Altman Z-Score Modeling Analysis: An Empirical Study on Software Services Companies Listed on The Bombay Stock Exchange

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***Abstract*—Indian Software services companies contribute a significant portion of the revenue towards the economic growth. The objective of the study is to examine financial distress as per Altman's model of predicting corporate bankruptcy. The study reveals that the selected software companies are financially strong, ensuring consistency of financial performance in the period of study. The research findings infer that TCS Ltd maintains good financial health throughout the study period. These findings can assist future investors in making informed financial decisions regarding their portfolio of investments.**

***Index Terms*—Financial health, Bankruptcy, Investments.**

I. INTRODUCTION

Every business undertaking is carried out to make a profit. All the stakeholders of the company or the business organization will want to know whether the organization will do well in future to keep their interest intact with that organization. Financial health is of great concern for a business organization. Many theories and tools have come up in this regard. Business failure has been a major reason for developing theories and tools with respect to bankruptcy. Business failure is a situation where the organization is unable to cover its expenses and debts with the revenue earned. Altman Z score, a forensic accounting tool, is one such model that helps to measure financial distress or bankruptcy. It was published by Edward I Altman in the year 1968. The Z-score model is mainly designed to measure the financial health of the company in terms of financial distress or bankruptcy. The model helps to measure the financial creditworthiness of the organization. The model uses the formulae based on the information found in the profit and loss account and balance sheet of the organization. The original Z-score model used five financial ratios to calculate a single Z score to indicate the likelihood of the company going bankrupt.

II. 'Z' SCORE

The most famous failure prediction model is Altman's Z-score model. Based on Multiple Discriminate Analysis (MDA), the model predicts a company's financial health based on a discriminate function of the firm.

$Z = 1.2\ X1 + 1.4X2 + 3.3X3 + 0.6X4 + 1.0X5$

Where Z = Discriminant function score of a firm;
X1 = Working capital / Total Assets;
X2 = Retained earnings / Total Assets;
X3 = Earnings before Interest and Taxes (EBIT) / Total Assets;
X4 = Market Value of Equity / Book value of Total Liabilities and X5 = Sales / Total Assets

Z – SCORE COMPONENTS: The Z score is calculated by multiplying the following accounting ratios which is efficient in predicting bankruptcy.

(i) X1 (Working Capital / Total Assets):
This ratio signifies the liquidity position of the firm towards the total capitalization. Working capital is identified as the difference between current assets and current liabilities.

(ii) X2 (Retained earnings / Total Assets):
This ratio indicates the amount reinvested, the earnings or losses which reflects the extent of companies leverage.

(iii) X3 (EBIT / Total Assets):
This ratio indicates the operating performance and the earning power of the company.

(iv) X4 (Market value of Equity / Book value of Total Liabilities):
It is the measure of the long-term solvency of a firm.

(v) X5 (Sales /Total Assets):
This ratio indicates the sales generating capacity of the firm's assets and measure of managements capacity to deal with competitive conditions.

ALTMAN GUIDELINES FOR HEALTHY ZONE

Situation	Z – Score	Zones	Remarks
I	Below 1.8	Not Healthy – Distress zone	Its failure is certain and extremely likely and would occur probably within a period of two years
II	Between 1.8 and 2.99	Healthy – Grey zone	Financial viability is considered healthy. The failure in this situation is uncertain to predict
III	3 and above	Too Healthy – Safe Zone	Its Financial Health is viable and not to fail

ABOUT THE SOFTWARE SERVICES COMPANIES

Tata Consultancy Services was founded in 1968. Tata Consultancy Services (TCS) provides IT services, consulting and business solutions and has been partnering with many of the world's largest businesses in their transformation journeys. The company offers a consulting-led, cognitive-powered, integrated portfolio of IT, business and engineering services and solutions. TCS works with leading corporations across the world, departments of the Government of India and various state governments, systemically important entities and the private sector. The company has a pan-India presence and 50+ countries globally, with major presence in countries across Europe, the UK, the Middle East, North America, Latin America, and Southeast Asia.

Infosys Ltd was established in the year 1981. Infosys provides consulting, technology, outsourcing and next-generation digital services, to enable clients to execute strategies for their digital transformation. With services including software application development and maintenance, and IT consulting. Infosys helps businesses navigate digital transformation with cloud and AI, driving agile digital solutions and continuous improvement through innovation and skill development. The company operates across 12 states in India and has a strong presence in North America and Europe, serving clients in over 90 countries worldwide.

WIPRO Ltd was founded in the year 1945. Wipro is a global information technology, consulting and business process services company. Wipro Limited is a global business organization that deals in information technology (IT), consulting and business process services. Its IT Services segment provides a range of IT and IT-enabled services which include digital strategy advisory, customer-centric design, consulting, custom application design, development, re-engineering and maintenance, systems integration, package implementation, global infrastructure services, analytics services, business process services, research and development and hardware and software design to leading enterprises worldwide. It provides services in AI, cloud, consulting, cybersecurity, data analytics, and digital experiences. It serves industries like banking, healthcare, energy, aerospace, automotive, manufacturing, and more, with a strong focus on sustainability. The company serves

customers across 14 states in India and 56 countries worldwide.

