The Use of Financial Ratios in Predicting Corporate Failure in Sri Lanka

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Abstract- **The purpose of this research is to develop a model using financial ratios to predict corporate failure of listed companies in Sri Lanka. This study utilized publicly available data from annual reports of a sample of 70 failed firms and a sample of matched 70 non failed firms listed on Colombo stock market for a period covering the 2002 to 2008 financial years with logistic regression analysis. A total of fifteen financial ratios were used as predictor variables of corporate failure.**

Analysis of the statistical testing results indicated that the prediction accuracy of the model consists with financial ratios is 77.86% one year prior to failure. Furthermore, predictive accuracy of the model in all three years prior to failure is above 72%. Hence model is robust in obtaining accurate results for up to three years prior to failure. Final model includes three financial ratios; working capital to total assets, debt ratio and cash flow from operating activities to total assets. These variables are having more explanatory power to predict corporate failure.

Therefore, model developed in this study can assist investors, managers, shareholders, financial institutions, auditors and regulatory agents in Sri Lanka to forecast corporate failure of listed companies.

Keywords: Corporate failure prediction; logistic regression; financial ratios

I. INTRODUCTION

Throughout the centuries, a huge number of businesses have succeeded, while others have struggled for survival and subsequently failed. Corporate failures are a common problem of developing and developed economies (Altman et al., 1979). Hence, predicting corporate failure has been the subject of considerable academic research for nearly four decades. Continued research in corporate failure prediction reflects the importance of the subject. The motivation to undertake this study was provided following the corporate failures in Sri Lankan companies during last decade. Corporate failures often result in significant direct and indirect costs to many stakeholders including shareholders, managers, employees, creditors, investors, auditors, suppliers, customers and the community. Therefore, the proper failure prediction model should be developed. This model should accumulate the possible causes of firms' failure.

The substantial volume of researchers developing the corporate failure prediction models admits that the financial ratio is one of major predictors of the financial distress because the financial ratio can reflect the financial conditions of firms. The earlier work of Beaver (1966) indicated that the financial ratios can predict the likelihood of corporate failure. In addition, Altman (1968) believed that financial ratio measurements of a failed firm and a nonfailed firm are significantly different. Only few studies were carried out on corporate failure prediction models in Sri Lanka and such studies were based on Altman's Z-score (1968) using multiple discriminant analysis (MDA). However, the use of financial ratios alone in prior studies is subject to one serious criticism. That is, the financial ratios previously deployed are accrual accounting financial ratios that cannot reflect the ability of a firm to manage its future cash flows. Cash flow has been an important determinant of failure. Sharma (2001) was critical of Altman for not including cash flow as a factor and examined it as a key issue in predicting corporate failure. Sharma and Iselin (2003) pointed out that, because the accrual system provides management with opportunities for "window-dressing" their accounts, cash-flow information could serve as an alternative source because it provides fewer opportunities for such manipulation.

Therefore, to the authors' best knowledge, this is the first study to utilize a comprehensive model which incorporates both accrual based and cash flow based financial ratios in predicting corporate failure in Sri Lankan. As a result, this study will address the empirical gap exists in the local context.

II. LITERATURE REVIEW

A. Return on assets (ROA)

ROA is an indicator of how profitable a company is relative to its total assets. ROA gives an idea as to how efficient the management is at using its assets to generate earnings. It is calculated by dividing a company's annual earnings by its total assets. The previous literature found ROA is a significant factor in explaining corporate failure. For example, Altman (1968), Altman, Haldeman and Narayanan (1977), Izan (1984), Mcgurr and DeVaney (1998), Laitinen and Laitinen (2000), Zapranis and Ginoglou (2000), Ginoglou, Agorastos and Hatzigagios (2002) and Beaver, McNichols and Rhie (2005), found ROA as a significant variable.

B. Operating profit margin (OPM)

Ratio is calculated by dividing Operating profit for a certain period by revenue for that period. Operating profit margin indicates how effective a company is at controlling the costs and expenses associated with their normal business operations. Platt and Platt (2002) found the operating profit margin is a significant variable in predicting financial distress among companies in the Automobile supplier industry. Consistent with Platt and Platt (2002), Parker, Peters and Turetsky (2002) also found the operating profit margin is significantly related to the survival likelihood of failed companies.

C. Return on equity (ROE)

ROE measures the return earned on the funds contributed by the company's ordinary share holders. This is calculated by dividing {net profit (after tax)} - preference dividends by average ordinary share holders' equity. Altman (1968) found that return on equity outperformed other profitability measures including cash flow. Consistent with Altman (1968), Izan (1984) also found return on assets a useful factor in discriminating failed companies.

