

## Predicting financial distress companies in the manufacturing and non-manufacturing sectors in Malaysia using macroeconomic variables

Mohd Norfian Alifiah<sup>a\*</sup> and Muhammad Sohail Tahir<sup>b</sup>

<sup>a</sup>Universiti Teknologi Malaysia

<sup>b</sup>COMSATS Institute of Information Technology, Pakistan

CHRONICLE

ABSTRACT

### Article history:

Received: November 26, 2017

Received in revised format: January 31, 2018

Accepted: April 23, 2018

Available online:

April 23, 2018

### Keywords:

Macroeconomic variables

Financial ratios

Financial distress

Manufacturing sector

Non-manufacturing sector

Malaysia

This paper attempts to predict financial distress companies in the manufacturing and non-manufacturing sectors in Malaysia using financial distress companies as the dependent variable and financial ratios and macroeconomic variables as the independent variables. Logit Analysis was used as the analysis procedure because 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 distressed. This study found that the independent variables that can be used to predict financial distress companies in the manufacturing sector in Malaysia were total assets turnover ratio, current ratio, net income to total assets ratio and money supply (M2). However, the independent variables that can be used to predict financial distress companies in the non-manufacturing sector in Malaysia were debt ratio, working capital ratio, net income to total assets ratio and money supply (M2). This study provides the prediction models of financial distress companies in the manufacturing and non-manufacturing sectors in Malaysia using financial ratios and macroeconomic variables as its independent variables.

© 2018 by the authors; licensee Growing Science, Canada

## 1. Introduction

The prediction of financial distress companies plays an important role for managing organizations but there are limited studies to predict financial distress firms in the manufacturing and non-manufacturing sectors in Malaysia using a combination of macroeconomic variables and financial ratios. This study will develop financial distress prediction model in the manufacturing and non-manufacturing sectors in Malaysia using macroeconomic variables and financial ratios. Logit Analysis will be used to develop the prediction model. Previous studies in Malaysia combined consumer products and industrial products sectors to represent the manufacturing sector (Chin, 2005; Fauzias & Chin, 2001; Zulkarnain & Karbhari, 2004; Zulkarnain et al., 2001). Therefore, this study considers other sectors besides consumer products and industrial products as non-manufacturing sector. However, finance, properties and construction sectors will be excluded from the study due to their different nature of businesses.

\* Corresponding author.

E-mail address: [m-nfian@utm.my](mailto:m-nfian@utm.my) (M. N. Alifiah)

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 results and the findings of the study. Section 5 provides the conclusion and some suggestions for future research.

## 2. Literature Review

Multiple Discriminant Analysis (MDA) and Logit Analysis were two multivariate statistical techniques that were normally used in previous studies on the prediction of bankruptcy and financial distress. In general, bankruptcy and financial distress prediction models have been successful in classifying companies as bankrupt/non-bankrupt or financial distress/non-financial distress by using multivariate statistical techniques. The availability of modern computer facilities and its ability to deal with several variables simultaneously were two reasons why multivariate statistical techniques have become very popular among researchers (Ganesalingam & Kuldeep, 2001).

Some studies had been conducted in Malaysia using MDA in the mixed sector (Chin, 2005; Karbhari & Zulkarnain, 2004; Mohamed et al., 2001; Nur Adiana et al., 2007). Furthermore, other studies in Malaysia had been conducted using MDA in the manufacturing sector (Chin, 2005; Fauzias & Chin, 2001; Karbhari & Zulkarnain, 2004; Zulkarnain & Karbhari, 2004; Zulkarnain, et al., 2001).

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, 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 (Low et al., 2001; Mohamad Isa et al., 2005; Mohamed, et al., 2001; Mohamad Isa, 2004; Nur Adiana, et al., 2007; Tew & Enylna, 2005). Fauzias and Chin (2001) had also conducted a study in the manufacturing sector in Malaysia using Logit Analysis.

