

FINANCIAL DISTRESS PREDICTION USING ACCOUNTING VARIABLE: A REVISIT TO ALTMAN Z-SCORE IN THE CASE OF INDIAN LISTED COMPANIES

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ABSTRACT

Financial distress is a phenomenon where the business is not able to generate adequate revenue to meet its financial obligations. Timeous and accurate financial distress prediction is important as it helps the companies to identify their feebleness much in advance and take preventive steps. Altman Z score is a world- renowned model for financial distress prediction and thus wondering the Altman Prediction capabilities in the western countries hold the same for Indian companies which are regulated by the Securities Exchange Board of India (SEBI). This study uses Altman Z-Score model to test the financial distress of few selected manufacturing companies. The study used the sample companies which are admitted for Bankruptcy under the Insolvency and Bankruptcy Board of India. The data collected covers a period of 5 years viz., 2017- 2021. The study reveals that all the five unhealthy firms show a low Z-score which proves that they are distressed and four out of five healthy company shows a high Z-score which is an indication of their financial soundness.

Key Words: Financial distress, Z score, accounting variables, Manufacturing sector, Indian companies

Introduction

Financial Viability is an important aspect for evaluating overall performance of an organization. Poor financial health threatens the very survival of the firm and leads to business failure (policy & 2019, n.d.). The economic slowdown due to global pandemic is an added cause for corporate distress. During the time of distress, the companies are forced to reassess their operational strategies to avail the maximum benefit from the available limited resources.

Financial Distress

Financial distress is considered as the reduction in financial efficiency which leads to cash shortage that includes a condition when promises to creditors of a company are broken or honored with difficulty. It can further define as shortage of cash on the asset side of the balance sheet or as a debt overhanging in liabilities. Financial distress can also be expressed in terms of negative cash flow from

operations (CFO) and a decline in return on assets (ROA) (Korteweg et al., 2007; Outecheva., 2007; Rahman et al., 2021). In Indian context, as per The Companies Act defines “financially distressed” in section 128(f), Chapter 6 of Companies Act of 2013 to mean that it appears to be:

i. reasonably unlikely that the company will be able to pay all of its debts as they fall due and payable within the immediately ensuing six months, or ii. reasonably likely that the company will become insolvent within the immediately ensuing six months

Manufacturing sector In India

The manufacturing sector in India currently contributes 16-17% to GDP and gives employment to around 12% of country's workforce. The analysis on different sectors indicates that the service sector contributes 53% whereas industry contributed 25.92%. The contribution of agriculture sector to GDP was 20.97% (Mahapatra, D. M., Ranjan, S., & Baral, S. K. 2022). As per the survey

conducted by the Federation of Indian chambers of commerce and industry (FICCI), the capacity utilization in India's manufacturing sector stood at 72% in the second quarter of FY22, its an indication of significant recovery in this sector. Inspite of all these forward movement in this sector the National Company Law tribunal (NCLT) projects an upward trend in the number of manufacturing firms applying for bankruptcy under the bankruptcy code of 2016. There is very less literature which contributes to financial distress of manufacturing firms in India with regards to Altman (1968) Z score and on listed manufacturing firms in India.

1.1 Research Problem

Financial distress has a negative impact on the profitability, efficiency and liquidity of firms. An early detection of distress helps the business entities to take corrective measures so that they can avoid insolvency and bankruptcy. Many distress prediction models have developed in the recent years, in that Altman (1968) Z score is considered to be one of the best for manufacturing firms. But these models are developed for western countries, so it has to be studied and tested that whether the same formulas can be used in the Indian context also. Manufacturing sector in India has the high potential to grow, at the same time as per the report of Ministry of Corporate Affairs (MCA) shows an upward trend in the number of companies applying for bankruptcy. So this study finds it necessary to focus on prediction of financial distress of manufacturing firms in India.

1.2 Research Objective

- i) To study the applicability of Altman's Z score in Indian manufacturing firms which are applied for bankruptcy.
- ii) To study the relevance of Z score in other listed manufacturing companies
- iii) To analyse the factors that contributing for the low performing companies

1.3 Significance of the study

This study is significant since it involves prediction of financial distress of the listed manufacturing firms. Testing of financial viability enables the management to act proactively before the situation goes beyond control. This helps them to avoid the cost related to distress which includes legal fees, auditors' fee, restructuring fees and other bankruptcy cost (Ally et al., n.d, 2019). The findings of the study will help the management to rely on the existing model of Zscore. At the same time the study also gives a check on the financial soundness of the other listed manufacturing companies. Testing the financial distress of a company and analysing the financial soundness is essential for both the management and other stakeholders of the company. Management can identify the causes of distress and take preventive steps before it moves out of hand and at the same time investors and creditors can also plan their activities respectively (Shah, N., 2014). Therefore, testing financial distress in manufacturing firms in India is very important as this study will serve the entire public interest.