D. Current ratio (CR)

An indication of a company's ability to meet short-term debt obligations; the higher the ratio, the more liquid the company is. Current ratio is equal to current assets divided by current liabilities. Studies that found the current ratios useful in predicting corporate failure include Beaver (1966), Alman, Haldeman and Narayanan (1977), Izan (1984), McGurr and Devaney (1998), Charalambous, Charitou and Kaourou (2000), Laitinen and Laitinen (2000), Parker, Peters and Turetsky (2002) ,Platt and Platt (2002).

E. Quick ratio(QR)

This is an indicator of a company's short-term liquidity. The quick ratio measures a company's ability to meet its short-term obligations with its most liquid assets. The higher the quick ratio, the better the position of the company. It is calculated by dividing quick assets (current assets minus inventories) by current liabilities. The quick ratio was found significant as

regards financial distress, financial failure or bankruptcy in Laitinen and Laitinen (2000) and Laitinen (2005).

F. Working capital to total assets ratio (WCTA)

Working capital is the measure of the net liquid assets of the firm relative to the total capitalization. Since net working capital is defined as current assets minus current liabilities, Beaver (1968) pointed out that this measure is free from manipulation through window dressing. According to Altman (1968), working capital to total assets is the most valuable ratio in predicting corporate failure compared to the other two liquidity variables, namely, the quick and the current ratio. Similarly, Beaver (1966) also found that working capital to total assets is a useful factor in predicting bankruptcy. In addition, Chen and Lee (1993) explored how long firms were able endure the oil and gas industry turmoil of the early 1980 before facing financial distress.

G. Debt to equity ratio (DER)

Debt/equity ratio is equal to long-term debt divided by common shareholders' equity. If the ratio is greater than 1, the majority of assets are financed through debt. If it is smaller than 1, assets are primarily financed through equity.

H. Debt ratio (DR)

The debt ratio compares a company's total debt to its total assets, which is used to gain a general idea as to the amount of leverage being used by a company. A low percentage means that the company is less dependent on leverage, i.e., money borrowed from and/or owed to others. The lower the percentage, the less leverage a company is using and the stronger its equity position. In general, the higher the ratio, the more risk that company is considered to have taken on. It is calculated by dividing total liabilities by total assets. Based on univariate analysis, debt ratio was found to be one of the six best predictors of corporate failure by Beaver (1966). Beaver (1968) also confirmed that the debt ratio predicts corporate failure better than do the other relevant ratios at one, four and five years before failure. Incorporating financial ratios' stability measurements with MDA in predicting corporate failure, Dambolena and Khoury (1980) found debt ratio to be one of best predictors in discriminant function.

I. Assets turnover ratio (ATR)

This ratio indicates how successful a firm is in utilizing its assets in generation of sales revenue This is calculated by dividing net sales by total assets. Altman (1968) pointed out that total assets turnover is the standard financial ratio presenting the ability of a firm to generate sales from assets and it is one measure of management's capacity to deal with competitive conditions

J. Capital turnover ratio(CTR)

It measures the ability of the firm to generate sales using capital invested. It is calculated by dividing net sales by total capital employed. Studies that found the capital turnover ratio useful in predicting corporate failure include Molinero and Ezzamel (1991) and Laitinen (1992).

K. Cash flow from operations to total debt (CFFOTD)

Beaver (1966) suggested that the ratio of cash flow to total debt, which measures a company's ability to cover future debt obligations, is the single best predictor of bankruptcy. His definition of cash flow equates with the modern classification of cash flows from operations; this ratio is supported in subsequent literature by authors such as Holmen (1988), Mills and Yamamura (1998) and Sharma and Iselin (2003).

L. Cash flow from operations to net income (CFFONI)

The cash flow from operations to net incomes ratio indicates the extent to which net income generates cash in a business.

M. Cash flow from operations to current liabilities (CFFOCL)

Operating cash flow is a measure of how much cash a company has on hand, while current liabilities show expenses it must pay in the near future. The operating cash flow ratio thus shows a company's ability to meet these liabilities without having to sell assets or take any similar actions.

N. Cash flow from operations to total liabilities (CFFOTL)

It measures the firm's ability to generate cash flow from operations to service debt. The ratio equals cash flow from operations divided by total liabilities.

O. Cash flow from operations to total assets (CFFOTA)

This ratio indicates the cash a company can generate in relation to its size. It is calculated by dividing cash flow from operations by total assets.

