

Assessing Corporate Financial Distress in Automobile Industry of India: An Application of Altman's Model

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Abstract:

This paper attempts to investigate the financial health of automobile industry in India and test whether Altman's Z score model can foresee correctly the corporate financial distress of the automobile industry in Indian context for the study period, 2003-04 to 2009-10. Present analysis reveals that automobile industry under our study was just on the range of intermediate zone. In our study, Z values for all the seven years were more than 1.81 but less than 3 (Z score= In between 1.81 and 3.0= Indeterminate). It is an alarming matter that Z score value is gradually declining since 2007-08 after global recession hits Indian economy in general and automobile industry in particular. This indicates that overall financial performance of automobile sector in India is at present viable as Z score indicates but may lead to corporate bankruptcy in near future unless regulatory measures are undertaken immediately.

Key words: Corporate distress, Altman, Bankruptcy, automobile, industry.

1. Introduction:

Financial distress prediction is a critical accounting and financial research area since 1960s and consequently prediction of corporate financial distress has long been the object of study of corporate finance literature. Since the seminal work of Altman (1968), numerous researchers have attempted to improve upon and replicate such studies in capital markets worldwide. However, in the context of emerging economies, this topic has received much less attention mainly due to the short history of financial markets in emerging economies. Although corporate failures are perceived to be a problem of developed economic environments (Altman *et al*, 1979), firms operating in emerging economies are no exception.

The financial crisis has already thrown many financially strong companies out of business all over the world. All these have happened because they were not able to face the challenges and the unexpected changes in the economy. Financial distress for a company is the ultimate declaration of its inability to sustain current operations given its current debt obligations. Basically, all firms must have some debt loads to expand operation or just to survive. Good economic planning often requires a firm to finance some of its operation with debt. The degrees to which a firm has debt in excess of assets or is unable to pay its debt as it comes due are the two most common factors in corporate financial distress.

Distress prediction model will assist a manager to keep track of a company's performance over a number of years and help in identifying important trends. The model may not specifically dictate the manager what is wrong but it should encourage them to identify problems and take effective action to minimize the incidence of failure. A predictive model may warn an auditor of company's vulnerability and help to protect them against charges of 'negligence of duties in not disclosing the possibility of corporate failure [Jones, F.L(1987)]. In addition, lender may adopt predictive model to aid in assessing a company defaulting on its loan. Regulatory agencies are concerned whether a monitored company is in danger of failure. A company may be made exempted from anti trust prohibitions and permitted to merge under Failing Company Doctrine if it can be demonstrated that it is in danger of insolvency or failure.

Research on financial distress has been carried out for many years in many countries, especially in industrially developed countries. Altman (1997) studied the financial ratios of public companies which

indicate corporate financial distress in the United States. Almeida and Philippon(2000) analyzed risk adjusted cost of financial distress of public companies in the United States which have issued corporate bonds and have difficulties to pay coupon and its bond. Fitzpatrick(2004) conducted empirical research on the dynamic of financial distress of public companies in the United States whereas Gennaiolla and Rossi(2006) explored the optimal solution of financial distress in Sweden. Outtecheva(2007) analysed probability of financial distress risk and the way of avenues to avoid financial distress in NYSE.

On the other hand, a very few studies have been conducted in developing countries. Chang(2008) studied the corporate governance characteristics of financially distressed firms in Taiwan. Hui and Jhao(2008) explored the dynamics of financial distress of 193 companies which have experienced financial distress in China during 2000- 2006. Zulkarnian(2006) analyzed the corporate financial distress among Malaysian listed firms during Asian financial crisis. Ugurlu and Hakan(2006) conducted a research to predict corporate financial distress for the manufacturing companies listed in Istanbul stock exchange for the period, 1996-2003. Chiung-Ying Lee and Chia-Hua Chang (2010) analyzed the financial health of public companies listed in Taiwanese stock exchange using Logistic Regression model of early warning prediction.

