A study of financial distress of listed companies in Colombo stock exchange: A survival analysis approach

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Introduction

Financial Distress (FD) is a stage before bankruptcy, common to almost all the markets in the world and it is defined as a condition in which a company or individual cannot generate sufficient revenues or income, making it unable to pay its financial obligations [2]. When FD has not handled timely, it could lead a company to bankruptcy causing huge financial losses and breakdown costs for both the company and its stakeholders [4]. Therefore, recognizing the early signs of the business failure and warning signs of FD is very much important for the survival of the company and its investors or stake holders.

Colombo Stock Exchange (CSE) is the only share market in the economy of Sri Lanka which allows the businesses of the country to raise their capital to pay off their debts and to expand their operations in turn affecting the overall economy. Sri Lankan economy has gone through a series of growths and declines within the past few decades with the influence of the civil war lasting in 2009. According to Radikoko *et al*.(2019), CSE has a positive impact on the country's GDP. Currently, the CSE has become the main dynamical force behind the national economy of Sri Lanka. It creates a platform for capital generation for investors and creates an investor conducive environment. This study focuses on the FD of the CSE registered companies belonging to nineteen sectors except for Bank Finance & insurance. In this study, the FD has been related to both financial and corporate governance factors using a survival analysis approach since there is a lack of efficient models in forecasting and comparing the early stages of bankruptcy and FD in Sri Lankan companies on their survival that supports the decision-making

process of investors and to avoid financial failure of a company. The objectives of the study are:

- To examine the relationship between firm size, liquidity, profitability, financial risk, gender of Chief Executive Officer (CEO), CEO duality and the time to occur financial distress of companies or the survival time of the companies.
- To obtain an efficient model to predict the FD of a company using survival analysis.
- To compare the survival time of a firm by its sector in CSE.

Methodology

The sample of the current study consists of all the companies listed on the CSE (222) belonging to 19 Global Industry Classification Standard (GICS) industrial sectors for the period of financial years from 2010 / 2011 to 2018 / 2019. The data was collected from the published annual reports of the companies, websites of the relevant companies, CSE databases, central bank reports, and other publications of the relevant companies. To increase the accuracy of the analysis, the finance, insurance and banking sector have not been considered since it has separate characteristics which are different from the other industrial sectors by its nature. The analysis technique used in the study is a survival analysis approach. To identify an event that is a FD, Current Ratios (CR) were used. The CR is defined as

$$CR = \frac{Current\ Assets}{Current\ liabilities}.$$

A company experiencing FD for the first time within the study period was considered as the event and it was identified using the CR and FD

companies are companies of CSE that have a CR less than one at least for two years in a row. The differences between the survival time of GICS sectors of CSE were examined using a KM curve and log-rank test. A Cox PH model was developed to examine the association between the survival time (time to occur financial distress from a company's origin) of the firm and the explanatory variables of profitability, liquidity, firm size, financial risk, and the corporate governance features of the dual position of CEO, gender of CEO. The finalized Cox PH model was used to compare the hazards of companies to experience financial distress using Hazard ratios. In fixing the Cox proportional hazard model, it was assumed the covariates used do not vary with time and the best model was selected through backward elimination. Residual analysis was carried out to confirm the model adequately fit with the observed data.

Results and Discussion

The results of the study showed that out of the 222 companies used in the study within the period from 2010 / 2011 to 2018 / 2019, 121 companies experienced FD while 101 companies did not experience financial distress (Table 1). The highest number of companies that experienced FD has been recorded in the year 2011. From 2011, the number of companies experiencing FD decreased gradually in Sri Lanka.

Table 1. Number of companies in each 19 sectors experiencing FD in each year.

Year	Number companies financially distressed
2011	50
2012	14
2013	10
2014	13
2015	7
2016	7
2017	8
2018	4
2019	8
Total	121

When considering the total number of financially distressed companies in each sector, the hotels and Travel sector had the highest

number of FD companies during the study period which is 27. Figure 1 shows the number of FD companies in each sector in red bars. The number of companies not felt FD is considered as right-censored observations are shown in blue bars.
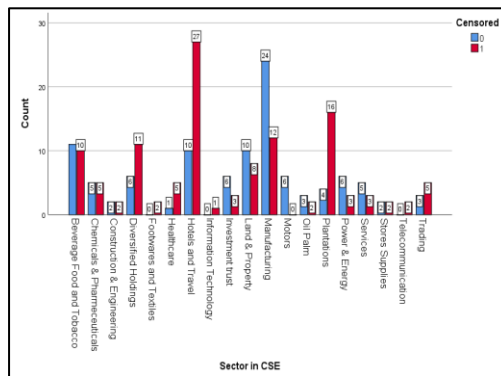
Figure 1. Number of companies experiencing financial distress in each year.

