THE USE OF FINANCIAL RATIOS IN PREDICTING FINANCIAL DISTRESS OF LISTED ENTITIES IN SRI LANKA

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Abstract

Corporate failure represents the most severe circumstance an organization or a business entity may encounter. Consequently, forecasting impending financial distress is paramount in circumventing corporate failures and shakeouts. This study aims to construct a framework employing the formulated financial indicators to anticipate the financial distress of listed companies in Sri Lanka. The research encompasses many listed entities in the Colombo Stock Exchange, except for financial institutions. It relies on publicly accessible information from the corporate annual reports of a comprehensive sample of 50 firms. These firms are divided into two clusters, namely 25 distressed firms and 25 non-distressed firms, which possess comparable capacities. The investigation spans 6 years, commencing in 2016 and concluding in 2021. A set of ten devised financial ratios were utilized to ascertain the model and examined through logistic regression analysis. The findings from the statistical tests revealed that the model's ability to forecast accurately, in line with the financial ratios, stands at 77.86% one year before the onset of financial distress. Moreover, the model's predictive performance remains commendable, with an accuracy that surpasses 72% throughout the three years leading to financial distress. As a result, it can be concluded that the model's robustness in generating reliable outcomes extends up to three years before the manifestation of failure. Therefore, in relation to the requisite and the prevailing circumstances, the enterprises, shareholders, workers, providers, banking establishments, regulatory entities, and assessors will derive advantageous insights from the advanced framework in Anticipating the financial distress of listed entities in Sri Lanka.

Keywords: *Financial Distress, Corporate Failure, Financial Ratios, Listed Entities*

JEL Classification: G10

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1   Introduction

Every business will have an objective to thrive, survive and stabilize in the industry in which it operates. But it is noticed that a number of businesses established with such motive have failed in large numbers in the recent past causing widespread implications on multiple stakeholder bases. Referring to the above as corporate failure, which is a common problem for both developed and developing economies (Altman et al., 1979). There had been a considerable number of studies conducted on corporate failure and bankruptcy in depth, widespread spectrums exemplify the importance of the particular field of study. Referring deeper, corporate failure doesn't happen overnight instead lasting unattended financial distress causes the corporate failures to happen, which results in the collapse of the entire business or conglomerate Lakshan and Wijekoon (2023). Having said that, financial distress being the earlier step of corporate failure; if an entity or a business was able to predict the forthcoming financial distress, they could have taken steps to understand the causes of such a situation and could have generously reacted in a way mitigating the emerged condition which would in return allow them to address the financial distress and ultimately get rid of the corporate collapse. As there were entities and businesses which failed during the last decade in Sri Lanka, which has led to so much of negative consequences among the stakeholders, including the shareholders, employees, customers, depositors, auditors and community, which could have been avoided, provided that they have predicted the forthcoming financial distress and ultimately the corporate failure. The consequence and importance of the mentioned financial distress prediction motivated to conduct the study in the field of predicting financial distress. In addition, Beaver (1968) suggested that the utilization of financial ratios has the potential to anticipate the probability of corporate insolvency. Altman (1968) believed that the financial ratio measurements of a failed firm and a non-failed firm are significantly different. Out of the very few studies which were conducted in predicting corporate failure in the Sri Lankan context and as the majority of which liaise around Altman's Z score model (1968), this study would want to incorporate the analysis of financial ratios in predicting the financial distress. The intended study will be using accrual accounting financial ratios as they do deploy a certain amount of insights on the financial position, stability and performance of a firm, but there are possibilities of management window dressing when we solely rely upon the accrual

ratios perhaps, for us to have a holistic understanding and also to strengthen the intellectual argument the study will also be incorporating the cashflow based financial ratios which reflect its ability as to how it manages the cashflow, and subsequently, the study will be developing a financial distress prediction model using the variables considered. Having generated the model and featuring the relationship of the obtained financial ratios with that of the financial stability and distress of the considered entities, It is reclaimed to extend the study to test the existing Altman's Z score model to rationalize the findings with the existing model and ultimately to put forward a justified conclusion whether if we could use the Altman's Z score corporate failure model in predicting the upcoming financial distress in Sri Lankan context. Therefore, research problem is that, Given the current context of our country, we see many corporates putting themselves in the extreme of financial distress, and subsequently they fail Lakshan & Wijekoon (2023). Liaising around a problem where financial distress is not something which happens overnight instead, it takes a long series of time gradually. Therefore, if a firm had applied relevant mechanisms, couldn't they have predicted the rising financial distress? Will it be possible for a firm to feel any financial indicators that don't seem to be look good, and If that is the case, why the entities which failed were unable to predict such downfall before or at least at the earliest of financial distress which could have mitigated the serious implications on multiple stakeholders? Can we feature any deviations in the financials of a firm which led to financial distress compared to that of the one which was financially stabilized?. Hence in finding an answer to such a problem, the study would intend to figure out how the financial ratios can be used in foreseeing the forthcoming financial distress of a company. Below four (04) research questions were tested,

a) Do the financial ratios support predict forthcoming financial distress of listed companies in Sri Lanka?

b) If so, what financial ratios could be considered used in predicting financial distress?

c) How to identify a Sri Lankan listed entity which is/was financially distressed?

d) What is the nature of the relationship between the type/cluster of financial ratios and its predictability of financial distress?