There are also a number of careful research studies using data from United States firms that provide various methods to identify failing firms. After the establishment of Altman's Z score model, abundant studies have done further research on the z score model, including Deakin(1972), Taffler (1983), Goudie (1987), Agarwal and Taffler (2007), Sandin and Porporato (2007). Many studies also have been done relevant to the Ohlson model, including Lau (1987), Muller, Steyn-Bruwer, and Hamman (2009).

Despite several attempts to predict bankruptcy, four decades after Altman (1968)'s seminal study, financial distress prediction research has not reached an unambiguous conclusion. Lack of harmony in the study of financial distress prediction is partially attributable to the nature of the explanatory variables, as studied for four decades. A number of researchers have attempted to discriminate between financial characteristics of successful firms and those facing failure. The objective has been to develop a model that uses financial ratios to predict which firms have greatest likelihood of becoming insolvent in the near future. Altman is perhaps the best known of these researchers who uses multiple discriminate analysis (MDA) which is also used in this study.

In the midst of limited literature regarding the financial distress of public companies in the developing countries like India, using Altman's Z Score model, this paper is therefore devoted to study the dynamics of financial distress of public companies of Indian automobile industry listed in Bombay Stock Exchange.

1.1. Objectives of the study:

The study investigates the overall financial performance of automobile industry in India and also predicts the financial health and viability of the industry. In order to fulfill the objective, we empirically try to reexamine the most commonly referred method in credit risk measurement research, Altman's Z-score model, by using recent bankruptcy data from 2003-04 to 2009-10.

1.2. Structure of the paper:

The paper is structured as follows: Section 2 presents recent trend in automobile industry in India. Section 3 describes the methodological issues pertaining to data collection, the variables analyzed and the statistical methods adopted in the paper. Section 4 presents analysis of results and summary and conclusions are depicted in section 5.

2. Recent trend in Indian automobile Industry:

The Indian Automotive Industry after de-licensing in July, 1991 has grown at a spectacular rate of 17% on an average for last few years. The industry has now attained a turnover of Rs. 1,65,000 crores (34 billion USD) and an investment of Rs. 50,000 crores. Over of Rs. 35,000 crores of investment is in pipeline. The industry is providing direct and indirect employment to 1.31 crore people. It is also making a contribution

of 17% to the kitty of indirect taxes. The export in automotive sector has grown on an average CAGR of 30% per year for the last five years. The export earnings from this sector are 4.08 billion USD out of which the share of auto component sector 1.8 billion USD. Even with this rapid growth, the Indian Automotive Industry's contribution in global terms is very low. This is evident from the fact that even though passenger and commercial vehicles have crossed the production figure of 1.5 million in the year 2005-06, yet India's share is about 2.37 percent of world production as the total number of passenger and commercial vehicles being manufactured in the world are 66.46 million against the installed capacity of 85 million units. Similarly, export constitutes only about 0.3% of global trade. It is a well accepted fact that the automotive industry is a volume driven industry and a certain critical mass is a pre-requisite for attracting the much needed investment in Research and Development and New Product Design and Development. R&D investment is needed for innovations which is the life-line for achieving and retaining the competitiveness in the industry. This competitiveness in turn depends on the capacity and the speed of the industry to innovate and upgrade. No nation on its own can make its industries competitive but it is the companies which make the industry competitive. The most important indices of competitiveness are the productivity both of labour and capital.

[Insert Table-1 here]

In Table 1, Maruti Udyog Limited (MUL) is the number one Indian automotive assembler commanding more than a 50% share of the Indian passenger vehicle market. MUL's relatively large production volumes offer scale economies in production and distribution that pose formidable barriers to entry. It has also established a solid supplier-base located around India. Occupying the second position in 2006 is Hyundai Motor India Ltd which occupies more than 18 percent market share over the last five years of our study. Despite occupying the third position and producing passenger vehicles only in small volumes, Tata Engg. & Locomotive Company Ltd. (TELCO) is noteworthy, not only because it is a part of the powerful Tata industrial family, but also because it is one of the few firms with indigenous product development capabilities, and has been a dominant player in the commercial vehicles segment. TELCO holds about 70% of the heavy commercial vehicles market, and (after entering the market late) has also managed to fend off Japanese competition by gaining about 50% of the light commercial vehicles segment with its in-house product development. It entered the passenger vehicles market only in 1991-92, and has quickly established itself in the higher end of this segment with its Estate and Sierra models. The firm has entered into a joint venture with Mercedes Benz to assemble the E220's, and is also said to be planning an entry into the small/economy car segment challenging Maruti's stronghold.

