



Management

## **PREDICTING BANKRUPTCY OF SELECTED MANUFACTURING COMPANIES LISTED IN COLOMBO STOCK EXCHANGE: APPLYING ALTMAN'S Z-SCORE**

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### **Abstract**

Bankruptcy is the legal status for an individual or company incapable to pay off outstanding debt. Predication of Bankruptcy is critical task. Early stage of identification of likelihood of solvency may avoid evils in the near future & may shelter the firm from Bankruptcy situation. Bankruptcy of organizations can be predicated by using Altman's Z-Score Model. This study tries to apply the model to understand the likelihood of Bankruptcy of selected listed manufacturing firms for past 5 years from 2010 to 2014 which are listed in Colombo Stock Exchange. The study reveals that four companies completely belong to Safe Zone for the entire period of study. Three firms are in Distress Zone which clearly indicates that these firms may go Bankrupt in near future.

**Keywords:** Bankruptcy; Manufacturing Companies; Z-Score Model.

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### **1. Introduction**

Most of the organizations survive with an objective of profit maximization. To achieve profit maximization objective, firm needs strong internal & external support. The failure of internal support system such as effective utilization of funds, labor, material etc & external support system such as economic, political & socio-cultural conditions results in Bankruptcy of the organization.

Bankruptcy is a situation where the firm's total liabilities exceed total assets. The real net worth of the firm is, therefore negative. This leads to reduced sales, increased cost & losses, ineffective competition etc. Ultimately firm will be under distress stage. Under such situations it becomes difficult for investors & lenders to analyze the financial performance of the organization. Several

bankruptcy models for example, logit analysis, recursive portioning algorithm and neural networks are available but still Altman's model is considered to be superior and pervasively applied by researchers all over the world in the present days. Altman's Z-Score Model is the output of a credit-strength test that predicts company's likelihood of bankruptcy.

## 2. Objectives of the Study

This study intends to estimate likelihood of Bankruptcy of selected Listed Manufacturing firms by applying Altman's Z-Score Model.

## 3. Altman's Z-Score Model

### The Standard Z-Score

The formula for the Z-Score (which incorporates those seven simple pieces of data) is:

$$\text{Z-Score} = ([\text{Working Capital} / \text{Total Assets}] \times 1.2) + ([\text{Retained Earnings} / \text{Total Assets}] \times 1.4) + ([\text{Operating Earnings} / \text{Total Assets}] \times 3.3) + ([\text{Market Capitalization} / \text{Total Liabilities}] \times 0.6) + ([\text{Sales} / \text{Total Assets}] \times 1.0)$$

In general, the lower the score, the higher the chance of bankruptcy. For example, a Z-Score above indicates financial soundness; below 1.8 suggests a high likelihood of bankruptcy. Altman added a statistical technique called multivariate analysis to the mix of traditional ratio analysis techniques, and this allowed him to consider not only the effects of several ratios on the "predictiveness" of his bankruptcy model, but to consider how those ratios affected each other's usefulness in the model. The model formed by Altman for predicting a company's financial health is as follows;

### The Original Z-Score Formula or for Manufacturing Firms

X1 = Working Capital / Total Assets

X2 = Retained Earnings / Total Assets

X3 = Earnings Before Interest and Taxes / Total Assets

X4 = Market Value of Equity / Total Liabilities

X5 = Sales / Total Assets

Z score bankruptcy model:

$$Z = 1.2X1 + 1.4X2 + 3.3X3 + 0.6X4 + .999X5$$

Zones of Discrimination:

$Z > 2.99$  -"Safe" Zone

$1.81 < Z < 2.99$  -"Gray" Zone

$Z < 1.81$  -"Distress" Zone

## 4. Methodology

### 4.1.Data Collection & Research Sample

The study depends on the secondary source & annual reports (financial statements) are collected from the websites of respective organizations. The time frame of data being collected is set for past 5 years i.e. from 2010 to 2014. Study covers the sample size of 19 companies which listed in Colombo Stock Exchange in Sri Lanka. Below shown are the companies which are selected for the study for the period of 5 years.

