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## **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.

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 at least 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 (X1) and sales requirements (X2) have been treated as independent variables. The object is to determine weights for X1 and X2, that is the values of 'a' and 'b' in

$$Z = aX_1 + bX_2$$

where, Z is the discriminant index.

**Table 1**

Good and poor risk units in terms of current ratio  
(Group A consists of those units whose current ratio is at least 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								
	n1 = 3	n1 = 4	n1 = 4	n1 = 2	n1 = 5	n1 = 7	n1 = 6	n1 = 5	n1 = 5	n1 = 5	n1 = 5	n1 = 5	n1 = 6	n1 = 6	n1 = 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											
		n2 = 14	n2 = 13	n2 = 13	n2 = 15	n2 = 12	n2 = 10	n2 = 11	n2 = 12	n2 = 12	n2 = 12	n2 = 12	n2 = 12	n2 = 11	n2 = 11

**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 – Maharashtra 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**

The selected units falling in the good and poor risk group are presented in Table 1. 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 2 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.

**Table 2**  
**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.

The discriminant co-efficient given in Table 2 was multiplied with the mean values of each industry ratio in order to obtain the discriminant score of each units. Table 3 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.

$$\text{Cut of Value} = \frac{n_1 Z_1 + n_2 Z_2}{n_1 + n_2}$$

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.

Table 3

## 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

It is evident from Table 3 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, Maharashtra 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.

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, Maharashtra 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, Maharashtra 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, Maharashtra 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, Maharashtra 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.

**Table 4**  
**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**

The number of good and risk units as per the current ratio and as per the discriminant score are presented in Table 4. 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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