[Insert Table-2 here]

The Indian automobile industry produced around 5.3 billion vehicles during 2001-02 which amounting to around USD 16 billion. During the financial year, 2006-07, industry produced 11 billion vehicles amounting USD 32 billion. The sector shows average growth of production at the rate of 15 percent per annum. More interestingly, India is the second largest two wheeler market in the world. Due to the contribution of many different factors like sales incentives, introduction of new models as well as variants coupled with easy availability of low cost finance with comfortable repayment options, demand and sales of automobiles are rising continuously. Government has also contributed in this growth by liberalizing the norms for foreign investment and import of technology and that appears to have benefited the automobile sector.

[Insert Table-3 here]

The growth rate in domestic sale of different vehicles (Table 3) has increased @13% p.a over the decades. The growth in percentage of sale of different vehicles have been due to the enhanced purchasing power, especially among middle class people of India, easy availability of finance, favourable government policy, development of infrastructure projects, replacement period of vehicle.

Indian vehicle exports have grown at the rate of 39% CAGR over our study period, led by export of passenger car at 57% and two wheeler export at the rate of 35%. The key destination of exports are SAARC countries, European Union(Germany, UK, Belgium, Netherlands, Middle east and North America).

The export growth of Indian automobile sector is showing declining trend (Table 4) at least during our observation period. While a beginning has been made in export of vehicles, potential in this area still remains to be fully tapped. More significantly, the export in two/three wheeler sector of the industry has been displaying drastic improvement in export of these vehicles. The automobile exported crossed 1 billion mark in 2003-04 and reached USD 2.28 billion mark during 2006-07.

[Insert Table-4 here]

In June 2008, India based Tata Motors Ltd announced that it had completed the acquisition of the Two iconic British brands-Jaguar and Land Rover from the US based Ford Motors for USD 2.3 billion. The deal included the purchase of JLR's manufacturing plants, two advanced design centres in the UK, national sales companies across the world and also the license of all intellectual property rights. There was widespread skepticism in the market over an Indian company owning the luxury brands. According to industry analysts, some of the issues that could trouble Tata Motors were economic slowdown in European and US markets, funding risks and currency risks etc.

Tata Motors was interested in the deal because it will reduce company's dependence on the Indian market, which accounted for 90% of its sale. Morgan Stanley reported that JLR's acquisition appeared negative for Tata Motors as it had increased the earning volatility given the difficult economic conditions in the key markets of JLR including the US and Europe. Tata Motors raised 3 billion dollars(Rs 12000 crores approximately) through bridge loan from a clutch of banks .

Nevertheless, Tata motors stood to gain on several fronts from the biggest deal. First, the acquisition would help the company acquire a global footprint and enter the high end premier segment of the global automobile market. Second, Tata also got two advance design studio and technology as a part of the deal that would provide Tata motor to access latest technology thereby allowing to improve their core product in India. Moreover, this deal Provided Tata instant recognition and credibility across the world which would otherwise have taken years. Third, the cost competitive advantage as Corus was the main supplier of automotive high grade steel to JLR and other automobile industry in Europe and Us market would have provided a synergy for Tata Group as a whole. Last but not least, in the long run, Tata motors will surely diversify its present dependence on Indian market(which contributed to around 90% of Tata's revenue). Moreover, Tata's footprint in South East Asia will help JLR do diversify its geographical dependence from US (30% of volumes) and Western Europe(55% of volumes).

A survey of the literature shows that the majority of international failure prediction studies employ MDA (Altman 1984; Charitou et al. 2004). No exclusive conclusion was found in a review of international applications of default prediction studies. The application of financial distress measurement literature flows into the international application of credit risk measurement to verify the robustness of such measures and techniques in different countries. Applying research on indicative variables and statistical methodologies internationally, Altman and Narayanan (1997) tried to identify financially stressed companies, but they concluded that no statistical method was consistently dominant.