Below research objectives were tested under the above research questions.

a) To identify whether the financial ratio analysis justifies the forthcoming financial distress.

b) To formulate a model using the financial ratios which predict the corporate financial distress.

c) To identify what the ratios would support in predicting the financial distress.

d) How and what are the ratios that aid in predicting such distress would differ in comparison with different industries?

e) To ascertain the nature and the correlation of the relationship between the type of financial ratios with the prediction of financial distress.

The significance of this study is that the study will be trying to ascertain the use of financial ratios in predicting corporate financial distress. Unattended malfunctions and misappropriations cause the entities to go under the shell of financial distress and which ultimately results in corporate failure. The collapse of an entity would have multifaceted implications on the stakeholders, including the shareholders, managers, employees, customers, lenders, etc; whereby on the flip side, the negative implications due to financial distress are much more limited than the above. It does have significant negative consequences, such as long outstanding suppliers, pay cuts, restricted dividends, etc but the impact of which is much lighter than that of the collapse of an entire entity. Therefore, using this, the study intends to look through how the financial ratios could be used as indicators of financial distress, where the findings of which would allow the entities to apply and test in terms of their financial strength and stability and taking the required corrective actions and strategies to alleviate any negatives which would prevent them from being under financial distress and ultimately from corporate failure.

2 Literature Review

Effects and implications of financial distress could lead to corporate bankruptcy and corporate failure which can be highly devastating to an economy and also to the key stakeholders. Hence it is important to utilize the distress prediction models or to predict the forthcoming distress as an early warning to evaluate more accurately whether the business or the entity considered will be under financial distress which would ultimately lead to the business being kicked out of the industry. Therefore, this study would mainly focus on how to predict the financial distress of companies which

are listed on the Colombo Stock Exchange by the use of financial ratios and also by applying the existing Altman's Z – score model Altman (1968) in the Sri Lankan context. Unattended malfunctions and misappropriations cause the entities to go under the shell of financial distress and which ultimately would result in corporate failure. The collapse of an entity would have multifaceted implications on the stakeholders including the shareholders, managers, employees, customers, lenders and etc., whereby on the flip the negative implications due to financial distress is much more limited than the above. It does have significant negative consequences such as, long outstanding suppliers, pay cuts, restricted dividends and etc. But the impact of which is much lighter than that of the collapse of an entire entity. Therefore, by means of this study, it is intended to look through how the ratios could be used as the indicators of financial distress, where the findings of which would allow the entities to apply and test in terms of their financial strength and stability and take any corrective actions and strategies to alleviate any negatives which would prevent them from being under financial distress and ultimately from corporate failure.

As there were substantial number of researches conducted around corporate failure prediction models and reviewing the existing corporate failure models, financial ratios being a major standout predictor of financial distress which ultimately leads towards the corporate failure which has much worse and wide implications than a span of financial distress, predicting the situation of financial distress as early as before it occurs will allow the entities and corporates to make sure that the downfall will be managed effectively Lakshan and Wijekoon (2023). Beaver's (1968) previous research suggested that financial ratios have the ability to forecast the probability of a company's failure. Furthermore, Altman (1968) posited that there are notable distinctions in the financial ratios between failed and non-failed firms. Having said that there were many studies conducted focusing on the corporate failure prediction models and mainly based on the Altman's Z-Score model (1968) using multiple discriminant analysis (MDA).

In order to identify the causes of failure and financial distress, studies have undertaken the variations of multiple discriminant analysis and another quantitative modelling to receiving the entity's financial statements (Beaver et al., 2005; Casey & Bartczak, 1984; Charitou et al., 2004; Ciampi, 2015; Murty & Misra, 2004). Researchers were undertaken utilizing financial performance ratios derived from the revenue and aggregate expenses in examining the organizational success. In addition

to the financial performance predictability ratios, studies were conducted liaising around the predictability of corporate failure in relation to corporate governance (Lakshan & Wijekoon, 2023).

In working along with the study, an entity was classified as financially distressed according to two stipulations, initially, if an entity incurred losses before tax for three years continuously or in the case of an entity incurring negative net operating cash flows for three years in a row. If either of these two stipulations were present in an entity listed on Colombo Stock Exchange, it is considered a financially distressed firm. Further, we have taken two pools of entities into consideration, namely fifty Financially Distressed entities and fifty Financially Non-Distressed entities between the period 2013 to 2021.

Referring through the papers, there are two most accessed papers in the area of financial distress which are by Edward Altman and Beaver. Beaver (1996) through his study examined how the financial ratios could predict a business failure by using univariate analysis and Altman (1968) figured out that the cashflow to debt ratio to be a significant predictor and liquid asset ratios to be a weaker variable in predicting the business failure. Altman (1968) applied the multiple discriminant analysis on 66 firms of which 33 were bankrupt firm and the other half was non bankrupt and the study resulted in an accuracy of 95% one year prior to the bankruptcy and the same study resulted in a 72% accuracy two years before the bankruptcy. In addition, he Altman (1968) claimed that there a mix of five financial ratios could explain the bankruptcy, which are; Retained Earnings by total assets, EBIT by total assets, Working capital by total assets, Market Value of Equity by total debt and Sales by total assets. Apart from these two studies, Charitou et al. (2004) established a corporate failure prediction model using neural networks and logit methodology to a pair of 51 failed and non-failed UK firms. The study ultimately exemplified that the three financial variables including Cashflow, Profitability and Financial Leverage has a significant say in predicting the corporate failure yielding an accuracy of 83%, one year before the failure.

