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Title

OPERATIONAL ADEQUACY OF WORKING CAPITAL MANAGEMENT OF SELECTED INDIAN AUTOMOBILE INDUSTRY – A BIVARIATE DISCRIMINANT ANALYSIS

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Abstract:

The study in general aims at making a study of the management performance relating to working capital in the selected units of the automobile industry in India. It covers seventeen major units in the automobile industry (five in commercial vehicles sector, three in passenger cars and multiutility vehicles sector and nine in two and three wheelers sector). For the purpose of the study, necessary data on working capital and other related variables were collected for the period 1992-93 to 2006-07. The financial statements used were mainly the Profit and Loss accounts and Balance Sheets published in the annual reports of the respective units. The study used a variety of financial ratios to accomplish the objectives. It employed discriminant analysis to examine adequacy of working capital.

The operational adequacy of the working capital of the selected units has also been assessed by employing the discriminant analysis based on the size of working capital in terms of monthly operational requirements and sales requirements as independent variables. The construction of discriminate function suggests that the size of net working capital in terms of monthly operational requirements appeared to be stronger than sales requirements in all the years. The discriminate Z values were estimated and the good risk and poor risk enterprises may also be identified by computing the cut-off values.

The comparison of good and poor risk units as per the current ratio and as per the discriminant score shows that the misclassification of units is noticed in all the years. It can be concluded that in the years 1992-93 to 2006-07 Ashok Leyland Ltd in commercial vehicles sector, Mahindra and Mahindra Ltd in passenger cars and multiutility vehicles sector and Bajaj Auto Ltd in two and three wheelers sector units maintained adequate size of the working capital throughout the period under study.

Introduction:

Working capital is the portion of an enterprise's total capital which is employed in short-term operations, i.e., current assets. A typical list of these assets in order of liquidity includes cash in hand and at bank, short-term investment, payments in advance, accounts receivables, raw materials inventory, inventory of goods in process and finished goods inventory. The

management of all these current assets assumes greater importance because the sum total of investment in current assets forms over one-half of an enterprise's total assets. Besides, liquidity and profitability, the two desired goals of financial management are directly affected by working capital management performance. As the size of working capital increase, both the enterprise's risk and return would decrease and vice-versa. Since, the current assets (working capital) affect the risk return trade off to be achieved by the enterprise, the study of structure, sources and utilization appears to be one of the important areas of investigation on working capital management.

Methodology:

Objectives of the study

The present study in general aims at making a comparative study of working capital management performance in commercial vehicles, passenger cars and multiutility vehicles and two and three wheelers sectors of Indian automobile industry. The specific objectives of the study are:

1. To analyze and evaluate Working Capital Management policies of selected units during the period from 1992-93 to 2006-07.
2. To analysis the operational adequacy of the working capital of the selected units has also been assessed by employing the discriminant analysis based.
3. To assess the discriminant analysis be useful in assessing the short-term liquidity position of enterprises
4. To examine the comparison of good and poor risk units as per the current ratio and as per the discriminant score.
5. To assess the discriminant analysis be useful in assessing the short-term liquidity position of enterprises

Selection of sample

Keeping in view the scope of the study, it is decided to include all the companies under automobile industry working before or from the year 1992-93 to 2006-07. But, owing to several constraints such as non-availability of financial statements or non-working of a company in a particular year etc., the researcher is compelled to restrict the number of sample companies to 17. Therefore, this study is expost facto based on survey method making a survey of seventeen companies in Indian automobile industry. There are 26 companies operating in the Indian Automobile Industry. The companies under automobile industry are classified into three sectors namely; commercial vehicles, passenger cars and multiutility vehicles and two and three wheelers. The details of the sector with the available companies of Indian automobile industry are presented in Table 1.

All the three sectors have been selected for the purpose of the study. The selected sectors include 26 companies. Out of 26 companies, 5 are under commercial vehicles, 8 under passenger cars and multiutility vehicles and 13 under two and three wheelers sector. Out of 26 companies of the selected sectors, 15 years data is available for 17 companies only. Therefore, all the 17 companies are included in the sample. It accounts for 69.23 per cent of the total companies available in the Indian automobile industry. The selected 17 companies include 5 under commercial vehicles, 3 under passenger cars and multiutility vehicles and 9 under two and three wheelers sectors.

