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Applying Altman's Business Failure Prediction Model To Indian NSE Small Cap And Mid Cap Auto And Auto Ancillary Companies

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Abstract - It has long been established that a detailed ratios analysis has good potential to determine and establish the financial performance of an organization by evaluating its operational and financial efficiencies. Altman's business failure prediction model is based on a Z score that takes into account certain identified key ratios proven to have predictive power up to 3 years before the occurrence of failure/bankruptcy. Several studies have been conducted throughout the world propounding various failure prediction models. Despite all these attempts, the international research community is yet to reach an unambiguous conclusion. This paper seeks to apply Altman's Z score model to predict the propensity for business failure of Indian small cap (3 in number) and mid cap (7 in number) auto companies (in all, 10 companies) listed on the CNX Small Cap and CNX Mid Cap indices and attempts to evaluate the predictive power and strength of the Altman's Z score model within the Indian context in terms of its ability to predict financial failure of these companies for the period 2000-01 to 2011-12 (12 years).

The current study reveals that the Altman's Z score model failed in its accuracy and strength to be able to accurately classify these companies as successful or failed, highlighting its limited usefulness and in its application to the small cap and mid cap segments of the Indian auto industry vis-à-vis the definition of failure used in this research. This clearly demonstrates that further studies are required to develop an empirical model that best suits and is more applicable to the small cap and mid cap industries within the Indian ecosystem.

Keywords – bankruptcy, business failure, failure prediction, ratio analysis, Z score

I. INTRODUCTION

The objective of all organizations is to create and increase share holder value. All stake holders, including banks, financial institutions, regulatory bodies, the government, suppliers/vendors, customers, etc. want them to do well and be effectively and efficiently managed to prevent driving them to the brink of business failure/bankruptcy and then pushing them to failure, if mismanagement continues. Therefore, it is essential to predict bankruptcy/business failure and take appropriate corrective steps to reduce its impact. Its adverse impact is all the more profound on manufacturing industries.

In recent times, we have been witnessing auto and auto ancillary companies being upbeat and innovating their product offerings in terms of new models, new variants, and new features besides differentiating their services offerings too. This is driving the Indian auto and auto ancillary sectors in top gear in as much as the country is seeing a major upheaval in almost all segments with a number of models being introduced into the market at regular intervals from major auto makers. Given this situation, it is appreciated that predicting business bankruptcy/failure of these companies can be very useful for them to initiate corrective measures for better financial planning, operational efficiency, and overall corporate governance.

Every organization has an element of risk of business failure; auto and auto ancillary companies are no exception. Reference [3] described business failure as an indication of resource misallocation. Reference [6] defines failure as 'the inability of a firm to pay its financial obligations as they mature'. Reference [15] defines failure as a situation that a firm cannot pay lenders, preferred stock shareholders, and suppliers, or a bill is overdrawn. Failure has also been defined as existing when 'the realized rate of return on invested capital is significantly and continually lower than prevailing rates on similar investments'.

This research paper defines business failure as three successive years of any or a combination of the following:

Negative net profit

Negative net cash flow

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Absence of dividends
Negative net current assets
Total debt greater than total assets.

This is in line with how the research community has defined business failure over the years. Reference [4] proposed the popular Z score model for manufacturing companies which is essentially an MDA approach to classify manufacturing businesses as successful or failed. It can potentially identify bankruptcy before its occurrence. It uses a multivariate combination of five financial ratios that together contain failure predictive power.

The Z score is a weighted average of five financial ratios with their own independent coefficients. According to this model, a company with a Z score < 1.81 is classified as bankrupt or failed (facing acute problems with very high propensity to fail or go bankrupt) and a company with a Z score > 2.67 is classified as successful. The financial health of a company with a Z score between 1.81 and 2.67 is said to be indeterminate; i.e., it is in a grey area and needs to be carefully monitored lest it slips into the danger zone of Z < 1.81. This study evaluates the application of Altman's Z score model and assesses the predictive power and strength of the model as applied to Indian auto companies listed on the CNX Small Cap and Mid Cap indices. To do so, relevant financial data was collected from the balance sheets, profit and loss statements, and cash flow statements of these companies for a period of 12 years, i.e., from year 2000-01 to 20011-12.

II. LITERATURE REVIEW

Reference [17] conducted the first study in business failure prediction by proposing five stages of business failure which he called incubation, financial embarrassment, financial insolvency, total insolvency, and confirmed insolvency. Reference [6], using univariate analysis, and [4] set the direction by proposing his now renowned Z score model using the multi-discriminatory analysis, essentially a multivariate approach. This approach was adopted by [18] through multivariate statistical analysis. Many others [11], [14], [19], [32], [41], [43], [50], and [51] used data from developed countries to add to the research knowledge. Cash flow ratios as predictors of business failure were comprehensively dealt with by [53].

Many methods using both classical and artificial intelligence approaches have been explored by researchers. Reference [22] used a mixed logit model; [27] used machine learning models for the purpose of bankruptcy prediction. While several financial ratios-based models such as multi-discriminatory analysis (MDA), multi-regression analysis (MRA), logit, probit, recursive partitioning, artificial neural network (ANN), Classification and Regression Trees, case based reasoning (CBR), Rough Set Theory (RST), genetic algorithms, support vector machines (SVM), Bayesian Network Models, etc. have been propounded by researchers, literature survey indicates that a vast majority of international failure prediction studies employ the MDA technique.