III. METHODOLOGY AND SAMPLE SELECTION

A. Sample selection

All the listed companies in Colombo Stock Exchange (CSE) that had been failed during the period 2002 to 2008 were taken for the study and the matched sample design method was applied for this analysis. Each failed company has a non failed partner in the sample. The failed companies will be paired to the non failed companies using criteria; same industry, same failure year and closest asset size.

This matching design is consistent with the vast variety of prior corporate failure studies (Altman, 1968; Aziz and Lawson, 1989; Beaver, 1968; Casey and Bartczak, 1985; Charitou et al., 2004; Wilcox, 1973).

Based on reviewing literature, the present study employs a failure definition adapted from Hopwood et al. (1988), Lee et al. (2003), Sori and Jalil (2009) and Abou EI Sood (2008). A company is considered among the failing companies if and only if one of the following conditions is satisfied. (1)The companies that had been incurring losses for three years continuously or more, (2) The companies that had illustrated negative position in cash flow for three years continuously or more.

A total of 70 failed companies were identified during the years of determination and with the match sample criteria, total sample consist with 140 companies; 70 failed and 70 non failed.

B. Modelling approach

Models have been used extensively as tools for predicting corporate failure since the late 1960s. Logistic regression is a technique for the analysis of data when the dependent variable is categorical and independent variables are quantitative or qualitative, and the assumption of multivariate normality is not satisfied (Perera, 2006). It allows for the prediction of the probability of a discrete outcome from a set of variables that may be continuous, discrete, dichotomous or a mix of any of these. Generally, the dependent variable is dichotomous (0/1), such as the presence or absence of success. In the analysis for this study, the dependent variable is the failure (1) of a company or its lack of failure/continuing success (denoted by a 0); the model uses the independent variables to deliver a probability of failure. There is a strong argument to support the view that it is the most appropriate tool for this form of predictive analysis. Hence, this study used the logistic regression as the modeling approach.

We use following logistic regression model to develop the corporate failure prediction model.

$$P_i(Y=1) = 1/(1+e^{-z})$$
$$= 1/\{1+\exp[-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots + \beta_{15} X_{15})]\}$$

Where,
$P_i(Y=1)$ = Probability of failure for firm i;
exp = exponential function;
$\beta_1, \beta_2, \ldots$ = slope coefficients;
$X_1, X_2, \ldots$ = Financial ratios

IV. RESULTS AND DISCUSSIONS

A. Descriptive statistics

Table I presents the summary statistics and paired sample t tests for the independent variables. Looking at the mean values for the ratios under study, it can be seen that differences between the two groups do appear to exist. ROA, OPM and ROE for non failed companies averaging 10.98%, 26% and 15% respectively indicate that profits were generated throughout the period, for non failed companies. On the other hand, ROA, OPM and ROE for failed companies are 3%, .06% and -71% respectively. The t-values for OPM and ROE are not significant. However, the t-value for ROA is statistically significant. Therefore, among profitability ratios, return on equity is significant in differentiating failed companies from non failed companies.

Looking at the differences in cumulative liquidity ratios for both non failed and failed companies, differences between the two groups does appear very small except for working capital to total assets ratio (WCTA). Other two measurements of liquidity: Current ratio (CR) and quick ratio (QR) are not significantly different between two groups. Mean values of CR for failed and non failed companies are 2.39 and 3.48 respectively. Further, mean values of QR for failed and non failed companies are 2.1 and 2.8 respectively. Hence, almost two ratios for both groups are same with the same variations throughout the period under study. This was also proved by the calculated t- values for these ratios. However, it is found that the mean value of WCTA is about 16% for the non failed companies and -8% for failed companies. Difference in mean values of WCTA for failed and non failed companies is statistically significant at 1% level. Therefore, among three liquidity ratios, working capital as a percentage of total assets is significant in differentiating failed companies from non failed companies.

Looking at the debt to equity ratio (DER) throughout the period under study, it can be seen that failed companies are highly leveraged with a cumulative DER ratio of 3.03 times. Variation of the values as given by respective standard deviation seems to be very high for failed companies. Further, variations of mean values of DER for non failed companies are little compared to failed companies. Moreover, debt ratio (DR) for non failed companies is approximately 38% and DR ratio for failed companies is 66%. According to the t values, it is evident that DR is statistically significant in differentiating failed companies from non failed companies than DER. Further, none of the efficiency ratios both assets turnover ratio and capital turnover ratio were significant in differentiating failed companies from non failed companies.