Logit Analysis may be better 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 polytomous) dependent variable using coefficients of the independent variables (Zavgren, 1985). Furthermore, Logit Analysis does not require the independent variables to be multivariate normal and they have the ability to determine the significance of individual variables. In addition, 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. The four main groups of financial ratios that are used in this study is based on a previous study in Malaysia (Mohamad 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 Mohamad Isa (2004). Mohamad Isa (2004) also consider 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 (Al-Darayseh, 1990; Bunn & Redwood, 2003; Hol, 2007; Kritzer, 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 manufacturing and non-manufacturing sectors 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).

### **3. Methodology/Materials**

Section 3 is separated into four sub-sections. Section 3.1 describes the independent variables that are applied in this study along with the hypothesis while Section 3.2 describes the population and the sample selection of this study. Section 3.3 and 3.4 explain the data collection and data analysis procedures that are applied in this study respectively.

#### *3.1 Independent variables and hypothesis*

Financial ratios are normally chosen as independent variables due to their popularity and predictive ability in the previous studies (Altman, 1968; Beaver, 1966; Ohlson, 1980). Other principles that were applied in selecting financial ratios were their simplicity and relevancy to the local environment (Low, et al., 2001; Mohamed, et al., 2001). In this study, we chose the financial ratios that have been found to be significant in at least ten previous studies on the prediction of financial distress companies whereas macroeconomic variables were chosen if they were found to be significant in at least one previous study.

Leverage ratios show the proportion of capital of a company that is raised by fixed interest borrowings. A company is said to be highly geared if it has a high level of borrowings while a company is considered to be lowly geared if it is mainly financed by equity capital. A highly geared company has to generate more income in order to pay its obligations and debts and vice versa. Therefore, this study hypothesized that there is a positive relationship between leverage ratios as represented by the debt ratio and financial distress.

Asset management ratios represent the relationship between a company's level of operations and the assets that are required to maintain its operating activities. It displays the ability of a company in applying its assets effectively in order to generate sales. High activity ratios show that a company is able to generate a high amount of sales per unit ringgit of sales and vice versa. Thus, this study hypothesized that there is a negative relationship between asset management ratios as represented by the total assets turnover ratio and financial distress.

Liquidity ratios signify the ability of a company to pay its debt when it comes due. High liquidity ratios indicate that a company is able to pay its debt when it comes due and vice versa. Hence, this study hypothesized that there is a negative relationship between liquidity ratios as represented by current ratio, quick ratio and working capital ratio and financial distress.

Profitability ratios signify a measure of return on a company's investment and it also displays the health of a company. High profitability ratios display that companies are profitable and vice versa. Therefore, this study hypothesized that there is a negative relationship between profitability ratios as represented by net income to total assets ratio and financial distress.

Base lending rate is used to show the cost of borrowing in any country and an increase in base lending rate will result in a higher cost of borrowing. A high cost of borrowing is bad for any company because

it rises its expenditure and decreases its profits and vice versa. Therefore, this study hypothesized that there is a positive relationship between base lending rate and financial distress.

Gross Domestic Product (GDP) is used as a proxy for economic growth and it represents the general economic condition of any country. Companies tend to do well when the economy is good and face a financial problem when the economy is bad. Therefore, this study hypothesized that there is a negative relationship between GDP and financial distress.

Money supply is used to represent the liquidity of any country. An increase in money supply will surge the liquidity of any country and cause a decline in interest rate. A decline in interest rate will result in a lower cost of borrowing. A low cost of borrowing is good for any company because it decreases its expenditure and rises its profits and vice versa. Therefore, this study hypothesized that there is a negative relationship between money supply and financial distress.

Consumer Price Index (CPI) is used as a proxy for inflation of any country. A rise in CPI means that there is a rise in inflation of a country and also an increase in the use of debt among companies to support their daily operations and vice versa. Therefore, this study hypothesized that there is a positive relationship between CPI and financial distress.

Kuala Lumpur Composite Index (KLCI) is used to represent the stock market performance in Malaysia. In general, KLCI will be high when the economy is performing well and vice versa. Therefore, this study hypothesized that there is a negative relationship between KLCI and financial distress.

