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# PREDICTING CORPORATE FINANCIAL DISTRESS USING THE LOGIT MODEL: THE CASE OF MALAYSIA

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## ABSTRACT

This study examines the usefulness of financial ratios in predicting the probability of financial distress in companies. These financially troubled companies have obtained court protection against their creditors under Section 176 of the Malaysian Companies Act, 1965. The findings suggest that the fairly popular ratios of liquidity and profitability maybe somewhat deceiving. Interpretation of these two measures should be made carefully because high ratios by themselves *do not* necessarily imply that the company has sufficient money to pay its obligations. It is shown that the cash position of a company provides a better warning signal of financial deterioration and therefore should be emphasized in detecting financially distressed companies. The predictive ability of the model is tested on a holdout sample and the overall accuracy rate for the estimation and the holdout samples are 82.4% and 90% respectively. The findings provide a better understanding on the relevant factors that lead to corporate distress so that prompt actions could be taken to minimize the risk of financial distress.

## INTRODUCTION

Malaysia had a relatively sound economic fundamentals prior to the start of the Asian financial crisis in the middle of 1997. The aftermath of the crisis had resulted in many of the debt-laden companies facing the threat of insolvency as many were finding it increasingly difficult to fulfill their obligations. These financially troubled companies are practically fighting hard for their survival and one alternative route available to them is to carry out a scheme of arrangement pursuant to Section 176 (S176 thereafter) of the Malaysian Companies Act, 1965. This scheme allows viable company which is constrained by cash flows as a result of either escalating debt levels or a temporary set-back in business cycles, some breathing space to formulate its restructuring plans or strategies. Most importantly, S176 protects viable businesses by freeing them from the pressing problem of servicing debt and thus allowing them to use the available cash to

Since 1998, there have been quite a number of financially troubled companies which have filed for S176 for the purpose of obtaining court protection against their creditors. This has kindled our interest in searching for the various potential symptoms that lead to the condition of financial distress in a company. This study provides some evidence on the relevant financial dimensions of a company that are useful in predicting the probability of financial distress.

## LITERATURE REVIEW

The early studies on financial distress and bankruptcy predictions can be traced back to the 1960's and the usefulness of accounting information to predict bankruptcy was first studied by Beaver (1966) and Altman (1968). However, as pointed out by Scott (1981), many of the empirical work in this area does not rest on any strong underlying theory. He raises an important issue about the definition of failure used in many of the empirical research subsequent to the work of Beaver (1966). Although Beaver (1966) and Deakin (1972) to name a few, use a broad definition for the term failure, many empirical research that follow confined the definition to mean bankruptcy, which Scott (1981) believes to be somewhat misleading. Furthermore, the theoretical framework associated with financial distress generally define a financially distressed firm in terms of its inability to pay debt/obligation when due [see Bahnson and Bartley (1992)]. Accordingly, Scott (1981) argues that the failure of firms to fulfill its financial commitment does not always lead to bankruptcy. Scott (1981)'s argument seems logical in the sense that there are several options available to companies in financial distress (failing to meet its financial obligations) other than filing for bankruptcy. Pastena and Ruland (1986) identify three alternative strategies followed by firms in financial distress namely bankruptcy, continued operating with the expectation of achieving future solvency or participating in mergers. Hence, not all of the problematic companies will fail but some may survive whereas others may eventually fail. In addition, as pointed out by Taffler (1984), it is more appropriate to interpret the results of bankruptcy prediction models as an explanation for the financially distressed condition of the firm rather than as a prediction for bankruptcy *per se*.

Previous bankruptcy studies have identified many pre-filling financial ratios of the bankrupt companies that are important in predicting bankruptcy and such review of the literature are found in the work of Altman (1983), Foster (1986) and Jones (1987) among others. A review of previous empirical work indicates that these studies have differed in their selection of variables used in the prediction model and most of the studies report good predictive powers for their ratios[1]. Beaver (1966) finds that some ratios have better predictive power than others up to five years before failure and his finding shows that cash flow to total debt is the best univariate predictor of financial instability. Gentry et al. (1985) find that model using several cash flow variables together with some financial ratios yields better

bankruptcy prediction than model using either cash flow or financial ratios alone. Ohlson (1980) shows that the variables size, total liability/total assets, funds provided by operation/total liabilities and the percentage change in net income are significant in predicting bankruptcy within one year. The findings of Ward and Foster (1997) suggest that the use of a dichotomous variable, healthy versus loan default as a dependent variable in generating the prediction model provides a better measure than the bankruptcy dependent variable in terms of predicting the ability of firm to fulfill its obligations when due. Their results indicate that four accrual ratios, three cash flow variables and firm size have significant predictive power one year before the firm experience a loan default. On the other hand, in the bankruptcy model, only one accrual ratio and one cash flow ratio are found to be significant. An important implication that arises from their study concerns with the issue of validity of bankruptcy as a measure of financial distress. Since the theoretical interpretation of financial distress is defined in terms of insolvency, Ward and Foster (1997) argue that the use of dichotomous variable, healthy versus loan default as a dependent variable provides a better indicator for insolvency than bankruptcy and therefore is more consistent with the underlying theoretical explanation.