Company Names	year	X1	X2	X3	X4	X5	ALTMANS
ACL Plastic Plc	2010	0.42035781	0.175055074	0.177502377	2.256600842	1.130651027	3.819875852
	2011	0.42867228	0.204725561	0.084002859	1.902872582	1.295530453	3.515485957
	2012	0.492250242	0.263112092	0.056400793	2.241472157	1.436170746	3.926233876
	2013	0.461607018	0.283509472	0.107941336	1.10578635	1.210224395	3.180744296
	2014	0.518273383	0.375780523	0.125045255	2.445490472	1.262500457	4.290464875
Tokyo Cement	2010	-0.064978507	0.289972969	0.100369877	0.424627315	0.843142638	1.757127567
	2011	-0.079606639	0.301970302	0.093300571	0.224467327	0.980377529	1.750180265
	2012	-0.127235293	0.30205712	0.06457695	0.212484614	0.987547296	1.598339614
	2013	-0.035343849	0.273636563	0.083262822	1.659045437	0.959591886	2.57046503
	2014	-0.070054483	0.286511672	0.048171807	1.60121799	0.983733154	2.420481872
SINGER INDUSTRIES (CEYLON) PLC	2010	0.21967902	0.04464113	0.046837111	4.849771514	0.726491354	4.117029134
	2011	0.191350228	0.042633892	0.036352487	3.011182669	0.686955636	2.902936167
	2012	0.211468656	0.310526747	0.01885385	2.63980377	0.545441245	2.880041044
	2013	0.194164349	0.29151633	0.007798928	3.913960296	0.603653523	3.618886242
	2014	0.204631558	0.295310389	-0.004144527	3.837268147	0.630192841	3.577869202
HAYLEYS EXPORTS PLC	2010	0.067927771	0.111075908	-0.053694367	1.607273085	1.245731526	2.269923564
	2011	0.110865513	0.068256693	0.004373334	0.938022398	0.906954638	1.712798064
	2012	0.2137446	0.113807263	0.03772571	1.622012017	0.738353042	2.251878785
	2013	0.180761092	0.145668849	0.038401772	1.150816728	0.774441248	2.012506832
	2014	0.138886763	0.121085267	0.010083513	1.07375143	0.760519546	1.774229485
Lanka Aluminium Industries Performance	2010	0.162120617	0.229461873	0.035596135	2.451093103	0.97842079	3.08233526
	2011	0.076356241	0.117543375	0.014077887	0.693514439	0.796722826	1.51547673
	2012	0.093475671	0.113256525	0.010491614	0.624373428	0.700837437	1.38081376
	2013	0.083614109	0.108150111	0.034055927	0.026710734	0.666179336	1.04633742
	2014	0.11069698	0.146141559	0.082882467	0.051892691	0.706593638	1.348675952
Richard Pieris Exports PLC	2010	0.060293988	0	0.007108201	0.577216853	0.868089945	1.310229905
	2011	0.076356241	0.117543375	0.014077887	0.693514439	0.796722826	1.51547673

