Variables affecting working capital management of Tata motors: Factor analysis approach using R programming

Dr Nitin Untwal

Designation Associate Professor MIT Aurangabad

Abstract- **Today, several factors contribute to the working capital management are difficult to examine. Data collected on these factors often has several variables. It is a non-trivial exercise to determine which of the factors that significantly influences the working capital. This paper adopts the use of Principal Component Analysis (PCA) on the several variables expected to influence the working capital management of Tata Motors. The principal component analyses have identified the factors and are expected to assist the mangers to identify areas where they might improve financial performance of their operation. Finally the variables ROA, DTO, ITO, CSR, CR are having communalities greater than 0.5 are incorporated and Each variable is loaded on a single component, thereby enhancing the interpretability of the factors. The variables can be broadly classified in to four viz, profitability (ROA), efficiency (DTO and ITO), absolute liquidity(CSR) and liquidity factor(CR). The above identified variables can be used for multiple regression analysis.**

Index terms- **Working Capital Management, Factor Analysis**

INTRODUCTION

Working capital management efficiency is vital especially for manufacturing firms, where a major part of assets is composed of current assets (Horne and Wachowitz, 2000).Working capital is consider to be important element of overall financial management of the business concern. It is important to analyze the variable factors which impact or influence working capital. The variable factors which have relationship with working capital need to be recognize and identified for proper management of working capital. The solve this problem researcher had used different statistical tools for analysis. Factor analysis is one of the tools which identify such variables. According to Malhotra and Dash (2012), factor analysis is used in the following circumstances: a) to identify the underlying dimensions, or factors, that explain the correlations among a set of variables. b) to identify a new, smaller set of uncorrelated variables to replace the original set of correlated variables in subsequent multivariate analysis. c) to identify a smaller set of salient variables from a larger set for use in subsequent multivariate analysis. Here we conduct the factor analysis for identifying variables which influence working capital. The factor analysis is applied in different areas of management like marketing, leadership, portfolio management, and knowledge management. We find that factor analysis approach has not been used by the researchers to identify the existence of the correlation and linear dependency among the independent variables. Previous studies use the variables relating to the policy of the firm, operational factors, convertibility factors and ratios of assets (Deloof, 2003; Pandachi, 2006; Lazaridis and Tryfonidis, 2006; Raheman and Nasr, 2007; Teruel and Solano, 2007;Yadav et al., 2009; Falope and Ajilore, 2009; Sen and Oruc, 2009; Ramachandran and Jankiraman, 2009; Charitou et al., 2010; Alipour, 2011).

OBJECTIVES OF THE STUDY

The primary aim of study is to examine and assess the factors affecting the management of working capital and profitability of the Tata motors that are provided in the screener database. The variables considered in this work for factor analysis are profitability (ROA) efficiency (DTO and ITO), absolute liquidity (CSR) and liquidity factor(CR).

RESEARCH METHODOLOGY

Period of study Year2008 –Year 2014

Data collected – Financial data is collected from screener financial data base. stock screener is a research tool for Indian stocks analysis.

Statistical test applied – Factor analysis on R programming and varimax on statistical software Minitab.

Financial analysis- analysis is done by applying working capital ratios and return on asset ratio

Research question: Is there any significant relationship between profitability (ROA) and working capital management (DTO, CSR, ITO, CR return on asset ratio).

Statistical package used for analysis Mini Tab

Analysis and Interpretation

Table 1.1 Descriptive Statistics: ROA, DTO, ITO, CSR, CR

Variable	Mean	St Dev	Variance	CoefVar	Sum	Minimum	Median	Maximum	Skewness	Kurtosis
ROA	0.03143	0.02410	0.00058	76.69	0.22000	0.01000	0.03000	0.08000	1.57	2.91
DTO	21.67	4.64	21.56	21.43	151.68	14.64	20.86	28.18	-0.12	-0.73
ITO	11.123	1.208	1.460	10.86	77.860	8.880	11.780	12.100	-1.38	0.82
CSR	0.04000	0.02517	0.00063	62.92	0.28000	0.01000	0.05000	0.08000	0.18	-0.49
CR	1.500	0.470	0.221	31.35	10.500	1.030	1.340	2.360	1.13	0.73