In our paper, we provide some evidence on the usefulness of accounting information in predicting the probability of financial distress in companies. These financially troubled companies have chosen their survival option by implementing a scheme of arrangement pursuant to S176 of the Malaysian Companies Act, 1965. We believe that models with the ability to predict financially distressed companies may be of more practical use than those with the ability to predict bankrupt companies. The logical reasoning behind this is that, most firms have the tendency to be in a financially distressed condition before reaching the bankruptcy state. Moreover, many stakeholders of the company especially the creditors may suffer huge losses even though bankruptcy has yet to occur. Therefore, we believe that financial distress model will provide better information to the various claim holders of the company in terms of identifying the various potential symptoms of financial distress early and thus giving them more time to formulate their plan of action. Although prior bankruptcy studies have shown that several financial ratios are important in differentiating healthy companies from financially distressed companies, the findings of Gilbert et al. (1990) indicate that within the group of financially troubled companies, the bankruptcy model is unable to distinguish companies that actually fail from other financially troubled companies. Accordingly, it become difficult to assess the likelihood of bankruptcy for these troubled companies. Nevertheless, the objective of this paper is to identify important financial dimensions that could help to differentiate financially troubled companies from their non-troubled counterparts so that the various claim holders of the company have sufficient time to react to the potential losses. To the extent that many financial ratios could provide early warning signs of financial difficulty, we conjecture that cash flow ratios are the best single indication of financial instability

of a company. Therefore, cash flow information is considered to be more relevant in recognizing financial difficulty in a company.

## DATA AND METHODOLOGY

A financial distress prediction model was developed using an estimation sample consisting of both the distressed and non-distressed companies. The 26 distressed companies were selected from 9 different industries. Based on the same 9 industries, 42 companies were randomly selected to form the sample of non-distressed companies. The distressed group consists of companies that filed for court protection against creditors under S176 in the year 1998 and were granted such protection. The sample of 42 non-distressed companies were randomly selected in the year 1998. Companies included in the sample must have a complete set of financial data available in the companies' annual report for a period of 2 years prior to the event year i.e. 1998[2]. The dependent variable is coded as 1 if companies were granted a protection and 0 otherwise. The independent variables used in this study were based on prior studies [e.g., Ward and Foster (1997), Casey and Bartczark (1985) and Ohlson (1980)]. As pointed out by Scott (1981) although there is a huge number of possible financial variable available to predict bankruptcy, researchers were neither guided nor constrained by theory in their selection process. The lack of theoretical basis in the selection of independent variables in earlier studies has prompted us to apply a stepwise procedure using eleven independent variables as shown in Table 1.

**Table 1: Variables Used in the Study**

| Variable Name | Abbreviation |
|---|---|
| Net Income/Total Assets | NI/TA |
| Sales/Current Assets | S/CA |
| Current Assets/Current Liabilities | CA/CL |
| Stockholders' Equity/Total Liabilities | SHE/TL |
| Current Assets/Total Assets | CA/TA |
| Cash & Marketable Securities/Total Assets | CMS/TA |
| Size of the Firm [log(total assets)] | SIZE |
| Cash Flow from Operating Activities/Total Liabilities | CFOA/TL |
| Cash Flow from Investing Activities/Total Liabilities | CFIA/TL |
| Cash Flow from Financing Activities/Total Liabilities | CFFA/TL |
| Change in Net Income | CHGNI* |

* Following Ohlson (1980) and McKibben (1972) CHGNI is defined as $(NI_t - NI_{t-1}) /(|NI_t| + | NI_{t-1}|)$ where $NI_t$ is the net income for the most recent period.

