Prediction of financial distress companies in the trading and services sector in Malaysia using macroeconomic variables

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Abstract

This study attempts to predict financial distress companies in the trading and services sector in Malaysia using financial distress companies as the dependent variable and macroeconomic variables and financial ratios as the independent variables. Logit Analysis was used as the analysis procedure because financial ratios do not have to be normal if it is used. It is also suitable when the dependent variable is binary in nature. Furthermore, it can also provide the probability of a company being financially distress. In addition, it can also provide us with the sign of the independent variable(s). This study found that the independent variables that can be used to predict financial distress companies in the trading and services sector in Malaysia were debt ratio, total assets turnover ratio, working capital ratio, net income to total assets ratio and base lending rate.

Keywords: Bankruptcy; Financial Distress; Macroeconomic Variables; Financial Ratios; Trading and Services Sector; Malaysia

1. Introduction

Prediction of financial distress companies has been one of the most popular areas of research in finance. The ability to predict financial distress is important to the companies themselves, to the potential and current investors and to the stock market regulators. In Malaysia, the stock market regulator is Bursa Malaysia and to deal with financial distress companies, Bursa Malaysia had introduced Practice Note No. 4/2001 (PN4) on 15 February 2001 and Practice Note No. 17/2005 (PN17) on 3 January 2005.
PN17 was further amended on 5 May 2006 to improve the ways that Bursa Malaysia deal with listed financial distress companies. However, the literature has shown that no studies have been conducted in predicting financial distress companies in the trading and services sector in Malaysia using a combination of macroeconomic variables and financial ratios. This study aims to develop financial distress prediction model in the trading and services sector in Malaysia using macroeconomic variables and financial ratios. The prediction model is developed using Logit Analysis.

The rest of the paper is organized as follows. Section 2 discusses the literature review of financial distress prediction. Section 3 explains the independent variables, data collection and data analysis procedures that are used in this study. Section 4 provides the findings of the study from using Logit Analysis and finally, Section 5 summarizes the findings of the study and provides some suggestions for future research.

2. Literature review

A number of studies had been conducted in the area of predicting financial distress companies in the mixed sector in Malaysia using Multiple Discriminant Analysis (MDA) (Chin, 2005; Karbhari & Zulkarnain, 2004). Besides studies in the mixed sector, other previous studies in Malaysia had been conducted in the manufacturing sector using MDA (Fauzias & Chin, 2001; Zulkarnain & Karbhari, 2004). MDA works on the assumptions that the group dispersion (variance-covariance) matrices are equal for failed and non-failed companies and the population must be distributed in a multivariate fashion. However, it had been found that these assumptions are often violated by the data set under study and MDA procedure will only be optimal if the normality conditions are met (Karels & Prakash, 1987). They concluded that MDA do not necessarily provide better results if the ratios that are used depart from the normality assumptions.

Due to the weaknesses of MDA, a number of studies had been conducted in the mixed sector in Malaysia using Logit Analysis (Mohmad Isa, 2004; Tew & Enyлина, 2005). Besides the mixed sector, Fauzias and Chin (2001) had also conducted a study in the manufacturing sector in Malaysia using Logit Analysis. Logit Analysis may be preferable in bankruptcy and financial distress prediction studies where it is not only classification that is required but rather the probability of occurrence of failure (Barnes, 1987). Logit Analysis provides the probability of occurrence of an outcome described by a dichotomous (or polynomous) dependent variable using coefficients of the independent variables (Zavgren, 1985). In addition, Logit Analysis does not require the independent variables to be multivariate normal and they have the ability to determine the significance of individual variables. Furthermore, Logit Analysis does not have the same demanding assumptions as MDA (Keasey & Watson, 1991).

Numerous studies had been conducted to identify the determinants of bankruptcy and financial distress. In general, the determinants of bankruptcy and financial distress can be divided into four main groups of financial ratios that are asset management ratios, leverage ratios, liquidity ratios and profitability ratios. Financial ratios are calculated using items from the Income Statements and Balance Sheets. The four main groups of financial ratios that are used in this study is based on a previous study in Malaysia (Mohmad Isa, 2004).