Restianti and Agustina, (2019) in their study had an objective which was similar to the one of this study as well, that is to analyze the influence of financial ratios against the financial distress of listed Indonesian companies. As means of the study they have concluded that EBIT to total assets and return on equity have an impact of financial distress, and on the other hand current ratio, retained earnings to total assets, debt to

assets ratio, and total assets turnover has no impact in predicting the company's financial distress. Ultimate recommendation was that, condition of financial distress can be avoided by reducing the usage of debt financing, increasing sales and maximizing the use of assets and equity.

Morum and Roy (2013) created a forecasting model for corporate illness in the Indian Steel Industry. The model utilized seven financial ratios, namely debt to equity ratio, long term debt to equity ratio, current ratio, fixed asset turnover ratio, debt turnover ratio, return on capital employed, and rate of growth of PAT. The observation was that rate of growth of PAT and debt to equity ratio are significant predictors of sick steel companies Balasubramanian et al. (2019)

A study by Lakshan and Wijekoon, (2013) addressed the same mentioned above, where it was conducted focusing on predicting the corporate failure of listed companies in Sri Lanka. The study was conducted considering not only the cashflow based financial ratios, rather did include accrual based financial ratios in predicting the corporate failure. The result of the study was that, working capital to total assets ratio, Cashflow from operating activities to total assets and debt ratio are the vital and significant predictors of corporate failure. Therefore, the failed companies were seemed to be highly leveraged, insufficient in utilizing their assets and unable to generate sufficient liquidity than the non-failed firms.

Predominately debt ratio, leverage ratios and gearing along with profitability ratios have a significant say in predicting both the financial distress and business failure. Whereas working capital and liquidity ratios were proven very minimal handful in predicting either financial distress or business failure except for the study which was conducted based on the Sri Lankan context by Lakshan and Wijekoon, (2013) the study which justifies that the use of cash based, and accrual based working capital ratios have a significant say in predicting the corporate failure in the Sri Lankan context.

In addition to the ones mentioned, there were significant number of studies conducted in liaising around predicting the corporate failure, but taking a step forward this study would go to an extent of predicting the financial distress, non-adherence of which could result in the corporate failure. Corporate failure is an extension and devastation of financial distress and if an entity could predict its fore coming financial distress, would allow them to manage it effectively.

3 Research Methodology

This study would aim to address the highlighted gap in identifying the use of financial ratios in predicting the financial distress of listed entities in Sri Lanka.
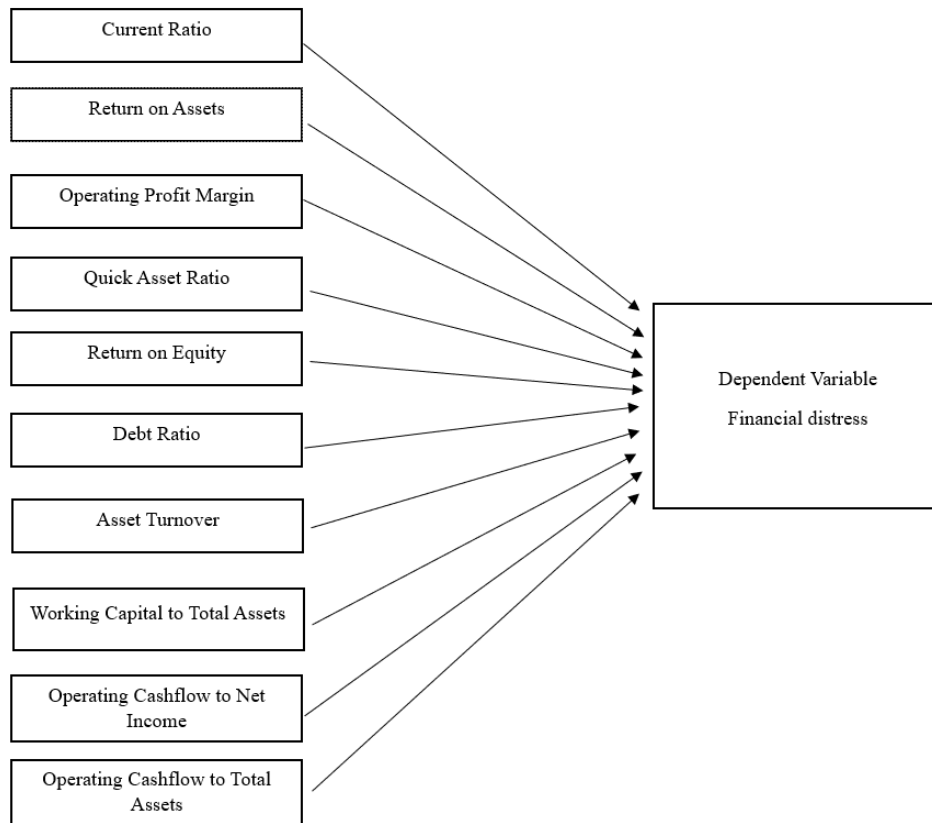
3.1 Conceptual Framework

Figure 1: Conceptual framework
Source: Research data

3.2 Development of Hypotheses

Based on the findings of the study (Lakshan & Wijekoon, 2013), below hypotheses were formed.