Precious contribution supported by empirical evidence in this regard mostly from manufacturing companies in the United States and the other developed countries has been found to exist, but in view of the review of literature, it is explicitly evident that very little research work has been conducted so far on analyzing the financial distress of industrial sectors in India. The above mentioned pertinent research gaps in Indian context after a thorough and careful review of literature have guided me to undertake the study of assessing financial health of individual fertilizer industry in India which is based on Altman's Z score model.

3. Methodology:

3.1. Data source:

For testing the financial health of India's automobile companies, Altman's Z score model has been used in this study which is based on secondary data. The data from the published sources is the basis for analysis. The required accounting information for Z score analysis is obtained from *CMIE Prowess* Database. The financial data used are annual and cover a period of 2003-04 to 2009-10 comprising of 62 publicly traded companies listed in *Bombay Stock Exchange*.

3.2. Econometric specification of Altman Model:

The Z scores, developed by Professor Edward I. Altman, is perhaps the most widely recognized and applied model for predicting financial distress (Bemmann, 2005). Altman developed this intuitively appealing scoring method at a time when traditional ratio analysis was losing favour with academics (Altman, 1968). Altman Z scores model requires a firm to have a publicly traded equity and be a manufacturer. Altman (1968) collected data from 33 bankruptcies and 33 non-bankruptcies, during the period 1946-1965, to find discriminating variables for bankruptcy prediction. In his seminal paper, Altman evaluated 22 potentially significant variables of the 66 firms by using multiple discriminant analysis to build the discriminant function with five variables. This model was later modified to Altman model (1993) that uses the same variables multiplied by different factors.

Individual financial ratio to predict the financial performance of an enterprise may only provide caution when it is too late to take a corrective action. Further, a single ratio does not convey much of the sense. There is no internationally accepted standard for financial ratios against which the result can be compared. Edwin Altman, therefore, combines a number of accounting ratios (liquidity, leverage, activity and profitability) to form an index of the probability, which was effective indicator of corporate performance in predicting bankruptcy. The Z score is a set of financial ratios in a multivariate context, based on a multiple discriminated model for the firms, where a single measure is unlikely to predict the complexity of their decision making.

3.3. Elements of the Altman Z Score model:

The Z score calculation is based entirely on numbers from the company's financial reports. It utilizes seven pieces of data taken from the corporation's balance sheet and income statement. Five ratios are then extrapolated from these data points (shown in table-5).

[Insert Table-5 here]

The independent variables of five ratios are measured in ratio scale. The operational definition of dependent and independent variables are presented in table-6.

[Insert Table-6 here]

The discriminant function is as follows:

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

Where $X_1 \equiv$ Working capital/total assets (WC/TA),

$X_2 \equiv$ Retained earnings/total assets (RE/TA),
 $X_3 \equiv$ EBIT/total assets (EBIT/TA),
 $X_4 \equiv$ Market value of equity/book value of liability (MVE/TL),
and $X_5 \equiv$ Sales/total assets(S/TA).

Z= Overall index of Bankruptcy.

When using this model, Altman concluded that:

Z score < 1.81 = High probability of bankruptcy,

Z score > 3 = Low probability of bankruptcy

Z score = In between 1.81 and 3.0 = Indeterminate.

A score of Z less than 2.675 indicates that a firm has a 95% chance of becoming bankrupt within one year. However, Altman result shows that in practice, scores between 1.81 to 2.99 should be thought of as a grey area. Firms, with Z scores within this range, are considered uncertain about credit risk and considered marginal cases to be watched with attention. Altman (1968) formerly described the grey area as the “zone of ignorance”. This area is where firms share distress and non-distress financial characteristics and should be carefully observed before it is too late for any remedial or recovery action. Firms with Z scores below 1.81 indicate failed firm, Z score above 2.99 indicates non-bankruptcy. Altman shows that bankrupt firms have very peculiar financial profiles one year before bankruptcy. These different financial profits are the key intuition behind Z score model.