### *3.2 Population and sample selection*

The population of this study is 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 2015. 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.

### *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). Every year prior to financial distress is denoted as year's t-1, t-2, t-3, t-4, and t-5 in order to facilitate the presentation and discussion of the results. The "first year before financial distress" or "t-1" is defined as the year that was included in the most recent financial statement prior to the date that the company was considered to be financially distressed. The "second year before financial distress" or "t-2" is the fiscal year before the first year. The third, fourth and fifth years are similarly defined. The financial statements of the non-financial distress companies were obtained for the same fiscal years as those of their financial distress mates.

The list of companies that are listed under PN4, PN17 and Amended PN17 were obtained from the Media Releases and Companies Announcements from the Bursa Malaysia website ([www.bursamalaysia.com](http://www.bursamalaysia.com)) from January 2001 to December 2015. 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 and also Annual Companies Handbook (various editions).

### 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 such as multivariate normality and equality in dispersion matrices among groups. Logit Analysis shows the probability of occurrence of an outcome 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.

In contrast to the difficult interpretation of the  $Z$ -score in MDA, Logit Analysis results in a value that can be interpreted as the conditional probability of failure. If this value,  $P(Z)$ , instead of the logistic cumulative function, is placed into the normal cumulative probability function, the model is called a probit model. Due to the non-linearity of the model, coefficients are often estimated by the maximum likelihood method instead of the least squares method (Laitinen & Kankaanpaa, 1999).

The value of the probability  $P(Z)$  is always between 0 and 1 with all values of  $Z$ , i.e. instead of resulting in a group membership like the MDA model, it generates the probability of a group membership since its value changes between 0 and 1. If  $Z$  approaches minus infinite,  $P(Z)$  approaches zero, and if it approaches plus infinite,  $P(Z)$  approaches the value of 1. When the value of  $Z$  is 0, the probability of failure  $P(Z)$  is 0.5, which is a commonly used critical value in classifying financial distressed and non-financial distressed companies. If misclassification costs for both error types are used when defining the critical value, it is often lower than 0.5 (misclassification costs for the Type I error are usually estimated to be higher than those of the Type II error) (Laitinen & Kankaanpaa, 1999). Based on the probability, a company is classified as financially distressed or non-financially distressed, using a cut-off probability. Maximum likelihood estimation procedures are employed to determine the parameters.

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 [ $\ln(\text{odd}) = \ln(P / 1-P)$ ]. 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:

$$Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \mu \quad (1)$$

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, Eq. (1) can be written in the logistic regression functional form as:

$$\ln\left(\frac{P}{1-P}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \mu \quad (2)$$

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

$$P = \frac{1}{1 + e^{-(\alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n)}} \quad (3)$$

Eq. (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 (Nam & Taehong, 2000; Nur Adiana, et al., 2007; Ohlson, 1980).

Pearson correlation analysis procedure is used to test for multicollinearity. The rule of thumb that are used in this study is that the correlations among the independent variables ranging from -0.80 to 0.80 would not cause a problem of multicollinearity (Gujarati, 1995). However, before Pearson correlation analysis procedure is conducted, a t-test is run to test whether there is significant difference between the independent variables for the financial distress and non-financial distress companies. Only independent variables that are significantly different are selected for testing of multicollinearity.

The cut-off probability is determined using the basic or estimation sample. A 0.5 cut-off point is used because data on Malaysia's average cost of bankruptcy is not available (Chin, 2005). This is consistent with previous studies on the prediction of financial distress and bankruptcy in Malaysia (Fauzias & Chin, 2001; Low, et al., 2001; Mohamad Isa, et al., 2005; Mohamad Isa, 2004; Nam & Taehong, 2000; Nur Adiana, et al., 2007; Ohlson, 1980; Tew & Enyilina, 2005).