HCL Technologies Ltd, a part of HCL Group, was incorporated in 1991, headquartered in Noida, Uttar Pradesh. It provides a wide range of software and IT infrastructure services. Its offerings include IT infrastructure management, digital process operations, cloud services, cybersecurity, digital analytics, internet of things (IoT), engineering and R&D, and more. HCL serves sectors like financial services, manufacturing, telecom, retail, media, life sciences, banking, automotive, healthcare, energy, and more. The company partners with major technology vendors and operates globally, with offices in the Americas, Asia-Pacific, the Middle East, Africa, and Europe.
Tech Mahindra Ltd, part of the Mahindra Group, was established in 1986. It is a global consulting and systems integration company operating in over 90 countries. Tech Mahindra delivers solutions combining digital innovation and industry expertise to help clients transform and scale quickly. The company offers a wide range of services, including consulting, IT, enterprise applications, business process services, engineering, network services, customer experience, AI & analytics, and cloud & infrastructure services. Tech Mahindra aims to create value, promote future readiness, and foster a more equal world for enterprises, employees, and society.

III. REVIEW OF LITERATURE:

ROHINI (2016) research is based on the model to understand Altman Z score of some selected firms from the BSE and NSE listed companies. The data collection period is for 5 years from 2011-2015. The researcher selects manufacturing and non-manufacturing for analysis. The research concludes that most of the firms are suffering from the distress zone.

SETYANI (2016) the research was based on again Altman Z score and the study period was 2009 to 2014. The Author concludes that the retained earnings to total assets ratio have no significant effect on the company's performance. The other ratio of Z score, EBIT to total assets has the only significant factor which affect the company's stock price but not fully.

SANJAYSINH (2020) The Author has used the Altman Z Score model to analyse the financial distress level of the Havells Company. The Study Period is 10 years from 2009 to 2018. Apart from all the factors of Altman Z Score, the author has also collected the data regarding the ratios like Current Assets ratio, Quick Assets ratio, Debtors Turnover ratio, Liquidity ratio, Return on Assets ratio, Return on Capital Assets ratio etc. On the basis of ten years of Altman Z Score, the research concludes that the Havells company is in Safe Zone in all the ten years.

SHIVANISINH (2021) The research study is based on evaluating financial efficiency of selected FMCG companies of India by the Altman z-score model. The study period is five years from 2015 to 2019. The Author has selected the five companies from FMCG sector i.e., Dabur India Ltd., Godrej Consumer Ltd., Marico Ltd., Emami Ltd., and Sheela Foam Ltd. by using convenience sampling method. With the help of Altman Z score, it is being analysed that none of the selected companies are in distress zone.

IV. RESEARCH METHODOLOGY:

OBJECTIVES OF THE STUDY

1. To know the financial health of the selected Software companies in BSE.
2. To evaluate the financial distress level of the selected Software companies
3. To identify the zone of financial distress of the selected Software companies.

SAMPLE SIZE AND PROCEDURE

The study was concerned with Software companies and has been confined to the IT industry in terms of market capitalization. The Software Companies was selected by using the judgmental sampling method. The selection has been done on the basis of Market capitalization shown in the BSE. This study is based on secondary data collection in which data were collected from the annual reports of the BSE. The collected data were analysed with the help of financial Ratio analysis. The period of the study will be five years from 2020 to 2024.

LIMITATIONS OF THE STUDY

1. Only five Software companies were selected for this study.
2. Performance evaluation has been done through one model.
3. Data analysis has been done based on only five years.

V. DATA ANALYSIS AND INTERPRETATION:

TABLE 1: FACTOR WISE ANALYSIS OF WIPRO

Factor	Multiplier	2020	2021	2022	2023	2024
X1	1.2	0.44	0.42	0.34	0.40	0.41
X2	1.4	0.89	0.78	0.77	0.78	0.76
X3	3.3	0.52	0.57	0.47	0.44	0.45
X4	0.6	5.09	8.47	3.05	3.72	4.87
X5	1	0.75	0.74	0.73	0.77	0.78
Altman Z Score		7.69	10.98	5.36	6.11	7.27
Zone		Safe	Safe	Safe	Safe	Safe
Average Z Score						7.48 – Safe Zone

Table 1 shows the calculated values of X1 (Working Capital / Total Assets), X2 (Retained earnings / Total Assets), X3 (EBIT / Total Assets), X4 (Market value of Equity / Book value of Total Liabilities), X5 (Sales /Total Assets) for the study period from 2020 to 2024. The calculated Altman Z score was highest during the year 2021 at 10.98 and lowest during the year 2022 at 5.36. The average Altman Z score is 7.48 for the study period. The average Altman's score indicates that the Software company's financial health is under the safe zone.

