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EFFICACY OF ALTMAN'S Z-SCORE TO PREDICT FINANCIAL UNASSAILABILITY: A MULTIPLE DISCRIMINANT ANALYSIS (MDA) OF SELECT AUTOMOBILE COMPANIES IN INDIA

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Abstract

The performance of automobile industry can be used as anindicator to assess the economic strength of any country.This paper attempts to study the financial health of automobile industry in India. There are a number of techniques available which can be used to check the financial performance of the company and Altman's Z score model is one of them. Altman's Z score model is based on multiple discriminant analysis (MDA). This modelcan help the company in making good financial decisions and can also provide guidance to investors in selecting right company forthe investment. Altman's Z score model for manufacturing firms are applied to automobile industry. It assesses the financial performance of the companies to check the present financial soundness and chances of bankruptcy in future. This paper analyzedselect automobile companies which are listed on Bombay Stock Exchange (BSE) for last five years i.e. 2010 to 2014. The findings of this study revealed that Z scoresfor all the select automobile companies were more than 2.9 during the study period except Tata Motors which according to the study had Z score between 1.8 and 2.9 during the year 2010 and 2011. Hence, at present they all are financially sound, away from bankruptcy zone and are safe to invest.

Keywords: Altman's Z score,financial health, automobile industry, corporate distress,bankruptcy

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INTRODUCTION

Corporate failure is a process which starts with the poor decision making of the managementand cause the disturbances in corporate soundness. Its route cause can be tracked by analyzing various accounting ratios. The automobile industry is one of the most vibrant and growing industries of India.This industry is fully delincensed, FDI is allowed upto 100% for the purpose of generatingemployment prospects and there is no minimum investment criteria imposed by government. The Automotive Mission Plan (AMP) targets towards sustained and accelerated growth over the period 2006-2016, for making India a global automotive hub, employment generation and to double the contribution of the automotive sector towards GDP. Twenty two percent of the India's total manufacturing industry Gross Domestic Product (GDP) belongs to automobile industry. Therefore, there is a need to keep watch on this industry otherwise it could be detrimental for the economy.Industrial sickness doesn't appear suddenly, it takes times and passes through different stages to become chronic. The persistent chronic stage causes the permanent closure of the industrial unit. Industrial sickness is just like human sickness, some symptoms appear, which if diagnosed at earlier stage help in curing and recovering. There are various models proposed by different scholars to predict industrial sickness i.e. Univariate model, Multivariate Discriminant Analysis (MDA), Taffler and Tisshow model etc. In this paper we have used Multivariate Discriminant Analysis (MDA), commonly known as Altman's Z score, developed by Edward I. Altman. This model has established itself as the popularly used multivariate predictor around the world.This paper tries to examine the combined effect of various financial ratios with the help of Multiple Discriminate Analysis (MDA) in detecting corporate failure or bankruptcy.

LITERATURE REVIEW

There were researchers like McDonald and Morris (1985) who argued that it is not possible to predict bankruptcy as it occurs due to some unanticipated events. However, there are many researchers like Altman (1968); Kida 1998; Shirata (1998); Shumway (2001) etc. who supported that bankruptcy can be predicted by developing a model.

Edward Altmanpublished z-score model in the year 1968 which offered a simple and efficient way to calculate chances of bankruptcy using a multivariate estimator that included certain key financial ratios. Altman selected 66 publicly traded manufacturing companies out of which 33 companieswere those that went bankrupted during 1946-1965 and rest 33 that were in good financial condition during that time.He then tested 22 financial ratios to find which mix of the ratios helped maximum in predicting bankruptcy.Hederived an equation called Z score from the sample companiesusing multiple discriminate analysis (MDA).

Shirata (1998) developed an alternative bankruptcy prediction model using four variables andclaimedthat this model has more than 86.14% accuracy in predicting bankruptcy irrespective of industry and size.

Gupta (1999) tried a modification in Beaver's method for predicting business failure.

Jonah Aiyabei (2002)used Z score model to investigate the financial performance of small business firms in Kenya.

Ben McClure (2004)followed Z score model in his research study and stated that investors should analyze their companies' Z-score on a routine basis.