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; Karbhari & Zulkarnain, 2004; Zulkarnain & Karbhari, 2004). The construction of the matched sample based on industry or sector and company size based on total assets will enhance the validity and reliability of the analysis. This is because if the matched sample consisted mostly of big companies without matching in terms of size, the prediction accuracy of the model will be overstated due to the sample bias (Nam & Taehong, 2000).

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

#### 4. Results and Findings

After all tests had been conducted, Table 1 shows that only four independent variables made a statistically significant contribution to the model in the manufacturing sector. The four independent variables are total assets turnover ratio, current ratio, net income to total assets ratio and money supply. 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 1, all the three financial ratios that are total assets turnover ratio, current ratio and net income to total assets ratio have negative B coefficient values which means that companies in the manufacturing sector in Malaysia with high total assets turnover ratio, current ratio and net income to total assets ratio are less likely to be in financial distress. Furthermore, the findings indicates that one of the macroeconomic variables that is money supply (M2) is significant and it has a positive B coefficient value which means that high money supply (M2) may lead companies in the manufacturing sector in Malaysia to financial distress.

**Table 1**

Estimation results of Logit Analysis in the manufacturing sector

IV	B	S.E	Wald	df	p-value
TAT	-2.144	0.512	17.567	1	0.000***
CR	-1.59	0.312	25.952	1	0.000***
NITA	-0.013	0.006	5.55	1	0.018**
M2	0.056	0.021	6.886	1	0.009***
Constant	2.347	0.481	23.812	1	0.000***

\*\*\*statistically significant at 1% level

\*\*statistically significant at 5% level

Therefore, based on Table 1, the equation for the manufacturing sector and using financial ratios and macroeconomic variables is:

$$P = \frac{1}{1 + e^{-(2.347 - 2.144X_1 - 1.59X_2 - 0.013X_3 + 0.056X_4)}} \quad (4)$$

where,

- X1 = Total assets turnover ratio
- X2 = Current ratio
- X3 = Net income to total assets ratio
- X4 = Money supply (M2)

The financial ratios that had been found to be significant in the manufacturing sector in Malaysia are total assets turnover ratio, current ratio and net income to total assets ratio. Total assets turnover ratio had also been found to be significant in the manufacturing sector in other previous studies (Altman, 1968; Chin, 2005; Gombola et al., 1987; Holmen, 1988; Zhang et al. 1999). In this study, the total assets turnover ratio has a negative B coefficient value. This is consistent with the hypothesis of this study which stated that there is a negative relationship between total assets turnover ratio and financial distress. However, the sign of the total assets turnover ratio in previous studies was not reported and therefore, it cannot be compared with the findings of this study. One reason that it was not reported was that previous studies did not use Logit Analysis in their studies. Another reason is that even if Logit Analysis was used, it was used for comparison purposes with other methodologies and the sign of the independent variables were not important and were not reported.

Current ratio had also been found to be significant in the manufacturing sector in other previous studies (Papoulias & Theodossiou, 1992; Zhang, et al., 1999). In this study, the current ratio has a negative B

coefficient value and this is consistent with the findings of Papoulias and Theodossiou (1992). Zhang et al. (1999) did not report the sign of the independent variable because Logit Analysis was used for comparison purposes with Artificial Neural Network and the sign of the independent variables was not important and not reported. The negative B coefficient value for the current ratio is also consistent with the hypothesis of this study which stated that there is a negative relationship between current ratio and financial distress.