As the correlation shows the degree of relationship between dependent and independent Variables, It shows how much strong or weak the relationships between two variables are. Hence, the below data shows there is a strong positive relationship between return on assets (dependent variable), cash turnover ratio, inventory turnover ratios (independent variables). Moreover, the below number shows that there is a moderate negative co-relationship between debtors turnover and dependent variable and less than moderate negative co-relationship between current ratio and dependent variable

The correlation matrix :

Table 1.2 Correlation matrix

	ROA	DTO	ITO	CSR	CR
ROA	1	-0.21494	0.661457	0.963512	-0.01658
DTO	-0.21494	1	-0.76871	-0.34423	-0.4192
ITO	0.661457	-0.76871	1	0.788104	0.484014
CSR	0.963512	-0.34423	0.788104	1	0.100682
CR	-0.01658	-0.4192	0.484014	0.100682	1

Factor Analysis: ROA, DTO, ITO, CSR, CR

Descriptive Analytics

Descriptive analytics is the interpretation of historical data to better understand changes that have occurred in a business. Descriptive analytics describes the use of a range of historic data to draw comparisons. For purpose of study we used Descriptive Analytics tools like mean, median, mode Skewness, Kortosis, correlation matrix.

Skewness

If skewness is 0, the data are perfectly symmetrical, although it is quite unlikely for real-world data. As a general rule of thumb: If skewness is less than -1 or greater than 1, the distribution is highly skewed. If skewness is between -1 and -0.5 or between 0.5 and 1, the distribution is moderately skewed.

First we apply factor analysis by using R programming but to get more insight about the data we use Principal Component Factor Analysis.

Principal Component Factor Analysis of the Correlation Matrix

An unrotated factor solution simply tries to explain the maximum amount of variance with a minimal number of factors; however, most communication researchers use factor analysis in order to extract meaningful data that accurately represents the underlying nature of their data. A communality is the extent to which an item correlates with all other items. Higher communalities are better. If communalities for a particular variable are low (between 0.0-0.4), then that variable may struggle to load significantly on any factor. The factor solution should explain at least half of each original variable's variance, so the communality value for each variable should be 0.50 or higher. The communalities provide an index to the efficiency of the reduced set of variables. Table 1.3 shows the communalities of variables. Here all variables are having communality more than 0.5. High value of communality is observe

for CSR (0.979) and low value communality observed for CR (0.726). The communalities are over and above standard 0.50 in all variables which helps for further detail investigation for applying varimax rotation. The variance for factor 1 and factor 2 is 57 Percent and 30 Percent with cumulative percentage variance of 87 Percent

Table 1.3 Unrotated Factor Loadings and Communalities

Variable	Factor1	Factor2	Communality
ROA	0.750	-0.626	0.955
DTO	-0.677	-0.544	0.755
ITO	0.962	0.211	0.969
CSR	0.891	-0.430	0.979
CR	0.366	0.770	0.726
Variance	2.8734	1.5100	4.3834
% Var	0.575	0.302	0.877

Varimax rotation is a statistical technique used at one level of factor analysis as an attempt to clarify the relationship among factors. Generally, the process involves adjusting the coordinates of data that result from a principal components analysis.