Review of previous studies:

Mukhopadhyay (2004)[1] in his study made an attempt to study the effectiveness and adequacy of working capital and short-term solvency in an engineering company for the period of ten years from 1993-94 to 2002-03. The study concluded the working capital management should not be treated as an isolated management function but it is the part and parcel of overall corporate management functions and impact of corporate management policy and strategy effects working capital management practice of the firm. It is thus necessary to work out and analyze cause-effect relationship of very function of the management to assess its impact on the working capital management.

Narware (2004)[2] in his study found that out of nine indicators representing working capital management selected for the study, three variables were negatively associated with the selected profitability measures whereas the remaining ones recorded positive association with the profitability.

Santanu Ghosh and Santi Gopal Maji (2004)[3] in their study examined that the efficiency of working capital management practice and ability improve their efficiency up to the industrial average in 20 large cement companies operating in India for the period of ten years from 1992-93 to 2001-02 with three index suggested by Bhattacharya. The study observed that the Indian cement industry did not perform remarkably well during this period. Some of the sample firms had successfully improved efficiency during these years; the existence of a very high degree of inconsistency in this matter clearly points out the need for adopting sound working capital management policies by these firms and identifies the forces for inefficiency.

Sudarshan (2004)[4] examined the status of inventory holding in Chemicals and Pharmaceutical Central Publics Enterprises. The analysis reveals that Chemical and Pharmaceutical Central Public Enterprises could reduce the inventory holding in terms of number of days of consumption, cost of production and cost of sales in order to improve their working capital efficiency. Further, the enterprises did not enjoy economics of scale in respect of inventory holding in relation to sales. However, still there is scope for further improvement. The study suggested that the proper control over inventories improves the operational efficiency and profitability of the enterprises.

An investigation into the effectiveness of working capital management of an organization with particular reference to its short-tram liquidity and solvency and impact on commercial operations of the organization was made by **Mukhopadhyay(2004)**[5] in his study entitled "Working capital management in Heavy Engineering firm". The study concluded that working capital management should not be treated as an isolated management function but it is the part and parcel of overall corporate management functions and impact of corporate management

policy and strategy effects working capital management practice of the firm. It is thus necessary to work out and analyze cause-effect relationship of every function of the management to assess its impact on the working capital management

Sudarsana Reddy, Sivarami Reddy and Mohan Reddy (2004)[6] in their study evaluated the performance of the debtors' management of the paper industry in Andhra Pradesh. For this purpose, the analysis of trends in sales and debtors, debtors' size, turnover, collection period and aging of receivables had been carried out. The forgoing analysis reveals that the sample mills adopted liberal credit policy, which had a favourable effect on sales with the exception of Sirpur. The size of trade debtors as a percentage of current assets has shown declining trend. But the collection period of debtors slowly increased in all the mills except in Sirpur. The increasing debtors' collection period was an indication of slackness in collection efforts of the mills. To reduce the collection period, the collection and follow up efforts of trade debtors shall be rationalized and the slackness should altogether be removed.

Sudipta Ghosh (2005)[7] in his study made an attempt evaluate the performance Stewarks & Lloyds of India Limited. The data of Stewarks & Lloyds of India Limited used in this study have been collected from published Annual Reports of the company. The study covers a period of five years from 1996-97 to 2000-2001. The results of the study showed the overall performance of the company regarding inventory management is satisfactory in terms of efficient utilization of inventories during the period of study. The study suggested that the help an efficient inventory management, a proper balance between these two extreme situations should be maintained for smooth operation of the business.

Amit K. Chakraborty (2005)[8] in his study made an attempt to examine the working capital management of Andrew Yule and Company Limited during the period form 1993-94 to 2002-03. The study revealed that the short-term liquidity position of the company is not satisfactory at all. But the acid test ratio indicates very good short-term liquidity position of the company. The cause of this attitude of the ratio is due to exclusion of the inventory from the total

current assets. Further the study concluded that the inventory contributes only (average) 17.92 percent in gross working capital, which indicates proper utilization and maintenance of inventory.