	2012	0.093475671	0.113256525	0.010491614	0.624373428	0.700837437	1.38081376
	2013	0.083614109	0.108150111	0.034055927	0.428665327	0.666179336	1.287510176
	2014	0.11069698	0.146141559	0.082882467	0.832796179	0.706593638	1.817218044
Lanka Floortiles PLC	2010	0.19088399	0.070709232	0.228119343	7.725215329	0.964697908	6.68067465
	2011	0.184608957	0.329243137	0.174172176	2.305269381	0.836840059	3.477241009
	2012	0.182899142	0.320154185	0.125899277	1.522263755	0.81920841	2.815729105
	2013	0.250867745	0.381951326	0.144366265	1.844578194	0.892473349	3.311402092
	2014	0.307098915	0.45655731	0.177334837	2.949829966	0.889758596	4.252560471
Laxapana Batteries PLC	2010	0.322273074	-0.013148727	0.037021621	3.957886377	0.774296364	3.639519011
	2011	0.217606436	0	-0.307200595	3.650755844	1.197510577	2.635329842
	2012	0.0316101	0.025774002	-0.22528834	3.859057244	0.618821721	2.264820269
	2013	0.051472466	0.010591221	0.065508351	2.528367964	0.702502982	2.512295988
	2014	0.270784289	0.026442898	0.187928367	1.668937563	1.011139371	2.994626723
Orient Garments PLC	2010	0.167020529	0.093781705	0.073910032	0.082784551	2.125344727	2.750637582
	2011	0.169154235	0.231601723	0.036293833	0.085979289	1.947224316	2.645809031
	2012	0.079928332	0.151388908	0.002855992	0.056475662	1.593442097	1.944610738
	2013	-1.440732421	-0.018268793	2.390958839	1.518127229	13.08913543	20.13572072
	2014	-0.105752155	-0.317284211	0.325242281	0.30053741	1.08676004	1.769281532
primal Glass Ceylon PLC	2010	-0.034138689	0.087051298	0.089045331	2.736270342	0.62626461	2.642781798
	2011	-0.016855173	0.14406791	0.102323482	1.606256816	0.75253086	2.235421308
	2012	0.022770269	0.199162204	0.10830629	1.664631084	0.773617398	2.435958214
	2013	0.004174072	0.286305409	0.127592518	1.060978519	0.791661997	2.255140878
	2014	0.069377179	0.303902787	0.078655756	1.907018455	0.895797227	2.80828881
Printcare PLC	2010	0.103779126	0.121695543	0.11896523	4.498918467	1.133622174	4.520467225
	2011	0.105988319	0.160796424	0.123621863	6.306006263	0.979567755	5.523424636
	2012	0.101851295	0.432833924	0.10469186	6.269435189	0.786442109	5.621775409
	2013	0.144188451	0.447021843	0.081682529	6.690629713	0.755980191	5.838767086
	2014	0.148804092	0.442578888	0.100240695	7.059183896	0.754437848	6.118917833
Royal Ceremics Lanka PLC	2010	0.003421929	0.280674232	0.182314222	7.081998685	0.373063153	5.620949537
	2011	0.000502357	0.436043568	0.241443537	3.898092472	0.264993644	4.011676623
	2012	0.000116014	0.472737096	0.099734816	3.366105018	0.249270657	3.260029711
	2013	-0.035715448	0.399134075	0.051286402	1.404797266	0.185084751	1.713137404
	2014	-0.080153608	0.397555265	0.045569174	1.802861506	0.189973536	1.882461756
Sierra Cables PLC	2010	0.308578425	0.142927025	0.037513249	2.450808182	0.315971322	2.480641899
	2011	0.519488566	0.146880682	0.051627794	1.29981423	0.929814682	2.709094175
	2012	0.251937105	0.117012354	0.006010675	0.821567068	0.657080429	1.635997717
	2013	0.152016834	0.034470263	-0.129906513	0.900720421	0.785290435	1.127709765