Chowdhury &Barua (2009)examined the financial aspects of Z-category companies' shares by using Z-score analysis and established the outcome that 90% of the companies under study were facing financial problem.

From the above reviews it is clear that monitoring of financial performance is very important and Altman's Z score model is the most accepted predictor to check financial soundness.

STATEMENT OF THE PROBLEM

Internal decision making of the management affect the performance of company and in aggregate the whole industry over the period of time that ultimately impact the overall economy.This necessitates the continuous monitoring of them and therefore periodical assessment of the financial health of companies, is very important. Automobile industry represents an integral part of Indian economy and contribute a significant proportion in economic growth and GDP of India. Therefore the present study is concentrated on the analysis of financial health of select automobile companies that are listed on BSE.

OBJECTIVES

1. Toexamine the overall financial performance of select automobile companieslisted on Bombay Stock Exchange (BSE).
2. Topredict the financial health and viability of select automobile companieslisted on Bombay Stock Exchange (BSE).

HYPOTHESES OF THE STUDY

A. H_0: Networking capital to total asset ratio is uniform in the sample units.

H_1: Networking capital to total asset ratio is not uniformin the sample units.

B. H_0: Retained earnings to total assets ratio is uniform in the sample units.

H_1: Retained earnings to total assets ratio is not uniform in the sample units.

C. H_0: EBIT to total assets is uniform in the sample units.

H_1: EBIT to total assets is not uniform in the sample units.

D. H_0: Market value of the Equity to total liability ratio is uniform in the sample units.

H_1: Market value of the Equity to total liability ratio is not uniform in the sample units.

E. H_0: Total asset turnover ratio is uniform in the sample units.

H_1: Total asset turnover ratio is not uniform in the sample units.

F. H_0: Altman Z score is equal in the sample units.

H_1: Altman Z score is not equal in the sample units.

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METHODOLOGY

This study is analytical in nature and related to the analysis of financial health or soundness of selectautomobile companies' viz., Bajaj Auto, Mahindra & Mahindra, Maruti Suzuki India, Tata Motors and TVS Motor Company, which are listed on Bombay stock Exchange (BSE). This study is based mainly on secondary data and acquired the requisite accounting information from prowess database, journals, articles etc. Altman Z score model is used to predict the financial health of select automobile companies. Statistical techniques like mean, standard deviation and ANOVA (one way) are also used to check consistency and stability of different variables used in calculating relevant financial ratios and Altman Z score. MS Excel and SPSS software were used to compute these statistical values.

Multiple Discriminant Analysis (MDA)

There are various financial ratio available to predict the chances of bankruptcy or insolvency or sickness of a unit. In a business concern, different ratio has different significance and making a common interpretation from these independent financial ratios pertinent to sickness prediction is a bit difficult. Multiple Discriminant Analysis (MDA) is a linear analysis based on five variables that forms a model i.e. Z score. The derived equation of Z scoreis dependent on discriminant coefficient computed by MDA and actual values of independent variables i.e. financial ratios calculated from annual financial statement of the company.

The Altman's Z score model is as follows-

$$Z = 0.012T1 + 0.014T2 + 0.033T3 + 0.006T4 + 0.999T5$$

Where,

T1 = Net Working Capital/ Total Assets

T2 =Retained Earnings/Total Assets

T3 = EBIT/Total Assets

T4 = Market Value of Equity/Total Liability

T5 = Net Sales/Total Assets

Discriminant coefficient calculated from MDA for different independent variables are as follows:

Financial ratios	Discriminant coefficient
T1	0.012
T2	0.014
T3	0.033
T4	0.006
T5	0.999

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Classification of firm on the basis of Z score:

Score	Status of Financial soundness
Z score > 2.99	No danger of bankruptcy, safe zone
Z score <1.81	Vigilantneed totake caution, Probable failure
Z score Between 1.81 and 2.99	Financial position is distressing, Grey or bankruptcy zone

