

# Working Capital Management and Profitability: A Sensitivity Analysis

Arunkumar O.N & T. Radha Ramanan

Department of Mechanical Engineering, National Institute of Technology Calicut, Calicut 673601, Kerala, India  
E-mail : arunkumar\_pme09@nitc.ac.in, radha\_ramanan@nitc.ac.in

*Abstract – This paper analyzes the effect of working capital management on the profitability of manufacturing firms. The data analysis was carried for 1198 manufacturing firms listed in Centre for Monitoring Indian Economy for a period of 5 years. The relationship of debtor’s days, inventory days, creditor’s days, current ratio, ratio of current liability to total assets, assets turnover ratio, financial assets to total assets, and size with return on assets employed is analyzed in this study. The authors apply correlation analysis and group wise weighted least squares regression analysis to identify the effects of these variables on profitability. The correlation analysis shows that the firms’ profitability is highly influenced by the variables relating to assets. We find a positive relationship between profitability and debtors’ days and inventory days. Creditor’s days shows a significant positive relationship. We conduct sensitivity analysis to find out the range of return on assets to the given level of independent variables*

*Keywords – working capital management, manufacturing firms, profitability, correlation analysis, regression analysis, sensitivity analysis.*

## I. INTRODUCTION

Today, business is expanding at a rapid pace with changing needs. Business plays a vital role in the capital formation of a country, and people consider it the life blood of a growing economy. Therefore, it is very important to manage business effectively and efficiently. One of the major issues encountered by fund managers today is not just the procurement of funds but also their meaningful deployment to generate maximum returns. Working Capital Management (WCM) is an important corporate financial decision since it directly affects the liquidity and profitability of the firm. Working capital management efficiency is vital especially for manufacturing firms, where a major part of assets is composed of current assets [1].

Working capital ratios are useful tools in appraising the financial strength and immediate solvency of a

company. The financial analyst must rely on these ratios. From an operational point of view, however, the financial manager’s primary concern is with the current cash flows and those flows expected in the near future. An examination of the combination of working capital ratios and cash flows are helpful to identify the relevant factors affecting the management of working capital.

Specific research studies exclusively on the impact of WCM on profitability of manufacturing firms are scanty, especially for the case of India. Keeping this in view and the wider recognition of the potential contribution of the manufacturing sector to the economy of developing countries, the following objectives have been made for the study

- To make a panel data analysis of the manufacturing firms listed in Centre for Monitoring Indian Economy (CMIE) for a period of 5 years
- To study the variables affecting the profitability of the Indian firms
- To establish a relationship between the profitability and the variables affecting the manufacturing firms
- To conduct the sensitivity analysis of the variables considered.

The rest of the paper is organized as follows: Section II looks at the relevant literature. The data and the variables are explained in section III. Section IV explains the empirical analysis and its interpretation, by providing the results of descriptive statistics, correlation analysis, regression analysis and sensitivity analysis. Section V gives the conclusion.

## II. LITERATURE REVIEW

Smith [2] identified eight major approaches taken towards the management of the working capital. Efficiency of working capital management is based on

the principle of speeding up collections as much as possible and slowing down disbursements as much as possible. This working management principle, based on the traditional concepts of the cash conversion cycle introduced by Richards and Laughlin[3], is a powerful performance measure for assisting how well a company is managing its working capital.

As a part of a study of the fortune 500s financial management practices, Gilbert and Reichert [4] found that account receivable management models are used in 59% of these firms to improve WCM projects, while, inventory management models were used in 60% of the companies. Shamsud and James [5] analyze the content and process of turnaround strategies in smaller manufacturing firms. Weinraub and Visscher [6] observe a tendency of firms with low levels of current ratios to have low levels of current liabilities. Shin and Sonen [7] found a strong negative relation between the cash conversion cycle and corporate profitability for a large sample of listed American firms for the 1975-1994 periods. Howorth and Westhead [8] examined working capital management routines of a large random sample of small companies in the UK.