	2014	0.221694785	0.099705813	0.138393148	1.572350633	1.128345598	2.934075247
Swadeshi Industrial Works PLC	2010	-0.117426382	0.225845655	0.060295317	0.002934615	2.148761795	2.524769369
	2011	-0.089525842	0.252262562	0.081103255	0.002652759	2.368131467	2.883100441
	2012	-0.075472072	0.257326499	0.022432574	0.002595062	2.411352518	2.756627662
	2013	-0.11386326	0.276287051	0.03067176	0.003861493	2.25763238	2.611332043
	2014	-0.090238569	0.173497796	-0.069989278	0.002820332	2.361805816	2.267144028
Swisstek Ceylon PLC	2010	0.105691317	-0.289128346	-0.011640735	3.47885578	0.186990654	1.957939591
	2011	-0.149750401	-0.252855994	0.003363463	1.75039648	0.206009866	0.733648309
	2012	-0.097588528	-0.237031951	0.010431998	1.20191801	0.253416998	0.560042433
	2013	-0.053758524	-0.1742298	0.057858457	1.673932712	0.346856032	1.233716618
	2014	-0.013558727	-0.061374958	0.081008504	4.148292775	0.308467632	2.962575946
Central Industries PLC	2010	0.466571284	0.420465068	0.137717258	6.255666847	1.396032779	6.752436473
	2011	0.421962827	0.436258712	0.136280259	2.808357268	1.508693697	4.760550503
	2012	0.421266032	0.460754001	0.111097358	2.507461846	1.48030673	4.501979959
	2013	0.435060197	0.45124882	0.071621543	1.880288344	1.271282774	3.789627457
	2014	0.433197874	0.442913017	0.110046284	1.869258081	1.360185971	3.984809229
Kelani Cables	2010	0.42928795	0.320488042	0.076995408	1.813647127	1.357657757	3.663759679
	2011	0.512699347	0.406039334	0.141475162	1.63961997	1.527701033	4.162035331
	2012	0.429065147	0.367728341	0.076429806	0.898317808	1.226850808	3.047757706
	2013	0.464404964	0.402133623	0.083210986	1.138768388	1.345411253	3.42354157
	2014	0.419158511	0.562619683	0.134176373	0.825631633	1.886646873	4.115465653
Samson	2010	0.285098397	0.385166952	-0.096303595	1.592418837	1.231920478	2.750921727
	2011	0.316172232	0.243231567	0.030496259	1.522573291	1.641723561	3.375836063
	2012	0.038486185	0.312891819	0.093816439	1.657421353	1.645739309	3.43401834
	2013	0.371556813	0.353325252	0.09626453	1.637562044	1.45623685	3.696970554
	2014	0.172069282	0.282706096	0.047616259	0.94901522	1.16238073	2.491195189
Lanka Ceramic	2010	0.116406668	-0.311221673	0.165346344	55.79339168	0.47581049	34.20146609
	2011	0.104667137	-0.254681047	0.165346344	27.13449104	0.518867561	17.11425222
	2012	-0.010337167	-0.012481689	0.064349069	3.552980404	0.14158852	2.455849723
	2013	-0.002280164	0.03946417	0.052875254	5.36008453	0.166885265	3.609937965
	2014	0.043055548	0.127704062	0.219749091	8.575421049	0.14368071	6.244557682

## 5. Data Analysis & Findings

Interpretation:

Company Name	Year	Z Value	Zone
Acl Plastic PLC	2010	3.819875852	Safe
	2011	3.515485957	Safe
	2012	3.926233876	Safe

	2013	3.180744296	Safe
	2014	4.290464875	Safe
Tokyo Cement	2010	1.757127567	Distress
	2011	1.750180265	Distress
	2012	1.598339614	Distress
	2013	2.57046503	Gray
	2014	2.420481872	Gray
Singer Industries (Ceylon) PLC	2010	4.117029134	Safe
	2011	2.902936167	Gray
	2012	2.880041044	Gray
	2013	3.618886242	Safe
	2014	3.577869202	Safe
Hayleys Exports PLC	2010	2.269923564	Gray
	2011	1.712798064	Distress
	2012	2.251878785	Gray
	2013	2.012506832	Gray
	2014	1.774229485	Distress
Lanka Aluminium Industries Performance	2010	3.08233526	Safe
	2011	1.51547673	Distress
	2012	1.38081376	Distress
	2013	1.04633742	Distress
	2014	1.348675952	Distress
Richard Pieris Exports PLC	2010	1.310229905	Distress
	2011	1.51547673	Distress
	2012	1.38081376	Distress
	2013	1.287510176	Distress
	2014	1.817218044	Gray
Lanka Floortiles PLC	2010	6.68067465	Safe
	2011	3.477241009	Safe
	2012	2.815729105	Gray
	2013	3.311402092	Safe
	2014	4.252560471	Safe
Laxapana Batteries PLC	2010	3.639519011	Safe
	2011	2.635329842	Gray
	2012	2.264820269	Gray
	2013	2.512295988	Gray
	2014	2.994626723	Safe
Orient Garments PLC	2010	2.750637582	Gray
	2011	2.645809031	Gray
	2012	1.944610738	Gray
	2013	20.13572072	Safe
	2014	1.769281532	Distress
Primal Glass Ceylon PLC	2010	2.642781798	Gray
	2011	2.235421308	Gray
	2012	2.435958214	Gray
	2013	2.255140878	Gray
	2014	2.80828881	Gray