2. Review of literature

The review facilitates to understand the background study prevailed in the field of financial distress and prediction models. The subject financial distress and prediction models are well-researched topics among the academicians. Some of the earliest studies done by Beaver (1966) and Altman (1968) used financial variables to predict financial failure and the risk of bankruptcy. The first remarkable prediction model was developed by Altman (1968) which is widely known as the Z-Score and used Multivariate discriminant analysis (MDA) technique. Eventually in response to the accounting standards in the 1970s, Altman modified the Z-Score and came up with Zeta model (E. I. Altman et al., 1977b) which also used MDA technique.

Table 1 Review of literature

Author	Title of the study	Contribution
Sherin (2010)	"Liquidity v/s profitability - Striking the right balance"	Implication of liquidity and profitability in a pharmaceutical company.

Chenet l.,(2012)	Effect of pricing of corporate debt due to “unionized workers”	Used different accounting variables including Altman's model for predicting financial distress.
Singhal et al. (2013)	Bankruptcy risk, costs and corporate diversification	Altman Z-score is used to represent the likelihood of bankruptcy which is highly correlated with leverage. It was found that focused firms are more likely to go bankrupt than diversified firms
Celli (2015)	Z-Score Model Predict Listed Companies' Failures in Italy? An Empirical Test.	Z-score degree of reliability is relatively high and still works quite adequately in predicting listed industrial company failure in Italy. It proved a precious tool in the detection of a company's operating and financial difficulties up to 3 years before the default.
Panigrahi et al. (2018)	“Liquidity and Profitability Trade off: A Study of Indian Pharmaceutical Companies”	Undertaken a research study on the liquidity and profitability of the top five Indian pharmaceutical companies.

3. Methodology

This part comprises the techniques applied in the study which includes research design, data collection techniques and data analysis techniques.

3.1 Research design

The study employed Altman(1968) Z-score model in testing the financial distress of listed manufacturing firms in India. Z-score used MDA technique for testing distressed and non distressed firms. So current study also used descriptive research analysis from Multivariate Analysis (MDA) technique. In this study the variables were selected based on the requirement of the Altman Z-score model. The result of the study is presented by use of tables, figures and charts.

3.2 Population, Variable selection and model Specification

The population of this study consist of five manufacturing firms that had applied for bankruptcy code (IBC) for the year 2022. An equal number of matching financially sound companies also constituted the sample making the total sample size as ten. The data for five years immediately preceding (2017 - 2021) the bankruptcy filing was collected for sample companies. Relevant variables included can be categorised into dependent and independent variable. Dependent variable is Z which is the discriminate variable that was used to measure financial distress. Its results

whether the firm is financially distressed or not. Along each independent variable X_1, X_2, X_3, X_4 and X_5 there is corresponding coefficient value which remains unchanged, and this is according to the requirements of Altman Z score model. The Z score can be characterized as a linear combination of 5 accounting ratios which are commonly used to test the liquidity, profitability, solvency and efficiency of the companies. The first set of data which includes the financially distressed companies are collected and used the Z-score formula to arrive the Z value. Thereafter a matched sample of firms is collected for the surviving firm, with matching by industry and asset size. Z - Score for healthy firm helps to identify their financial stability for the near future.

Z-Score Analysis

Altman used five accounting ratios to calculate the Z-score. These different ratios were combined into single measure called Z-score analysis. The original formula used to evaluate the Z-score analysis as established by Altman is as follows:

$$Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5$$

Where X_1 = Working capital/ Total assets (WC/TA)

X_2 = Retained earnings / Total Assets (RE/TA)

X_3 = Earnings before interest and taxes / Total Assets (EBIT/TA) X_4 = Market value of equity / Book value of total debt (MV/TL)

X_5 = Sales / Total Assets (S/TA)

Z = Overall Index

X1 = Working capital/ Total assets: This ratio is a measure of the net liquid assets of the firm relative to the total capitalization. Working capital is defined as the capital required for the functioning of day today activities and it is the difference between current assets and current liabilities.

X2 = Retained earnings / Total Assets: This ratio measures the cumulative profitability of the company as these profits are not distributed to shareholders as dividend. This is an indicator of firms earning power as well as age.

X3 = Earnings before interest and taxes / total Assets: This ratio measures the true productivity of the firm's assets abstracting from any tax or leverage factors. Since the success of any firm is based on its earning power of its assets, this ratio is very important for financial distress studies.