Deloof [9] investigates the relation between WCM and corporate profitability of 1,009 large Belgian non financial firms. From the studies conducted to identify the trends in WCM and its impact on Mauritian small manufacturing firms, Pandachi, [10] identify that the working capital needs of an organization changes over time as does its internal cash generation rate. Raheman and Nasr [11] conducted a study to analyze the relationship between WCM and profitability in case of Pakistani firms. The result shows that, there is a strong negative relationship between variables of WCM and profitability of the firm. The firms can increase their profitability by reducing investment on accounts receivable and inventories to a reasonable minimum, indicated by the benchmarks for their industry [12].

The analysis of WCM of Nigerian firms shows that a well designed and implemented working capital management is expected to contribute positively to the creation of firm's value [13]. The study conducted by Olufisayo [14] show that sales growth, cash conversion cycle, account receivables and inventory period affect firm positively, while leverage and account payable affect firm profitability negatively. In another study of selected firms in Nigerian shows that firm's profitability is reduced by lengthening the number of day's accounts receivable, number of days of inventory and number of days accounts payable. The result shows that shortening the CCC improves the profitability of the firms [15]. The study on Kenyan firms suggest that more profitable firms takes the shortest time to collect cash from their customers and high inventory levels reduce costs of

possible interruptions in the production process and loss of business due to scarcity of products. The study also reveals that the longer a firm takes to pay its creditors, the more profitable it is [16]. The analysis of a sample of 88 American firms listed on New York Stock Exchange for a period of 3 years from 2005 to 2007 found statistically significant relationship between the cash conversion cycle and profitability, measured through gross operating profit. It follows that managers can create profits for their companies by handling correctly the cash conversion cycle and by keeping accounts receivables at an optimal level [17]. Hofmann and Kotzab [18] developed and discussed a supply chain-oriented approach of working capital management by considering the shareholder value added (SVA) as the main performance measure. The opportunities of the collaborative cash to cash cycle approach represent areas for further improvement for companies and supply chains that could only be superficially touched on this analysis

The above discussion clearly implies the importance of working capital management (WCM) in determining the firm's success. The present work tries to identify the various factors of working capital management influencing profitability of manufacturing firms in India.

### III. DATA AND VARIABLES

This study uses financial statements of executive summary, assets and liability statements of manufacturing firms listed in Centre for Monitoring Indian Economy (CMIE) for a period of 5 years (i.e. 2005-06 to 2009-10). The data was collected for 1211 firms and the firms with the 1% outlying values for Debtors Days (DTRDAYS), Inventory Days (INVDAYS), and Creditors Days (CTRDAY) were left out. Thus the samples size consists of a balanced panel set of 5990 firm year observations of 1198 firms.

Return on assets (ROA), the dependent variable, is taken as a proxy for profitability. ROA is computed as Profit before depreciation tax accounts divided by total assets. Table I presents the independent variables, notations and its calculation methods used in the analysis.

Table I. Variables Used in the Analysis

No	Variable	Notations	Calculation Method
1	Debtors Days	DTRDAYS	[accounts receivable * 365] / Sales.(It is taken from executive summary of the firms)

2	Inventory Days	INVDAYS	[Inventories*365] / Cost of goods sold
3	Creditors Days	CTRDAYS	[accounts payable*365]/ Cost of goods sold. (It is taken from executive summary of the firms)
4	Current Ratio	CR	Current Assets / Current Liability
5	Ratio of Current Liability to Total Assets.	CLTOTA	Current Liability/ Total Assets
6	Financial Assets to Total Assets	FATOTA	Financial Assets / Total Assets
7	Size	SIZE	Natural Logarithm of Total Assets
8	Assets Turnover Ratio	ATR	Sales/total asset

IV. DATA ANALYSIS AND INTERPRETATION

A. Descriptive Statistics

Table II shows the descriptive statistics. The firm receives the payment on sales after an average of 65.49days with median 51.26 days.