The form of logistic model used is given as follows[3]:

$$P_i = 1/[\ 1 + \exp\ \{-\ (\alpha + \beta_1 Xi_2 + \beta_2 Xi_2 + \beta_3 Xi_3 + \ldots +\ \beta_n Xi_n)\}]$$

Where $P_i$ is the probability of financial distress for the i th company, $X_{in}$ is the set of n independent variables for the ith company. The independent variables represent the financial ratios calculated from the company's financial statements for one fiscal year prior to the filing of S176. Contemporaneous data were collected for the sample of non-distressed companies. The intercept and coefficients of the independent variables are represented by $\alpha$ and $\beta$ respectively. The estimation of the model was based on a maximum likelihood estimation procedure. The predictive ability of the model is tested on a holdout sample of 10 companies consisting of equal number of distressed and non-distressed companies. The correlation matrix presented in Table 2 shows that potential problem of multicollinearity do exists, judging from the correlations between the independent variables. It is shown that as many as 16 of the pair-wise correlation coefficients have values greater than or equal to 0.3 and they are significant at the 5% level. As such, if a non-stepwise procedure is used, any statistical inferences made from the model will be questionable.

**Table 2: Pearson Correlation Coefficients (Significance Level in Parentheses)**

| | NI/TA | S/CA | CA/CL | SHE/TL | CA/TA | CMS/TA | SIZE | CFOA/TL | CFIA/TL | CFFA/TL | CHGNI |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NI/TA | 1.00 | -0.12 | 0.43 | 0.29 | -0.18 | -0.11 | 0.47 | -0.17 | -0.01 | -0.07 | 0.39 |
| | | (0.32) | (0.00) | (0.01) | (0.13) | (0.39) | (0.00) | (0.17) | (0.95) | (0.59) | (0.00) |
| S/CA | | 1.00 | -0.03 | 0.26 | -0.31 | 0.16 | -0.34 | 0.18 | 0.24 | -0.24 | 0.11 |
| | | | (0.82) | (0.04) | (0.01) | (0.20) | (0.00) | (0.14) | (0.05) | (0.04) | (0.39) |
| CA/CL | | | 1.00 | 0.76 | -0.11 | 0.37 | 0.32 | 0.08 | 0.16 | -0.24 | 0.30 |
| | | | | (0.00) | (0.38) | (0.00) | (0.01) | (0.52) | (0.19) | (0.04) | (0.01) |
| SHE/TL | | | | 1.00 | -0.42 | 0.31 | 0.27 | 0.13 | 0.36 | -0.46 | 0.29 |
| | | | | | (0.00) | (0.01) | (0.02) | (0.29) | (0.00) | (0.00) | (0.02) |
| CA/TA | | | | | 1.00 | -0.07 | -0.14 | -0.34 | 0.18 | 0.06 | -0.16 |
| | | | | | | (0.55) | (0.25) | (0.00) | (0.15) | (0.63) | (0.19) |
| CMS/TA | | | | | | 1.00 | -0.03 | 0.13 | 0.06 | 0.07 | 0.05 |
| | | | | | | | (0.81) | (0.29) | (0.62) | (0.57) | (0.71) |
| SIZE | | | | | | | 1.00 | 0.03 | 0.07 | -0.19 | 0.25 |
| | | | | | | | | (0.81) | (0.57) | (0.13) | (0.04) |
| CFOA | | | | | | | | 1.00 | -0.30 | -0.15 | 0.31 |
| | | | | | | | | | (0.01) | (0.23) | (0.01) |
| CFIA | | | | | | | | | 1.00 | -0.71 | -0.01 |
| | | | | | | | | | | (0.00) | (0.96) |
| CFFA | | | | | | | | | | 1.00 | -0.13 |
| | | | | | | | | | | | (0.29) |
| CHGNI | | | | | | | | | | | 1.00 |

## RESULTS AND DISCUSSIONS

**Table 3: Descriptive Statisitics of Non-Distressed and Distressed Companies**

| | Non-Distressed Companies | | Distressed Companies | |
|---|---|---|---|---|
| Variable | Mean | Std Dev. | Mean | Std Dev. |
| NI/TA | 0.041 | 0.053 | -0.647 | 0.992 |
| S/CA | 1.264 | 0.971 | 0.945 | 0.731 |
| CA/CL | 1.616 | 0.845 | 0.774 | 0.434 |
| SHE/TL | 2.141 | 2.858 | 0.136 | 0.597 |
| CA/TA | 0.477 | 0.246 | 0.591 | 0.241 |
| CMS/TA | 0.084 | 0.089 | 0.074 | 0.088 |
| SIZE | 6.464 | 0.941 | 5.961 | 1.054 |
| CFOA/TL | 0.071 | 0.238 | -0.093 | 0.333 |
| CFIA/TL | -0.079 | 0.489 | -0.074 | 0.304 |
| CFFA/TL | 0.021 | 0.324 | 0.165 | 0.278 |
| CHGNI | -0.098 | 0.420 | -0.657 | 0.489 |