RESULTS & FINDINGS

A. T1 = Net Working Capital/ Total Assets

T1= Net Working Capital/ Total Assets							
Year	BAJAJ AUTO	MAHINDRA AND MAHINDRA	MARUTI SUZUKI INDIA	TATA MOTORS	TVS MOTOR COMPANY	MEAN	SD
2010	-0.32	0.056535809	0.005341129	-0.233640548	0.062365212	-0.08588	0.1783435
2011	-0.23	-0.015650018	0.180870086	-0.149743056	0.072118913	-0.028481	0.165399
2012	-0.1	-0.002991142	0.122109716	-0.290887288	-0.06591821	-0.067537	0.1508922
2013	-0.07	0.012925759	0.057511731	-0.20175712	-0.08239341	-0.056743	0.0997129
2014	-0.11	0.099877047	-0.03823837	-0.188823638	-0.09441295	-0.06632	0.1073712
MEAN	-0.166	0.0301395	0.0655189	-0.2129703	-0.0216481		
SD	0.10549882	0.04756764	0.08797651	0.05292636	0.08184597		

Source: Computed data

Inference

This ratio indicates the ability of the company to meet the current obligation,higher the value higher the capacity to meet the liabilities. From the above table it is clear that Bajaj Auto has overall negative ratio with a mean of -0.166 during study period and it is observed that the ratiohas followed an increasing trend year by yearbut unable to touch positive value. Maruti Suzuki managed to keep this ratio positive but in 2014 it is also having anegative ratio of -0.0382. Tata Motors also has an overall negative ratio and following a fluctuating trend. TVS Motor Company showing declining ratio. However, a company keeps low current assetif it invests in some profitable endeavor and in such casesit is not bad to observe low value of this ratio.

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SPSS results ofANOVA (One Way)

		Sum of Squares	df	Mean Square	F	Sig.
NET WORKING CAPITAL/ TOTAL ASSETS * COMPANY	Between Groups (Combined)	.300	4	.075	12.238	.000
	Within Groups	.123	20	.006		
	Total	.422	24			

Inference

As the calculated value i.e. F=12.238 is greater than critical value 2.866081 (table value) and statistically significant difference is seen. There is no evidence available to accept the null hypothesis which means Networking Capital to Total Asset is not equal in the select sample units.

B. T2 = Retained Earnings/Total Assets

T2= Retained Earnings / Total Assets							
Year	BAJAJ AUTO	MAHINDRA AND MAHINDRA	MARUTI SUZUKI INDIA	TATA MOTORS	TVS MOTOR COMPANY	MEAN	SD
2010	0.65238158	0.702832206	0.923683483	0.4520741	0.45038985	0.6362723	0.1973425
2011	0.88262148	0.793047444	0.977581798	0.559156	0.5333281	0.749147	0.1965957
2012	0.93698023	0.773954387	0.924823401	0.6198669	0.59518984	0.770163	0.1619928
2013	0.95476859	0.803073243	0.922866973	0.553737	0.66486306	0.7798618	0.1702489
2014	0.9640887	0.803260073	0.91898284	0.5500644	0.72324393	0.791928	0.1651712
MEAN	0.8781681	0.7752335	0.9335877	0.5469797	0.593403		
SD	0.13010403	0.04219437	0.02469121	0.0602558	0.1072732		

Source: Computed data

Inference

This ratio indicates the extent to which a company has the ability to accumulate earnings or profits using its total assets. From the above table it is observed that Bajaj Auto and TVS Motor Company are increasing their retained earnings for future endeavors year by year. Mahindra &Mahindra, Tata Motors and Maruti Suzuki India are showing fluctuating trend due to increase or decrease in their debt level. Still, Maruzi Suzuki has maintained highest ratio i.e. 0.977 in 2011 and with a mean of 0.933.

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SPSS results ofANOVA (One Way)

		Sum of Squares	df	Mean Square	F	Sig.
RETAINED EARNINGS TO TOTAL ASSETS * COMPANY	Between Groups (Combined)	.582	4	.146	21.115	.000
	Within Groups	.138	20	.007		
	Total	.720	24			

Inference

As the calculated value i.e. F=21.115 is greater than critical value 2.866081 (table value) and statistically significant difference is seen. There is no evidence available to accept the null hypothesis which means Retained Earnings to Total Assets is not uniform in the select sample units.

