An Examination of Five Financial Ratios: The Altman Z Score is a Technique used to Assess the Creditworthiness of Selected Passenger Car Companies

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***Abstract*— The purpose of this study was to look into the financial health of Indian passenger automobile makers. Financial health evaluations have been practiced for a long time. Duration of the study is from 2015-16 through 2019-20. In this research, Altman's Z Score is used to evaluate the financial performance of automobile sectors like commercial vehicles, passenger cars, and diversified. However, in this research, Altman's Z Score is considered for passenger car manufacturers. The Altman Z-score is a credit-strength test result that is derived using data from a company's annual report and is based on five financial measures. "In 2020, India was the world's fifth-largest car market, with 3.49 million passenger and commercial vehicles sold". It was the world's seventh-largest commercial vehicle manufacturer in 2019. Domestic automotive manufacturing increased at a CAGR of 2.36 percent between FY16 and FY20, reaching 26.36 million vehicles. Between FY16 and FY20, domestic automotive sales increased at a 1.29 percent compound annual growth rate (CAGR), with 21.55 million vehicles sold in FY20. Between FY16 and FY20, domestic automotive manufacturing increased at a CAGR of 2.36 percent, reaching 26.36 million vehicles. Domestic automotive sales increased at a 1.29 percent compound annual growth rate (CAGR) between FY16 and FY20, with 21.55 million vehicles sold in FY20". Production volume of mainly passenger vehicles, three-wheelers, two-wheeler, and quadricycles reached 2,214,745 units in October 2021 (excluding BMW, Mercedes, Tata Motors, and Volvo Auto). The total number of passenger vehicles produced by manufacturers in the country in FY21 was 22,652,108. The automobile sector is currently confronting challenges in order to reduce liquidity risk and increase profitability, not only in India but globally. By 2022, the major automobile firms in India are anticipated to make India the world's leader in the two-wheeler and four-wheeler sectors. To overcome the difficulties and meet the challenges of vehicle production, industries are encouraged to bring in additional investments into the stream in order to reduce liquidity risk and increase profitability. The liquidity and profitability trade-off can be effectively addressed in the manufacturing sector by enhancing and implementing effective monetary methods. The study aids in the provision of recommendations to businesses in order to help them avoid financial difficulty by utilizing Altman's Z-Score model, a popular tool for predicting bankruptcy. In this study, the financial performance of vehicle firms was examined, as well as the risk of bankruptcy for a sample of automobile companies in the industry.**

***Keywords*— Automobile companies in India, Altman's Z-Score model, Liquidity risk, Monetary methods, Bankruptcy.**

I. INTRODUCTION

The global financial crisis, as well as the rising number of business defaults, emphasize the need of good fund management. Sources: "India's automobile industry is the world's fourth largest, with the country ranking as the world's fourth largest producer of cars and fourth largest producer of commercial vehicles by 2020. Between FY16 and FY20, domestic automotive manufacturing grew at a CAGR of 2.36 percent, reaching 26.36 million vehicles. Domestic automotive sales grew at a 1.29 percent compound annual growth rate (CAGR) between FY16 and FY20, with 21.55 million vehicles sold in FY20. In FY21, a total of 22,652,108 passenger automobiles were produced. In October 2021, total passenger vehicle production, including two-wheelers and three-wheelers, had reached 2,214,745 units". Naturally, the Z-score method was devised and launched by Edward Altman, a professor at New York University, in the late 1960s as a remedy to the time-consuming and rather complex procedure investors had to go through to evaluate how close a firm was to bankruptcy. In practice, the Z-score methodology devised by Altman ended up giving investors an idea of a company's overall financial health. Many stakeholders in today's organizations are interested in developing a reliable strategy for predicting insolvency and financial difficulties. Methods for predicting bankruptcy events have received mixed assessments to date. An attempt has been made to examine the financial performance of passenger car vehicles as well as anticipate the likelihood of bankruptcy. Altman's Z-Score model is a popular tool for predicting bankruptcy, but this study is the first to look at how passenger car companies' performance affects their likelihood of going bust. "The Altman's Z score is designed to forecast the likelihood of manufacturing businesses going bankrupt. There is

evidence that it predicts the bankruptcy of the underlying sample with a 76.9% accuracy rate (Begley et al. 1996). Chen and Shemerda (1981) discovered that financial ratios can predict bankruptcy with an accuracy of up to 90%.".