Table 3 shows the descriptive statistics of variables included in the study for one financial year prior to the event year. It is not surprising that the sample of non-distressed companies has better mean values than the sample of distressed companies for most of the variables except for the variables Current Assets to Total Assets (CA/TA), Cash Flow from Investing Activities to Total Liabilities (CFIA/TL) and Cash Flow from Financing Activities to Total Liabilities (CFFA/TL). In other words, the sample of distressed companies seems to show a higher level of capital turnover as measured by CA/TA, a higher level of cash flow from investing and financing activities as measured by CFIA/TL and CFFA/TL respectively. The findings suggest that these cash-strapped companies are aggressively seeking other options of improving their cash flow position. For example, by selling assets (cash flow from investing) or borrowing money (cash flow from financing). With regard to those variables that entered the stepwise regression model, all of the four variables, namely Sales to Current Assets (S/CA), Current Assets to Current Liabilities (CA/CL), Cash & Marketable Securities to Total Assets (CMS/TA) and Change in Net Income (CHGNI) are worst off in the sample of distressed companies. Table 4 compares the mean of variables between the two groups. Variables with a mean difference that is significant at the 5% level are Net Income to Total Assets (NI/TA), Current Assets to Current Liabilities (CA/CL), Stockholders' Equity to Total Liabilities (SHE/TL), Size of the Firm (SIZE), Cash Flow from Operating Activities to Total Liabilities (CFOA/TL) and Change in Net Income (CHGNI), two of which are important in predicting the probability of financial distress (CA/CL and CHGNI).

**Table 4: Comparison of the Means Between Non-Distressed and Distressed Companies**

| | Mean Difference | |
|---|---|---|
| Variable | t-statisitic | Pr>\|T\| |
| NI/TA | 3.535 | 0.002* |
| S/CA | 1.442 | 0.154 |
| CA/CL | 5.403 | 0.000* |
| SHE/TL | 4.396 | 0.000* |
| CA/TA | -1.861 | 0.067 |
| CMS/TA | 0.465 | 0.643 |
| SIZE | 2.046 | 0.045* |
| CFOA/TL | 2.373 | 0.021* |
| CFIA/TL | -0.048 | 0.962 |
| CFFA/TL | -1.876 | 0.065 |
| CHGNI | 5.009 | 0.000* |

* significant at the 5 percent level.

The results of the stepwise logistic regression are presented in Panel A of Table 5. The model chi-square is the difference between the log-likelihood of the model with intercept and independent variables and the log-likelihood based only on intercept. The –2 LOG Likelihood statistic tests the null hypothesis that the coefficients of independent variables in the model are zero and the model proves to be significant (p=0.0001). As shown in Panel A, the four independent variables that entered the stepwise regression model at the 5 percent level of significance are sales to Current Assets (S/CA), Current Assets to Current Liabilities (CA/CL), Cash and Marketable Securities to Total Assets (CMS/TA) and Percentage Change in Net Income (CHGNI). The significant positive coefficient for the variable S/CA suggests that companies with higher proportion of sales to current assets are more inclined to be in financial distress. The likely explanation for this is that these companies may have a large portion of their sales in credit terms and thus are more likely to face cash flow problem. Hence, they tend to become higher risk firms for financial distress. It is not surprising that higher credit sales is also reflected in a higher current ratio and the previous explanation is further supported by our finding that companies with higher current ratio (CA/CL) are more prone to experience financial distress.

**Table 5: Stepwise Logistic Regression: Analysis of Maximum Likelihood Estimates**

**Panel A: Variables Entering the Model***

| Variable | Coefficient | Pr>Chi-square |
|---|---|---|
| Intercept | -6.830 | 0.0034 |
| S/CA | 2.716 | 0.0062 |
| CA/CL | 6.195 | 0.0012 |
| CMS/TA | -12.526 | 0.0162 |
| CHGNI | 2.297 | 0.0074 |

Model Statistics**

-2 Log Likelihood 50.736 with 4 degrees of freedom (p=0.0001).

Somers' D = 0.886

* at the 5 percent level of significance.

* The –2 Log Likelihood Statistic tests the null hypothesis that all of the independent variables in the model are zero. Somers'D is an index of rank correlation assessing the correlation between the predicted probabilities and the value of dependent variable.