Patel (2005)[9] a case study Analysis of Working Capital of Colour-Chem Limited. A ratio analysis and Altman's 'Z'model has been used. It studied the position and efficiency of working capital for the period of 19 years from 1981 to1999. The study concluded that the company is in a position to pay its current obligations and efficiently utilizes its current assets. The model suggests that the company never become sick in future.

Rais Abramd and Ali Ghufran (2005)[10] in their analytical study indicated that components, financing and structure of working capital and impact of working capital on profitability in eight Marketing Cooperative Societies for a period of three years from 1997-98 to 1999-2000. The study concluded that 6 societies for their investment in working capital following aggressive approach, low dependencies for their financing of working capital as long-term funds, the liquidity position of all the societies is not satisfactory except one and negative impact on working components.

Jain and Praveen Kumar (2006)[11] viewed that working capital management practices assume vital importance in the smooth day-to-day functioning of business firms. While excess working capital can have an adverse impact on profitability, inadequate working capital can hold up production or sales operations of well managed business firms. Good working capital management is more crucial now than ever before in view of turbulence in the current business environment where competition is stiff and profit margins are low.

Ioannis Lazaridis and Dimitrios Tryfonidis (2006)[12] investigated the relationship of corporate profitability and working capital management. The purpose of this study was to establish a relationship that is statistically significant between profitability, the cash conversion cycle and its components for listed firms in the Athens Stock Exchange. The results of the study

showed that there was statistical significance between profitability, measured through gross operating profit, and the cash conversion cycle. The study concluded that managers can create profits for their companies by handing correctly the cash conversion cycle and keeping each different component (account receivables, accounts payables and inventory) to an optimum level.

Amir Jafar and Debasish Sur (2006)[13] concluded the study on the efficiency of the working capital management in the National Thermal Power Corporation (NTPC), the only 'Navaratha' Public Enterprise in the Indian power sector, during the period 1983-84 to 2002-03. This study reveals that the company achieved a higher level of efficiency in managing its working capital during the post-liberalization era by adapting itself to the new environment emanated from liberalization globalization and competitiveness.

Sanjay J.Bhayani (2006)[14] made an attempt to study the impact assets utilization on profitability of Indian Industry. For the purpose of study 24 Indian Industry has been selected which comprises 641 Indian firms. The results of the study indicate that fixed assets turnover and profitability has shown a positive relationship. So, it indicates that high fixed assets turnover higher profitability. Further, the results of analysis of multiple determinations make it clear that 40.70 percent of total variation in the corporate profitability was accounted for by the joint variation in the efficiency of inventory and receivable management.

Sukhdev Singh (2006)[15] in his study made an attempt to examine the Inventory control practices in Indian Farmers Fertilizer Cooperative Limited (IFFCO) by using various financial ratios. The inventory control practices revealed that correlation between sales and inventory ranges from very high to moderate among inventory items and the correlation is significant in case of all the components of inventory except stores and spares. The growth rate of stock of raw material, work-in-progress, finished goods and total inventory is more than the ideal situation and provides clues for improvements. The stock of stores and spares requires the immediate attention of management in order to stop ruthless purchases.

Anand and Malhotra (2007)[16] in their study discussed the Cash conversion efficiency, Days operating cycle and days of working capital in 339 India non financial companies for the period of three years from 2001-02 to 2003-04 for each company and for 98 industry groups. They concluded that there exists some relationship between working capital management and profitability on an aggregate basis suggest that there is a significant negative relation between cash flows from operating activities and average days of account receivables. Further, it is believed that immense use benchmarking and performance evolution of working capital management of corporate India.

Ghosh (2007)[17] in his study reviewed that the four different industries: (i) Working capital management in Pharmaceutical industry, (ii) Working Capital Management in Cement Industry, (iii) Working Capital Management in National Fertilizer Limited and (iv) Working Capital Management in Textile Industry: it includes the following objectives such as to determine size and source of working capital with a survey made in 98 small scale textile firms of Punjab. It concluded that in addition to the own capital, bank loans is the most prominent source of working capital among most of the survey units.

Sharma (2007)[18] in his study analysis that various procedures and techniques of financial analysis adopted by the textile industry of the accounting and control of various constituents of current assets in all aspects of textile units in India for a period from 2002-2006. It may be remarked that the existing system of current assets accounting in all the textile companies selected for this study as not been satisfactory and needs improvement in all the directions immediately. Today, manufacturing units of several other industries are using modern techniques of current assets accounting and the textile industry should not lag behind.