II. Literature Review

Gerantonis, Vergos, and Christopoulos (2009) investigated Z-score models to determine if they could predict bankruptcies up to three years in advance. According to the data, the Altman model did a good job of predicting failures. The findings can be used by business management in making financing decisions, regulatory agencies in making stock selection decisions, and portfolio managers in making stock selection decisions, according to the researchers. The Altman Z-Score indicators are applied to determine the insolvency of a company. In Altman's discriminant analysis model, Z = 1.22 (WCTA) + 1.44 (RETA) + 3.33 (EBITTA) + 0.06 (MVEBVL) + 1 (STA) (Endri, 2009; Ferbianasari, 2012). whereas, the Altman Z-Score model describes "working capital/total assets as abbreviated as WCTA, RETA (retained earnings and total assets), EBITTA which stands for earnings before interest and taxes on total assets, STA = sales/total assets and MVEBVL = market value of equity". Hayes, Hodge, and Hughes (2010) conducted research to construct and understand the Z score and apply it to the retail industry from 2007 to 2008. Mizan, Amin, and Rahman (2011) conducted research in Bangladesh to anticipate the collapse of the pharmaceutical business. They employed the Altman Z-score Model to do so, with a sample size of six significant industry organisations. According to their investigation, two firms are deemed to be financially solid, with no imminent risk of bankruptcy, while others are found to be unsatisfactory, with a high risk of experiencing a financial catastrophe in the near future. They also said that most companies' stock market valuations do not correspond to their fundamentals. Altman and Beaver showed that a financial statement is sufficient information for a large corporation's discriminating function (Kim-Soon et 2013). Alkhatib and Al Bzour (2011) used the Altman and Kida models to investigate the impact of financial ratios on bankruptcy prediction in Jordanian publicly traded enterprises. They advised Jordanian listed companies to employ at least one of these high-credibility models to predict corporate failure. Altman's business bankruptcy prediction model, which he created in 1968, is the most generally recognized and commonly used instrument (Mizan, Amin, and Rahman 2011). The Altman Z-score model is used to forecast bankruptcy in a number of countries. Altman's theories were put to the test when it came to predicting hotel bankruptcy. This research investigates the likelihood of bankruptcy for several hotel categories in Greece, with the goal of identifying the discrimination zone that may be classed as a bankruptcy certainty. Kumari's (2013) research employed Altman's Z score model to forecast the Metals and Minerals Trading Corporation of India's insolvency. From this research, it has come to the conclusion that MMTC's overall financial health is strong, and the firm is favourable to investors. Hari Prasad Reddy and Ramana Reddy (2013). The Z score research, which is also relevant to this article, shows Chittoor Co-operative Sugars Ltd.'s poor financial performance, which ultimately contributed to its bankruptcy. In comparison, Sri Venkateshwara Sugars Factory Ltd. has an excellent financial performance. The financial soundness of India's logistics industry was examined using Z-score analysis by Vikas Tyagi (2014). It shows that the logistics business in India was once prospering. The average Z score value increased from 2.54 to 3.01 when the Indian economy was hit by the global recession in 2006, which is a positive sign. This indicates that the logistics business in India did admirably overall. easy way to comply with the conference paper formatting requirements is to use this document as a template and simply type your text into it.

III. Objective of the Study

1. To investigate the selected passenger car companies' overall credit strength.
2. To forecast the possibility of passenger car automobile companies going bankrupt.

IV. Hypothesis

H1: There are four-wheeler automobile passenger car companies that are having to predict financial distress.