KM curves plotted on the same graph for each of the nineteen sectors in CSE except the finance, banking & insurance sector are shown in Figure 2. Three assumptions were considered in constructing this KM curve are:

- At any time of the study, the companies which are censored have the same survival aspects as the companies which continue to follow up the study.
- Survival probabilities are the same for the companies established before and later in the study.
- The event of FD occurs at the time specified.
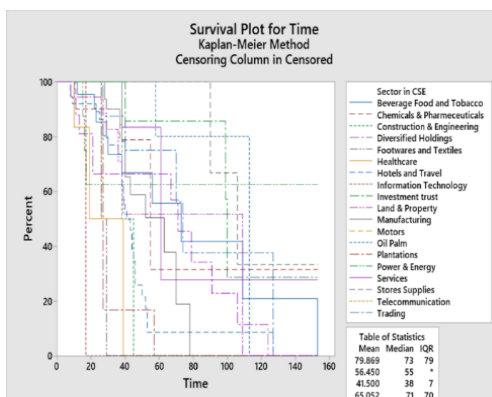
Figure 2. KM survival curves 19 GICS.

It can be noticed that the curves appear to be quite different from each other. To check the significance of the above-mentioned differences between the survival curves, the log-rank statistic was performed. The results of the log-rank test are given below in Table 2.

Table 2. Results of the log rank test.

Method	Chi-Square	DF	P-Value
Log-rank	102.457	18	0.000
wilcoxon	84.091	18	0.000

The log-rank test compares the survival of the nineteen sectors taking the complete study period into account. The log rank test statistic value is 102.457 (p value< 0.001). Thus, it provides evidence for rejecting the null hypothesis (sig. level=0.05) and can be statistically concluded that there is a significant difference among the nineteen survival curves been compared belonging to the nineteen sectors of CSE.

Log-rank test is totally a significance test, and it cannot be implied in describing the amount of difference between the survival of the sectors. Therefore, to answer the research problem, Cox proportional hazard model is estimated. This was done in three major steps and a finalized model was obtained. The basic Cox PH model developed in the 1st step is as follows.

$$h(t,X) = h_0(t)e^{\begin{pmatrix}(\beta_1*\text{Profitability})+(\beta_2*\text{Liquidity})+\\(\beta_3*\text{Firm size})+(\beta_4*\text{Financial risk})\\+(\beta_5*\text{Dual position})+(\beta_2*\text{Gender})\end{pmatrix}}$$

Table 3. Statistical analysis of survival time with covariates in 1st step.

	B	SE	Wald	df	Sig.	Exp(B)
Dual position (Separate/ Dual)	-.009	.199	.002	1	.966	.991
Gender of CEO	-.019	.176	.012	1	.912	.981
Liquidity (Current Ratio)	-.005	.006	.792	1	.373	.995
Size of the firm (Total Assets)	.000	.000	.422	1	.516	1.000
Profitability (Return on Assets)	-.032	.013	6.489	1	.011	.968
Financial Risk (Debt to Asset)	.534	.241	4.897	1	.027	1.705

Table 4. Statistical analysis of survival time with covariates in final step.

	B	SE	Wald	df	Sig.	Exp(B)
Profitability (Return on Assets)	-.054	.016	11.336	1	.001	.947
Financial Risk (Debt to Asset)	1.161	.327	12.593	1	.000	3.194
Financial risk*Profitability	.047	.020	5.493	1	.019	1.048

Table 5. Model significance test results of final model.

Omnibus Tests of Model Coefficients									
Log Likelihood	Overall (score)			Change From Previous Step			Change From Previous Block		
	Chi-square	df	Sig.	Chi-square	df	Sig.	Chi-square	df	Sig.
1013.447	25.342	3	.000	25.115	3	.000	25.115	3	.000
a. Beginning Block Number 1. Method = Enter									

$$h(t,X) = h_0(t)e^{(-0.054*\text{Profitability})+(1.161*\text{Financial risk})+(0.047(\text{Profitability}*\text{Financial risk}))} \quad (1)$$

Since there were non-significant terms in the model based and presence of interaction the final model was fitted as equation (1) and the significance of the model was tested, and the results are given in table 5. The results of the final fit of the Cox model (Table 4) indicate that only Profitability, financial risk, and their confounding effect variables are present in the model. Table 4 gives the relevant coefficient values for the terms in the model.

Conclusion
The findings of the study provide evidence for a significant and negative relationship between profitability and financial distress while there exists a significant and positive relationship between financial risk and financial distress.

Also, the results revealed a significant interaction between the variables of profitability and financial risk. Accordingly, the companies should take steps to control the confounding effect of one variable on the other in order to prevent experiencing financial distress while considering significant interaction profitability and financial risk. A balance between profitability and financial risk should be maintained within the companies for their constant financial health.

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