Azhagaiah and Gejalakshmi (2007)[19] in their study makes an attempt to examined the working capital management efficiency of the Indian Textile Companies during 1995-1996 to 2005-2006. For measuring the efficiency of working capital management three - index values - performances utilizations and efficiency indexes are calculated. Using industry norm as target –

efficiency level of the individual firms, this study also tests the speed of achieving that target level of efficiency by an individual firm during the period of study. Findings of the study indicate that Indian Textile Industry as a whole performs remarkably well during the period. The liquidity is strong, performance and utilization of current assets are satisfactions and adoption of sound WCM policy has been successful.

Pradeep Singh (2008)[20] in his study made an attempt to examine the inventory and working capital management of Indian Farmers Fertilizer Co-operative Limited (IFFCO) and National Fertilizer Limited (NFL). He concluded that the overall position of the working capital of IFFCO and NFL is satisfactory. But there is a need for improvement in inventory in case of IFFCO. However inventory was not properly utilized and maintained by IFFCO during study period. The management of NFL must try to properly utilize the inventory and try to maintain the inventory as per the requirements, so that liquidity will not interrupted.

Data Analysis and Interpretation:

The present study attempts to apply linear discriminant analysis with only two sets of independent variables. The sample units were classified in two categories as per their liquidity ratios. Group A consisted of those units where current ratios were found to be atleast 1.5:1 and rest of the units have been classified in Group B. In this study, adequacy of the size of net working capital has been treated as dependent variable and sizes of net working capital in terms of monthly operational requirements (X_1) and sales requirements (X_2) have been treated as independent variables. The object is to determine weights for X_1 and X_2, that is the values of 'a' and 'b' in

$$\mathbf{Z = aX_1 + bX_2}$$

where, Z is the discriminant index.

As per the rule, the selected units falling in the good and poor risk group are presented in Table 2. After classifying the selected units in to the good and poor risk classes, the discriminant function of the selected years are estimated and presented in Table 3 where the co-efficient for 'a' and 'b' indicate the size of net working capital in terms of monthly operational requirements

and sales requirements. The table reveals that the size of net working capital in terms of monthly operational requirements appeared to be stronger than sales requirements in all the years.

The discriminant co-efficient given in Table 3 was multiplied with the mean values of each industry ratio in order to obtain the discriminant score of each units. Table 4 presents the data relating to the discriminant score of all the units. With the help of the discriminant scores, the cut-off value was calculated as follows.

$$\text{Cut of Value} = \frac{n_1\overline{Z}_1 + n_2\overline{Z}_2}{n_1 + n_2}$$

where n_1 and n_2 are the size of samples and z_1 and z_2 represent the mean of the discriminant score of group A and group B respectively. The cut-off values have also been presented in Table 3. Actual Z scores of the individual units were then compared with the discriminating Z scores. In case where the Z scores were found to be more than the discriminating Z scores, it can be said that the sizes of net working capital were more than the operational and sales requirements.

It is evident from Table 4 that during the year 1992-93 to 1995-96, considering discriminant Z score, in case of Scooters India Ltd, the size of working capital was found to be very low considering the operational and sales requirements. In rest of the cases, size of working capital was found to be in excess in relation to operational and sales requirements.

In 1996-97 the cut-off Z score was found to be 2.23. In case of Ashok Leyland Ltd, Tata Motors Ltd, Swaraj Mazda Ltd, Hindustan Motors Ltd, Mahindra and Mahindra Ltd, Bajaj Auto Ltd and Kinetic Engineering Ltd, the size of working capital was found to be in excess to meet their operational and sales requirements. In case of Eicher Motors Ltd, it had satisfactory size of working capital as its Z score was less than 2.23 but was not low to be inadequate. In rest of the cases, size of working capital was found to be inadequate in relation to operational and sales requirements.