Eidleman (1995) defines each of the above ratios as follows:

X_1 is a liquidity ratio, the purpose of which is to measure the liquidity of the assets ‘in relation to firm’s size’. It is the measure of net liquid asset of a concern to the total capitalization which measures the firm’s ability to meet its maturing short-term obligations.

X_2 is an indicator of the ‘cumulative profitability’ of the firm over time which indicates the efficiency of the management in manufacturing, sales, administration and other activities.

X_3 is a measure of firm’s productivity which is crucial for the long-term survival of the company. It is a measure of productivity of an asset employed in an enterprise. The ultimate existence of an enterprise is based on earning power. It measures how effectively a firm is using its resources. It measures the managements overall effectiveness as shown by the returns generated on sales and investment.

X_4 defines how the market views the company. The assumption is that with information being transmitted to the market on a constant basis, the market is able to determine the worth of the company. This is then compared to firm’s debt. It is reciprocal of familiar debt equity ratio. Equity is measured by the combined market value of all shares, while debt includes both current and long term liabilities. This measure shows how much of an asset can decline in values before liabilities exceed the assets and the concerns become insolvent. It measures the extent to which the firm has been financed by debt. Creditors look to the equity to provide the margin of safety, but by raising fund through debt, owners gain the benefit of marinating control of the firm with limited investment.

X_5 is defined as a ‘measure of management ability to compete’. The capital turnover ratio is the standard financial measure for illustrating the sales generating capacity of the assets.

4. Interpretation of results:

The five financial ratios mentioned above have been utilized as yardsticks in the equation for evaluating the financial health of India’s automobile companies for the period 2003-04 to 2009-10.

Proportion of working capital in the total assets also gives investors an idea of the company’s underlying operational efficiency. Money that is tied up in inventory or money that customers still owe to the company cannot be used to pay off any of the company’s obligations. So, if a company is not operating

in the most efficient manner (i.e. slow collection), it will show up as an increase in the working capital. This can be seen by comparing the working capital from one period to another; slow collection may signal an underlying problem in the company's operations. The better a company manages its working capital, the less the company needs to borrow. Even companies with cash surpluses need to manage working capital to ensure that those surpluses are invested in ways that will generate suitable returns for investors.

In the study, the content of working capital in the total assets(X_1) has been slightly decreased from 49.30% in 2003-04 to 49.28% in 2009-10 with little fluctuations. It indicates more or less moderate use of working capital over the years. The moderate usage of working capital is favourable for efficient running of the companies and it is congenial for the financial health of the companies. Uniform level of working capital usage would ensure better liquidity. But the sector should enhance the usage of working capital in near future with growing volume of operational activity because lower the working capital, greater the risk and also higher the profitability of the firm. A declining working capital ratio over a longer time period could also be a red flag that warrants further analysis. The declining usage of working capital in the industry may have several indications. Declining usage of working capital may cause shortage of liquid funds which may be the hindrance in necessary purchasing and accumulation of inventories causing more chances of stock out. On the other hand, it implies lesser number of debtors which may cause lower incidences of bad debts which may result into overall efficiency in the organizations.

[Insert Table-7 here]

The retained earnings to total assets ratio(X_2) measures the company's ability to accumulate earnings using its total assets. A retained earnings to total assets ratio indicates the extent to which assets have been paid for by company profits. A retained earnings to total assets ratio near 1:1 (100%) indicates that growth has been financed through profits, not increased debt. A low ratio indicates that growth may not be sustainable as it is financed from increasing debt, instead of reinvesting profits. An increasing retained earnings to total assets ratio is usually a positive sign, showing the company is more able to continually retain more earnings.

In our study, the content of retained earning to total assets was recorded as 21.91% in 2003-04 and during the next couple of years, the ratio gradually increases slightly to 24.98% in 2009-10 which means that automobile companies are able to generate adequate reserve for future prospect of the business. This means that firms within automobile industry may have been able to pay off major portion of assets out of reinvested profit which is a good sign for automobile industry.

The ratio of a company's earnings before interest and taxes (EBIT) against its total net assets(X_3) is considered an indicator of how effectively a company is using its assets to generate earnings before contractual obligations must be paid. The greater a company's earnings in proportion to its assets (and the greater the coefficient from this calculation), the more effectively that company is said to be using its assets.