**Panel B: Classification Errors**

| | **Distressed Classified as** | **Non-Distressed Classified as** | **Overall** |
|---|---|---|---|
| | Non-Distressed (Type I) | Distressed (Type II) | Misclassification |
| Estimation Sample | 6 (23.1%) | 6 (14.3%) | 12 (17.6%) |
| Holdout Sample | 1 (20%) | 0 (0%) | 1 (10%) |

This result implies that the component of current assets for these firms consists mainly of non-cash items and thus this increases their chances of not being able to fulfill their debt obligations. The variable CHGNI measuring the percentage change in net income, has a positive and significant coefficient. This finding is consistent with the results reported by Ohlson (1980) for his second model

predicting bankruptcy within two years given that the company remains solvent within the subsequent year. As proposed by Deakin (1972), Ohlson (1980) contended that firms with a positive change in earnings tend to become higher risk firms for financial distress because these firms may be especially tempted to seek external financing through borrowing. Our finding of a positive and significant coefficient for the variable CHGNI shows that although these companies experience a positive percentage change in net income, they do not seem to generate enough cash flows to satisfy their debt obligations and thus become more likely to experience financial distress. This finding not only reinforces the important difference between accounting profit and cash flows but also supports the notion that cash flows variables serve as a better indicator to potential lenders about the creditworthiness of prospective borrowers.

Our explanation is further supported by the finding of a negative and significant coefficient for the variable CMS/TA, implying that companies with higher cash flow ratio are less likely to experience financial distress. This result is consistent with that reported by Gilbert et al. (1990) who found that cash flow variable played a significant role in predicting bankrupt firms. The coefficient of the estimated model are then applied to a holdout sample to evaluate the validity of the model. The holdout sample of 10 companies consists of equal number of distressed and non-distressed companies. Predicted probabilities of financial distress were computed for firms in both the estimation and holdout samples. Classification of firms into distressed and non-distressed groups is based on a cut-off value of 0.5. A firm was classified as distressed firm if it had a predicted probability of financial distress greater than 0.5. Panel B of Table 5 shows the classification results. The overall accuracy rate for the estimation and holdout samples are 82.4% and 90% respectively. The frequency of Type 1 error is higher in the estimation sample with as many as 23.1% of the firms being misclassified.

From a practical point of view, the results of the study have some important implications for investors, creditors and management of the company. With an understanding of the important factors that lead to corporate distress, portfolio managers may be able to make better investment decisions by avoiding investing in companies which they believe are in the danger of failing. From the perspective of the management, the findings are also useful in terms of providing the management with early warning signs of deterioration of financial standing of the company so that corrective actions can be taken to minimize the risk of financial distress. As for the creditors, it is also important that they be acutely aware of the various symptoms of impending financial distress in a company. This is because once a company has filed for court protection under S176, creditors are restricted from taking any action against the company. Furthermore, creditors are usually not given prior notice by the so-called ailing company that a court protection is being arranged. Therefore, it is crucial that creditors are able to identify the symptoms of financial distress in companies.

## CONCLUSIONS

The results of the study indicate that the probability of financial distress is directly related to the ratios of sales to Current Assets (S/CA), Current Assets to Current Liabilities (CA/CL) and the Percentage Change in Net Income (CHGNI) of a company. These ratios are among the many ratios used in the literature to measure the liquidity and profitability aspects of a company. The positive coefficient of these ratios suggests that a company is more likely to fail if it has higher S/CA, CA/CL and CHGNI. Therefore, the results suggest that these popular measures of liquidity and profitability may be somewhat misleading because high ratios of these two measures *do not* necessarily mean that the company has sufficient money to service its debt obligations. However, the probability of financial distress is shown to be inversely affected by the ratio of cash and marketable securities to total assets (CMS/TA). In other words, there is lower likelihood of corporate failure when the company has a higher level of cash position. As such, the results imply that an important factor for predicting financial distress of a company is the cash position because cash flow provides a more accurate forecast of financial status and therefore serves as a better indicator to detect potential failure of a company. These results are intuitively logical and in a nutshell, models that predict financial distress are useful not only to the management but also to various claim holders of the company such as creditors and investors.

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## ENDNOTES

[1] For a review on the summary of financial ratios used, see Chen and Shimerda (1981).

[2] Event year is defined as the year in which firms were granted the bankruptcy protection.

[3] There are several statistical reasons for favoring logistic analysis to multiple discriminate analysis as discussed in McFadden (1984) and Lo (1987). Platt and Platt (1990) provides several practical reasons for using logistic analysis.