In 1997-98, the cut off Z score was 0.41. Considering this discriminant score, in the case of Hindustan Motors Ltd and Tata Motors Ltd, Z scores were found to be less than 0.41 but were not too low to be inadequate. In the case of Bajaj Tempo Ltd, Eicher Motors Ltd, Maruti Udyog Ltd, LML Ltd, Maharastra Scooters Ltd, TVS Motor Company Ltd, Kinetic Motors Ltd, Hero Honda Motors Ltd and Majestic Auto Ltd, the size of working capital was found to be very low. In rest of the cases it was found that working capital was in excess as Z scored by the individual units were more than the cut off Z score.

In 1998-99, the cut off Z score was found to be 1.43. In case of Eicher Motors Ltd and Maruti Udyog Ltd, the working capital positions was found to be quite satisfactory. In case of Tata Motors Ltd, Bajaj Tempo Ltd, Hindustan Motors Ltd, LML Ltd, Maharastra Scooters Ltd, TVS Motor Company Ltd, Kinetic Motors Ltd, Hero Honda Motors Ltd and Majestic Auto Ltd, the size of working capital was found to be too low and in rest of the case the sizes of working capital was in excess to meet their respective operational and sales requirements.

In 1999-2000, the cut off Z score was 2.81. Considering it as discriminating Z score, it was found that in the case of Ashok Leyland Ltd, Swaraj Mazda Ltd, Mahindra and Mahindra Ltd, Baja Auto Ltd, Kinetic Engineering Ltd and Scooters India Ltd, the size of working capital was found to be in excess to meet their respective operational and sales requirements and in the rest of the cases the size of working capital was found to be too low.

In 2000-01, the cut off Z score was 2.09. In case of Ashok Leyland Ltd, Mahindra and Mahindra Ltd, Bajaj Auto Ltd, Maharastra Scooters Ltd, Kinetic Engineering Ltd and Scooters India Ltd, the size of working capital was found to be in excess to meet their respective operational and sales requirements and in the rest of the cases the size of working capital was found to be too low.

In 2001-02, the cut off Z score was 2.76. In the case of Bajaj Tempo Ltd and Kinetic Motors Ltd, Z score was found to be less than 2.76 but was not too low to be inadequate. In other words size of working capital was found to be quite satisfactory. In the case of Tata Motors Ltd, Eicher Motors Ltd, Hindustan Motors Ltd, Maruti Udyog Ltd, LML Ltd, TVS Motor Company Ltd, Hero Honda Motors Ltd and Majestic Auto Ltd, the size of working capital was found to be very low. In rest of the cases, it was found that working capital was in excess as Z scored by the individual units were more than the cut off Z score.

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In 2002-03, the cut off Z score was found to be 1.81. Considering it as discriminating Z score it was found that in the case of Ashok Leyland Ltd, Bajaj Auto Ltd, Maharastra Scooters Ltd, Kinetic Motors Ltd, Kinetic Engineering Ltd and Scooters India Ltd, the size of working capital was found to be in excess to meet their respective operational and sales requirements and in the rest of the cases, the size of working capital was found to be too low.

In 2003-04, the cut off Z score was 1.25. Considering it as discriminating Z score it was found that in the case of Maruti Udyog Ltd, Bajaj Auto Ltd, Maharastra Scooters Ltd and Scooters India Ltd the size of working capital was found to be in excess to meet their respective operational and sales requirements and in the rest of the cases, the size of working capital was found to be too low.

In 2004- 05, the cut off Z score was found to be 1.83. In case of Ashok Leyland Ltd, Maruti Udyog Ltd, Bajaj Auto Ltd, Maharastra Scooters Ltd, Scooters India Ltd, the size of working capital was found to be in excess to meet their operational and sales requirements. In case of Hero Honda Ltd it had satisfactory size of working capital as its Z scores was less than 1.83 but was not too low to be inadequate. In rest of the cases, size of working capital was found to be inadequate in relation to operational and sales requirements.

In 2005-06, the cut off Z score was 0.98 considering it as discriminating Z score it was found that in the case of Ashok Leyland Ltd, Mahindra and Mahindra Ltd, Maruti Udyog Ltd and Bajaj Auto India Ltd, the size of working capital was found to be in excess to meet their respective operational and sales requirements and in the rest of the cases the size of working capital was found to be low.