This is a pure measure of the efficiency of a company in generating returns from its assets, without being affected by management financing decisions. Return on Assets gives investors a reliable picture of management's ability to pull profits from the assets and projects into which it chooses to invest. The overall efficiency of an enterprise can be judged through the ratio of EBIT/Total asset. The operating efficiency ultimately leads to its success. The ratio of EBIT to total assets ranges from 10.19% to 8.70% which is not good sign for the company. The ratio begins to decline since 2007-08 and the management of the companies within the said industry should be cautious enough to enhance the ratio.

Market Value of Equity to Total Liabilities(X_4) ratio shows how much business's assets can decline in value before it becomes insolvent. Those businesses with ratios above 200 percent are safest. The result shows that India's automobile sector did not maintain the above standard during the study period. The market value of equity was less than that of debt. In the study, the ratio of market value of total equity to book value of debenture was 44.61% in 2003-04 which decreased to 20.93% in 2009-10. It means that book value of debenture ranges from 55.39% to 79.07% during the study period. Decrease in this ratio has an indication that the firm's sale price are relatively low and that its cost is relatively high. The proportion

in which interest bearing funds (debt) and interest free funds (equity) employed had a direct impact on its financial performance. The sector will have the chance of facing interest burden in near future. Therefore, a reasonable change in the financial structure is needed to protect the company from adverse financial performance.

Net Sales to Total Assets ratio(X_5) indicates the effectiveness with which a firm's management uses its assets to generate sales. A relatively high ratio tends to reflect intensive use of assets. It is a measure of how efficiently management is using the assets at its disposal to promote sales. A high ratio indicates that the company is using its assets efficiently to increase sales, while a low ratio indicates the opposite. The financial performance and profitability centered on sales revenue. The ratio of sales volume to total assets, though ideally expected to be 2:1, during the study period, it clearly showed that this sector had not been successful in achieving the standard ratio through sales but ratio gradually improves. Poor ratio of turnover indicates that companies failed to fully utilize the assets which will have an adverse impact on the financial performance of the company.

Present analysis reveals that automobile industry under our study was just on the range of intermediate zone. In our study, Z values for all the seven years were more than 1.81 but less than 3 (Z score= In between 1.81 and 3.0= Indeterminate). It is an alarming matter that Z score value is gradually declining since 2007-08 after global recession hits Indian economy in general and automobile industry in particular. This indicates that overall financial performance of automobile sector in India is at present viable as Z score indicates but may lead to corporate bankruptcy in near future unless regulatory measures are undertaken immediately.

The poor financial health of this sector which took place since 2007-08 may be probably due to the reasons that the sector failed to achieve the sales target due to underutilization of available capacity, which contributed for the deterioration of financial health of the sector. Excess debt (as reflected in X_3 factor) was a serious concern as it carries with high interest burden which has affected the financial health of the sector.

In the light of the above financial problems faced by the sector concerned, it is suggested that capital structure of India's automobile sector has to be changed in such a way to have ideal debt equity ratio and hence re-scheduling of debt is an urgent necessity. The sector should take necessary step to fully utilize the available capacity and therefore, fixed asset are to be purchased only when the company can utilize its capacity fully. The company must fix up achievable sales target and steps should be taken to achieve it. Managerial incompetence should be taken care of, if any. For this, decentralization in decision making process should be introduced which gives the employees the initiative and responsibility to adapt their behaviour and decisions according to changes in working environment.

Research shortcomings:

The study concentrates on a single specific industry where data on a relatively small sample of failed and non-failed companies was available. Consequently, there is some risk that the results have been affected by the sample size. The MDA methodology violates the assumption of normality for independent variables. The bankruptcies studied in USA by Altman were for the period between 1946-1965. Hence, it is not clear whether past experience will always be transferable to future situations given the dynamic environment in which the business operates. Consequently, there is a question whether Altman's model is as useful now as it was when developed.