X4 =Market value of equity / Book value of total debt: Equity is calculated by total of preference and ordinary shares. This ratio measures the extend to which the assets must decline in value before the firm becomes insolvent.

X5 = Sales / Total Assets: This ratio measures the ability of the firm in utilizing its assets to generate sales. Revenue or profit for a business comes from its sales and it is the base for all other business activities. Because of its relevance this ratio stands second in its contribution to overall discriminating ability of the model.

The Z-score which is calculated using the above mentioned formula classifies companies based on their solvency. The higher the value is the lower the risk of bankruptcy. A low or negative value indicates high risk of bankruptcy. The critical values set by Altman between companies on the survivability indicator is expressed in table1 as under:

Score	Zone	Result
Z < 1.81	Distress	Likely to Bankrupt

1.81 < Z < 2.99	Gray Zone	Stable
Z > 2.99	Safe Zone	Safe

Table 1 Critical values set by Altman

This model has been widely used by auditors, management consults, law firms, academicians and researchers for predicting financial distress. This model is not free from errors. MDA was found to violate the assumption of normality and group dispersion, which can cause bias to the test of significance and estimated error rates (Ohlson, 1980, Harith et al., 2021). But practitioners find it is easy because it is more precise and lead to clear conclusions. It is reliable and can be statistically evaluated. It is faster and less costly to work with compared to other modern techniques which are using artificial intelligence (AI) for distress prediction. The relationship between the independent variable (Predictors) and the Z-score (outcome) is given in the below figure 1 as under:

WC/TA
RE/TA
Financial
Z Score
EBIT/TA
Distress
(Outcome)
MC/ TL
S/ TA
Independent Variables

Figure:1

4. Findings and discussion

The table 2 and 3 exhibit the information of the financial health of the distressed companies. The values of independent variables and Z-score which were used for the calculation of financial distress.

Table-2: Independent variable Values of distress firms

Company Name	Year	WC	TA	RE	EBIT	MC	TL	TS
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DCW Ltd	2021	-130.08	1272.427	634.989	133.349	683.9	1126.49	1462.262
	2020	-262.401	1179.386	625.604	67.794	190.813	1101.85	1277.277
	2019	-449.608	1052.563	857.331	82.162	483.963	1120.76	1352.802
	2018	-372.506	1151.947	590.909	44.108	681.746	1184.95	1213.407
	2017	-368.663	1185.531	610.046	81.588	671.129	1184.12	1304.915
IMP Powers Ltd	2021	-47.71	47.56	19.12	-63.72	12.05	335.78	93.99
	2020	46.71	121.84	89.64	9.49	9.15	281.04	264.55
	2019	65.43	140.97	103.96	31.22	35.93	268.49	413.31
	2018	52.15	127.29	102.25	34.88	76.87	269.41	450.3
	2017	34.65	113.91	96.74	29.44	76.78	256.55	424.71
Innovative Tyres & Tubes Ltd	2021	8.071	100.29	49.66	-5.24	15.29	85.18	139.172
	2020	8.605	107.287	58.505	-6.45	11.33	87.22	148.862
	2019	12.248	119.172	68.332	2.99	44.53	83.63	171.788
	2018	16.13	107.435	67.341	9.03	69.27	65.18	141.02
	2017	7.073	80.788	35.949	10.38	0	79.07	135.03
Shree Rama Newsprint Limited	2021	-280.35	482.37	180.77	-40.32	245.62	542.27	264.86
	2020	-219.62	512.71	257.67	-12.51	336.53	488.07	336.53
	2019	-133.57	562.26	302.6	66.87	503.83	413.16	503.83
	2018	-135.39	535.78	264.56	-7.19	434.34	380.48	434.34
	2017	-114.37	574.69	294.31	9.4	487.56	354.34	391.99
Castex Technologies Ltd	2021	-7287.28	-1671.63	-1912.01	-539.9	13.99	7886.87	289.53
	2020	-7224.23	-1124.65	-1362.73	-496.84	13.99	7861.29	296.4
	2019	-7203.11	-619.95	-857.63	-736.92	32.14	7851.82	459.48
	2018	-6952.53	126.99	-110.16	-1163.6	133.48	7824.66	525.22

	2017	-5527.41	1929.68	1694.47	-699.36	302.88	7152.36	1467.2
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Source: Computed by the autor