V. Theoretical Framework

Altman's Z Score: Under this research Z Score balance-sheet metric is determined for measuring a manufacturing company's financial soundness that is quantitative in nature. "The Z score is made up of five different variables: X1, X2, X3, X4, and X5. A score of more than 3.0 is considered a "safe" enterprise, or those with a low risk of insolvency", "Z = 1.2 * X1 + 1.4 * X2 + 3.3 * X3 + 0.6 * X4 + 1.0 * X5".

MODEL ALTMANS Z 'Score
X1 = Working Capital / Total Assets
X2 = Retained Earnings / Total Assets
X3 = EBIT / Total Assets
X4 = Market Value of Equity / Total Liabilities
X5 = Net Sales / Total Assets Original
SCORE
Z > 2.67 = Athi Sundar
1.81 > Z > 2.67 = Sundar
Z < 1.87 = Financial Distress

VI. Research Methodology

To explain its conclusions, this study employs cross-time series and cross-sectional or panel data (pooled data) that help to determine the results and fulfil the objectives of the study. Purposive sampling was used to determine the sample size in this study, and the criteria used to pick the sample automobile companies were descriptive in nature. The research was carried out over a five-year period, from

2015 to 2019. Data was gathered entirely from secondary CMIE (Prowess) database secondary source and financial statements. The sample design consists of the five passenger car companies selected from the automobile industry. The companies are selected on the basis of market potential and fundamentals. The sample companies for the studies are Tata Motors Ltd, Maruti Suzuki Limited, Hyundai Motor Company, Mahindra & Mahindra Limited, Ford Motor Company, and General Motors Company.

The quantitative descriptive analysis method was used to analyse and predict financial distress using the methods of Altman Z Score Modification. This method also analyses the problems with raising questions about the independent variables that may be one variable or more than one variable. The stages performed by the method of Altman Z-Score as follows:

VI.1. Calculate Several key ratios are used in the formulation of an Altman Z-Score Value. "The Z-Score model is the 1960's brainchild of Professor Edward Altman".

"X1 = Working Capital / Total Assets
X2 = Retained Earnings / Total Assets
X3 = EBIT / Total Assets
X4 = Market Value of Equity / Total Liabilities
X5 = Net Sales / Total Assets Original".

VI.2. Using the formula to do computations with Altman modifications: The formula for calculating the Z score for public manufacturing enterprises in the original model is as follows. The Altman Z-Score is a measure of a company's health and is calculated as Z = 1.2*X1 + 1.4*X2 + 3.3*X3 + 0.6*X4 + 1.0*X5 (Credit Strength).

Whereas,
Z > 2.67 = Health
1.81 > Z > 2.67 = Manageable (Grey)
Z <1.87 = Financial Distress Risk

VII. Result and Discussion

Using the formula to do computations with Altman modifications: The formula for calculating the Z score for public manufacturing enterprises in the original model is as follows. The Altman Z-Score is a measure of a company's health and is calculated as Z = 1.2*X1 + 1.4*X2 + 3.3*X3 + 0.6*X4 + 1.0*X5 (Credit Strength).

X1 is the liquidity ratio that is used to measure the asset liquidity of a firm in order to relate it to its size. X1 helps firms take decisions based on their short-term liabilities. X2 ratios are used to measure the cumulative profit of a company, which proves efficient management in terms of production, sales, and other areas. X3 is a useful ratio that determines the company's productivity, whereas its long-term survivability depends on both productivity and revenue generation. It concludes that an efficient management company keeps utilisation of its resources, and management evaluates overall performance by its sales and investment return.

X4 explores the market perception. It helps collect all the information about the market. Based on the market information, the company assesses its worth, such as debt and equity ratios. X4 also determines, based on the market information, how the company's assets depreciate in value before the compulsion surpasses the assets and the company becomes bankrupt.X5 is another important ratio that measures the overall management ability to strive. In this case, companies used capital turnover ratios as a financial indicator in order to generate revenue.

TABLE-1
THE RESULTS OF Z "SCORE ANALYSIS
(MARUTI SUZUKI LIMITED FOR THE PERIOD 2015–19)
(In Million Dollars.)