C. T3 = EBIT/Total Assets

T3= EBIT / Total Assets							
Year	**BAJAJ AUTO**	**MAHINDRA AND MAHINDRA**	**MARUTI SUZUKI INDIA**	**TATA MOTORS**	**TVS MOTOR COMPANY**	**MEAN**	**SD**
2010	0.59063915	0.281670678	0.302184648	0.128312751	0.112036903	0.2829688	0.1924631
2011	0.622198622	0.273404783	0.259194882	0.134630286	0.170526044	0.2919909	0.1936325
2012	0.608598122	0.245724589	0.154496886	0.136353518	0.24903436	0.2788415	0.1913694
2013	0.455932484	0.263295462	0.211817849	0.051431091	0.23102122	0.2426996	0.1445391
2014	0.424771565	0.229895283	0.224854499	-0.026118227	0.252807801	0.2212422	0.1610091
MEAN	0.540428	0.2587982	0.2305098	0.0849219	0.2030853		
SD	0.09269663	0.0209942	0.05504419	0.07150253	0.06065059		

Source: Computed data

Inference

This ratio indicates how effectively company is using its assets to generate profits for meeting out its obligations. None of the companies maintained an increasing trend in this ratio which means they are not utilizing their assets to its optimal level. However, Bajaj Auto shows maximum ratio of 0.62219 amongst all companies during the study period and its average is also maximum (0.54) as compared to all select companies.

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SPSS results ofANOVA (One Way)

		Sum of Squares	df	Mean Square	F	Sig.
RETURN ON TOTAL ASSETS * COMPANY	Between Groups (Combined)	.567	4	.142	33.968	.000
	Within Groups	.083	20	.004		
	Total	.650	24			

Inference

As the calculated value i.e. F=33.968 is greater than critical value 2.866081 (table value) and statistically significant difference is seen. There is no evidence available to accept the null hypothesis which means Return on Total Assets is not uniform in the select sample units.

D. T4 = Market Value of Equity/Total Liability

T4= Market Value of Equity/ Book value of Debt							
Year	**BAJAJ AUTO**	**MAHINDRA AND MAHINDRA**	**MARUTI SUZUKI INDIA**	**TATA MOTORS**	**TVS MOTOR COMPANY**	**MEAN**	**SD**
2010	2.50608052	3.630146421	8.875437036	0.2375685	0.5112327	3.152093	3.4953945
2011	6.14406443	4.648605619	8.009747027	0.4632809	1.48052915	4.1492454	3.1559673
2012	9.3408663	3.64435045	5.478277408	2.5074947	0.98815782	4.3918293	3.2158886
2013	11.3485313	4.132421846	4.767135391	2.599395	0.81371124	4.732239	4.0012562
2014	11.7011786	4.16607109	6.230793099	4.1958598	2.15283536	5.6893476	3.6569479
MEAN	8.2081442	4.0443191	6.672278	2.0007198	1.1892933		
SD	3.87686521	0.42404651	1.72430043	1.6512339	0.64313979		

Source: Computed data

Inference

This ratio indicateshow much market value of company can decline before its liabilities exceed the assets to make the businessinsolvent. Bajaj Auto and Tata Motors are showing increasing trend in five years while others are having fluctuating ratios. The average ratio of Bajaj Auto during study period is found to be maximum (8.20) while TVS Motors showing minimum average ratio (1.189).

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SPSS results ofANOVA (One Way)

		Sum of Squares	df	Mean Square	F	Sig.
EQUITY TO DEBT RATIO * COMPANY	Between Groups (Combined)	179.271	4	44.818	10.509	.000
	Within Groups	85.293	20	4.265		
	Total	264.565	24			

Inference

As the calculated value i.e. F=10.509 is greater than critical value 2.866081 (table value) and statistically significant difference is seen. There is no evidence available to accept the null hypothesis which means Market Value of Equity to Total Liability is not uniform in the select sample units.