Reference [9] used market-based models supported by academic and research communities as it is argued that since market prices reflect future expected cash flows, they could be more useful in predicting business failure. The effect of industry-wide distress on defaulted firms was analysed by [1]. Reference [39] expressed that market data such as the firm's market size, its previous returns, and the standard deviation of these returns are better predictors of bankruptcy than financial ratios based parameters; [21], [34], [38], [47], and [12] continued work along these lines. Reference [12] proposed an econometric model that employed both financial data and market data to predict business failure. Despite support from the academic and research communities, the superiority of market-based models over financial ratios-based models is still mixed [40], [10], [2].

Reference [5] reviewed international failure studies across 22 countries, including a number of developing countries, and concluded that multivariate approaches such as MDA, logistic regression, and probit models based on financial ratios are better indicators of failure. These models can perform well over several time periods and across different countries. From amongst these models, MDA was found to be more superior and more acceptable.

Reference [20] studied a sample of Indian companies financed by ICICI and showed that some cash flow coverage ratios were better predictors of business failure; [52] used probit analysis to develop his model; [23] argued that final failure occurs when total liabilities exceed the physical assets of the company. References [8], [33], and [35] used the MDA model to analyse a sample of failed and non-failed firms. Survival Analysis was employed by [30] as a tool to predict corporate failure. The sway of financial ratios over corporate failure was studied by [13], [16], [28], and [44].

Reference [31] conducted a study on textile mills using the Z score. Country-wise failure studies were done by [24], [25], [29], [45], and [49]; [36] assessed failure in the Indian automobile industry; [37] and [48] conducted a study on the cement industry using the Z score model; [46] examined business bankruptcy for selected Indian airline companies; [7] and [42] examined bankruptcy prediction within the retail sector; [26] measure financial distress of IDBI using Altman's Z score model.

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III.OBJECTIVES OF THE STUDY

The objectives of this study are twofold, viz:
To assess the predictive power and
To evaluate the strength of the Z score model
as applied to Indian auto and auto ancillary companies listed within the CNZ Small Cap and Mid Cap indices of the NSE.

IV. RESEARCH METHODOLOGY

This research is based on both empirical and analytical studies. It focuses on Indian auto and auto ancillary companies that are part of the NSE's CNX Small Cap and CNX Mid Cap indices. Secondary data from www.moneycontrol.com are used for the research. Twelve years' annual financial data from 2000-01 to 2011-12 are considered to evaluate the financial health of these companies. Financial ratio analysis is used as it has proven to be an important financial tool to analyse the operational and financial efficiencies of a company. The CNX Small Cap index consists of three companies within the auto and auto ancillary sector while the CNX Mid Cap index consists of seven companies from the sector. Therefore, a total of ten companies are included in this research paper.
The Altman Z Score Model is used to understand the financial position of the companies and to determine if the model is able to predict the propensity of their failure in the future given their prevalent financial health as portrayed through select financial ratios.

V. ALTMAN'S Z SCORE MODEL

Edward Altman's Z score model (1968) is the most widely recognized and accepted model to predict financial failure. The model is applicable to a company that is publicly traded and belongs to the manufacturing sector. In his study, Altman collected comprehensive data from 33 bankrupt and 33 non-bankrupt companies (total 66 companies) from the period 1946-1965, to find variables that have the ability to discriminate between bankruptcy/failed and non-bankrupt/non-failed or successful companies. He examined 22 variables of these companies by using MDA to propound a discriminant function with five significant variables (ratios). While determining the model, Altman considered a number of financial ratios representing liquidity, leverage, activity and profitability, to propose one that could effectively predict business failure. The final Z score, therefore, is a set of five financial ratios within a multivariate context.
The Z score is determined from the company's financial statements such as its balance sheet, profit and loss statements, and cash flow statements. The score, represented by Z, is the dependent variable whose value is based on the degree of contribution of five key variables (financial ratios) called independent variables as measured through their coefficients. The discriminant function is:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 1.0X_5$$

where, X_1 = Working Capital/Total Assets (WC/TA)
X_2 = Retained Earnings/Total Assets (RE/TA)
X_3 = EBIT/Total Assets (EBIT/TA)
X_4 = Market Value of Equity/Book Value of Debt (MVE/BVD)
X_5 = Net Sales/Total Assets (NS/TA).
Z = Failure/Bankruptcy Index

It is noticed that the independent variable, X_3, ratio of EBIT/TA, contributes most to the Z score with a coefficient of 3.3 while other independent variables explain the Z score in lower measures.

Altman assesses that:
Z score < 1.81 signifies high probability of failure
Z score > 2.67 signifies low probability of failure
Z score between 1.81 and 2.67 signifies an indeterminate condition

Thus, firms having scores less than 1.81 are classified as bankrupt/failed and those with Z scores more than 2.67 are classified as non-bankrupt/non-failed or successful. Scores between 1.81 and 2.67 represent an inconclusive area; firms with such Z scores are classified as marginal and must be scrutinized with great care with regard to their risk taking capability and other financial

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characteristics so that they have sufficient time to take corrective measures to turn around. The model is based on the premise that firms that are at the brink of failure exhibit some peculiar financial profiles before the event.

VI. EXPLANATION OF THE INDIVIDUAL VARIABLES IN THE MODEL

X_1, the ratio of Working Capital to Total Assets (WC/TA), is a liquidity ratio. It denotes liquidity of the assets viewed against the size of the firm. It signifies the firm's ability to meet its short-term obligations and expresses its operational efficiency. Continued operating losses lead to a decrease in current assets vis-à-vis total assets which is reflected in this ratio. When most of the firm's cash is in the form of inventory or when its customers are unable to pay their dues for a formidable period of time, the firm will be unable to meet its financial commitments/obligations. Such a situation reflects inefficient operation in terms of the average collection period.