In general, the findings of previous studies in Malaysia showed that their models can be used for predicting bankruptcy or financially distressed companies. However, all studies in Malaysia used financial ratios only in their studies except for Mohmad Isa (2004). Mohmad Isa (2004) also considers macroeconomic variables in his study and he found that Gross Domestic Product (GDP) is a significant
variable in predicting financially distressed companies in Malaysia. However, his study was conducted in the mixed sector only. GDP was also found to be significant in predicting financial distress companies in other previous studies (Bunn & Redwood, 2003; Kritzler, 1985). Other macroeconomic variables that had been found to be significant in predicting financially distressed companies were stock price index (Al-Darayseh, 1990; Mitchem, 1990) and money supply (Hol, 2007).

The literature shows that no studies have been made in the trading and services sector in Malaysia using macroeconomic variables and financial ratios. A survey on previous studies on the prediction of financial distress companies showed that there is a lack of studies on prediction models for companies in individual sectors due to the unavailability of data (Aziz & Dar, 2006). Suggestions had also been made to study the ability of prediction models to predict financial distressed companies in individual sectors in Malaysia (Chin, 2005). This study hopes to develop a financial distress prediction model for the trading and services sector in Malaysia using macroeconomic variables and financial ratios.

3. Methodology

3.1 Independent variables

Most researchers selected financial ratios as predictor variables based on their popularity and predictive ability in the previous bankruptcy research studies (Altman, 1968; Beaver, 1966). Other criterions that were used to choose financial ratios were their simplicity and relevancy to the local environment (Low, Fauzias, & Yatim, 2001; Mohamed, Ang, & Sandra, 2001). In this study, we select the financial ratios that have been found to be useful in at least ten previous studies on the prediction of financial distress companies whereas macroeconomic variables were selected if they were found to be useful in at least one previous study. In this study, financial ratios are represented by debt ratio, total asset turnover ratio, current ratio, quick ratio, working capital ratio and net income to total assets ratio whereas macroeconomic variables are represented by base lending rate, gross domestic product (GDP), money supply, consumer price index (CPI) and Kuala Lumpur Composite Index (KLCI).

3.2 Population and sample selection

The population of this study are companies listed as financial distress by Bursa Malaysia under the requirements of PN4, PN17 and Amended PN17 respectively from 15 February 2001 until 31 December 2010. Standard practice in financial distress prediction studies involves pooling data across different years in order to obtain a sufficiently large sample of bankrupt companies for analysis (Mensah, 1984). Therefore, this study also pool data for five years before a company was listed as financial distress by Bursa Malaysia under the requirements of PN4, PN17 and Amended PN17 respectively. This study uses the estimation sample to develop the prediction models (Doumpos & Zopounidis, 1999).

3.3 Data Collection Procedures

Financial statements for financial distress companies and non-financial distress companies were collected for the five fiscal years prior to being listed under the PN4, PN17 and Amended PN17 categories by Bursa Malaysia. The five years relative to the financial distress date are defined as year’s t-1, t-2, t-3, t-4, and t-5 that are consistent with previous studies. It would produce a serious bias if ratios were calculated for one reporting period prior to financial distress for the whole sample (Nam & Taehong, 2000). The list of companies listed under PN4, PN17 and Amended PN17 were obtained from the Media Releases and Companies Announcements from the Bursa Malaysia website (www.bursamalaysia.com) from January 2001 to December 2010. The annual reports of the selected companies were obtained from Datastream database that can be assessed through the website of Perpustakaan Tun Abdul Razak, Universiti Teknologi Mara.
3.4 Data Analysis Procedures

Logit Analysis is used in this study. It is an alternative parametric approach to MDA that has been widely used in financial distress prediction to overcome MDA's limitations (multivariate normality and equality in dispersion matrices among groups). Logit Analysis provides the probability of occurrence of an outcome described by a dichotomous (or polytomous) dependent variable using coefficients of the independent variables. The developed Logit Analysis model has the form of the cumulative logistic probability function (Laitinen & Kankaanpaa, 1999).

Under Logit Analysis, the dichotomous dependent variable is simply the logarithm of the odds that a particular event (financial distress / non-financial distress) will occur. That is, here modelling of the ‘log odds’ of belonging to a group is pursued, rather than modelling the group membership itself. Although it would be possible to model the odds, it is simpler to model the log (natural log, ln) of the odds \[\ln (\text{odd}) = \ln \left(\frac{P}{1-P}\right)\]. This transformation into natural log, allows the dependent variable to take any value between negative infinity and positive infinity. In this way, the dependent variable becomes continuous too, rather than discrete.