Net income to total assets ratio had also been found to be significant in the manufacturing sector in other previous studies (Gombola, et al., 1987; Ohlson, 1980; Papoulias & Theodossiou, 1992; Theodossiou, 1991). In this study, the net income to total assets ratio has a negative B coefficient value and this is consistent with the findings of other previous studies (Ohlson, 1980; Papoulias & Theodossiou, 1992; Theodossiou, 1991). Furthermore, it is also consistent with the hypothesis of this study which stated that there is a negative relationship between net income to total assets ratio and financial distress. Furthermore, one of the macroeconomic variables that is money supply (M2) was found to be significant in predicting financial distress companies in the manufacturing sector in Malaysia. However, based on the literature, no study had found money supply (M2) to be significant in predicting financial distressed companies in the manufacturing sector. In this study, money supply (M2) has a positive B coefficient value but it cannot be compared with any other previous studies. However, this finding is inconsistent with the hypothesis of this study which stated that there is a negative relationship between money supply (M2) and financial distress. This study would like to suggest that money supply (M2) has a positive B coefficient value because companies in the manufacturing sector in Malaysia reacted differently to the movement in money supply. Although an increase in money supply will lead to a decrease in interest rate and hence lower cost of borrowing, companies in the manufacturing sector in Malaysia do not react by borrowing more to expand their businesses and this should be an interesting issue for future research.

The findings of this study show that financial ratios and macroeconomic variables can be used to predict financial distress companies in the manufacturing sector in Malaysia. The financial ratios that are significant are total assets turnover ratio, current ratio and net income to total assets ratio while the macroeconomic variable that is significant is money supply (M2). In addition, after all tests had been conducted, Table 2 shows that only four independent variables made a statistically significant contribution to the model in the non-manufacturing sector. The four independent variables are debt ratio, working capital ratio, net income to total assets ratio and money supply. 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, all the 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 non-manufacturing 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 indicates that one of the macroeconomic variables that is money supply (M2) is significant and it has a positive B coefficient value which means that high money supply (M2) may lead companies in the non-manufacturing sector in Malaysia to financial distress.

**Table 2**

Estimation results of Logit Analysis in the non-manufacturing sector

IV	B	S.E	Wald	df	p-value
DR	-0.018	0.006	10.761	1	0.001***
WCR	-2.983	0.879	11.511	1	0.001***
NITA	-0.125	0.037	11.185	1	0.001***
M2	0.087	0.038	5.141	1	0.023**

\*\*\*statistically significant at 1% level

\*\*statistically significant at 5% level



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

$$P = \frac{1}{1 + e^{-(0.018X_1 - 2.983X_2 - 0.125X_3 + 0.087X_4)}} \quad (5)$$

where,

X1	=	Debt ratio
X2	=	Working capital ratio
X3	=	Net income to total assets ratio
X4	=	Money supply (M2)

The independent variables that had been found to be significant in the non-manufacturing sector in Malaysia are debt ratio, working capital ratio, net income to total assets ratio and money supply that is represented by M2. In this study, the debt ratio, working capital ratio and net income to total assets ratio have negative B coefficient values. Based on the literature, no previous study stated specifically that the study was conducted on predicting financial distressed companies in the non-manufacturing sector. Therefore, the findings of this study cannot be compared with any other previous study. The negative B coefficient values for the working capital ratio and net income to total assets ratio are also consistent with the hypothesis of this study which stated that there is a negative relationship between working capital ratio and financial distress and between net income to total assets ratio and financial distress. However, the negative B coefficient value for the debt ratio is inconsistent with the hypothesis of this study which stated that there is a positive relationship between debt ratio and financial distress. This study would like to suggest that the debt ratio has a negative B coefficient value because Malaysian companies in the non-manufacturing sector depends too much on debt and if they were too low on debt ratio, there will be a higher probability of those companies going into financial distress.

Furthermore, one of the macroeconomic variables that is money supply was also found to be significant in predicting financial distress companies in the non-manufacturing sector in Malaysia. However, based on the literature, no study had found money supply to be significant in predicting financial distressed companies in the non-manufacturing sector. In this study, money supply has a positive B coefficient value but it cannot be compared with any other previous studies. However, this finding is inconsistent with the hypothesis of this study which stated that there is a negative relationship between money supply and financial distress. This study would like to suggest that money supply has a positive B coefficient value because companies in the non-manufacturing sector in Malaysia reacted differently to the movement in money supply. Although an increase in money supply will lead to a decrease in interest rate and hence lower cost of borrowing, companies in the non-manufacturing sector in Malaysia do not react by borrowing more to expand their businesses and this should be an interesting issue for future research.