TABLE 2: FACTOR WISE ANALYSIS OF INFOSYS

Factor	Multiplier	2020	2021	2022	2023	2024
X1	1.2	0.435	0.408	0.342	0.302	0.440
X2	1.4	0.487	0.418	0.455	0.469	0.467
X3	3.3	1.534	1.349	1.468	1.508	0.399
X4	0.6	11.82	15.018	8.934	7.68	9.708
X5	1	0.978	0.927	1.032	1.166	1.115
Altman Z Score		15.25	18.12	12.23	11.12	12.12
Zone		Safe	Safe	Safe	Safe	Safe
Average Z Score						13.76 – Safe Zone

Table 2 shows the calculated values of X1 (Working Capital / Total Assets), X2 (Retained earnings / Total Assets), X3 (EBIT / Total Assets), X4 (Market value of Equity / Book value of Total Liabilities), X5 (Sales /Total Assets) for the study period from 2020 to 2024. The calculated Altman Z score was highest during the year 2021 at 18.12 and lowest during the year 2023 at 11.12. The average Altman Z score is 13.76 for the study period. The average Altman's score indicates that the Software company's financial health is under the safe zone.

TABLE 3: FACTOR WISE ANALYSIS OF HCL

Factor	Multiplier	2020	2021	2022	2023	2024
X1	1.2	0.21	0.35	0.39	0.41	0.43
X2	1.4	0.01	0.01	0	0	0
X3	3.3	0.57	0.62	0.63	0.69	0.70
X4	0.6	4.89	8.22	6.26	8.50	9.79
X5	1	0.85	0.87	0.96	1.08	1.10
Altman Z Score		11.42	10.07	8.24	10.68	12.02
Zone		Safe	Safe	Safe	Safe	Safe
Average Z Score						10.48 – Safe Zone

Table 3 shows the calculated values of X1 (Working Capital / Total Assets), X2 (Retained earnings / Total Assets), X3 (EBIT / Total Assets), X4 (Market value of Equity / Book value of Total Liabilities), X5 (Sales /Total Assets) for the study period from 2020 to 2024. The calculated Altman Z score was highest during the year 2024 at 12.02 and lowest during the year 2022 at 8.24. The average Altman Z score is 10.48 for the study period. The average Altman's score indicates that the Software company's financial health is under the safe zone.

TABLE 4: FACTOR WISE ANALYSIS OF TCS

Factor	Multiplier	2020	2021	2022	2023	2024
X1	1.2	0.522	0.498	0.466	0.464	0.456
X2	1.4	0.668	0.608	0.605	0.627	0.478
X3	3.3	0.360	0.340	0.371	0.400	0.114
X4	0.6	29.71	31.68	23.06	26.2	27
X5	1	1.298	1.255	1.355	1.569	1.645
Altman Z Score		21.87	22.82	17.82	20.04	19.44
Zone		Safe	Safe	Safe	Safe	Safe
Average Z Score						20.39– Safe Zone

Table 4 shows the calculated values of X1 (Working Capital / Total Assets), X2 (Retained earnings / Total Assets), X3 (EBIT / Total Assets), X4 (Market value of Equity / Book value of Total Liabilities), X5 (Sales /Total Assets) for the study period from 2020 to 2024. The calculated Altman Z score was highest during the year 2023 at 20.04 and lowest during the year 2022 at 17.82. The average Altman Z score is 20.39 for the study period. The average Altman's score indicates that the Software company's financial health is under the safe zone.

TABLE 5: FACTOR WISE ANALYSIS OF TECH MAHINDRA

Factor	Multiplier	2020	2021	2022	2023	2024
X1	1.2	0.35	0.41	0.28	0.28	0.29
X2	1.4	0.73	0.71	0.74	0.83	0.73
X3	3.3	0.46	0.50	0.55	0.48	0.27
X4	0.6	1.51	7.89	3.65	4.09	5.44
X5	1	0.98	0.95	0.99	1.15	1.19
Altman Z Score		4.03	10.46	6.21	8.42	7.92
Zone		Safe	Safe	Safe	Safe	Safe
Average Z Score						7.40 – Safe Zone

Table 5 shows the calculated values of X1 (Working Capital / Total Assets), X2 (Retained earnings / Total Assets), X3 (EBIT / Total Assets), X4 (Market value of Equity / Book value of Total Liabilities), X5 (Sales /Total Assets) for the study period from 2020 to 2024. The calculated Altman Z score was highest during the year 2021 at 10.46 and lowest during the year 2020 at 4.03. The average Altman Z score is 7.40 for the study period. The average Altman's score indicates that the Software company's financial health is under the safe zone.

VI. CONCLUSION

The study undertaken has given greater insight into the financial position of the software service companies. From the study, we get to know that basically the Altman Bankruptcy Model is not a prediction for any company instead, it determines various zones in which company resembles to other firms that have filed for bankruptcy. Thus, the poorest zone based on financial health is the distress zone where the company has a high probability of going bankrupt. It doesn't mean if a company is in distress zone that it has a probability of 1 for bankruptcy instead, with management having a greater role for deciding the fate of the company and all credit goes to them for success. TCS Ltd has been successful in maintaining a higher liquidity and solvency position. According to the findings of the study, it can be concluded that the selected software service companies selected from the BSE are financially healthy and are in the Safe Zone as per the Altman average Z score model for the study period. The study shows that Altman Z score model is indeed an effective tool to predict the financial distress in a company. Investors can identify such financially sound companies through this study and take their investment decisions accordingly.

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