Year/Ratio	X1 / WC/TA	X2 / RE/TA	X3 / EBIT/TA	X4 / MVE/TL	X5 / NS/TA	WC	RE	EBIT	MVE	NS	TA	TL
2015-16	-0.02	0.62	0.13	2.3	1.5	-100	3371	681	4078	8016	5328	1579
2016-17	-0.11	0.6	0.14	2.5	1.4	-626	3778	916	4516	8726	6338	1822
2017-18	-0.09	0.61	0.15	2.4	1.5	-685	4789	1195	5577	11921	7862	2285
2018-19	-0.13	0.61	0.16	2.4	1.4	-1125	5573	1428	6411	12595	9114	2704
2019-20	-0.03	0.65	0.13	2.7	1.4	-225	5875	1152	6660	12416	9084	2424
Average	**-0.08**	**0.62**	**0.14**	**2.5**	**1.4**							
Z score	**2015-16** / **4.3**	**2016-17** / **4.1**	**2017-18** / **4.2**	**2018-19** / **4.0**	**2019-20** / **4.3**							

Source: Compiled from Annual report

From table 1, the X1 ratio shows that the Maruti Suzuki Limited average is negative. From the above calculation, it concludes that X1, the working capital of Maruti Suzuki, is financed through debt that is determined by public debtors and credit policy ratios. ever, a company is able to maintain and retain earnings. At X2 Maruti Suzuki, the company is able to finance its total assets up to 62% on average, which shows the efficiency of the company in accumulating its profits and total assets where an increasing and decreasing trend is identified. However, a company is able to retain more or less earnings. X3 shows the company's not having the lowest ratio in terms of using assets and generating profit in years 2019–20. There is a decrease of 0.13 compared to the previous year. That happened due to the financial crisis that happened that year, and the company also increased its sales for the duration of its existence. X4 and X5 show an average result. For X4 Market, the value

of equity is increasing, which indicates the company's financial soundness. For X5, the net sales ratio is consistent, which shows the company has the ability to leverage resources. If it is decreasing, it means there are changes in net sales that will affect a company's gross profit and gross profit margin.

TABLE-2

THE RESULTS OF Z "SCORE ANALYSIS

(MAHINDRA & MAHINDRA LTD FOR THE PERIOD 2015–19)

(In Million Dollars.)

Year/Ratio	X1 WC/TA	X2 RE/TA	X3 EBIT/TA	X4 MVE/TL	X5 NS/TA	WC	RE	EBIT	MVE	NS	TA	TL
2015-16	0.02	0.16	0.05	0.3	0.4	32.43	239	69	415	616.73	1521	1521
2016-17	0.02	0.16	0.04	0.3	0.4	24.07	269	64	432	659.43	1635	1635
2017-18	0.03	0.18	0.06	0.7	0.4	45.85	319	98	413	730.56	1769	616
2018-19	0.02	0.18	0.08	0.6	0.4	48.38	387	159	465	759	2106	728
2019-20	0.02	0.18	0.05	0.2	0.3	53.94	419	128	577	773.86	2358	2358
Average	**0.02**	**0.17**	**0.06**	**0.42**	**0.38**							
Z score	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**							
	0.96	**0.94**	**1.25**	**1.27**	**0.93**							

Source: Compiled from Annual report

From table 2, it is evident that the X1 ratio for Mahindra & Mahindra Ltd. has positive working capital, which indicates the company has enough capital to meet its short-term liabilities. At X2 Mahindra & Mahindra Ltd, the company is able to finance its total assets up to 91% on average, which shows the efficiency of the company in accumulating its profits and total assets where an increasing and increasing trend is identified. However, a company is able to retain more earnings. X3 shows the company's constantly fluctuating in terms of using assets and generating profit in years 2019–20. Hence, it indicates whether the company is in debt and, if so, managed properly, then the company is on track for long-term growth in 2019–2020. X4 and X5 show an average result. For X4 Market, the value of equity is fluctuating, which indicates the company's financials are not stable. For X5, the net sales ratio is consistent in years 2019–20 and later it has decreased to 0.3, which shows the company has the ability to leverage resources but with proper strategy.