In 2006 – 07, the cut off Z score was 0.43. In the case of Bajaj Tempo Ltd and Eicher Motors Ltd, Z scores was found to be less than 0.43 but was not too low to be inadequate. In other words size of working capital was found to be quite satisfactory. In case of Hindustan Motors Ltd, LML Ltd, Maharastra scooters Ltd, Kinetic Motors Ltd and Majestic Auto Ltd, the size of working capital was found to be very low. In rest of the cases it was found that working capital was in excess as Z scored by the individual units were more than the cut off Z score.

Conclusion:

In the years 1992-93 to 2006 -07 Ashok Leyland Ltd in commercial vehicles sector, Mahindra and Mahindra Ltd in passenger cars and multiutility vehicles sector and Bajaj Auto Ltd in two and three wheelers sector units maintained adequate size of working capital in relation to sales and output requirements throughout the period under study.

The number of good and risk units as per the current ratio and as per the discriminant score are presented in Table 5. It is clear from the table that the misclassification of units is noticed all the years. Generally one unit in the good risk group has been misclassified as poor risk under the criteria of discriminant score. Such industries are Ashok Leyland Ltd in 2003-04, Eicher Motors Ltd in the years 1997-98 and 1998-99, Maruti Udyog Ltd in 2002-03, TVS Motor Company Ltd in 1997-98 and Hero Honda Motors Ltd in the years 2003-04 and 2004-05. It is also inferred that the poor risk industries appeared to be good risk under the criteria of discriminant score. Such unit is Ashok Leyland Ltd in the year 2006-07, Tata Motors Ltd in 1992-93, 1993-94, 1994-95, 1995-96, 1996-97 and 2006-07, Bajaj Tempo Ltd in 1992-93, 1993-94, 1994-95 and 1995-96, Eicher Motors Ltd in 1992-93, 1993-94, 1994-95 and 1995-96, Swaraj Mazda Ltd in 1992-93, 1993-94, 1994-95, 1995-96, 1996-97, 1997-98, 1998-99, 1999-2000, 2001-02 and 2006-07, Hindustan Motors Ltd in 1992-93, 1993-94, 1994-95 and 1995-96, Mahindra and Mahindra Ltd in 1992-93, 1995-96, 2000-01, 2001-02, 2005-06 and 2006-07, Bajaj Auto Ltd in 1992-93 and 2003-04, LML Ltd in 1992-93, 1993-94, 1994-95 and 1995-96, Maharastra Scooters Ltd in 1992-93, 1993-94, 1994-95 and 1995-96, TVS Motor Company Ltd in 1992-93, 1993-94, 1994-95, 1995-96 and 2006-07, Kinetic Motors Ltd in 1992-93, 1995-96 and 2002-03, Hero Honda Motors Ltd in 1993-94, 1994-95 and 1995-96 Kinetic Engineering Ltd in 1993-94, 1994-95, 1995-96, 2002-03 and 2006-07. Majestic Auto Ltd in the years 1992-93, 1993-94, 1994-95, 1995-96.

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Table 1

Total number of companies available in Indian Automobile Industry

S.No	Sectors	Total companies available	15 years data available companies
1	Commercial Vehicles	5	5
2	Passenger Cars and Multiutility Vehicles	8	3
3	Two and Three Wheelers	13	9
	Total	**26**	**17**

Source: Prowess Database, 2007.

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Table 2

Good and poor risk units in terms of current ratio

(Group A consists of those units whose current ratio is atleast 1.5:1 and remaining units in Group B)

