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Companies financial crisis prediction

Predicción de crisis financiera de empresas

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ABSTRACT

Financial crises are one of the most common phenomena in the economy. This research studies important variables in predicting financial crisis and bankruptcy of companies and have identified the most important financial variables in predicting financial crisis. After identification, the most important predictors of bankruptcy and a model for forecasting the financial crisis and bankruptcy of the companies have been presented and its predictive power has been tested. To identify the most important variables in the prediction of financial crisis and bankruptcy of companies, a linear separation function model has been used and a 9-variable model has been designed and presented. The results of the survey show that up to five years before the financial crisis can be predicted using a relatively high accuracy model.

Key words:predictingfinancial crisis, financial variables, companies, sales tax, model

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RESUMEN

Las crisis financieras son uno de los fenómenos más comunes en la economía. Esta investigación estudia variables importantes para predecir la crisis financiera y la bancarrota de las empresas y ha identificado las variables financieras más importantes para predecir la crisis financiera. Después de la identificación, se presentaron los factores predictivos más importantes de la bancarrota y un modelo para pronosticar la crisis financiera y la bancarrota de las empresas y se probó su poder predictivo. Para identificar las variables más importantes en la predicción de crisis financiera y quiebra de empresas, en este estudio se ha utilizado un modelo de función de separación lineal y se ha diseñado y presentado un modelo de 9 variables. Los resultados de la encuesta muestran que se pueden predecir hasta cinco años antes de la crisis financiera mediante un modelo de precisión relativamente alta.

Palabras clave: predicción de crisis financiera, variables financieras, empresas, impuesto a las ventas, modelo.

Introduction

Currently, businesses operate in a highly competitive environment. The quick and correct response to highly variable market situations is very important in the corporate environment. With the development of monetary and financial markets and, consequently, the prevailing competitive situation, many insolvent companies will leave the competition (Altman, 1968). This has raised concern for capitalist owners to seek ways to anticipate the corporate financial crisis, in order to prevent their core capital from being fueled. Research and academic assemblies have made many efforts in devising models for decision making and financial crisis predictions that use of financial ratios is the result of this research. The financial crisis and, ultimately, the bankruptcy of economic units can bring huge losses to micro and macro levels. At the macro level, the financial crisis of companies will reduce GDP, increase unemployment, waste of resources and so on (Altman, 1982). At micro level, stakeholders and business entities, such as partners, potential investors, creditors, managers, employees, suppliers of raw materials and customers, will suffer losses, and significant losses can be incurred for these groups (Altman, 1983). As a result, in order to avoid the huge losses caused by the financial crisis, a study is required. If the accounting information has the ability to predict the issue, then a model can be proposed to inform shareholders and other claimants about the financial crisis in the company. With the prediction of corporate financial crisis, planning can be done to prevent their bankruptcy (Altman, 1977).

Therefore, it is very important to find methods to predict a financial crisis that occurs before bankruptcy, in which accounting information plays a significant role (Altman, 1993). The present research seeks to predict the financial crisis and the loss of control of the company with regard to accounting information. If the accounting information has the ability to predict the issue, then a model can be proposed that inform shareholders and other claimants about the financial crisis in the company (Azar, Adel & Mansour, 2004). With the prediction of corporate dissolution, planning can be done to prevent their bankruptcy. Therefore, this study, with a comprehensive review of financial ratios and indicators, identifies

the best variables in the prediction of financial crisis and, using separate models, has proposed a model to predict the financial crisis of the companies admitted to the stock exchange.Most of Altman's bankruptcy studies are. The turning point of discovering and identifying financial crises was Altman's multivariate analysis method. Altman proposed a model that is known as the Z-Score model. Of course, this model was later renamed by experts, called ZETA Credit Valuation Model. Experts in 2000 introduced a reverse model of the model. He chose multiple segmental analysis as a suitable statistical technique for classifying observations in one of the two target groups (bankrupt or insolvent companies) (Altman, 2000). The Z-Score model is a linear separation function that consists of some objectively measurable measures as the basis for the classification of companies in a bankrupt and non-bankrupt group. A logarithmic model for predicting bankruptcy is also presented. Four major factors have been investigated for bankruptcy. These four factors, including the size or size of the company, were scales of firm fiscal pressure, performance metrics, and company separation criteria. He has not chosen financial ratios for the criteria mentioned.