Working Capital must be well managed so that there is less need for the firm to borrow; firms having surplus cash must also manage their working capital by investing it in opportunities that have high potential to generate attractive returns to its share holders ensuring better liquidity. Lower the WC, greater the risk and higher the profitability. Decreasing WC causes less liquidity leading to problems in purchasing materials and stock outs. However, it also indicates less debt (signifying less chances of bad debts) that can increase overall efficiency of the firm.

X_2, the ratio of Retained Earnings to Total Assets (RE/TA), signifies the profitability accumulated over time. It is a measure of the management's efficiency in managing manufacturing, sales, marketing, administrative and other activities. It shows to what extent the firm's assets are financed by its profits. While this is an important ratio, it is accepted that it may be biased in favour of firms that have existed for a long time thus having sufficient time to accumulate their earnings over the years. A high value indicates that the firm is able to finance assets through its RE; i.e., the firm is in a good position to generate good reserves that can be invested in high growth areas. On the other hand, low RE/TA ratio signifies paucity of earnings to invest in future growth. Therefore, when the firm identifies an area for future growth, it will be constrained to borrow funds from external resources thereby increasing its debt. This can prove to be an option that may not be sustainable in the long term.

X_3, the ratio of EBIT to Total Assets (EBIT/TA), is a productivity ratio. It signifies the long-term survival of the company in terms of the productivity and efficiency of the firm's assets. It is a measure of the firm's ability to effectively use its resources and the management's efficiency in posting returns generated through the firm's sales and investments. It indicates how efficiently the firm manages its assets and the projects it chooses to invest in to generate profits before meeting its financial obligations. The better the company manages its assets, the more profitable the company is; therefore, less likely is it to be a failure. A high value indicates efficient operations and that projects invested in are well identified, chosen, invested in and managed to generate future profits. A low EBIT/TA ratio signifies that the firm is not using its assets efficiently and that chosen projects are not profit-driven, sometimes even driving the ratio to negative values.

X_4, the ratio of the Market Value of Equity to the Book Value of Debt (MVE/BVD), signifies market perception of the firm in terms of its overall worth vis-à-vis its debt. Equity here represents all shares, while debt represents current liabilities and long term liabilities. It signifies the degree to which the value of the assets can fall before liabilities exceed its assets and fails, i.e., it measures the extent to which the firm can be financed by debt. It is also interpreted as the extent to which a company's assets can decline in value before its liabilities exceed them and it becomes a business failure. It is commonly used in the study of business failure. MVE falls when there is a decline in profitability due to the perceptions and sentiments of the market towards the firm's profitability. A value exceeding 2.00 is considered very safe.

X_5, the ratio of Net Sales to Total Assets (NS/TA), represents the ability of the firm's assets to generate sales. It signifies the firm's effectiveness to use its assets to generate sales. It is expected to be near or more than 2. It is well recognized that overall financial performance and profitability is dependent on sales revenue. A high ratio is good as it indicates that the firm is using its assets efficiently to drive sales. A low ratio indicates that the firm is unable to fully and effectively employ its assets to provide enough sales revenues. This adversely impacts its overall financial performance and profitability in the long run.

VII. COMPANY-WISE DATA, EMPIRICAL RESULTS AND ANALYSIS

The three companies from CNX Small Cap Index are designated S_1, S_2, and S_3 while the seven from CNX Mid Cap Index are designated M_1, M_2, M_3, M_4, M_5, M_6, and M_7. Financial data of these companies have been taken from their balance sheets, profit and loss accounts, and cash flow statements, from www.moneycontrol.com.

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TABLE 1: COMPANY S_1

RATIO	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
X_1 (WC/TA)	0.3032	0.3938	0.3600	0.3699	0.3554	0.2992	0.6448	0.5586	0.2277	0.2436	0.2223	0.1823
X_2 (RE/TA)	0.0356	0.0078	0.0187	0.0244	0.0538	0.0663	0.0468	0.0482	0.0832	0.0852	0.0427	0.0756
X_3 (EBIT/TA)	0.0755	0.0621	0.0495	0.0458	0.0816	0.1178	0.0811	0.0851	0.1618	0.1657	0.1405	0.1699
X_4 (MVE/BVD)	0.6699	1.1598	1.3379	0.5175	1.4290	4.1824	2.1905	2.0278	0.6928	0.3410	0.2546	0.3375
X_5 (NS/TA)	0.2931	0.2389	0.1943	0.1770	0.2769	0.3776	0.2975	0.4123	0.9923	0.9862	0.7607	0.7690

While company S_1 did not post a negative ratio for the period of analysis, all of its key ratios do not bode well in comprehensive terms. Its worst ratio is the RE/TA ratio that clearly indicates that the firm has not made enough profits to plough back into potential profitable projects. The last years have particularly been bad with its EBIT/TA taking a massive hit for not managing its assets well. This is further compounded by the fact that its assets have not really been able to drive the company's sales aggressively as reflected by its low NS/TA ratio. The MVE/BVD, an offshoot of the quality of its operations, has not been very encouraging either, signalling the market sentiment towards it, though the ratio was very good in the years 2005 to 2007. This is also indicative of increased use of debt. Overall, if S_1 has to improve its financial health, it needs to focus on better and optimal management of its total assets to ensure scaling up of its EBIT and, hence, its RE. It should also focus its efforts in adopting a more aggressive approach to managing its WC needs on a consistent basis.