The findings in this study show that financial ratios and macroeconomic variables can be used to predict financial distress companies in the non-manufacturing sector in Malaysia. The financial ratios that are significant are debt ratio, working capital ratio and net income to total assets ratio while the macroeconomic variable that is significant is money supply.

## 5. Conclusion

This study develops prediction models of financial distress companies in the manufacturing and non-manufacturing sectors in Malaysia using financial ratios and macroeconomic variables. The financial ratios that were chosen were debt ratio, total assets turnover ratio, current ratio, quick ratio, working capital ratio and net income to total assets ratio. They were chosen on the basis that they had been found to be useful in at least ten previous studies. The macroeconomic variables that were chosen were BLR,

GDP, CPI, KLCI and M2. They were chosen on the basis that they had been found to be useful in at least one previous study.

This study found that independent variables that can be used to predict financial distress companies in the manufacturing sector in Malaysia were total assets turnover ratio, current ratio, net income to total assets ratio and money supply (M2). However, the independent variables that can be used to predict financial distress companies in the non-manufacturing sector in Malaysia were debt ratio, working capital ratio, net income to total assets ratio and money supply (M2). Therefore, this study proves that there is a need for different prediction models for financial distress companies in the manufacturing and non-manufacturing sectors.

This study uses financial ratios and macroeconomic variables in predicting financial distress companies in the manufacturing and non-manufacturing sectors in Malaysia. Therefore, 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, this study would also like to suggest that cash-flow-based ratios should be considered as the independent variables in predicting financial distress companies in Malaysia.

### Acknowledgement

This research work is supported by the Research University Grant, Vot No. 13J15 supported by the Malaysian Ministry of Higher Education and Universiti Teknologi Malaysia.

### References

- Al-Darayseh, M. M. (1990). *Corporate failure for manufacturing industries using financial ratios and macroeconomic variables with logit analysis*. Unpublished Ph.D., The University of Nebraska - Lincoln, United States -- Nebraska.
- Alkhatib, K., & Al Bzour, A. (2011). Predicting corporate bankruptcy of Jordanian listed companies: Using Altman and Kida Models. *International Journal of Business and Management*, 6(3), 208-215.
- Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of Finance*, 23(4), 589-609.
- Aziz, A., & Dar, H. (2006). Predicting corporate bankruptcy: Where we stand? *Corporate Governance*, 6(1), 18-33.
- Barnes, P. (1987). The analysis and use of financial ratios: A review article *Journal of Business Finance & Accounting*, 14(4), 449-461.
- Beaver, W. H. (1966). Financial ratios as predictors of failure. *Journal of Accounting Research*, 4(3), 71-111.
- Bunn, P., & Redwood, V. (2003). Company accounts based modelling of business failures and the implications for financial stability. *Bank of England Quarterly Bulletin*, 43(4), 462-462.
- Chin, N. S. (2005). *Prediction of corporate failure: A study of the Malaysian corporate sector*. Unpublished Ph.D. Dissertation, Multimedia University, Malaysia.
- Fauzias, M. N., & Chin, Y. F. (2001). *Z-Score revisited: Its applicability in the prediction of bankruptcy in the Malaysian environment*. Paper presented at the Malaysian Finance Association Third Annual Symposium, Malaysia.
- Ganesalingam, S., & Kuldeep, K. (2001). Detection of financial distress via multivariate statistical analysis. *Managerial Finance*, 27(4), 45-55.
- Gujarati, N. D. (1995). *Basic econometrics* (3rd ed.). Singapore: McGraw Hill International Editions.
- Hol, S. (2007). The influence of the business cycle on bankruptcy probability. *International Transactions in Operational Research*, 14(1), 75-90.