In order to present the idea, let us start by considering the following model:

\[Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \mu_i\]  \hspace{1cm} (I)

where,

- \(X_i\) = the explanatory variable (s)
- \(Y_i = 1\) if the event occurs (say a company is financially distressed)
- \(Y_i = 0\) if the event does not occur (say a company is not financially distressed)

Now, Equation 1 can be written in the logistic regression functional form as:

\[\ln \left(\frac{P}{1-P}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \mu\]  \hspace{1cm} (2)

Hence, the probability that an event may occur, company become financial distress in this case, is given by:

\[P = \frac{1}{1 + e^{-(\alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n)}}\]  \hspace{1cm} (3)

Equation 3 is estimated using Maximum Likelihood method. Assuming that 1 indicates financial distress, the greater the resulting decimal fraction is above 0.5 (which implies an equal chance of a company being financially distressed or non-financially distressed), the higher chance there is of the subject company being financially distressed. It should be stated that the negative coefficients of ratios in the developed logit model indicate that these ratios are negatively correlated with the probability of financial distress (they decrease the risk of financial distress), while the ratios with positive coefficients have a positive effect on the probability of financial distress (they increase the risk of financial distress).

In order to get reliable results in Logit Analysis, it is necessary to find major explanatory financial ratios that can discriminate between the two groups. The stepwise procedure is applied to finalize the appropriate explanatory variables to be used in the maximum likelihood estimate. The score and p-value of the ratios must be statistically significant. An overall significance test of the variables based on likelihood ratio is also done to confirm the significance of the variables. Maximum likelihood estimates of the variables should also be obtained (Nam & Taehong, 2000).
Optimal p (weights) can be estimated where the likelihood value is maximized. The probability of bankruptcy is obtained by substituting p into the cumulative probability function. If the calculated probability from the Logit Analysis model is over 0.5, the company is classified as financial distress, otherwise as non-financial distress (Nur Adiana, Rohani, & Abd. Halim, 2007; Ohlson, 1980).

Companies that are financially distressed are matched with non-financially distressed companies that are selected within the criteria that they are from the same industry or sector as the financial distress companies and they are approximately similar in terms of total asset size (Alkhatib & Al Bzour, 2011; Lakshan & Wijekoon, 2012; Li, 2012; Monti & Garcia, 2010; Wang & Campbell, 2010). These criteria will be set as control factors to guarantee the lowest amount of bias in choosing the basic or estimation sample that is employed in the development of the financial distress prediction model (Chin, 2005).

Logit Analysis (the stepwise procedure) is used in this study to predict financial distress companies in the trading and services sector in Malaysia. The analysis is conducted using Statistical Package for Social Sciences (SPSS) Version 16.

4. Findings

The data for the trading and services sector includes a total of 20 companies involving 10 financial distress companies and 10 non-financial distress companies for the period from 2001 to 2010. The t-test analysis shows that all financial ratios are significantly different at 1% level except for total assets turnover ratio that is significant at 10% level. No t-test is conducted on the macroeconomic variables because the values for the financially distressed and non-financially distressed companies are the same due to the matching procedure used in this study. Therefore, all financial ratios and macroeconomic variables are included in the next analysis that is the Pearson correlation test for multicollinearity.

Based on Pearson correlation test for multicollinearity, quick ratio is excluded from the next analysis that is the stepwise Logit Analysis due to its high multicollinearity with current ratio (0.99). However, none of the macroeconomic variables are highly correlated to each other or to the accruals-based ratios. Therefore, the independent variables that are chosen in the stepwise Logit Analysis are debt ratio, total assets turnover ratio, current ratio, working capital ratio, net income to total assets ratio, base lending rate, CPI, GDP, KLCI and money supply (M2).

Stepwise logit analysis was conducted to evaluate the impact of a number of independent variables on the likelihood that companies will be financially distressed. The final model contains five independent variables that are debt ratio, total asset turnover ratio, working capital ratio, net income to total assets ratio and base lending rate. The final model was statistically significant whereby the chi-square value is 77.667 with six degrees of freedom and p<0.005. This indicates that the model was able to distinguish between financially distressed and non-financially distressed companies.

The model correctly classified 85% of overall cases or also known as the percentage accuracy in classification which is higher than the 50% when the analysis was conducted without any of the independent variables that are used in the model. The classification table is shown in Table 1.