Table 1: Hypotheses of the study

FINANCIAL RATIO	HYPOTHESIS
Current Ratio	H1. Current Ratio is significantly different between distressed and non-distressed firms.
Quick Asset Ratio	H2. Quick Asset Ratio is significantly different between distressed and non-distressed firms.
Return on Assets	H3. Return on Assets is significantly different between distressed and non-distressed firms.
Return on Equity	H4. Return on Equity is significantly different between distressed and non-distressed firms.
Operating Profit Margin	H5. Operating Profit Margin is significantly different between distressed and non-distressed firms.
Asset Turnover	H6. Asset Turnover ratio is significantly different between distressed and

	non-distressed firms.
Debt Ratio	H7. Debt Ratio is significantly different between distressed and non-distressed firms.
Working Capital to Total Assets	H8. Working Capital to Total Assets is significantly different between distressed and non-distressed firms.
Operating Cashflow to Net Income (OCNI)	H9. OCNI is significantly different between distressed and non-distressed firms.
Operating Cashflow to Total Assets (OCTA)	H10. OCTA is significantly different between distressed and non-distressed firms.

A deductive approach was taken into consideration in the study. Further a longitudinal method of study was adhered.

3.3 Population and Sample

Study population comprises of entities listed in Colombo Exchange excluding the financial institutions and fully fledged service vending organizations during the period of 2016 to 2021, of which sample selected based on purposive sampling technique. The entire population considered clustered in to two parts as, Financially Distressed Companies and Non-distressed companies. A purposive sampling technique upheld in arriving at the sample.

Through such sample, 25 distressed entities during the mentioned period selected and for each selected distressed company, a non-distressed company also matched depending on the industry, failed year and asset value for the comparison and justification purpose. Therefore, out of the population of listed entities excluding the financial institutions, 50 listed entities considered as the sample size of the study.

3.4 Method of Data Analysis

Data collected from published secondary data, and as means of data collection 50 entities were analyzed over a span of 06 years, covering 300 individual annual reports, 900 financial statements being reviewed namely Income statement, Statement of Financial Position and Cashflow statement and resulting in 3000 financial ratios being measured, and which analyzed via binary logit regression.

Refereeing to the prior literature relating to this study (Tahir, 2018; Freitas Cardoso et al., 2019; Werner et al., 2018; Sameera & Senaratne, 2015; Hafiz & Desi, 2017) has used Altman Z-score model to distinguish firms who are financially distressed and firms who are not financially distressed and binary logistic regression analysis to

analyze the data. Since according to the intended study, as a further addition the study also tested existing corporate failure prediction model of Altman's Z score model in which this method of study used. The analysis for this study focuses on the dependent variable, which is the level of distress experienced by a company. Distress is represented by the value 1, while the absence of distress or continued success is marked by 0. The model utilizes independent factors to calculate the probability of distress.

Z = 1 { Financially Distressed }
Z = 0 { Financially Non-Distressed

A further addition, validation of financial distress prediction model developed as follows,

$$Pi\,(Y = 1) = 1 / [\ 1 + exp\ \{\beta 0 + \beta 1\,X1 + \beta 2\,X2 + \beta 3\,X3\ \dots\ \beta 10\,X10\ \}\ ]$$

Formula 01

3.5 The Econometric Model

The below econometric model was formulated referring to the prior studies (Lakshan & Wijekoon, 2013; Tahir, 2018; Sameera & Senaratne, 2015) and the identified variables. The findings of the aforementioned financial ratios of listed entities in Sri Lanka tested through Altman's Z score model and via a self-developed model respectively.

$$FD = c + \beta 1(CR) + \beta 2(QR) + \beta 3(ROA) + \beta 4(ROE) + \beta 5(OP) + \beta 6(AT) + \beta 7(DR) + \beta 8(WCTA) + \beta 9(OCNI) + \beta 10(OCTA) + \text{\texteuro}U$$

Formula 02

4   Analysis and Findings

4.1 Descriptive Statistics

Table 2: Descriptive statistics

	Mean	**Max.**	**Min.**	**Std Dev**	**Skew.**	**Kurt.**
FD	0.500	1.00	0.00	0.505	0.00	-2.085
CR	1.514	7.94	0.12	1.713	3.91	18.941
ROA	0.234	2.96	-1.10	0.799	4.52	25.718
OPM	0.029	0.46	-1.04	0.227	-2.54	9.932
QAR	1.126	5.81	0.05	1.634	4.79	26.427
ROE	0.034	4.98	-2.42	1.185	0.60	10.473
DR	0.331	0.81	0.01	0.270	1.24	1.143
AT	2.509	25.31	0.08	4.102	4.17	20.357
WC_TA	-0.004	0.65	-1.70	0.356	-2.38	10.337
OC_NI	1.434	14.81	-6.07	3.133	1.64	6.507
OC_TA	0.117	0.81	-0.31	0.173	1.27	4.460