Rotated Factor Loadings and Communalities
Varimax Rotation

Variables are only checked for complex structure if there is more than one component in the solution. Variables that load on only one component are described as having simple structure. If a variable has complex structure, it should be removed from the analysis. No variable is having a complex structure, so no variable is dropped from the analysis. Finally the variables ROA, DTO, ITO, CSR, CR are having communalities greater than 0.5 are incorporated in the analysis. Table 1.4 shows the results of final rotated component matrix. Each variable is loaded on a single component, thereby enhancing the interpretability of the factors. The variables can be broadly classified in to four factors, viz, profitability, efficiency, absolute liquidity and liquidity factor. The first factor has large weights for ROA, CSR. The above variables are classified as a factor relating to the Profitability and absolute liquidity of the firms, while the second factor has high loading for CR and DTO and ITO. This vector represents mainly the movements of debtors and Inventory, the policies of the firm. The variance for factor 1 and factor 2 is 47

Percent and 39 Percent with cumulative percentage variance of 87 Percent.

Table 1.4 Rotated Factor Loadings and Communalities

Variable	Factor1	Factor2	Communality
ROA	0.975	-0.060	0.955
DTO	-0.223	-0.840	0.755
ITO	0.650	0.739	0.969
CSR	0.973	0.181	0.979
CR	-0.161	0.837	0.726
Variance	2.3952	1.9882	4.3834
% Var	0.479	0.398	0.877

Factor score coefficient matrix. Shows the coefficients by which variables are multiplied to obtain factor scores. Also shows the correlations between factor scores reveals moderate co-relation for ROA 0.456 and CSR with 0.419 for factor-1 . For factor two it is evident from table that DTO and CR have moderate correlation for factor -2

Table 1.5 Factor Score Coefficients

Variable	Factor1	Factor2
ROA	0.456	-0.179
DTO	0.024	-0.430
ITO	0.187	0.311
CSR	0.419	-0.046
CR	-0.199	0.486

CONCLUSION

This paper identifies the salient variables of working capital management and profitability using factor analysis. The study has been conducted on Tata Motors. The principal component analyses have identified the factors and are expected to assist the mangers to identify areas where they might improve financial performance of their operation. Finally the variables ROA, DTO, ITO, CSR, CR are having communalities greater than 0.5 are incorporated and Each variable is loaded on a single component, thereby enhancing the interpretability of the factors. The variables can be broadly classified in to four factors, viz, profitability (ROA) , efficiency(DTO and ITO), absolute liquidity(CSR) and liquidity factor(CR). The above identified variables can be used for multiple regression analysis.

Factor analysis using R- Programming

```
> # Create the data frame.
> Working capital <- data. Frame (
+ ROA = c (0.08,0.03,0.04,0.03,0.02,0.01,0.01),
+ DTO = c (25.24, 20.86, 14.64, 18.09, 20.05, 24.62,
28.18)
+ ITO = c (11.78, 11.28, 11.93, 12.10, 11.84, 10.05,
8.88)
+ CSR = c (0.08, 0.05, 0.05, 0.05, 0.03, 0.01, 0.01)
+ CR = c (1.29, 1.03, 1.34, 2.36, 1.87, 1.51, 1.10) + )
> print (Working capital)
  ROA  DTO   ITO   CSR  CR
1 0.08 25.24 11.78 0.08 1.29
2 0.03 20.86 11.28 0.05 1.03
3 0.04 14.64 11.93 0.05 1.34
4 0.03 18.09 12.10 0.05 2.36
5 0.02 20.05 11.84 0.03 1.87
6 0.01 24.62 10.05 0.01 1.51
7 0.01 28.18  8.88 0.01 1.10
>   Workingcapital.fa  <-  factanal(Workingcapital,
factors=2)
> Workingcapital.fa
Call: factanal(x = Workingcapital, factors = 2)
Uniquenesses:
ROA   DTO   ITO    CSR    CR
0.005 0.229 0.005  0.051  0.535
```

Loadings:

	Factor1	Factor2
ROA	0.996	
DTO	-0.153	-0.864
ITO	0.624	0.778
CSR	0.952	0.209
CR		0.678

	Factor1	Factor2
SS loadings	2.316	1.859
Proportion Var	0.463	0.372
Cumulative Var	0.463	0.835

Test of the hypothesis that 2 factors are sufficient. The chi square statistic is 0.65 on 1 degree of freedom. The p-value is 0.419

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