As shown in Table 2, only five independent variables made a statistically significant contribution to the model. The five independent variables are debt ratio, total assets turnover ratio, working capital ratio, net income to total assets ratio and base lending rate. This is based on the Wald test that is a test that shows the contribution or importance of each of the predictor or independent variables. Variables that contribute significantly to the models should have significance value of less than 0.05 (Pallant, 2007).
Based on Table 2, three financial ratios that are debt ratio, working capital ratio and net income to total assets ratio have negative B coefficient values which means that companies in the trading and services sector in Malaysia with high debt ratio, working capital ratio and net income to total assets ratio are less likely to be in financial distress. However, the findings also indicates that one of the financial ratios that is total assets turnover ratio has a positive B coefficient value which means that companies in the trading and services sector in Malaysia with high total assets turnover ratio are more likely to be in financial distress. Furthermore, the findings also indicates that one of the macroeconomic variables that is base lending rate is significant and it has a positive B coefficient value which means that high base lending rate may lead companies in the trading and services sector in Malaysia to financial distress.

Table 1. Classification table

<table>
<thead>
<tr>
<th>Predict</th>
<th>Distressed</th>
<th>Percentage Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Distressed</td>
<td>0</td>
<td>42</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>43</td>
</tr>
<tr>
<td>Overall Percentage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Estimation results of Logit Analysis

<table>
<thead>
<tr>
<th>IV</th>
<th>B</th>
<th>S.E</th>
<th>Wald</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DR</td>
<td>-0.018</td>
<td>0.007</td>
<td>6.585</td>
<td>0.01***</td>
</tr>
<tr>
<td>TAT</td>
<td>2.721</td>
<td>0.986</td>
<td>7.619</td>
<td>0.006***</td>
</tr>
<tr>
<td>WCR</td>
<td>-4.915</td>
<td>1.677</td>
<td>8.592</td>
<td>0.003***</td>
</tr>
<tr>
<td>NITA</td>
<td>-0.097</td>
<td>0.048</td>
<td>4.069</td>
<td>0.044**</td>
</tr>
<tr>
<td>BLR</td>
<td>0.094</td>
<td>0.039</td>
<td>5.819</td>
<td>0.016**</td>
</tr>
</tbody>
</table>

**Statistically significant at 1% level
***Statistically significant at 5% level

Therefore, based on Table 2, the equation for the trading and services sector using financial ratios and macroeconomic variables is shown below:

\[
P = \frac{1}{1 + e^{-(0.018X_1 + 2.721X_2 - 4.915X_3 - 0.097X_4 + 0.094X_5)}}
\]  

(4)

Where,  
\[X_1 = \text{Debt ratio} \]
\[X_2 = \text{Total assets turnover ratio} \]
\[X_3 = \text{Working capital ratio} \]
\[X_4 = \text{Net income to total assets ratio} \]
\[X_5 = \text{Base lending rate} \]

For instance, assume that the values of debt ratio, total assets turnover ratio, working capital ratio, net income to total assets ratio and base lending rate for a company that can be considered under the trading and services sector category are 0.53, 1.79, 0.02, 0.01 and -21.56 respectively. By inserting those values in Equation 4, the value of P is 0.85 which is greater than 0.5. Therefore, in this example, the company has the possibility of going into financial distress.

The independent variables that had been found to be significant in the trading and services sector are debt ratio, total assets turnover ratio, working capital ratio, net income to total assets ratio and base lending rate. Therefore, one of the macroeconomic variables that is base lending rate was found to be significant in predicting financially distressed companies in the trading and services sector in Malaysia. However,
based on the literature, no study had found base lending rate to be significant in predicting financially distressed companies in the trading and services sector. The findings show that financial ratios and macroeconomic variables can be used to predict financially distressed companies in the trading and services sector in Malaysia. The financial ratios that are significant are debt ratio, total assets turnover ratio, working capital ratio and net income to total assets ratio while the macroeconomic variable that is significant is base lending rate.

5. Conclusion

This study found that the independent variables that can be used to predict financial distress companies in the trading and services sector in Malaysia were debt ratio, total assets turnover ratio, working capital ratio, net income to total assets ratio and base lending rate. The values of the debt ratio, total assets turnover ratio, working capital ratio, net income to total assets ratio and base lending rate in Equation 4 should not go over 0.5 and if it does, there is a possibility that the company will go into financial distress.

This study would like to suggest that future studies should be conducted on the prediction of financial distress companies in other individual sectors in Malaysia. In addition, cash-flow-based ratios should be considered as the independent variables in predicting financial distress companies in Malaysia.

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References