Source: Research data (2022)

Table 3: Mean values and statistical significance

Ratio	Non-Distressed Comp		Distressed Companies		T - Stat	Sig – 2 Tailed
	Mean	Standard Deviation	Mean	Standard Deviation		
CR	1.3860	0.7495	1.6448	2.3228	-0.530	0.600
ROA	0.5116	1.0223	-0.0404	0.3180	2.578	0.013 ***
OPM	0.1424	0.0926	-0.0832	0.2642	4.029	0.000 ***
QAR	0.9704	0.5407	1.2812	2.2598	-0.669	0.509
ROE	0.3260	0.6588	-0.2560	1.5030	1.973	0.045 ***
DR	0.2696	0.1796	0.5928	0.3293	-1.942	0.009 ***
AT	3.0184	4.8740	2.0004	3.1717	0.875	0.386
WC_TA	0.0168	0.3954	-0.0260	0.3198	0.421	0.676
OC_NI	2.2820	3.0980	0.5864	2.9918	1.968	0.055
OC_TA	0.1808	0.1258	0.0540	0.1936	2.746	0.008 ***

Source: Research data (2022)

Further diagnostic tests were conducted to ensure whether the derived data set is normally distributed and to make sure that it doesn't exploit multicollinearity. According to the tests results Jarque Bera test, it was evident that the considered data set of 3000 financial ratios among 50 companies are normally distributed. In addition as per to the test results of Variance Inflation Factors, all the considered 10 financial ratios were proven to be having a centered VIF value which is less than ten (10) in

fact, which is even lower than 6 for all the ten independent variables, hence it could concluded that the data model doesn't suffer from Multicollinearity and it is viable to carry forward the data for further analysis.

Table 3 displays the summary statistics and the results of the independent sample T test for the independent variables, specifically the 10 financial ratios. For the purpose of determining whether or not there is statistical evidence that the associated population means are significantly different, the independent sample t test compares the mean values of two independent groups. According to the study, the independent groups consist of companies that are not in distress and companies that are in distress.

Having the objective of the study to determine the financial ratios which are significantly different between the distressed and non-distressed firms, identified mean values should be significantly different between the two independent groups and which should also be statistically significant.

For the purpose of carrying out the independent sample t test, Levene's Test for Equality of Variances was utilized, and the hypotheses that were utilized were as follows:

$H_0: \sigma_1^2 - \sigma_2^2 = 0$ ("the population variances of group 1 and 2 are equal")
$H_1: \sigma_1^2 - \sigma_2^2 \neq 0$ ("the population variances of group 1 and 2 are not equal")

By means of the above hypotheses which implies the fact that, if the null hypothesis of Levene's test is rejected it suggests that the variances between the two groups are not equal. With the derived output of independent sample t test, clarity has to be made in selecting the row of output between the Equal Variances Assumed and Equal Variances Not Assumed. Following the Levene's test, row of Equal Variances Assumed should be considered given that the derived P value is insignificant (P>0.05) and on the flip if the derived P value is significant (P<0.05), the row of Equal Variances Not Assumed should be considered along the statistical analysis. The reason for evaluating either row is that the computation utilizes pooled variances when assuming equal variances, and when equal variances cannot be assumed, the algorithm employs unpooled variances and adjusts the degrees of freedom.

Analyzing the considered independent variables, the ten financial ratios are clustered into four group of ratios namely Profitability ratios, Liquidity Ratios, Efficiency Ratios and Cashflow ratios whereas the interpretation of the presented summary statistics in table I will be based on the aforementioned four clusters of ratios.

4.2 Binary Logistic Regression Analysis

Having determined the five (05) financial ratios which are significantly different in between, filtering the above, the regression model could be developed as follows,

$$Z = C + \beta_1 \, DR \; + \; \beta_2 \, OCTA \; - \; \beta_3 \, OPM \; - \; \beta_4 \, ROA \; + \; \beta_5 \; ROE$$

Formula 03

And due to the categorical nature of the dependent variable financial distress (FD), the binary logistic regression analysis was adopted and to test the goodness of fit of the model

Hosmer and Lemeshow test was incorporated, and the results are as follows.

Table 4: Binary logit regression analysis

Variable	Coefficient	Z Statistic	Prob
C	1.025124	1.137787	0.2552
DEBT_RATIO	1.380351	0.908733	0.0435 ***
OC_TA	0.408344	0.167010	0.8674
OP_MARGIN	-17.50318	-2.266053	0.0234 ***
ROA	-2.166391	-0.830218	0.0264 ***
ROE	0.327709	0.828516	0.0174 ***
McFadden R Squared	0.414398		
LR Statistic	28.72386		
Prob (LR Statistic)	0.000026		
Obs with Dep = 0	25	Obs With Dep = 1	25

Source: Research data (2022)

Referring through the performed logistic regression, 50 observations or companies were included in the test with a count of 250 ratios being executed which were the ones, one year before becoming distressed or non-distressed. Briefing further four of the considered variables, Debt Ratio (DR), Operating Profit Margin (OPM), Return on Assets (ROA), and Return on Equity (ROE) are statistically significant at 5% level whereas OC_TA is not statistically significant.