TABLE-3

THE RESULTS OF Z "SCORE ANALYSIS

(HYUNDAI MOTOR FOR THE PERIOD 2015–19)

(In Million Dollars.)

Year/Ratio	X1 WC/TA	X2 RE/TA	X3 EBIT/TA	X4 MVE/TL	X5 NS/TA	WC	RE	EBIT	MVE	NS	TA	TL
2015-16	1.4	0.2	0.05	0.6	4.8	23736	3687	810	6666	82947	17454	10787
2016-17	1.5	0.2	0.05	0.7	4.8	25292	4053	861	7125	82130	17429	10304
2017-18	0.2	0.4	0.02	0.7	0.5	27579	60262	3973	66908	86257	159489	92581
2018-19	0.1	0.4	0.01	0.7	0.5	22227	62700	2385	69684	31294	170358	100674
2019-20	0.1	0.4	0.02	0.6	0.5	20037	60060	3664	61658	93056	171171	109512
Average	**0.66**	**0.32**	**0.03**	**0.66**	**2.22**							
Z score	**2015-16**	**2016**	**2017-18**	**2018-19**	**2019**							
	7.2	**7.4**	**1.8**	**1.7**	**1.6**							

Source: Compiled from Annual report

From table 3, it is evident that the X1 ratio for Hyundai Motor Company has positive working capital, which indicates the company has enough capital to meet its short-term liabilities. At X2 Hyundai Motor Company, indicated retained earnings of a company increase by up to 0.32 by using common types of debt and equity financing, and the company later pays the debt holder along with principal and interest over time. X3 shows the company's constantly fluctuating in terms of using assets and generating profit in years 2019–20. And also, the above table shows an average ratio of 0.03, indicating a Hyundai Motor Company with lower revenue and higher operating costs. If it continues to decline in the long term, the Hyundai Motor Company should reconsider its business model. For X4 Market, the value of equity is low, fluctuating at 0.66 in 2019–20, which indicates the company's financials are stable. For X5, the net sales ratio is consistent in years 2019–20 and later it has decreased to 0.22, which shows the company has the ability to leverage resources but with proper strategy.

TABLE-4

THE RESULTS OF Z "SCORE ANALYSIS

(GENERAL MOTOR FOR THE PERIOD 2015–19)

(In Million Dollars.)

Year/Ratio	X1 / WC/TA	X2 / RE/TA	X3 / EBIT/TA	X4 / MVE/TL	X5 / NS/TA	WC	RE	EBIT	MVE	NS	TA	TL
2015-16	0.03	0.1	0.04	0.1	0.8	6541	20285	8371	40323	152356	194520	154197
2016-17	-0.04	0.1	0.1	0.1	0.8	-8978	26168	12008	44075	166380	221690	177615
2017-18	-0.04	0.1	0.01	0.01	0.7	-8146	17627	1196	36200	145588	212482	176282
2018-19	-0.1	0.04	0.02	0.02	1.3	-6944	4667	1893	11659	147049	109920	98261
2019-20	-0.1	0.1	0.02	0.02	1.3	-9913	5744	2104	12726	137237	109217	96491
Average	**0.05**	**0.09**	**0.04**	**0.05**	**0.98**							
Z score	**2015-16 / 1.1**	**2016 / 1.1**	**2017-18 / 0.8**	**2018-19 / 1.4**	**2019 / 1.3**							

Source: Compiled from Annual report

From table 4, the X1 ratio shows that the General Motors Company's working capital is negative. From the above calculation, it is concluded that X1, the working capital of General Motors Company, is financed through debt that is determined by public debtors and credit policy ratios. ever, a company is able to maintain and retain earnings. At X2 General Motors Company, the company is able to finance its total assets up to 69% on average, which shows the efficiency of the company in accumulating its profits and total assets where an increasing and decreasing trend is identified. However, a company is able to retain more or less all of its earnings. X3 shows the company's not having the lowest ratio in terms of using assets and generating profit in years 2019–20. There is a decrease of 0.04 compared to the previous year. That happened due to the financial crisis that happened that year, and the company also increased its sales for the duration of its existence. X4 and X5 show an average result. For the X4 market, the value of equity is increasing by 0.05, which indicates the company's financial soundness is not good and the company is losing. For X5, the net sales ratio increased by 0.98, which shows the company has the ability to leverage resources. If it is increasing, it means there are changes in net sales that will affect General Motors' gross profit and gross profit margin.