5. Summary & Conclusions:

The prediction of corporate distress is a common issue in developed economies but has only recently emerged in developing economies like India. Although numerous studies have attempted to improve upon and replicate the model of the initial work of Altman (1968) in different capital markets worldwide, this topic has been less well-researched in emerging markets due to several major impediments; one of which being the short history of emerging markets. Therefore, this study is important to stakeholders because the issue of prediction of corporate failure from the Indian firms' perspectives was revealed.

The premises underlying this paper (also all empirical works on corporate failure prediction) is that corporate failure is a process commencing with poor management decisions and that the trajectory of this

process can be tracked using accounting ratios. This study tries to examine the combined effect of various financial ratios with the help of Multiple Discriminate Analysis (MDA). In this study, it has been examined whether Z -score model developed by Altman, can predict bankruptcy. It is found from the analysis that individual ratio within the multiple discriminate framework has depicted moderate picture as Z score value lies within 'Grey Zone' which means that firms within the automobile industry, with Z scores within this range, are considered uncertain about credit risk and considered marginal cases to be watched with attention. The said industry is moving towards gradual inefficiencies since 2007-08 that may endanger financial health of Indian automobile companies. It is also apparent that this model is useful in identifying financially troubled companies that may be bankrupt. This empirical evidence will provide a warning signal to both internal and external users of financial statement in planning, controlling and decision making. The warning signs and Z score model have the ability to assist management for predicting corporate problems early enough to avoid financial difficulties. In addition, managers could also adopt such models in their financial planning. If failure can be predicted three to four years before a crisis event, management could take remedial action such as a merger exercise or restructuring to avoid potential bankruptcy costs.

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Table 1: Estimated Market share of Passenger Vehicles by the Top 5 Firms in the Indian Automotive Industry (%)

Company	2002	2003	2004	2005	2006
Maruti Udyog Ltd (MUL)	50.29	51.43	51.15	52.20	50.38
Hyundai Motor India Ltd	19.08	18.65	17.36	18.18	18.13

Tata Motors Ltd	13.83	16.10	16.75	16.98	17.00
Fiat India Automobiles(P) Ltd	5.96	1.85	0.84	0.19	0.21
Hindustan Motors Ltd	3.63	2.28	1.90	1.69	1.42

Source: Association of Indian Automobile Manufacturers (AIAM), 2007-08.

Table 2:Category-wise Production trend in Indian Automobile Industry(In Nos)

Category /Year	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Passenger vehicle	669719	723330	989560	1209876	1309300	1544850
Total Commercial vehicle	162508	203697	275040	353703	391083	520000
Two Wheeler	4271327	5076221	5622741	6529829	7608697	8444168
Three Wheeler	212748	276719	356223	374445	434423	556124
Grand Total	5316302	6279967	7243564	8467853	9743503	11065142
Percentage Growth	11.70%	18.60%	15.12%	16.80%	15.06%	13.56%

Source: Society of Indian Automobile Manufacturing(SIAM),2007-08.

Table 3:Category-wise Domestic sales trend in Indian Automobile Industry(In Nos)

Category /Year	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Passenger vehicle	675116	707198	902096	1061572	1143076	1379698
Total Commercial vehicle	146671	190682	260114	318430	351041	467882
Two Wheeler	4203725	4812126	5364249	6209765	7052391	7857548
Three Wheeler	200276	231529	284078	307862	359920	403909

Grand Total	5225788	5941535	6810537	7897629	8906428	10109037
Percentage Growth	-	13.70%	14.60%	15.96%	12.77%	13.50%

Source: SIAM,2007-08.

Table 4: Category-wise Export trend in Indian Automobile Industry(In Nos)

Category /Year	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07
Passenger vehicle	50088	70828	126249	160677	170193	189347
Total Commercial vehicle	11870	12255	17432	29940	40600	49766
Two Wheeler	104183	179682	265052	366407	513169	619187
Three Wheeler	15462	43366	68144	66795	76881	143896
Grand Total	181603	306131	476877	623819	800843	1002196
Percentage Growth	-	68.57%	55.77%	30.81%	28.38%	25.14%

Source: SIAM,2007-08.