The log likelihood of the model is 28.723 and it is statistically significant at 5% level (0.000). Further the model seeks to exploit 41.44% as the McFadden R Square which is also considered to be as the goodness of fit of the model which implies that the 41% of the occurrences of financial distress could be predicted using the considered Five (5) specific financial ratios. The following logistic regression model was derived from the logit regression test as shown above.

$Z = C + \beta_1(CR) + \beta_2(QR) + \beta_3(ROA) + \beta_4(ROE) + \beta_5(OP) + \beta_6(AT) + \beta_7(DR) + \beta_8(WCTA) + \beta_9(OCNI) + \beta_{10}(OCTA) + \varepsilon U$

Formula 04

Derived regression model,

$Z = 1.025 + 1.380\ DR + 0.408\ OCTA - 17.503\ OPM - 2.166\ ROA + 0.328\ ROE$

Formula 05

4.3 Validation of the Logistic Model

The table presented below displays the validation results of the utilized logit model. To determine whether a firm is distressed or non-distressed using the provided data, the probability of financial distress is determined for each firm using the cumulative probability function.

$P = 1 / [\ 1 + e^{\text{Logit Function}}\ ]$

Formula 06

$P_i(Y = 1) = 1 / [\ 1 + \exp\ \{\ \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \dots.. \beta_{10} X_{10}\ \}\ ]$

Formula 07

The findings which were conveyed above and the model which was generated were using the data of listed entities which were from one year prior to becoming financially distressed. Having generated of which, to test the robustness of the study, same analysis was carried out to additional two more years, being two (02) years prior to becoming financially distressed and three (03) years prior to becoming financially distressed. Testing the model for its robustness.

Testing the overall robustness of the model, it was evident that it is 78.25%, 74.12% and 71.05% for one year, two years and three years before the occurrence of financial distress. Having the predictive powers being on top 70s, it can be concluded that the model is sufficiently robust and accurate for three years prior to becoming financially distressed. Keeping a step ahead not withstanding only with the robustness of the distress prediction, the study has also evaluated the application of existing corporate failure prediction of Altman's Z Score model in predicting the financial distress in Sri Lankan context.

Table 5: validation of the logit model

One year before the distress	Two years before the distress	Three years before the distress
78.25%	74.12%	71.05%

Source: Research data (2022)

4.4 Hypotheses Validation

Table 6: Hypotheses validation

FINANCIAL RATIO	HYPOTHESIS
Current Ratio	**H1**. Current Ratio **is not significantly different** between distressed and non-distressed firms.
Quick Asset Ratio	**H2**. Quick Asset Ratio **is not significantly different** between distressed and non-distressed firms.
Return on Assets	**H3**. Return on Assets **is significantly different** between distressed and non-distressed firms.
Return on Equity	**H4**. Return on Equity is **significantly different** between distressed and non-distressed firms.

Operating Profit Margin	**H5**. Operating Profit Margin is **significantly different** between distressed and non-distressed firms.
Asset Turnover	**H6**. Asset Turnover ratio is **not significantly different** between distressed and non-distressed firms.
Debt Ratio	**H7**. Debt Ratio is **significantly different** between distressed and non-distressed firms.
Working Capital to Total Assets	**H8**. Working Capital to Total Assets is **not significantly different** between distressed and non-distressed firms.
Operating Cashflow to Net Income (OCNI)	**H9.** OCNI **is not significantly different** between distressed and non-distressed firms.
Operating Cashflow to Total Assets (OCTA)	**H10.** OCTA is **significantly different** between distressed and non-distressed firms.

Source: Research data (2022)

4.5 Altman's Z-Score Model

With the increased corporate failures which happens much frequently in the country of Sri Lanka, the study doesn't limit itself only with the use of financial ratios in predicting financial distress, whereas the study extends itself further towards the testing of the application and viability of Altman's Z score model in the Sri Lankan context. But as the study stances at its very beginning that the corporate failure is the worst scenario that can happen to a business or an organization perhaps the unattended continued financial distress is what leads an entity towards the corporate failure. So, to be much proactive is it worthwhile predicting the upcoming corporate failure? Or else to predict the upcoming financial distress? Indeed, the financial distress that gives the entity a much of a breathing to amend adjust and correct itself to make things better so that the entity will be able to avoid the financial distress and ultimately the corporate failure.

Therefore, the study tests the application of the existing Altman's Z score model not to the scenario of corporate failure, but in the case of upcoming financial distress given the context of Sri Lanka.

As means of the study, 25 distressed listed entities in Sri Lanka within a 6-year span from 2016 – 2021 were put into analysis considering two years individually as one year before being distress and two years before being distress in determining the robustness of the application of Altman's Z score model in predicting the financial distress. Which in terms answers, whether the considered entity could have predicted the upcoming financial distress an year before or two accordingly.