TABLE 2: COMPANY S_2

RATIO	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
X_1 (WC/TA)	0.0170	0.1326	0.0980	-0.0003	0.2232	0.1636	0.1543	0.1981	0.1874	0.2722	0.2757	0.2389
X_2 (RE/TA)	0.0265	0.0480	0.0596	0.0472	0.0072	-0.0041	0.0118	0.0304	-0.2108	0.0097	0.0006	0.0457
X_3 (EBIT/TA)	0.0889	0.0793	0.1040	0.1001	0.0617	0.0486	0.0765	0.1664	-0.1760	0.0967	0.0628	0.1220
X_4 (MVE/BVD)	1.6583	1.9426	7.3623	3.7911	1.2452	2.2346	1.5404	1.0984	0.4523	0.3111	0.6227	0.9345
X_5 (NS/TA)	1.8776	1.4936	1.3569	1.2753	1.2270	1.3375	1.1017	1.0093	0.7509	0.4566	0.6822	0.7830

The year 2004 was particularly bad for S_2 since it posted negative RE/TA and EBIT/TA. In 2007, its EBIT/TA was a dismal 4% just pushing its RE/TA into the negative region. NS/TS has not been very bad as can be seen from the year 2006; in fact, it has been progressively increasing from then on till the year 2012, the last year of analysis. The major problem with S_2 is its wayward management of its WC which has in turn adversely affected the EBIT/TA. Even though its WC/TA is less than S_1, overall, S_2 appears to be better managed than S_1 due to its increased sales and less use of debt to finance its operations.

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TABLE 3: COMPANY S_3

RATIO	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
X1 (WC/TA)	-0.0659	0.0721	0.0624	0.0754	0.0357	0.0254	-0.0697	-0.1729	-0.2178	-0.1390	0.0741	0.2366
X2 (RE/TA)	0.0994	0.0797	0.0318	0.0084	0.0102	0.0322	0.0748	0.1232	0.1532	0.1865	0.0675	0.0747
X3 (EBIT/TA)	0.1982	0.1786	0.0821	0.0568	0.0328	0.0936	0.1661	0.2421	0.3240	0.3904	0.2052	0.1774
X4 (MVE/BVD)	2.7225	3.6202	0.9750	0.2976	0.6221	1.1166	4.3327	4.3201	8.3464	0.3932	0.2617	0.0682
X5 (NS/TA)	3.7810	3.4622	2.3349	2.1354	2.1638	2.6718	2.8102	3.3222	4.0639	4.9639	3.9371	3.0793

Firm S_3 has managed it WC/TA very bad as it has been in the negative region for 4 successive years, from the year 2003 to 2006 after which it managed some salvation before getting into the negative zone once again in the year 2012. NS/TA has been very strong throughout, though the market sentiment, reflected through the MVE/BVD ratio, has been upbeat only in the last two years, perhaps due to better debt management. Its WC, however, needs to be bolstered by adopting better debt recovery methods and reducing the average days outstanding if that is the crux of the issue. It must also take bold measures to ensure that its assets far exceed its liabilities.

TABLE 4: COMPANY M_1

RATIO	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
X1 (WC/TA)	0.5564	0.4967	0.4574	0.4678	0.5830	0.5338	0.4097	0.4132	0.3613	0.2855	0.2711	0.5022
X2 (RE/TA)	0.2014	0.1468	0.2241	0.1065	0.1392	0.1120	0.0878	0.0314	-0.0017	0.0308	0.0776	0.0902
X3 (EBIT/TA)	0.3530	0.3003	0.4157	0.2095	0.2480	0.1983	0.1621	0.0614	0.0609	0.1182	0.1659	0.1380
X4 (MVE/BVD)	14.8859	8.5262	7.6901	0.5476	1.1742	0.1837	0.4697	0.2985	0.2916	0.3741	0.4599	0.2967
X5 (NS/TA)	2.6056	2.3751	2.3202	1.9343	1.6950	1.5675	1.6599	1.1656	0.9373	0.9390	0.8997	0.7249

The progress of MVE/BVD of M_1 has been very good since 2010. NS/TA has also been good since 2006, especially since 2009. EBIT/TA, though found wanting for most of the period of analysis, has been respectable since 2008. Despite this, the RE/TA appears to be just enough indicating that the management lacks required courage, determination and confidence to take up new projects. Having said this, M_1 does have the ability to wither bad times and post better results vis-à-vis these ratios.

TABLE 5: COMPANY M_2

RATIO	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
X1 (WC/TA)	0.0919	0.0941	0.0538	0.1603	0.1923	0.1928	0.3357	0.2064	0.2150	0.2617	0.1628	0.3509
X2 (RE/TA)	0.0372	0.0455	0.1319	0.0417	0.1146	0.0579	0.0440	0.0450	0.0535	0.1472	0.0348	0.0139
X3 (EBIT/TA)	0.1291	0.1204	0.2489	0.1307	0.2442	0.1719	0.1250	0.1299	0.1439	0.2966	0.1489	0.1168
X4 (MVE/BVD)	1.8688	1.8373	3.1541	1.3225	4.3791	0.2099	0.1488	0.2027	0.2227	0.1583	0.1037	0.0484
X5 (NS/TA)	1.9487	1.4410	1.7646	1.9943	2.1876	2.0600	1.8929	2.0004	1.9236	2.2839	2.3447	1.4569

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M_2's position is worse than that of M_1. All ratios do not appear to be good. However, MVE/BVD and NS/TA are quite alright, especially the former. In recent years, WC/TA has been bad while it was encouraging up until 2009. RE/TA has never been good at all except for the year 2010. Both these ratios do not bode well for the company in the long run, not until good investment opportunities are capitalized on together with efficient management of its working capital. This does not appear to be impossible since the EBIT/TA is healthy enough to tide this seemingly difficult phase.