Experts have investigated the variables from the cash flow statement and the variables derived from accruals for the identification of bankrupt companies. They were investigated for a five-year period using 60 bankrupt companies and 230 non-bankrupt companies, using three ratios of cash flows and six ratios of accruals. The results of their study showed that cash flow faces variables were better than predictive for bankruptcy than accrual accounting variables.Gallen and Wigeland have examined the ability to predict accruals and cash items for financial statements (Hafiz, 2001). They are 60 bankrupt companies and 204 non-bankrupt companies. The results of their study showed that accounting information can be predicted five years before corporate bankruptcy.Gilbert, Menon and Schwartz examined the ability to predict models based on two samples. First categoryIt consists of 52 insolvent companies and 208 non-stop companies. They used fourteen financial ratios. Research findings showed that accounting information is useful in predicting bankruptcy, and cash flow ratios are important in predicting financial crisis. In the Middle East, there has also been research into financial crisis prediction. Suleimani Amiri conducted a study to predict the bankruptcy of Middle Eastern companies. His research sample consisted of 30 financially-hit financial companies and 30 companies without a financial crisis (Khosh, 2005). Of the 22 initial ratios, he selected the five ratios, which showed liquidity, profitability, leverage, operational efficiency, and market, out of the 22 preliminary ratios and used them in the final model. The results of the research showed that it could be predicted by the financial crisis, but the predictive power of the model for the long-term period was low. Raei and Fallahpour in their study using artificial neural networks, have predicted the financial distress of manufacturing companies. Their model variables included the ratio of operating profits to assets, the operating profit to sales ratio, the ratio of equity to debt, the ratio of working capital to assets, and the ratio of current assets to current liabilities. Their sample consisted of 80 manufacturing companies, selected in the period from 1990 to 2016 (Master´s thesis). The results of artificial neural network model showed that this model has high potential for predicting financial distress of companies and can be used with high reliability. Good-humor and conscientiousness in their research have estimated the KKE and Bartzak model for the Middle East's economic environment. In order to do their research, they used three variables related to the form of cash flows and six variables related to accruals (Rai, 2004). The variables used include the ratio

of cash to assets, the ratio of current assets to assets, the ratio of net profit to assets, the ratio of debt to special value, the ratio of sales to current assets, current assets ratio to current liabilities, cash flows of operations, the ratio of cash flows of operations The current debt and the ratio of operating cash flows to debts. In their research, they used the Multiple Audit Analysis method. To test the model, six accrual variables were first introduced into the model. Their model categorized 83% of the samples correctly. In the next step, three other variables related to cash flows were also included with the six accrual variables. The results showed that the model can correctly classify 95% of sample companies. Of course, they did not make any reference to their prediction period in their research, and it is unclear if their model has the power of prediction for several years or whether their results are for data for the same year (Pourheidari, 2008).

Methodology

The method used in this study is quasi-experimental. In this study, in order to identify important variables in predicting bankruptcy, the studies carried out in other countries, as well as studies on financial analysis were investigated, and 27 ratios and financial indicators were selected. The list of these ratios and indicators is presented in Table 1. T-test was used to examine the significant difference between the recognized ratios in financial crisis firms and financially unstable companies. After selecting important variables in predicting bankruptcy, using a linear separation function, a model is proposed to predict the corporate financial crisis.

Society and statistical sample

The statistical population of this study is all listed companies that have been active on the stock exchange since 2001 to 2017. Depending on the year the company was selected, in order to examine the model's ability to predict the financial crisis, this period was extended to five years ago. Given. The number of companies active in the stock exchange at the beginning of 1380 was about 305.According to the statistical society, the research sample is composed of 90 companies and classified into two groups. The first group consists of 30 financially-hit companies and the second group consist of 60 non-financial companies. Four criteria have been used to select companies with financial crisis. If a company meets all four criteria, it is selected as an example. These criteria are as follows:

1. The company has a net loss during the financial crisis;

2. The accumulated losses of the company are more than 50% of the company's capital;

3. The symbol of the company is closed for more than a year;

4. The ratio of debt to total assets is more than one.

Regarding the selection of the second group (companies without financial crisis), due to the lack of restrictions on the number of companies in this group, a careful selection of companies without a financial crisis has been made.The sample of the second group is selected to be based on the stock market classification of all the industries, and according to the years 2001 onwards, proportional to the number of companies in the first group and the 60 companies that lack the features of

the first group have the best financial status.The required data are selected based on the published financial statements of listed companies for each of the courses (from the financial crisis to five years before). Financial crisis data have been used to determine the financial crisis prediction model. Data from the last year to the last five years have been used to test the ability to predict the model to predict the financial crisis in companies admitted to the stock exchange.

Table 1: List of potential variables in predicting financial crisis

No	Variable names	How to calculate
1	The power to earn asset profits	Profit before interest and tax on assets
2	Asset rate	Net Profit Assets
3	Net profit margin	Net profit to sell
4	Educated capital	Profit accumulated in assets
5	Operating margin	Profit before interest and taxes on total sales
6	Net income to debt	Net Profit to Total Debt
7	Current ratio	Current assets to current liabilities
8	Asset turnover	Net sales to assets
9	Fixed asset turnover	Net sales to fixed assets
10	Debt ratio	Debt to Assets
11	The ability to pay interest	Profit before interest and taxes to interest expense
12	Capital in circulation of assets	The difference between current assets and current liabilities to assets
13	Working capital for long-term debt	The difference between current assets and liabilities to long-term debt
14	Turnover Capital to Sell	Current assets and current assets for sale
15	Turnover Capital into Cash Costs	Difference in current assets and liabilities to cash costs
16	Quality of profit	Operating cash flow minus net income to assets
17	Operating cash to sell	Cash from operations to sell
18	Operating cash flows to debts	Cash from operations to debts
19	Operating cash flow to equity	Cash from operation to equity
20	Equity interest in debt	Total Equity to Debt
21	Equity to equity	Total equity to equity
22	The ratio of the price to the profit of each share	The end of the fiscal year is the expected income of each share
23	Company size	Net sales log
24	Profit fluctuation	Homogeneous Profit Variance (Return on Assets)
25	Profitability index	Return on assets of year t to asset yield of year t-1
26	Leverage index	Debt ratio t of year t-1 debt ratio
27	Demand Index	Circulation of receivables from year t to the year t-1 accounts receivable

Linear separation analysis

n_2 ،x_{n1+n2}]،...،x_{n1+2}، X_2=[x_{n1+1} To describe a linear separation function, it is assumed that there are two existing societies, in which the vector:

n_1 ،x_{n1}]،...،x_2،X_1=[x_1 View from community 1 and vector:

View from community 2. Both variables p has a distinct variable. Fisher (1936)

proposed a linear (separation) function for classifying an element in two different societies. Fisher's separation of the P vector by a linear function to real values:

(1)

$$l(X) = a^t X$$

He tried to distinguish between these two communities as much as possible (here a is a p × 1 vector). Fisher takes vector a as the separator function optimizer | S (a) | Providing:

(2)

$$S(a) = \frac{\bar{y}_1 - \bar{y}_2}{S_y}$$

Here y1 and y2 are the meanings of converted variables.

$$S_y^2 = \frac{\sum_{j=1}^{n_1}(y_{1j} - \bar{y}_1)^2 + \sum_{j=1}^{n_2}(y_{2j} - \bar{y}_2)^2}{n_1 + n_2 - 2}$$

(3)Where:

S (a) given in equation (2) measures the difference between the converted mean y1 y 2 relative to the standard deviation of the sample (3) .If the transformation observations y1, y2, ..., yn1 and yn1 + 1, yn1 + 2, ..., yn1 + n2 are fully segregated, y 1 y 2 must be large because the regular changes of the data are converted it's also considered reflected by the Sy. Linear composition a ^{t} x ratio maximizes;

$$\hat{a} = S_{pooled}^{-1}\left(\bar{X}_1 - \bar{X}_2\right)^t$$

Whenever:(4)

$$i = 1,2,\ldots,n_1 + n_2 \quad \text{و} \quad y_i = a^t X_i$$

Where:

$$S_{pooled} = \frac{(n_1 - 1)S_1 + (n_2 - 1)S_2}{n_1 + n_2 - 2}$$

(5)