TABLE-5

THE RESULTS OF Z "SCORE ANALYSIS

(FORD MOTOR FOR THE PERIOD 2015–19)

(IN MILLION DOLLARS.)

Year/Ratio	X1 / WC/TA	X2 / RE/TA	X3 / EBIT/TA	X4 / MVE/TL	X5 / NS/TA	WC	RE	EBIT	MVE	NS	TA	TL
2015-16	0.1	0.1	0.04	0.1	0.7	20251	14414	10252	28657	149558	224925	196174
2016-17	0.1	0.1	0.02	0.03	0.6	18180	15634	6796	29187	151800	237951	208668
2017-18	0.1	0.1	0.03	0.03	0.6	22201	21218	8159	34918	156776	257808	222792
2018-19	0.1	0.1	0.01	0.02	0.6	19080	22668	4345	34966	160338	256540	220474
2019-20	0.1	0.1	-0.002	-0.002	0.6	15915	20320	-640	33230	155900	258537	225307
Average	**0.1**	**0.1**	**0.02**	**0.04**	**0.6**							
Z score	**2015-16 / 1.0**	**2016-17 / 0.94**	**2017-18 / 0.96**	**2018-19 / 0.91**	**2019 / 0.78**							

Source: Compiled from Annual report

From table 5, the X1 ratio shows that the Ford Motor Company's working capital is stable in all years. From the above calculation, it is concluded that X1, the working capital of Ford Motor Company, is stable. That indicates that the company is not heavily financing its debt to the public, so the credit policy ratios of the company are balanced. Further, retained earnings are stable with an average ratio of 0.1, and for 2019–20 it is a negative ratio of -0.002. This represents retained earnings that have not been reinvested in the company and have not been used to pay off debt. Retained earnings are negative because they indicate bankruptcy and inefficient management in X2 ratios. X3 shows the company's not having the lowest ratio in terms of using assets and generating profit in years 2019–20. There is a decrease of 0.02 compared to the previous year. That happened due to the financial crisis that happened that year, and the company also increased its sales for the duration of its existence. X4 Ford Motor Company is not able to maintain its market value equity with an average value of 0.04, which indicates losses in the company, and X5 shows an average result. For X5, the net sales ratio increased by 0.6, which shows the company has the ability to leverage resources and is having moderate sales in terms of generating profits. If it is increasing, it means there are changes in net sales that will affect the Ford Motor Company's gross profit and gross profit margin.

VIII. Conclusion

Based on the above findings of the data analysis and testing, as well as the discussion, the following conclusions may be reached.: The Altman Modification Z technique was used to score the results of the five-passenger car automobile company's makers from 2015 to 2019. In compared to the scores of the other corporations, it is evident that General Motors Company, Mahindra & Mahindra Ltd, and Ford Motor have very poor scores. If the score is less than 1.8, according to Z score research, bankruptcy is likely. All of the other companies included for the study, according to the Z score model, are in a decent situation. Other companies, except for Maruti Suzuki passenger vehicle companies, were not financially sound during the study period, according to the study.

IX. Suggestion

From the above discussion and conclusion, except for Maruti Suzuki, during the study period, all the companies' Z scores were not maintained properly and there was no consistency. Hence, company managers in terms of managing the company's finances must have active participation and efficiency for the soundness of the company, and the company doesn't have to be in financial distress. However, a company manager can make a decision based on the investment made by the company and its financial performance. In a nutshell, "it is preferred for future researchers to go into other industries such as real estate, banking, and other manufacturing companies as well." In addition, they can also use other methods like Springeti or the Olhson and Grover methods".

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