	0.0940	normal type
39	300147.SZ	medical biology	Guangdong	519.4663	0.0256	normal type
40	300383.SZ	media	Beijing	517.9678	0.0168	normal type
41	300300.SZ	computer	Zhejiang	517.7216	0.0279	normal type
42	300146.SZ	food and beverage	Guangdong	517.6696	0.0286	normal type
43	300002.SZ	computer	Beijing	517.2177	0.0662	normal type
44	300178.SZ	leisure service	Guangdong	516.9435	0.0120	dangerous model
45	300359.SZ	media	Guangdong	516.9014	0.0172	dangerous model
46	300030.SZ	medical biology	Guangdong	516.1341	0.0256	dangerous model
47	300326.SZ	medical biology	Shanghai	514.8011	0.0083	dangerous model
48	300114.SZ	mechanical equipment	Shanxi	514.6527	0.0940	dangerous model
49	300267.SZ	medical biology	Hunan	514.0366	0.0262	dangerous model
50	300007.SZ	mechanical equipment	Henan	513.3618	0.0914	dangerous model
51	300359.SZ	media	Guangdong	492.9014	0.0172	dangerous model
52	300030.SZ	medical biology	Guangdong	472.1341	0.0256	dangerous model
53	300326.SZ	medical biology	Shanghai	461.8011	0.0083	dangerous model
54	300114.SZ	mechanical equipment	Shanxi	452.6527	0.0940	dangerous model
55	300267.SZ	medical biology	Hunan	396.0366	0.0262	dangerous model
56	300007.SZ	mechanical equipment	Henan	387.3618	0.0914	dangerous model
57	300190.SZ	mechanical equipment	Beijing	270.3618	0.0914	dangerous model

It can be seen from table 2 that the Cash Ratio, the Growth Rate of Total Assets, the Turnover Rate of Total Assets, and the Cash Ratio of Operating Income all have some influence on the early warning system of financial crises.

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According to regression analysis, 0.5 can be used as the dividing point, and the P value can be determined by probability. Once the probability exceeds 0.5, the probability of financial crisis increases. On the contrary, if the value is below 0.5, the financial position of listed companies on GEM is at a normal level.

In table 3, among the samples tested, 7 samples are found to be different from the actual situation, and the accuracy of the model is 87.72%. The accuracy of the model overall is high, which is in line with the financial crisis analysis of listed companies on the GEM.

IV. Conclusion And Suggestions

This paper shows that Chinese entrepreneurial companies can use a series of financial indicators and appropriate early warning models to predict a financial crisis, avoid bankruptcy, and help enterprises grow and develop better health.

The conclusion of this study puts forward the following suggestions:

First, the decision-makers of listed companies on the GEM should change their financial management methods and educate their managers on the importance of the early warnings of financial crises.

Second, education should not be limited to the decision-makers and managers of GEM listed companies. The whole staff needs to be trained to form a common understanding of the early warning signs of a financial crisis. This will help to avoid loss caused by the employees' lack of understanding of the financial management of the enterprise.

Third, the government should strongly support the effective implementation of a financial crisis early warning operating system.

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