- Karbhari, Y., & Zulkarnain, M. S. (2004). Prediction of corporate financial distress: Evidence from Malaysian listed firms during the Asian financial crisis. Unpublished Working Paper. Social Science Research Network.
- Karels, G. V., & Prakash, A. J. (1987). Multivariate normality and forecasting of business bankruptcy. *Journal of Business Finance & Accounting*, 14(4), 573-593.
- Keasey, K., & Watson, R. (1991). Financial distress prediction models: A review of their usefulness. *British Journal of Management*, 2(2), 89-102.
- Kritzer, A. J. (1985). *Financial ratios, macroeconomic variables and their interaction effects in models of firm-specific financial distress* Unpublished Ph.D., University of Colorado at Boulder, United States -- Colorado.
- Laitinen, T., & Kankaanpaa, M. (1999). Comparative analysis of failure prediction methods: The Finnish case. *European Accounting Review*, 8(1), 67-92.
- Lakshan, A. M. I., & Wijekoon, W. M. H. N. (2012). Predicting corporate failure of listed companies in Sri Lanka. *GSTF Business Review (GBR)*, 2(1), 180-185.
- Li, J. (2012). Prediction of corporate bankruptcy from 2008 through 2011. *Journal of Accounting and Finance*, 12(1), 31-41.
- Low, S. W., Fauzias, M. N., & Yatim, P. (2001). Predicting corporate financial distress using logit model: The case of Malaysia. *Asian Academy of Management Journal*, 6(1), 49-62.
- Mensah, Y. M. (1984). An examination of the stationarity of multivariate bankruptcy prediction models: A methodological study. *Journal of Accounting Research*, 22(1), 380-395.
- Mitchem, C. E. D. (1990). *A cash flow and macroeconomic model of financial distress*. Unpublished Ph.D., Virginia Commonwealth University, United States -- Virginia.
- Mohamad Isa, H., Annuar, M. N., Shamsheer, M., & Taufiq, H. (2005). Prediction of corporate financial distress of PN4 companies in Malaysia: A logistic model approach. *Journal of Restructuring Finance*, 2(2), 143-155.
- Mohamed, S., Ang, J. L., & Sanda, A. U. (2001). Predicting corporate failure in Malaysia: An application of the logit model to financial ratio analysis. *Asian Academy of Management Journal*, 6(1), 99-118.
- Mohamad Isa, H. (2004). *Determination of capital structure and prediction of corporate financial distress in Malaysia*. Unpublished Ph.D. Dissertation, Universiti Putra Malaysia.
- Monti, N. E., & Garcia, R. M. (2010). A statistical analysis to predict financial distress. *Journal of Service Science and Management*, 3(3), 309-335.
- Nam, J. H., & Taehong, J. (2000). Bankruptcy prediction: Evidence from Korean listed companies during the IMF crisis. *Journal of International Financial Management & Accounting*, 11(3), 178-197.
- Nur Adriana, H. A., Rohani, M. R., & Abd. Halim, A. (2007). *Factors contributing to financially distressed companies*. Paper presented at the Malaysian Finance Association 9th Annual Conference, Malaysia.
- Ohlson, J. A. (1980). Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research*, 18(1), 109-131.
- Tew, Y. H., & Enylin, N. (2005). Predicting corporate financial distress using logistic regression: Malaysian evidence. Unpublished Working Paper. Universiti Teknologi Mara.
- Wang, Y., & Campbell, M. (2010). Business failure prediction for publicly listed companies in China. *Journal of Business and Management*, 16(1), 75-88.
- Zavgren, C. V. (1985). Assessing the vulnerability to failure of American industrial firms: A logistic analysis. *Journal of Business Finance & Accounting*, 12(1), 19-45.
- Zulkarnain, M. S., & Karbhari, Y. (2004). Bankruptcy prediction during the IMF crisis: Evidence from Malaysian listed industrial companies. Unpublished Working Paper. Social Science Research Network.
- Zulkarnain, M. S., Mohamad Ali, A. H., Annuar, M. N., & Zainal Abidin, M. (2001). Forecasting corporate failure in Malaysian industrial sector firms. *Asian Academy of Management Journal*, 6(1), 15-30.



© 2018 by the authors; licensee Growing Science, Canada. This is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).