TABLE 6: COMPANY M_3

RATIO	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
X1 (WC/TA)	-0.0815	0.0552	0.1240	0.1325	0.0717	0.2267	0.2791	0.4007	0.2907	0.3455	0.4120	0.4628
X2 (RE/TA)	0.0454	0.0552	0.0378	0.0105	0.0888	0.0957	0.0796	0.0744	0.0673	0.0362	0.0201	0.0209
X3 (EBIT/TA)	0.1431	0.1496	0.1089	0.0673	0.2379	0.2511	0.2333	0.1824	0.2232	0.1586	0.1287	0.1137
X4 (MVE/BVD)	3.3709	1.4228	1.6276	0.6157	2.6532	3.9691	3.5574	1.4224	0.3017	0.0801	0.0538	0.0302
X5 (NS/TA)	2.0144	1.7228	1.2526	1.1349	2.6256	2.9029	2.5470	2.0844	2.2297	1.6487	1.2167	1.0962

M_3's position for the year 2012 is perplexing. NS/TA and MVE/BVD are very good while its RE/TA and WC/TA are bad with the latter posting a negative value. This is due to liabilities far exceeding its assets indicating excessive borrowing and, hence, more debt servicing costs. RE/TA has never gone beyond 9.6%. Progress of MVE/BVD has been good since 2010. NS/TA has also been especially good since 2009. EBIT/TA has been respectable. Despite this, RE/TA indicates that management lacks required courage, determination and confidence to take up new projects. Overall, M_3 does have the ability post better results.

TABLE 7: COMPANY M_4

RATIO	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
X1 (WC/TA)	-0.3056	-0.1588	-0.1364	0.1168	0.0687	0.0554	0.0725	-0.0745	0.0167	-0.2316	-0.1989	0.1849
X2 (RE/TA)	0.1398	0.1460	0.0966	0.0456	0.0747	-0.0332	0.3326	0.1288	0.0623	0.2422	0.1215	0.1674
X3 (EBIT/TA)	0.2682	0.2586	0.1878	0.1140	0.1582	0.1700	0.3467	0.2688	0.2369	0.5179	0.0932	0.2517
X4 (MVE/BVD)	0.0054	0.0032	0.0026	0.0048	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
X5 (NS/TA)	1.6166	1.2021	0.9322	0.9158	3.3816	3.2339	2.6678	5.3994	3.5928	5.0017	4.3085	3.3755

M_4's negative WC/TA for three successive years from 2010 and for three years earlier cannot go unnoticed. From 2001 up until 2008 it had posted good NS/TA but the ratio sank in 2009 while salvaging a little in the next three years. This happened because sales took a solid beating in 2009 even as the TA just reduced too. This resulted in a dwindling market cap leading to a very bad state in respect of the MVE/BVD ratio. Reflecting this is the negative WC/TA for 6 of the 12 years, including the last three years of analysis. The only silver lining, if at all, is the RE/TA in the last two years indicating that the management if willing to consider investing in potentially profitable opportunities sometime in the future; corroborating this view is the quite encouraging EBIT/TA. M_4 appears to be in a position to be able to salvage its position if it is willing and able to aggressively shore up its NS through a positive WC; this can be achieved through appropriate remedial measures befitting its overall policies of governance.

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TABLE 8: COMPANY M_5

RATIO	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
X1 (WC/TA)	0.1649	0.1694	0.1125	0.1365	0.1861	0.1209	0.1278	0.2314	0.1648	0.2237	0.2404	0.3295
X2 (RE/TA)	0.1091	0.1963	0.1970	0.1508	0.1587	0.1296	0.0927	0.0755	0.0745	0.0590	0.0277	0.0311
X3 (EBIT/TA)	0.2135	0.3458	0.3552	0.3019	0.3017	0.2669	0.2106	0.1434	0.2062	0.1803	0.1318	0.1233
X4 (MVE/BVD)	#DIV/0!	5671.279	116.368	10.454	15.471	9.4564	0.6580	0.3585	0.4453	0.0456	0.0324	0.0297
X5 (NS/TA)	1.6739	1.8489	1.8253	2.3995	2.2923	2.0915	1.8290	1.6777	1.6437	1.3625	1.1573	0.9322

M_5 progressively reduced use of debt substantially with zero debt for the year 2012. The absence of debt, though, has not really driven the other key ratios dramatically, but they do appear encouraging nevertheless. WC/TA is in in permissible limits. This together with a robust EBIT/TA indicates good financial health; besides, the RE/TA ratio has been pretty alright from the year 2007 onwards. MVE/BVD has dramatically increased since 2007 with the reduced used of debt on a sustained basis. Overall, M_5 is in sound financial condition which augurs well for the company in the medium to long term.

TABLE 9: COMPANY M_6

RATIO	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
X1 (WC/TA)	0.1767	0.2228	0.1234	0.0679	0.2455	0.2557	0.3359	0.0410	0.1345	0.1300	0.1901	0.2044
X2 (RE/TA)	0.1060	0.1001	0.0983	0.0226	0.0929	0.1129	0.0838	0.1580	0.1601	0.0977	0.0482	0.0935
X3 (EBIT/TA)	0.2322	0.2320	0.2602	0.1223	0.2194	0.2389	0.1879	0.3551	0.3535	0.2819	0.2200	0.2900
X4 (MVE/BVD)	3.7199	4.6909	5.0225	1.9979	3.8065	1.8856	1.9808	5.9383	2.2876	0.1060	0.0304	0.0923
X5 (NS/TA)	1.6592	1.5698	1.5406	1.3758	1.5209	1.5468	1.1844	2.2692	2.2369	1.8940	1.5023	1.7375

At the outset, M_6 is in a sound position. NS/TA, while not in the vicinity of 2, looks quite good since 2007. EBIT/TA has been good too since 2010 registering more than 20% in the last three years of analysis. RE/TA has been hovering around 10% over the last three years since the company appears to have favoured distribution of dividends to its shareholders. This has translated into high MVE/BVD values since 2010 but has been decreasing though since that time. WC/TA is haphazard throughout the period of analysis but the management need not be worried as the other ratios are strong enough to support it.