Year	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Group A	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	ALL	MUL
	HHML	MML	MML	BAL	HML	EML	EML	MML	BAL	BAL	MUL	MUL	MUL	MUL	BAL
	KEL	BAL	BAL		MML	MML	MML	BAL	MSL	MSL	BAL	MSL	BAL	BAL	HHML
		KML	KML		BAL	BAL	BAL	KEL	KEL	KEL	MSL	HHML	MSL	MSL	SIL
					KEL	TMCL	KEL	SIL	SIL	SIL	SIL	SIL	HHML	HHML	
						KEL	SIL			-			SIL	SIL	
						SIL									
	$n_1 = 3$	$n_1 = 4$	$n_1 = 4$	$n_1 = 2$	$n_1 = 5$	$n_1 = 7$	$n_1 = 6$	$n_1 = 5$	$n_1 = 5$	$n_1 = 5$	$n_1 = 5$	$n_1 = 5$	$n_1 = 6$	$n_1 = 6$	$n_1 = 4$
Group B	TML	TML	TML	TML	TML	TML	TML	TML	TML	TML	TML	TML	TML	TML	ALL
	BTL	BTL	BTL	BTL	BTL	BTL	BTL	BTL	BTL	BTL	BTL	BTL	BTL	BTL	TML
	EML	EML	EML	EML	EML	SML	SML	EML	EML	EML	EML	EML	EML	EML	BTL
	SML	SML	SML	SML	SML	HML	HML	SML	SML	SML	SML	SML	SML	SML	EML
	HML	HML	HML	HML	MUL	MUL	MUL	HML	HML	HML	HML	HML	HML	HML	SML
	MML	MUL	MUL	MML	LMLL	LMLL	LMLL	MUL	MML	MML	MML	MML	MML	MML	HML
	MUL	LMLL	LMLL	MUL	MSL	MSL	MSL	LMLL	MUL	MUL	LMLL	BAL	LMLL	LMLL	MML
	BAL	MSL	MSL	LMLL	TMCL	KML	TMCL	MSL	LMLL	LMLL	TMCL	LMLL	TMCL	TMCL	LMLL
	LMLL	TMCL	TMCL	MSL	KML	HHML	KML	TMCL	TMCL	TMCL	KML	TMCL	KML	KML	MSL
	MSL	HHML	HHML	TMCL	HHML	MAL	HHML	KML	KML	KML	HHML	KML	KEL	KEL	TMCL
	TMCL	KEL	KEL	KML	MAL		MAL	HHML	HHML	HHML	KEL	KEL	MAL	MAL	KML
	KML	MAL	MAL	HHML	SIL			MAL	MAL	MAL	MAL	MAL			KEL
	MAL	SIL	SIL	KEL											MAL
	SIL			MAL											
				SIL											
	$n_2 = 14$	$n_2 = 13$	$n_2 = 13$	$n_2 = 15$	$n_2 = 12$	$n_2 = 10$	$n_2 = 11$	$n_2 = 12$	$n_2 = 12$	$n_2 = 12$	$n_2 = 12$	$n_2 = 12$	$n_2 = 11$	$n_2 = 11$	$n_2 = 13$

ALL – Ashok Leyland Ltd; TML – Tata Motors Ltd; BTL – Bajaj Tempo Ltd; EML – Eicher Motors Ltd; SML – Swaraj Mazda Ltd; HML – Hindustan Motors Ltd; MML – Mahindra and Mahindra Ltd; MUL – Maruti Udyog Ltd; BAL – Bajaj Auto Ltd; LMLL – LML Ltd; MSL – Maharastra Scooters Ltd; TMCL – TVS Motor Company Ltd; KML – Kinetic Motors Ltd; HHML – Hero Honda Motors Ltd; KEL – Kinetic Engineering Ltd; MAL – Majestic Auto Ltd; SIL – Scooters India Ltd

Source: Computed

Table 3

Discriminant functions for the period 1992-93 to 2006-07

Year	Function	Remark
1992-93	Z = 0.319a – 0.068b	a > b
1993-94	Z = 1.279a – 0.393b	a > b
1994-95	Z = 1.492a – 0.459b	a > b
1995-96	Z = 0.388a – 0.052b	a > b
1996-97	Z = 2.485a – 1.036b	a > b
1997-98	Z = 0.692a – 0.484b	a > b
1998-99	Z = 1.633a – 0.891b	a > b
1999-00	Z = 2.675a – 1.115b	a > b
2000-01	Z = 2.295a – 0.956b	a > b
2001-02	Z = 2.811a – 1.171b	a > b
2002-03	Z = 1.505a – 0.627b	a > b
2003-04	Z = 0.935a – 0.389b	a > b
2004-05	Z = 1.515a – 0.631b	a > b
2005-06	Z = 1.799a – 0.981b	a > b
2006-07	Z = 1.605a – 0.494b	a > b

Note: The expression *a* > *b* is to be read "*a* is stronger than *b*".

Source: Computed.