Table 7: Altman's Z-Scores

Entity	1 year before distress	2 years before distress
1	0.26	1.87
2	2.43	3.54
3	1.37	1.50
4	0.90	0.85
5	0.73	1.08
6	1.16	1.13
7	1.25	1.53
8	1.65	2.89
9	0.81	1.12
10	1.51	2.02
11	0.88	0.11
12	0.95	1.01
13	0.87	1.24
14	1.12	1.38
15	0.84	0.41
16	2.66	2.80
17	0.58	0.91
18	0.39	0.95
19	1.51	1.36
20	0.95	0.74
21	0.81	0.46
22	2.18	2.65
23	1.45	1.50
24	1.40	1.60
25	2.00	1.70

Source: Research data (2022)

Figure 2: Altman's Z-Score model
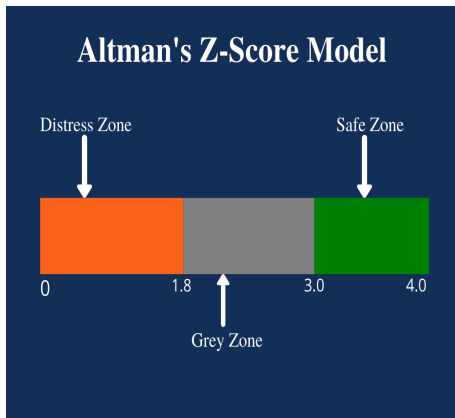
Source: Research data (2022)

Based on the analysis, and within the Z score spread of 0 – 4, out of the 25 distressed companies, 21 companies do result in a Z score which falls in between the spread of 0 - 1.8 an year prior to becoming financially distressed, which signals a red flag as they are in the verge of becoming distress, And 3 of the remaining companies do fall within the Z score spread of 1.8 to 3.00 which is not as severe as the red category but still an alarming condition an year prior to becoming financially distressed. And in making a justified point, the Altman's model doesn't signify any of the considered 25 distressed firms a "Safe Zone" one year prior to becoming distressed confirms its robustness and applicability.

Further along with the analysis of two years prior to becoming financially distressed, 19 companies fall within the spread of 0 – 1.8 which is critical given the Altman's score analysis and 05 companies falls within the spread of 1.8 – 3.00 which is referred to as the grey zone. Another significant conclusion which could be derived is that the entities' Z score scoring gets much worser in one year before the distress than two years before the distress in almost 24 entities out of 25 distressed entities which portrays the significance of the insights that the Altman's Z score model brings out in predicting the upcoming financial distress.

Having elaborated the findings and analysis of the intended use of financial ratios in predicting the financial distress of listed entities in Sri Lanka, as a rush through on the summary; Predominantly ten financial ratios, which were grouped in to four clusters were put into analysis, where four of those clusters being as Profitability Ratios,

Liquidity Ratios, Efficiency Ratios and Cashflow Ratios. Having analyzed 50 listed entities, of which 25 were financially distressed and 25 were financially non-distressed, the following outcomes were derived.

Starting off from the profitability ratios, namely three individual ratios were considered under profitability which were Operating Profit Margin, Return on Assets and Return on Equity. It was proven evident that all three of those ratios were significantly different between the distressed firms and non-distressed firms and also which were statistically significant too. Hence all three of those profitability ratios could be considered as signaling ratios of upcoming financial distress. On the flip it could be further justified as, non-distressed firms tend to generate sufficient revenue, income and profits where they yield a healthy return to its investors and the assets employed whereas as contrast, distressed firms do fail to generate sufficient revenue hence its profitability dips down setting both the entities a part.

Moving further along the liquidity ratios, three ratios were considered, which are Current Ratio, Quick Asset Ratio and Working Capital to Total Asset Ratios. Analyzing of which, it was evident that both the current ratio and quick asset ratio are more or less similar between the distressed and non-distressed firms implying that the ratio between current assets and current liabilities doesn't vary significantly. But Working Capital to Total Asset ratio is significantly different in between but it isn't statistically significant. Hence it is concluded that neither of the liquidity ratios could signal an upcoming financial distress. Same results were delivered in prior studies such as, (Zapranis & Ginoglou, 2000; Ginoglou, Agorastos, & Hatzigagios, 2002; Beaver, McNichols, & Rhie, 2005).

Summarizing the efficiency ratios, only two ratios were considered under, which are Debt ratio and Asset Turnover Ratio. Through the analysis it was concluded that, Debt Ratio is significantly higher in distressed firms than comparing it with non-distressed firms, which implies that distressed firms tend to finance themselves through much of debt than equity financing. Nearing the financial distress, as it was proven above, the profits revenue and income falls and dips below average hence the total fund flow becomes minimal and marginal therefore entities have to obtain more of debt either to refinance or to carry out their operations, hence studiously increasing debt ratio is indeed a red signal going forward. Whereas the Asset Turnover ratio is not deemed to be significantly different in between. The conclusion drawn from the

Debt Ratio aligns with previous research conducted by Beaver (1966) and Dambolena and Khoury (1980), which also revealed that the Debt Ratio is a highly effective predictor in discriminant function analysis. Flagg, Giroux, and Wiggins (1991) discovered that there is a substantial positive correlation between the Debt Ratio and the likelihood of business failure.