Print Care PLC	2010	4.520467225	Safe
	2011	5.523424636	Safe
	2012	5.621775409	Safe
	2013	5.838767086	Safe
	2014	6.118917833	Safe
Royal Ceremics Lanka PLC	2010	5.620949537	Safe
	2011	4.011676623	Safe
	2012	3.260029711	Safe
	2013	1.713137404	Distress
	2014	1.882461756	Gray
Sierra Cables PLC	2010	2.480641899	Gray
	2011	2.709094175	Gray
	2012	1.635997717	Distress
	2013	1.127709765	Distress
	2014	2.934075247	Gray
Swadeshi Industrial Works PLC	2010	2.524769369	Gray
	2011	2.883100441	Gray
	2012	2.756627662	Gray
	2013	2.611332043	Gray
	2014	2.267144028	Gray
Swisstek Ceylon PLC	2010	1.957939591	Gray
	2011	0.733648309	Distress
	2012	0.560042433	Distress
	2013	1.233716618	Distress
	2014	2.962575946	Gray
Central Industries PLC	2010	6.752436473	Safe
	2011	4.760550503	Safe
	2012	4.501979959	Safe
	2013	3.789627457	Safe
	2014	3.984809229	Safe
Kelani Cables PLC	2010	3.663759679	Safe
	2011	4.162035331	Safe
	2012	3.047757706	Safe
	2013	3.42354157	Safe
	2014	4.115465653	Safe
Samson PLC	2010	2.750921727	Gray
	2011	3.375836063	Safe
	2012	3.43401834	Safe
	2013	3.696970554	Safe
	2014	2.491195189	Gray
Lanka Ceramic PLC	2010	34.20146609	Safe
	2011	17.11425222	Safe
	2012	2.455849723	Gray
	2013	3.609937965	Safe
	2014	6.244557682	Safe

Among the companies under study Acl Plastic PLC, Print Care PLC, Central Industries PLC and Kelani Cables are in the safe zone for the entire period of study. In the case of Lanka Floor Tiles

PLC and Lanka Ceramic, even though they are in the Gray zone in the year 2012, prior and after that year they are in the safety zone. Singer Industries (Ceylon) PLC is identified under gray zone in the years 2011 and 2012, however, they shifted to safety zone in the years 2013 and 2014. Further Laxapana Batteries PLC has shifted to safety zone from Gray zone in the year 2014. In indicates that the above companies are in a good financial health condition and there are no symptoms for the bankruptcy in the near future. Thus, banks, financial companies, suppliers and other investors can continue their financial transactions with these companies.

Primal Glass Ceylon PLC and Swadeshi Industrial Works PLC are classified in Grey zone for the entire period of study and their scores are near to safety zone. Similarly, Tokyo Cement Company were in the distress zone from the year 2010 to 2012 and later improved their position to Gray zone in the years 2013 and 2014. Although, Royal Ceremics Lanka PLC was in the safety zone during the period from 2010 to 2012, it moved down to Grey zone in 2014. Samson Company was in the safety zone up to 2013 and shifted to grey in 2014. Similarly, Sierra Cables PLC and Swisstek Ceylon PLC also improved to Grey zone in the year 2014 and their scores for that year are near to safety zone. Richard Pieris Exports PLC was in the Distress zone up to 2013 and improved to Grey in 2014. According to the scores of these companies, there are chances for bankruptcy within the next 2 years of operations.

Lanka Aluminium Industries Performance Company was classified in the Distress zone in the entire period of study except in the year 2010. In the case of Hayleys Exports PLC, it was in the Grey zone in the years 2012 and 2013, however, it moved down to distress zone in the year 2014. Finally in the year 2014, Hayleys Exports PLC, Lanka Aluminium Industries Performance Company and Orient Garments PLC are in the distress zone. It implies that these companies are probably headed for bankruptcy in the very near future. It is a warning signal for the stake holders of the companies. Banks, financial companies and suppliers will refuse to continue further financial transactions with these companies in order to protect them.

## 6. Conclusion

This study attempts to estimate likelihood of Bankruptcy of selected Listed Manufacturing firms in Sri Lanka by applying Altman's Z-Score Model. It considers the data of 19 manufacturing companies, It was found that only four companies are identified under safety zone for the entire period of study. There are three companies in the distress zone at the end of the study period. These findings will support the stake holders of those companies to assess the likelihood of Bankruptcy of those companies and to determine their financial strategies.

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