E. T5 = Net Sales/Total Assets

T5= Net Sales / Total Assets							
Year	**BAJAJ AUTO**	**MAHINDRA AND MAHINDRA**	**MARUTI SUZUKI INDIA**	**TATA MOTORS**	**TVS MOTOR COMPANY**	**MEAN**	**SD**
2010	2.768566085	1.728821013	2.316414491	1.125473716	2.334874536	2.05483	0.6376236
2011	3.142433104	1.856842658	2.608575479	1.358915302	3.462223293	2.485798	0.8753713
2012	3.179358318	2.075782112	2.187861574	1.772543838	3.780958849	2.5993009	0.845527
2013	2.508051954	2.261052366	2.182876688	1.340149379	3.990330579	2.4564922	0.9636652
2014	2.084627593	1.972526764	1.928271066	1.018612628	4.210035111	2.2428146	1.1795808
MEAN	2.7366074	1.979005	2.2447999	1.323139	3.5556845		
SD	0.45800095	0.20400622	0.2473501	0.28954355	0.73602861		

Source: Computed data

Inference

This ratio indicates the efficiency of the company to generate sales revenue by utilizingits assets.

From the above table TVS Motor performance is better than all the select companies during study period. It has mean of 4.21. The positive value of all the companies showed that they are efficient enough in using their assets to maintain their solvency.

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SPSS results ofANOVA (One Way)

		Sum of Squares	df	Mean Square	F	Sig.
NET SALES TO TOTAL ASSETS * COMPANY	Between Groups (Combined)	14.023	4	3.506	18.685	.000
	Within Groups	3.753	20	.188		
	Total	17.776	24			

Inference

As the calculated value i.e. F=18.685 is greater than critical value 2.866081 (table value) and statistically significant difference is seen. There is no evidence available to accept the null hypothesis which means Net Sales to Total Assets is not uniform in the select sample units.

F. Altman's Z score

Z Score							
Year	**BAJAJ AUTO**	**MAHINDRA AND MAHINDRA**	**MARUTI SUZUKI INDIA**	**TATA MOTORS**	**TVS MOTOR COMPANY**	**MEAN**	**SD**
2010	6.74788923	5.886501342	9.936135868	2.0428566	3.71438511	5.6655536	3.0161703
2011	9.83865485	6.637871372	9.852816851	2.6829316	5.74301655	6.9510583	3.0221173
2012	11.9808449	6.151154517	7.423764301	4.2439837	5.9460499	7.1491595	2.9284861
2013	12.0719159	6.746932897	7.101001789	3.6012921	6.06887322	7.1180032	3.0881695
2014	11.7227205	6.473267884	7.647528434	3.9924216	7.231038	7.4133953	2.7948728
MEAN	10.4724051	6.3791456	8.3922494	3.3126971	5.7406726		
SD	2.27325602	0.35557834	1.38534615	0.9248928	1.27249077		

Source: Computed data

Inference

The Z score of all the companies are above 2.99 during 2010 to 2014. The exceptional case is Tata Motors that had Z score less than 2.99 in the year 2010 and 2011 but managed to come in safe zone from 2012 as indicated by Z score. During the study period of five years, the average score of Bajaj Auto is maximum (10.472) while Tata Motors scored the minimum average of 3.312. Mahindra and Mahindra maintained a consistency in its score throughout five years.

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SPSS results ofANOVA (One Way)

			Sum of Squares	df	Mean Square	F	Sig.
ALTMAN Z Score * COMPANY	Between Groups	(Combined)	147.324	4	36.831	19.009	.000
	Within Groups		38.752	20	1.938		
	Total		186.076	24			

Inference

As the calculated value i.e. F=19.009 is greater than critical value 2.866081 (table value) and statistically significant difference is seen. There is no evidence available to accept the null hypothesis which means Z score is not equal in the select sample units.

CONCLUSIONS

Corporate distress is a major concern in developing countries. An attempt has been made in the present study to bring an insight into the analysis of financial health of listed select automobile companies in India. The study concludes that overall financial health of all the companies was good.Z score model has the ability to helpthe management for predicting corporate problems at the initial stage to avoid financial distress by taking necessary action at the earliest. This model can also be used by the management in their financial planning and shareholders' decision making related to their present and future involvements with the company.

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