Table 3: Z-score values of financially distressed companies

Company Name Year		WC/ TA	RE/ TA	EBIT/ TA	MVE/ T L	S/ TA	Z Score
DCW Ltd	2021	-0.102	0.499	0.105	0.607	1.149	2.434
	2020	-0.222	0.530	0.057	0.173	1.083	1.851
	2019	-0.427	0.815	0.078	0.432	1.285	2.428
	2018	-0.323	0.513	0.038	0.575	1.053	1.854
	2017	-0.311	0.515	0.069	0.567	1.101	2.014
IMP Powers Ltd	2021	-1.003	0.402	-1.340	0.036	1.976	-3.066
	2020	0.383	0.736	0.078	0.033	2.171	3.936
	2019	0.464	0.737	0.221	0.134	2.932	5.330
	2018	0.410	0.803	0.274	0.285	3.538	6.226
	2017	0.304	0.849	0.258	0.299	3.728	6.311
Innovative Tyres & Tubes Ltd	2021	0.080	0.495	-0.052	0.180	1.388	2.111
	2020	0.080	0.545	-0.060	0.130	1.388	2.125
	2019	0.103	0.573	0.025	0.532	1.442	2.768
	2018	0.150	0.627	0.084	1.063	1.313	3.284
	2017	0.088	0.445	0.128	0.000	1.671	2.822
Shree Rama Newsprint Limited	2021	-0.581	0.375	-0.084	0.453	0.549	0.372
	2020	-0.428	0.503	-0.024	0.690	0.656	1.178
	2019	-0.238	0.538	0.119	1.219	0.896	2.488
	2018	-0.253	0.494	-0.013	1.142	0.811	1.839
	2017	-0.199	0.512	0.016	1.376	0.682	2.039
Castex Technologies Ltd	2021	-4.359	1.144	0.323	0.002	-0.173	-7.726
	2020	-6.424	1.212	0.442	0.002	-0.264	-10.600
	2019	-11.619	1.383	1.189	0.004	-0.741	-19.064
	2018	-54.749	-0.867	-9.163	0.017	4.136	-93.008

	2017	-2.864	0.878	-0.362	0.042	0.760	-2.619
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Source: Computed by the author

Interpretation of data

The Z-score values of DCW Ltd for the last five years were lesser than 2.99, it indicates that the firm was not in safe Zone never in the last five years. It is because the companies WC ratio is negative. Mean while company was able to maintain its Z-score values greter than 1.81 (gray zone) which means a moderate chance for filing bankruptcy. The main reason for low score is the shortage of working capital.

The Z-score values of IMP powers Ltd for the year 2021 shows -3.066 that indicate that the company is highly distressed. But the values shows that the company was in safe zone till the year 2020 with all psitive retuns and cash flows. But in the year 2021 the WC ratio

turned to be negative which made them to score very poor Zscore.

Innovative Tyres & Tubes Ltd shows a Z-score value lesser than 2.99 (except for the year 2018) but greater than 1.81 that means the company is in gray zone which idicate the chances of bankruptcy.

Shree Rama Newsprint Ltd Z-score value for the year 2021 and 2020 was lesser than 1.81 that means that the company is already in distress. During the other three years the company was in Gray zone.

Castex Technologies Ltd is also suffering from negative WC and Sales, it is a clear indication of low profit and financial distress.

Table4: Independent variable values for healty firms

Company Name	Year WC		TA	RE	EBIT	MVE	TL	TS
India Glycols Ltd	2021	85.46	2070.3	1214	242.04	1290.48	2501.77	6058.07
	2020	-240.92	1906.35	1126.81	280.54	659.17	2627.07	5951.17
	2019	-197.41	1881.74	1043.45	370.08	865.84	2429.03	5116.82
	2018	-456.41	1595.78	910.17	271.62	1400.23	2227.98	4155.45
	2017	-672.55	1435.84	815.26	181.62	495.69	2386.17	3583.22
Indowind Energy Limited	2021	11.46	286.11	138.78	2.31	34.1	62.24	16.36
	2020	4.21	287.82	47.7	5.35	15.44	155.47	18.92
	2019	3.1	291.77	47.7	-2.6	50.17	164.11	20.56
	2018	3.8	302.4	59.96	-16	65.87	162.94	24.24
	2017	15.51	332.86	143.12	3.22	37.33	105.42	23.94
Goodyear India Ltd Tyres	2021	507.66	875.4	816.5	186.59	2056.58	549.37	1791.71
	2020	588.63	952.53	892.67	120.81	1394.7	388.98	1745.57
	2019	560.27	1379.01	844.05	161.14	2179.54	946.68	1911.91
	2018	524.51	1254.28	779.12	202.17	2565.04	917.53	1705.97
	2017	451.64	1092.67	684.01	198.97	1949.76	739.08	1627.1