That is S1 variance-covariance matrix of the first society and S2 variance matrix - covariance of the second society. Also, X 1 is the mean vector P of the first society and X 2 is the vector of the mean P of the variable of the second society. X 0 belongs to the first society if:

(6) Or X_0 belongs to the second community if:

$$y_0 = \left(\bar{X}_1 - \bar{X}_2\right)^t S_{pooled}^{-1} X_0 \geq \hat{m}$$

(7)

$$y_0 < \hat{m}$$

Where:

(8)

$$S(a) = \frac{(\bar{y}_1 - \bar{y}_2)^2}{S_y} \left[t \; S_{pooled}^{-1} \left(\bar{X}_1 + \bar{X}_2\right) \right] \frac{}{2}$$

Results

Out of the 27 initial ratios, they were recognized by using linear analysis of nine variables to predict bankruptcy. These ratios include the EBIT/TA ratio before interest and taxes, the ratio of earned earnings to assets (RE/TA), the ratio of working capital to assets (WC/TA), the ratio of equity to debt E/TL), EBIT/S), current assets / current liabilities ratio CA/CL), net profit/net sales ratio (NE/S), debt/asset ratio (TL/TA) and company size (FS). Table 2 shows the mean and standard deviation of each of the variables and their significance test for two groups of companies. As shown in Table 2, all variables were more than 99% significant. Therefore, there is a significant difference between the variables of the two groups. A significant difference between the two groups confirms the information content of accounting items to distinguish between financially and financially disadvantaged companies.

Table 2: Significance test of variables

Variable	Have a crisis		Financial lack of financial crisis		Difference (distance)	
	Average	Standard deviation	Average	Standard deviation	t-test	P-value
EBIT/TA	-0/187	0/165	0/241	0/128	-9/686	0/000
AE/TA	-1/163	0/925	0/152	0/174	-9/625	0/000
WC/TA	-1/970	0/661	0/049	0/223	-7/443	0/000
E/TL	-0/354	0/255	1/205	0/470	-3/830	0/000
EBIT/S	-0/425	0/405	0/437	0/298	-7/471	0/000
CA/CL	0/615	0/374	1/155	0/468	-4/935	0/000
NE/S	-0/501	0/433	0/448	0/345	-7/316	0/000
TL/TA	1/313	0/273	0/602	0/215	8/924	0/000
FS	10/678	1/316	13/525	1/375	-8/040	0/000

Table 3: Test results the ability to predict the model according to the information five years before the financial crisis

Number of predictions	Percentage	Number of predictions	Percentage	Number	Real		Predicted	Predicted
Right	Right	Error	Error	n			first group	second group
The second group lacks a financial crisis 6 54						The first group has a financial crisis	22	8
First type error	22	73	8	27	30			
Second type error	54	90	4	10	60			
Total	76	84	14	16	90			

The results of this study indicate that accounting information can predict the corporate financial crisis. The research findings also show that up to five years before the financial crisis, with a relatively high degree of precision, the financial crisis can be foreseen in companies, but as the financial crisis drops,The ability to predict the model also decreases, which is due to a reduction in the clarity and precision of the financial sector's predictive indicators. The results of this study are consistent with the findings of other researchers, such as Altman, Beaver, Gilbert, Alson, Kce and Bartzak, Gallon, and Vigeland and Soleymani. The existence of financial crisis in companies can ultimately lead to bankruptcy. Therefore, according to the presented model, it is possible to predict the financial crisis in companies and take the necessary measures to revise the control of the company. With the change in company control and the adoption of necessary measures, it is possible to prevent a financial crisis and, eventually, bankruptcy of companies.According to the results of this research, the following suggestions are offered:

1. Investors are advised to use this model to evaluate companies and decide on buying their shares.

2. It is suggested to creditors, banks and other financing institutions to consider the proposed model for risk assessment of companies and use it as one of the risk assessment indicators for lending.

3. Given the large number of state-owned companies, the government has used this model to identify companies with financial crisis, decide on their restructuring or liquidation.

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