Moving further with Cashflow ratios, where the study has considered two cashflow ratios which matches with the net income measured on accruals and total assets held by the entity, namely Operating Cashflow to Net Income (OC_NI) and Operating Cashflow to Total Assets (OC_TA). Even though both ratios seemed to be significantly different between the distressed and non-distressed firms, only the OC_TA ratio is statistically significant. Which implies that an entity which is on the verge of becoming financially distressed tends to generate thin cash inflows in relevant to the total assets held by the entity, which is further in line with the above conclusion on profitability ratios. With dipped and minimized operations, the total cash inflows become thinner in relevant to the total assets held, whereas in contrast, non-distressed entities tend to exploit much of a stronger and consistent cash inflows in relation to its total assets held.

Further the application of existing corporate failure model of Altman's Z Score model was tested in Sri Lankan context as to the case of predicting the upcoming financial distress. Which was not an analysis conducted before, which was proven above that the Altman's model can be used in predicting the upcoming financial distress in Sri Lankan context. Following the analysis, 21 entities out of 25 were proven to be falling within the critical zone of 0 – 1.8 as per Altman's Z score model one year prior to being financially distressed and 19 out of 25 entities were proven to be falling within the critical red zone two year prior to being financially distressed. The test proves itself to consist of a predictive probability of 84%, one year prior and 76% two years prior to becoming financially distressed.

5   Conclusion

This study focuses on predicting the upcoming financial distress of listed entities in Sri Lanka using the binary logistic regression analysis. Out of the population of Listed Entities in Sri Lanka excluding the financial institutions, 50 listed entities in Sri Lanka were considered to be the sample of which, data were driven covering 6 latest financial periods from 2016 to 2021. 300 annual reports were analyzed, including 900

financial statements were reviewed namely Income statement, Statement of Financial Position and Cashflow Statement and resulted in 3000 individual financial ratios being measured. It is evident that there were several studies conducted around the prediction of upcoming corporate failure but then limited number of studies were conducted using both the accruals and cashflow based financial ratios. Similar study was conducted in Sri Lanka in order to predict the upcoming corporate failure which deemed to be the single study conducted by Lakshan and Wijekoon (2013). Having an understanding that financial distress is a period which occurs prior to corporate failure and financial distress being the cause of corporates to fail, the intention of this study was to keep a step ahead and go forward in predicting the upcoming financial distress to be much proactive rather than predicting the upcoming corporate failure which would have caused so much of negative consequences by that time.

There were no any studies were conducted prior, on the given nature in Sri Lankan context according to the author's best knowledge, hence this study being the first study conducted in order to predict the upcoming financial distress in Sri Lankan context.

As a result of the analysis, it was proven evident that five financial ratios were significantly different between the distressed and non-distressed firms which were Return on Assets (ROA), Return on Equity (ROE) and Operating Profit Margin (OPM) in terms of profitability ratios, Debt Ratio (DR) in terms of debt structure of the firms and Operating Cashflow to Total Assets (OCTA) in terms of cashflows. Analyzing of which, prediction model was generated for the firms and users to predict the upcoming financial distress with a predictability of 78% one year prior to distress and 74% two years prior to distress. Which proves the applicability of the resultant of the model in Sri Lankan context. Therefore, the entities can measure their individual financial ratios and interpret it to the model that the study has generated, so that they themselves will be able to analyze their progress towards being financially distressed.

Notwithstanding only upon the distress prediction model, the study has kept another further step ahead in order to test the application of existing internationally accepted corporate failure prediction model of Altman's Z score model in Sri Lankan context. But it was not executed to predict the corporate failure but to the level at which it could predict the upcoming financial distress with the same given spreads and measures. Analyzing of which, it was evident that, Altman's Z score mode, signals

84% of the distressed entities considered in the sample, as to be heading towards the financially distress one year prior and 76% of the entities two year prior to becoming financially distressed. Therefore, it was statistically concluded that, using the Altman's Z score model, entities could keep a step ahead and predict their upcoming financial distress.

Ultimately to conclude with, the study doesn't solely benefit the businesses and its management but the outcome of which could be used by a range of stakeholders including existing investors to review their investments way forward and to safeguard their assets, potential investors to select an ideal investment opportunity or a mix of opportunities which are both safer and potential going in to the future, suppliers who supply hundreds of thousands worth of goods before selling it on credit, customers before agreeing upon service agreements, lenders, financial institutions and etc. Hence the study does widely benefit a range of stakeholders and more prolifically in the context of Sri Lanka so that to ensure that, whatever the external situation it may be, wise decision making is as crucial as it could be.

However all our findings are based on the entities which are listed in Colombo stock exchange, therefore it can impose limitations on the model being applied to corporates around the globe, in addition the study has considered only ten (10) financial ratios, where there can be many ratios which could be proven significantly different in between, hence leaving a room for the new studies to work through a range of other financial ratios and on top of ratios, there can be non-financial ratios such as corporate governance factors which could be used in predicting the financial distress and differentiating both the group of entities. The study doesn't look deeper into the non-financial ratios but considering of which in future studies liaising; both financial and non-financial factors could be much effective and informative too. Further the study limits itself considering only the internal indicators where it doesn't look through the external factors, but future studies could be carried out which matches internal indicators with external factors such as interest rate, inflation rate, GNP, domestic yield and etc for it to present a detailed holistic picture to the intended recipients.

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