If we look at the average cumulative mean values for the Cash Flow ratios throughout the period under study, the largest differences in means with little variations is given by the cash flow from operating activities to total assets ratio (CFFOTA). It is significantly negative. This result indicates that CFFOTA is less than 0 for failed companies. Calculated t value for this ratio is 4.805 and it is statistically significant at 1% level. Except two cash flow ratios, other ratios resulted negative mean values for failed companies, while all the cash flow ratios are positive for their non failed companies.

TABLE I. DESCRIPTIVE STATISTICS FOR FINANCIAL RATIOS

Ratio	Non failed companies		Failed companies		t –stat
	Mean	Standard dev.	Mean	Standard dev.	
ROA	0.109	0.093	0.034	0.178	-3.309***
OPM	0.262	0.460	0.006	1.714	-1.248
ROE	0.158	0.163	-0.714	4.808	-1.514
CR	3.489	8.880	2.397	9.844	-0.764
QR	2.817	8.754	2.110	9.882	-0.447
WCTA	0.168	0.211	-0.084	0.403	-5.448***
DER	0.318	0.392	3.033	13.256	1.725
DR	0.377	0.227	0.663	0.611	3.892***
ATR	0.960	0.858	0.794	0.805	-1.389
CTR	1.681	2.142	1.641	2.188	-0.117
CFFONI	1.526	7.673	0.335	3.527	-1.190
CFFOTL	0.221	0.754	-0.263	4.683	-0.863
CFFOTA	0.074	0.099	-0.014	0.140	-4.805***
CFFOCL	0.521	1.008	-0.052	5.424	-0.888
CFFOTD	1.614	3.562	0.524	9.135	-0.969

***Denotes 1% significant level

ROA=return on assets; OPM=Operating profit margin; ROE=Return on equity; CR=current ratio; QR=quick ratio; WCTA=working capital to total assets; DER=debt to equity ratio; DR=debt ratio; ATR=assets turnover ratio; CTR=capital turnover ratio; CFFONI=cash flow from operating activities to net income; CFFOTL= cash flow from operating activities to total liabilities; CFFOTA= cash flow from operating activities to total assets; CFFOCL= cash flow from operating activities to current liabilities; CFFOTD = cash flow from operating activities to total debt.

B. Logistic analysis results

Table II shows results of logistic regression analysis for financial ratios. Based on the result of 140 complete observations, three financial ratios were deemed to be significant as given by their z-statistic. The variables deemed statistically significant were; working capital to total assets (WCTA), debt ratio (DR), and cash flow from operating activities to total assets (CFFOTA). WCTA and CFFOTA are statistically significant at 1% level. Further, DR is statistically significant at 5% level. Log likelihood ratio of the model is 62.020 and it is statistically significant at 1% level. Further, McFadden R squared of the model is 32%. Hosmer and Lemeshow test indicates that there is no statistical significant difference between model predicted values and observed values. So, it is reasonable to consider that the goodness of fit of the Model is quite acceptable, and expect a well performed forecast ability.

The final selected variables and related regression coefficients as shown in table II are used to derive the logistic regression function for model consists with financial ratios.

$$Z = -0.228 -5.190WCTA + 1.844DR -10.089CFFOTA$$

TABLE II. LOGISTIC REGRESSION ANALYSIS FOR FINANCIAL RATIOS

Variable	Coefficient	z-Statistic	Prob.
C	-0.228	-0.488	0.625
WCTA	-5.190***	-3.807	0.000
DR	1.844**	2.160	0.030
CFFOTA	-10.089***	-4.253	0.000
McFadden R-squared **0.320**			
LR statistic **62.020**			
Prob(LR statistic) **0.000**			
Hosmer & Lemeshow test **5.960 (0.65)**			

**Denotes 5% significant level; ***Denotes 1% significant level
WCTA=working capital to total assets; DR=debt ratio; CFFOTA= cash flow from operating activities to total assets.

C. Validation of the logit model

Table III shows validation test results for the model. Using in –the sample data, to classify a firm whether it is failed or non failed, the probability of corporate failure for each firm is calculated from the cumulative probability function $P = 1/\{1+e^{-logit\ function}\}$.

Corporate failure prediction model developed using one year before the failure data and it has been tested for robustness using two years before the failure and three years before the failure data. Validity of the model depends on its applicability for multi period. That is, the longer the accuracy of the model could be maintained, the better the model becomes. The overall correct classification results for one, two and three years prior to failure are 77.86%, 72.14% and 74.29%, respectively. As the predictive powers of the model in all three years prior to failure are above 72%, it can be concluded that the model is robust. Further, it indicates that valuable results could be obtained for up to three years prior to failure.