Table-5: Details of Data Point

Data Point	Where Found in Financials	Formula to Calculate
1. Earnings before Interest & Tax (EBIT)	Income Statement	Gross Earnings - Interest - Income Tax Expense
2. Total Assets	Balance Sheet (Total Assets)	Total Current Assets + Net Fixed Assets

3. Net Sales	Income Statement (Net Revenues or Sales)	(This number in the Financials reflects deduction of returns, allowances and discounts)
4. Market (or Book) Value of Equity	Book Value found on Balance Sheet (Stockholders Equity)	Total Market Value (public Cos.) or Book Value (private Cos.) of all shares of stock
5. Total Liabilities	Balance Sheet	Total Current Liabilities + Long Term Debt
6. Working Capital	Balance Sheet	Total Current Assets - Total Current Liabilities
7. Retained Earnings	Balance Sheet (Stockholders Equity)	(Portion of net income retained by the corporation rather than distributed to owners/shareholders)

Table-6: Operation of Independent and Dependent Variables

Conceptual definition	Operational definition	Expectation	Scale
$X1 = \text{Working Capital} / \text{Total Assets}$	Measures liquidity, a company's ability to pay its short-term obligations. The lower the value the higher the chance of bankruptcy.	Relationship with probability of failure	Ratio
$X2 = \text{Retained Earnings} / \text{Total Assets}$	Measures age and leverage. A low ratio indicates that growth may not be sustainable as it is financed by debt.	Relationship with probability of failure	Ratio
$X3 = \text{EBIT}^* / \text{Total Assets}$ *Earnings Before Interest and Tax	A version of Return on Assets (ROA), measures productivity – the earning power of the company's assets. An increasing ratio indicates the company is earning and increasing profit on each dollar of investment.	Relationship with probability of failure	Ratio
$X4 = \text{Market Value of Equity} / \text{Total Liabilities}$	Measures solvency – how much the company's market value would decline before liabilities exceed assets.	Relationship with probability of failure	Ratio
$X5 = \text{Net Sales} / \text{Total Assets}$	Measures how efficiently the company uses assets to generate sales. Low ratio reflects failure to grow market share.	Relationship with probability of failure	Ratio

Table-7: Analysis of Results by using Altman's Model: 2003-04 to 2009-10.

Ratios/Years	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10
Net working capital (Rs crores)	33828	40836	48314	60923	69280	100328	118143
Total assets(Rs crores)	68620	86772	103594	126315	145510	205591	239747
X1	49.30%	47.06%	46.63%	48.23%	47.61%	48.80%	49.28%
Retained earning (Rs crores)	15037	17977	24427	32238	33773	46438	58937
Total assets(Rs crores)	68620	86772	103594	126315	145510	205591	239747
X2	21.91%	20.72%	23.58%	25.52%	23.21%	22.58%	24.58%
Earning before interest &tax(Rs crores)	6990	8466	11057	13172	12514	10975	20860
Total assets(Rs crores)	68620	86772	103594	126315	145510	205591	239747
X3	10.19%	9.76%	10.67%	10.43%	8.60%	5.34%	8.70%
Market value of equity (Rs crores)	4783	5560	5754	6172	6795	8884	8937
Book value of total liability(Rs crores)	10723	12995	13714	17557	21659	37517	42695
X4	44.61%	42.79%	41.96%	35.15%	31.37%	23.68%	20.93%
Sales(Rs crores)	75574	97626	111585	139579	143334	154203	193844
Total assets(Rs crores)	68620	86772	103594	126315	145510	205591	239747
X5	110.13%	112.51%	107.71%	110.50%	98.50%	75.00%	80.85%
0.012*X1	0.592	0.565	0.560	0.579	0.571	0.586	0.591
0.014*X2	0.307	0.290	0.330	0.357	0.325	0.316	0.344
0.033*X3	0.336	0.322	0.352	0.344	0.284	0.176	0.287
0.006*X4	0.268	0.257	0.252	0.211	0.188	0.142	0.126
0.010*X5	1.10	1.13	1.08	1.11	0.985	0.75	0.809
Z scores	2.603	2.564	2.574	2.601	2.353	1.97	2.157

Source: Author's own estimate

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