Table 4

Discriminant Z values for the selected units (1992-93 to 2006-07)

Units	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07
Ashok Leyland Ltd	1.86	4.05	7.81	1.91	7.48	1.46	4.17	5.49	5.59	6.73	3.01	1.12	2.79	1.75	1.25
Tata Motors Ltd	0.63	2.07	1.30	0.13	2.38	0.36	0.36	-0.91	-2.51	0.50	-0.95	0.10	0.47	0.90	0.46
Bajaj Tempo Ltd	0.45	1.10	1.47	0.24	1.26	0.17	0.81	1.90	1.71	1.90	1.01	0.52	0.62	-0.40	-0.23
Eicher Motors Ltd	0.29	1.07	1.55	0.50	2.12	0.29	1.13	1.64	0.90	0.18	-0.01	0.21	0.26	-0.02	-0.14
Swaraj Mazda Ltd	-0.13	-0.74	-0.62	0.32	2.66	0.48	1.93	2.98	1.63	2.80	0.33	0.33	0.67	0.45	1.67
Hindustan Motors Ltd	0.17	1.23	1.35	0.48	3.05	0.38	0.80	1.83	1.12	0.88	0.68	-0.04	-0.42	-0.87	-0.25
Mahindra and Mahindra Ltd	0.52	2.95	2.84	0.26	4.20	0.60	2.47	4.18	2.55	3.34	1.43	0.20	0.65	1.05	1.40
Maruti Udyog Ltd	0.47	-0.51	-2.66	-0.01	0.75	0.05	1.08	0.16	0.42	0.79	1.70	1.38	2.54	2.70	2.35
Bajaj Auto Ltd	0.45	1.98	4.17	0.96	5.70	1.00	4.24	11.48	5.54	8.28	3.21	1.52	7.25	6.10	7.12
LML Ltd	-0.50	-1.71	0.06	0.15	0.33	0.07	0.74	1.86	0.50	-2.01	-0.37	-0.44	-0.80	-1.91	-6.65
Maharastra Scooters Ltd	0.68	2.41	4.40	0.59	1.58	0.12	0.76	2.62	4.04	9.38	10.71	12.18	7.74	4.89	-8.00
TVS Motor Company Ltd	-0.31	-0.27	0.42	-0.01	0.78	0.24	-0.05	1.00	0.55	0.80	-0.04	-0.03	0.17	-0.34	0.68
Kinetic Motors Ltd	0.21	1.57	1.56	0.22	0.80	0.16	0.81	1.45	1.85	1.13	2.20	0.72	0.13	-1.74	-3.38
Hero Honda Motors Ltd	0.34	0.58	0.29	0.01	0.01	0.12	0.10	-0.37	1.03	-1.51	1.13	0.92	1.54	1.44	1.82
Kinetic Engineering Ltd	0.86	2.59	2.26	0.48	3.41	0.59	1.92	5.54	4.32	6.33	3.00	0.91	1.39	-0.85	2.88
Majestic Auto Ltd	0.03	0.21	0.43	0.55	0.48	0.22	0.42	-1.08	-1.76	-4.02	-1.83	-1.03	1.42	-0.04	-0.30
Scooters India Ltd	-30.03	-141.22	-103.53	-26.67	0.93	0.61	2.62	7.99	7.98	11.50	5.56	2.67	4.76	3.50	6.70
Discriminant Z Score	**-1.41**	**-7.21**	**-4.52**	**-1.17**	**2.23**	**0.41**	**1.43**	**2.81**	**2.09**	**2.76**	**1.81**	**1.25**	**1.83**	**0.98**	**0.43**

Source: Computed

Table 5

Classification Matrix

Year	As per Current Ratio		As per Discriminant Score	
	Adequate	Inadequate	Adequate	Inadequate
1992-93	3	14	16	1
1993-94	4	13	16	1
1994-95	4	13	16	1
1995-96	2	15	16	1
1996-97	5	12	7	10
1997-98	7	10	6	11
1998-99	6	11	6	11
1999-00	5	12	6	11
2000-01	5	12	6	11
2001-02	5	12	7	10
2002-03	5	12	6	11
2003-04	5	12	4	13
2004-05	6	11	5	12
2005-06	6	11	7	10
2006-07	4	13	10	7

Source: Computed