TABLE 10: COMPANY M_7

RATIO	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
X1 (WC/TA)	0.1640	0.1664	0.2795	0.1728	0.3381	0.3903	0.4238	0.4583	0.4482	0.4720	0.4282	0.4419
X2 (RE/TA)	0.1251	0.1596	0.1259	0.1485	0.0641	0.1024	0.0524	0.0245	0.0181	0.1094	0.0814	0.0235
X3 (EBIT/TA)	0.2210	0.1527	0.2255	0.2826	0.1279	0.1946	0.1093	0.0684	0.0671	0.2094	0.1829	0.1276
X4 (MVE/BVD)	2.6705	1.8510	3.9002	8.3236	1.3582	2.6233	3.1208	2.4525	2.1691	2.1607	1.4503	0.6626
X5 (NS/TA)	2.6398	2.5476	2.8234	3.4334	2.4296	2.7667	2.7463	2.2944	2.2982	2.1983	2.1367	2.0304

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All ratios of M_7 are good in the later years of the 12-year period of analysis. Total Assets have been put to good use as they have resulted in very good NS/TA and EBIT/TA values. MVE/BVD also reflects the same. Earnings, however, were low during 2005 and 2005 but it can be seen that there was a quick rebound with current EBIT/TA hovering around a respectable 20%. The only glitch with the M_7 is that its RE/TA has consistently been less than just 10% except during the year 2007 before plunging about 40% from those levels in the very next year. During the successive years, it has done just well but is still only in the region of 12% - 15%.

Overall, M7 looks to be very well placed as against its peer companies from the list. This is also underscored by its healthy WC/TA ratio that indicates that the company is very well to manage all components of its working capital. Its collection policy could be robust entailing early recovery of accounts receivables.

Having said this, it is also clearly seen that the firm has very good opportunities to reinforce it position and post better ratios due to its aggressive sales figures. Its NS/TA has consistently been above 2.3 for the last 9 years on the trot. If it can drive this ratio to 3x and above, there can be no stopping the company gaining greater heights.

VIII. RATIO-WISE ANALYSIS

A. Ratio X_1

Of all small cap firms, only firm S_1 could manage its WC deftly to enjoy a WC/TA ratio of 30% or higher during the last 8, i.e., from 2005 to 2012. Firm S_2 had a respectable value of the ratio until 2008 but slipped into negative zone the very next year (2009). The following two years it could just hold up but went down further to just 1.7% for the year 2012. Firm S_3 is the worst hit of all the small cap firms. It ran into negative WC/TA ratios from 2003 up to 2006, did pretty well to post more than 7% n the year 2011 but went back into the negative in the year 2012. This is clear indication that form S3 is on a hard drive and is trying to get a hold of the ratio but without much success. Small cap firms, in general, faced liquidity issues during the period 2001 to 2004 and that the situation would be worse staring the year 2012. This could be due to bad average collection period of the accounts receivables. Of the 7 mid-cap firms, only M_1 managed more than 45% on the trot from the year 2007. It indicates good WC management but the ratio being more than 5 times the average shows that the firm uses a more cautious approach to its operations. M_4 happens to be the firm with the worst WC/TA ratio with seven of the twelve years posting negative values. M_2 is just okay while the other firms have the ratio at the levels of around 15%. Though mid cap firms appear to have a good control during this period, it is quite evident that even they have had problems in their WC management.

B. Ratio X_2

S_3 has performed well from 2003 to 2005 and again in 2011 and 2012. In recent years, however, M_1 and M_7 have done quite well. S_2 and M_4 posted negative values in the same year, 2007, while S_2 and M_1 posted formidable negative values both in the year 2004. M_4, M_5, and M_6 managed to post respectable values at near or more than 12% quite consistently. Reasons for the firms not doing well can be attributed to high input costs and, to some extent, high fund-servicing costs.

C. Ratio X_3

Small cap firms, S_1, S_2, and S_3, have all been inconsistent in their values of EBIT/TA, with S_2 even posting a negative value in the year 2004. It did well to rebound the very next year but has not really picked itself up in the future years. It has not posted more than 10.5% in recent years indicating that its management has been very wanting in efficient management of its assets. Of the three small cap firms, only S_3 has done quite well to post more than 16% in 8 of the 12 years. In general, they indicate a healthy trend. Of the mid cap firms, except for M_2 and M_3, all other firms have managed their assets well to post an EBIT/TA ratio exceeding 14% more often than not. M_6 has managed this ratio the best, closely followed by M_5, M_4, and M_1. The trend indicates that managers of mid cap firms have been able to better manage their firm's assets and post good profitability vis-à-vis the assets employed to generate these profits. Overall, however, both small cap and mid cap firms have done quite well to post good EBIT/TA ratios, though the former have done only half as well as the latter. This is understandable since small cap firms work with constrained budgets and limited resources with limited availability of funds to invest in profitable ventures. Given this situation, senior managers must devise ways that can unmistakably increase the ratio.