TABLE III. VALIDATION TEST RESULTS

1 year before the failure	2 years before the failure	3 years before the failure
77.86%	72.14%	74.29%

V. DISCUSSIONS

Evidence shows that the mean differences of the return on assets (ROA), working capital to total assets (WCTA) and cash flow from operating activities to total assets (CFFOTA) are significantly negative. As the ROA is a proxy for profitability, it can be stated that the failed companies have less ability to generate profit than the non failed companies. This is consistent with the results of previous studies such as Altman (1968), Altman, Haldeman and Narayanan (1977), Izan (1984), McGurr and DeVaney (1998), Laitinen and Laitinen (2000). Further, consistent with these studies, Zapranis and Ginoglou (2000), Ginoglou, Agorastos and Hatzigagios (2002) and Beaver, McNichols and Rhie (2005) also found ROA is a useful factor in discriminating failed companies in Australia.

However, other ratios used to measure the profitability of failed and non failed companies, are found to be insignificant. This means that the mean differences of return on equity (ROE) and operating profit margin (OPM) for failed companies and non failed companies are not significantly different between two groups.

Looking at the differences in cumulative liquidity ratio as measured by working capital to total assets (WCTA) for both non failed and failed firms, differences between the two groups does appear large and significant. It shows that the amount of liquidity carried by these non failed companies is significantly greater than those of the failed companies. Results revealed that most of the failed companies were unable to generate sufficient liquidity to their firms by utilizing assets employed in the organization. This may be due to idle assets in the organization. Research finding of WCTA is consistent with the results in previous studies. Deakin (1972) found that liquidity as proxy by WCTA was the best predictor of potential distress re-classification both in the near-term (1 year prior to event) and in the long-term (5 years prior to event).

For Cash Flow ratios, again it can be found that differences in cumulative mean values between the two groups do appear to be significant. It means that the failed companies demonstrate a much lower ability to utilize the assets to generate the cash flows. These findings are in accordance with those of Beaver (1966).

Study used two types of leverage ratios namely debt ratio (DR) and debt to equity ratio (DER). It can be seen that failed companies are highly leveraged than non failed companies during the period under study. As the larger use of long term debt is positively correlated to increasing interest and principal obligations, it is expected the firms to carry significantly higher financial risks. While this increases the possibility of interest or principal default. Research finding that DR is a significant variable in differentiating failed companies from non failed companies is consistent with Beaver (1966). Dambolena and Khoury (1980) found debt ratio to be one of best predictors in discriminant function. Flagg, Giroux and Wiggins (1991) also found that debt ratio is significantly positively related with a progression towards business failure for firms that enter a potential failure process. However, it is

observed that there is no statistical difference between failed and non failed companies when considering the debt to equity ratio (DE). According to the mean values of efficiency ratios which are measured by assets turnover ratio (ATR) and capital turnover ratio (CTR), there are no significant differences exist between two groups. Therefore efficiency ratios are not statistically significant in differentiating failed companies from non failed companies. This is consistent with Laitinen (1992). However, this is different from Altman (1968). He pointed out that total assets turnover is the standard financial ratio presenting the ability of a firm to generate sales from assets and it is one measure of management's capacity to deal with competitive conditions.

VI. CONCLUSION

This study focuses on predicting corporate failure of listed companies in Sri Lanka using logistic regression technique. It can be evident that a substantial amount of research effort has been devoted to the development of models to help predict such events. However, limited numbers of studies have been carried out using both accrual and cash flow based financial ratios to predict corporate failure. According to the authors' best knowledge, there were no any studies carried out in Sri Lanka using such a combined model. This is the first study to utilize a combined model to predict corporate failure of listed companies in Sri Lanka. Our results suggest that the working capital to total assets ratio, Cash flow from operating activities to total assets and Debt ratio are significant predictors of corporate failure. Hence, It can be seen that failed companies were highly leveraged, inefficient in utilizing assets to generate cash flows and unable to generate sufficient liquidity than non failed companies during the period under study. Estimating probability of failure is valuable for credit rating agencies and financial institutions to consider granting loans to companies , investment decisions in listed companies could be enhanced through predicting probability of failure. Investors can use this model as a valuable technique for screening out undesirable investments. Management and other regulatory institutions can use the model to predict the probability of firm's failure. So, there by they can take either preventive or corrective actions to mitigate the risk of further collapses.

However, all our findings are based on Sri Lankan stock market, so there may be limitations in extending to other countries. Corporate failure prediction variables employed in this study could be further explored in other aspects like corporate governance mechanisms. In addition to internal factors, however, future research could further explore the external factor of corporate failure. Particularly, macroeconomic variables, for instance, GNP, interest rates and unemployment rates could be added to the corporate failure model.

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