Orient Press Ltd	2021	21.94	89.8	65.94	1.57	82.9	106.56	159.07
	2020	19.61	91.42	69.18	5.28	84.55	116.19	189.88
	2019	23.93	95.74	71.52	7.95	149.95	115.98	223.94
	2018	24.08	98.63	71.98	10.58	260.05	107.8	226.12
	2017	14.06	82.26	59.85	9.9	54.39	98.41	202.39
Premier Ltd	2021	-481.33	-278.13	-313.64	-40.85	7.81	500.54	2
	2020	-404.18	-180.38	-230.72	34.45	3.58	40.37	9.87
	2019	-304.33	41.95	-40.25	-130.7	21.99	653.3	16.5
	2018	-245.09	281.13	153.93	58.49	58.92	580.12	20.07
	2017	-57.53	464.64	276.88	38.51	90.51	610.63	38.85

Source: Calculated by author

Table 5 Z-score value for healthy firms

Company Name	Year	WC/ TA	RE/ TA	EBIT/ TA	MVE/ T L	S/ TA	Z Score
India Glycols Ltd	2021	24.225	0.586	0.117	0.516	2.926	33.510
	2020	-7.913	0.591	0.147	0.251	3.122	-4.913
	2019	-9.532	0.555	0.197	0.356	2.719	-7.083
	2018	-3.496	0.570	0.170	0.628	2.604	0.143
	2017	-2.135	0.568	0.126	0.208	2.496	1.268
Indowind Energy Limited	2021	0.040	0.485	0.008	0.548	0.057	1.140
	2020	0.015	0.166	0.019	0.099	0.066	0.436
	2019	0.011	0.163	-0.009	0.306	0.070	0.466
	2018	0.013	0.198	-0.053	0.404	0.080	0.441
	2017	0.047	0.430	0.010	0.354	0.072	0.974
Goodyear India Ltd	2021	0.580	0.933	0.213	3.744	2.047	6.996
	2020	0.618	0.937	0.127	3.586	1.833	6.454

	2019	0.406	0.612	0.117	2.302	1.386	4.496
	2018	0.418	0.621	0.161	2.796	1.360	4.939
	2017	0.413	0.626	0.182	2.638	1.489	5.044
Orient Press Ltd	2021	0.244	0.734	0.017	0.778	1.771	3.615
	2020	0.215	0.757	0.058	0.728	2.077	4.019
	2019	0.250	0.747	0.083	1.293	2.339	4.732
	2018	0.244	0.730	0.107	2.412	2.293	5.406
	2017	0.171	0.728	0.120	0.553	2.460	4.410
Premier Ltd	2021	1.731	1.128	0.147	0.016	-0.007	4.142
	2020	2.241	1.279	-0.191	0.089	-0.055	3.848
	2019	-7.255	-0.959	-3.116	0.034	0.393	-19.917
	2018	-0.872	0.548	0.208	0.102	0.071	0.539
	2017	-0.124	0.596	0.083	0.148	0.084	1.132

Source: Calculated by author

Interpretation

These firms were considered as healthy as they have not filed for bankruptcy. Even though these companies have a history of low score which is an indication of financial instability, they were able to gear up for the year 2020 and 2021. This happened because of their increase in Market capitalisation, total sales and working capital ratios.

Indowind Energy Limited for the last five years shows a score value lesser than 1.81, that is a clear indication of financial distress. The firm has not applied for bankruptcy, but it is highly risky for the investors and other creditors of the company. The company has to take up preventive steps so that they can move to the safe Zone.

5. Conclusion and recommendation

This study aimed at testing the financial viability of manufacturing firms in Indian listed companies. Ten companies were studied for a period of five years (2017-2021). The study employed Altman Z score model which is one of the powerful model that can be predict financial distress.

The findings hold that the Z-score values of the distressed companies lies between 1.81 and 2.99 (gray zone) with a moderate chance for filing for bankruptcy. The low score is mainly because of negative working capital, low turnover and EBIT ratio. The healthy companies which were selected for the study also had a history of low performance for the first three year under study. But they were able to cover up that by increased WC, MC, TS ratios. The latest analysis of 2021 shows a Zscore much higher than 2.99 making them to settle in the safe Zone.

Indowind Energy Limited has a calculated Z-score value lesser than what is required to consider them as in the safe zone. It is a clear indication for the management to take corrective steps. They can revisit their cost structure and sources of working capital so as to enhance the production capacity.

The study has limited to the manufacturing sector and considered only the Z-score model to analyse financial distress. Including other models of financial distress would have strengthened the result. Also the sample size can

be increased, the larger the sample size the greater will be the accuracy of the result.

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