D. Ratio X_4

The performances of the small cap firms indicate that for most of the time (close to 50% of the time) their debts have been more than the MVE, a precarious situation. At the barest minimum, it is expected that MVE exceeds debt by at least 50%. Using this

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measure, S_1 is a sure failure, while S_2 has remarkably improved since the period 2001 to 2005, a period of low MVE/BVD. S3 has done well in 2011 and 2012 but, by and large, its value is inconsistent. Mid cap firms have done well only in recent years. In the past, most of the firms have carried more debt driving their MVE/BVD ratio down. M4 has been particularly extremely bad pushing itself to the brink of failure. M_6 and M_7 have done respectably well since 2004, and M3 since 2005 (except in the year 2009). The case of M_5 is interesting: it has used minimum debt since 2007; in the year 2012, it had zero debt driving its EBIT/BVD to infinity! Firms such as S_1 and M_4 can look to restructure their debt at the first sign of business failure to marginally stabilize their operations while realigning themselves to a healthy position. Such a decision has the potential to safeguard the firms from sub-optimal financial performance and hence negative market value impact.

E. Ratio X_5

Mid cap firms have employed their assets better than small cap firms to drive sales revenue. Yearly performance of mid cap firms has been consistently better than the corresponding year's performance of small cap firms signifying that the former are better placed in managing their assets to achieve higher levels of sales revenue. Both S_1 and S_2 have not posted a ratio exceeding 2 in any of the years under study, though the latter's performance was far better than that of the former. S_3 has done exceedingly well in generating sales by managing its assets very intelligently. Of the mid cap firms, only M_7 was able to achieve this status. In independent terms, most of the mid cap firms have to do much better to generate sales through efficient use of their assets.

TABLE 11: ALTMAN'S SCORE

Co.	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
S1	1.3579	1.6233	1.6185	1.1166	1.9053	3.7277	2.7188	2.6475	2.3317	2.1494	1.7036	1.856I
S2	3.2234	3.1471	6.3183	3.9461	2.4559	3.0292	2.4799	2.4978	0.3713	1.3026	1.5948	2.096I
S3	6.1285	6.4219	3.3103	2.6037	2.7023	3.7262	5.9788	6.6784	10.0941	6.5823	4.9548	4.0940
M1	13.6515	9.2834	9.1685	3.6648	4.1125	3.1294	3.0913	2.0872	1.7444	1.9393	2.1573	2.0873
M2	3.6584	3.1172	4.7276	3.4697	6.0120	3.0657	2.8589	2.8613	2.8648	3.8778	3.1423	2.3118
M3	4.4748	3.2137	2.7902	1.9000	5.2127	6.5193	5.8977	4.1247	3.5904	2.6856	2.1963	2.0741
M4	2.3338	2.0713	1.5252	1.4987	4.0906	3.8149	4.3646	6.3775	4.4819	6.7719	4.5473	4.6622
M5	#DIV/0![#]	3406.235	73.2296	10.0436	13.0160	8.9726	3.2018	2.7492	2.8935	2.3359	1.9389	1.7960
M6	5.0177	5.5575	5.6986	3.0911	4.9534	3.9315	3.5134	7.2742	5.1616	3.1806	2.5420	3.1261
M7	5.3432	4.5853	6.4195	9.7753	4.1619	5.5947	5.5612	4.5760	4.3843	4.9053	4.2385	3.4124

[#] *Total Debt for the year was zero.*

TABLE 12: CLASSIFICATION ACCORDING TO ALTMAN'S Z SCORE

Co.	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001
S1	F	F	F	F	I	S	S	I	I	I	F	I
S2	S	S	S	S	I	S	I	I	F	F	F	I
S3	S	S	S	I	S	S	S	S	S	S	S	S
M1	S	S	S	S	S	S	S	I	F	S	I	I
M2	S	S	S	S	S	S	S	S	S	S	S	I
M3	S	S	S	I	S	S	S	S	S	S	S	I
M4	I	S	F	F	S	S	S	S	S	S	S	S
M5	#DIV/0!	S	S	S	S	S	S	S	S	I	I	F
M6	S	S	S	S	S	S	S	S	S	S	I	S
M7	S	S	S	S	S	S	S	S	S	S	S	S

S: Successful F: Failed or Unsuccessful I: Indeterminate

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IX. LIST OF FACTUALLY FAILED COMPANIES PER DEFINITION OF FAILURE

As already mentioned, this research paper defines business failure as three successive years of any or a combination of the following:
Negative net profit
Absence of dividends
Total debt greater than total assets
Negative net cash flow
Negative net current assets

TABLE 13: LIST OF FACTUALLY FAILED COMPANIES

Company	Successful/Failed	Reason for Failure	Year Preceding Failure
S_1	Successful	-	-
S_2	Failed	No Equity Dividends	2003
S_3	Failed	Negative Net Current Assets	2002
M_1	Successful	-	-
M_2	Failed	Negative Cash Flow	2009
M_3	Failed	Negative Cash Flow	2010
M_4	Failed	Negative Cash Flow Negative Net Current Assets	2008 2009
M_5	Failed	Negative Cash Flow	2001
M_6	Failed	Negative Cash Flow	2006
M_7	Successful	-	-

IX. RESULTS AND CONCLUSIONS

Comparing outcomes of Altman's Z scores with factual outcomes for the year preceding the year of failure, the results are:

TABLE 14: COMPARISON OF OUTCOMES (YEAR PRECEDING FAILURE)

Company	Year Preceding Failure	Z Score Outcome	Factual Outcome
S_1	2008*	F	S
S_2	2003	F	F
S_3	2002	S	F
M_1	2003*	F	S
M_2	2009	S	F
M_3	2010	S	F
M_4	2008; 2009	S	F
M_5	2001	F	F
M_6	2006	S	F
M_7	-	S	S

** Z scores for S_1 and S_2 classify them as failed in the year 2009 and 2004 respectively while they are factually successful.*

Atlman's model is right in only 3 (1 from small cap and 2 from mid cap) instances, failing miserably in the remaining 7 out of the total 10 firms under study in this research paper, i.e., both Type I and Type II errors have occurred. Type I error (classifying failed companies as successful) occurs 5 times and Type II error (classifying successful companies as failed) occurs twice. The classification accuracy is seen in Table 15.

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TABLE 15: CLASSIFICATION ACCURACY (YEAR PRECEDING FAILURE)

True Class	Predictions		Number
	Classified as Successful	Classified as Failed	
Successful	1 (33.33%)	2 (66.67%) Type II Error	3
Failed	5 (71.43%) Type I Error	2 (28.57%)	7
Percentage Correctly Predicted		69.06%	10
Spread between the two errors		4.76%	

The results clearly show that Altman's Z score falls well short in terms of classifying the firms accurately. The spread between Type I and Type II errors is 4.76% but the percentage accuracy of the model is just about 69%. Type I error, proven to be a costly error, is just more than 71% which leaves a lot to be desired. Type II error, though not a costly one, is about 67%.

On the basis of this study and detailed analysis, this research paper concludes that the performance of the Z score model is inaccurate in terms of its ability classify auto firms within the Indian context specific to the small cap and mid cap space. Besides, the strength of the model is also insufficient to instill enough confidence within the stake holders to use this model to help them take important investment decisions. It will therefore be prudent to develop a unique model that well fits within the realms of the Indian auto industry, specific to small cap and midcap space, that has better ability to predict failure well in advance and hence accurately discriminate between failed and successful companies.

X. LIMITATIONS

This study took into account auto and auto ancillary companies listed on the CNX Small Cap and CNX Mid Cap Indices; their total number turns out to be 10. The small number of companies within this space could be an influencing factor in determining the accuracy and strength of the Z score model. The model may perhaps perform better had the number of companies been more considering that the model was propounded with 33 failed firms and 33 successful firms in its hold out sample.

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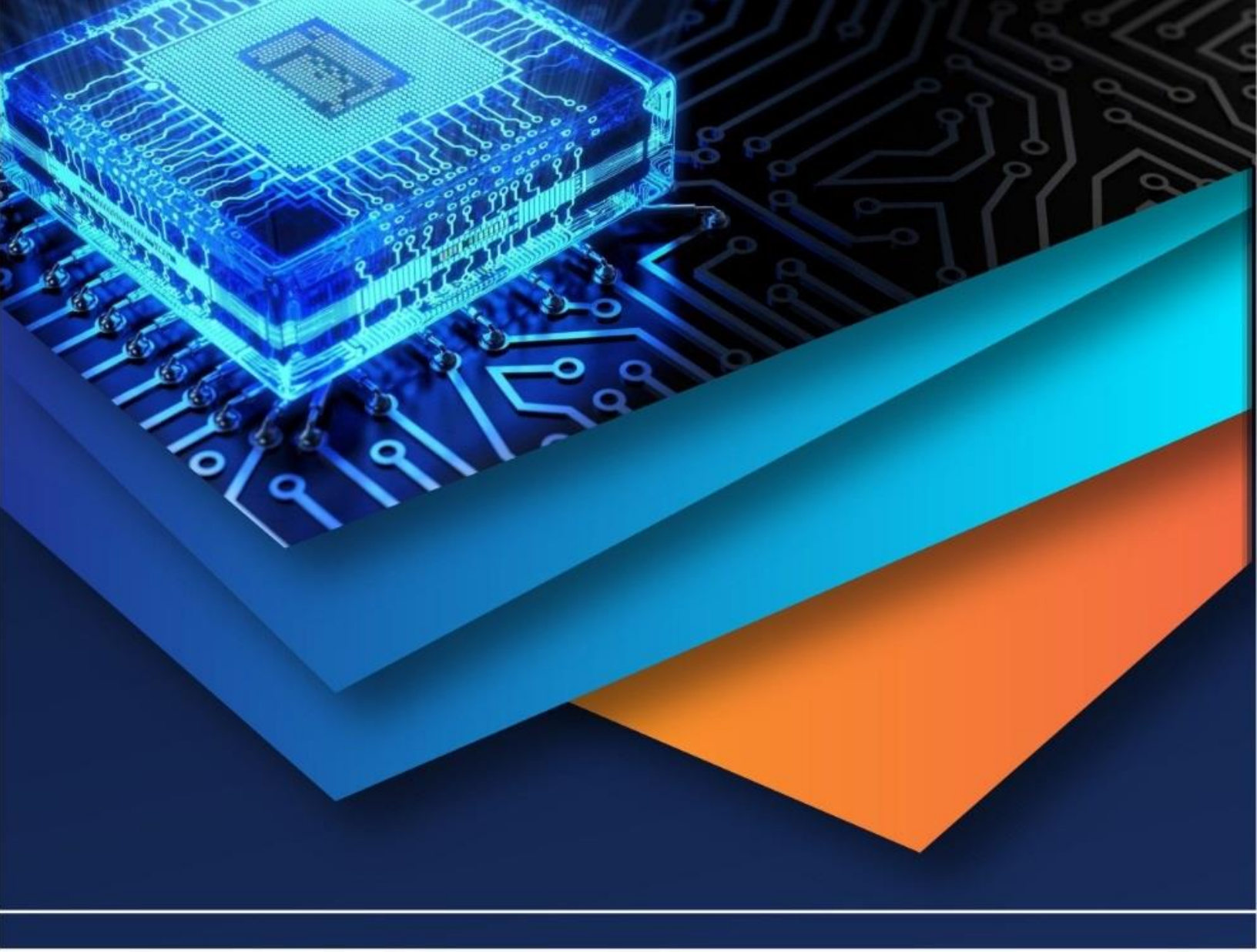

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