Table II. Descriptive Statistics

Variables	Mean	Minimum	Median	Maximum	Std. Dev
DTRDAYS	65.49	0.00	51.26	3174.30	90.00
INVDAYS	73.97	0.00	58.27	4584.80	100.26
CTRDAYS	81.83	0.00	64.20	4610.60	122.44
CR	3.76	-1.28	2.26	1080.00	17.24
CLTOTA	0.31	-0.20	0.21	144.22	1.98
FATOTA	.03513	-.00044	0.00053	56.27060	0.76002
SIZE	5.13	-3.22	5.07	12.43	1.71
ATR	1.30	0.00	1.02	384.74	5.29
ROA	0.14974	-2.3134	0.093702	118.78	1.5888

Firms take on average 73.97 days (median is 58.27) to convert the raw materials and sell the finished goods inventory and firms take on an average 81.83days (with median 64.20days) to pay purchases. The analysis of

Indian manufacturing firms shows that the firms giving less credit period to the customers in comparison with what they are enjoying. CR is the traditional measure of liquidity. It indicates the availability of current assets in rupees for every one rupee of current liability. The industry has a high liquidity with the average current ratio being 3.76. For manufacturing firms, the current liabilities are 31% of total assets. Sales are 1.3 times the total assets employed. Financial assets employed in the firm are only an average of 3.5% of the total assets. The size of the company is calculated as the logarithm of total assets. The mean value of ATR shows that sales of the firms are on an average of 1.3 times of the total assets. For most of the manufacturing firms in India, the sales are equal to the total assets employed by the firm. Ratio of Profit to total assets is 0.1496. That is profit is 14.96% of the total assets employed.

B. Correlation Analysis

Table III presents correlation coefficients at 5% critical value (two tailed) (=0.0253) for all variables considered. There is a negative relation between ROA and measures of working capital management such as DTRDAYS, INVDAYS and CTRDAYS. This is consistent with the view that, when we consider the variables independently, the time lag between the expenditure for the purchase of raw materials and the collection of sales of finished goods can be too long, and that decreasing this time lag increases profitability.

ROA shows a negative correlation with current ratio implies that profitability and liquidity are inversely related. ROA shows a positive correlation with CLTOTA, FATOTA and ATR. So, these variables have high influence on the return on assets. Size of the firm shows a negative correlation with ROA. The correlation analysis shows that the firms' profitability is highly influenced by the variables relating to assets.

C. Regression Analysis

Regression analysis is used to estimate the causal relationship between profitability and the other chosen variables. The determinants of corporate profitability are estimated by using group wise weighted least squares.

This study uses panel data regression analysis of cross-sectional and time series data. The specific forms of the models used for the linear regression analysis are as follows:

$$ROA_{it} = \beta_0 + \beta_1 DTRDAYS_{it} + \beta_2 INVDAYS_{it} + \beta_3 CTRDAYS_{it} + \beta_4 CR_{it} + \beta_5 CLTOTA_{it} + \beta_6 FATOTA_{it} + \beta_7 SIZE_{it} + \beta_8 ATR_{it} + \epsilon_{it} \tag{1}$$

Where

$\beta_0$  = Intercept of the equation

$\beta_1, \beta_2, \dots, \beta_6$  = Coefficient of the variables

$\varepsilon$  = Error tem

$i$  = Number of firms, 1 to 1198.

$t$  = Time period, 1 to 5.

The pooled ordinary least squares (OLS) regression model shows heteroskedasticity. Because of heteroskedasticity, t-test and F – test fail. To counter this problem, it is recommended, the analysis is conducted by using Weighted Least Squares [19]. It is a generalized least squares technique using weight. We conduct group wise weighted least squares. Weights are based on per unit error variance. Each unit will be used to estimate the model and the standard error of regression  $\sigma_i$  is calculated. Then each sub sample is weighted by the reciprocal of its estimated variance, which is the squared value of  $1/\sigma_i^2$  [20]. In this analysis the total number of units is 1198. Weights are calculated as follows:

1. The model is estimated for each company as given in (1), for  $i=1$  and  $t= 1$  to 5.
2. Calculate the standard error of regression for company 1.
3. Each sub sample (sub samples are: Sub sample 1 corresponding to  $i=1$  and  $t=1$  and sub sample 2 corresponds to  $i=1$  and  $t=2$ , likewise) is weighted by the reciprocal of its estimated variance.
4. Conduct step 1 to 3 for all 1198 companies.

The model for the analysis to be

$$\frac{ROA_{it}}{\sigma_i^2} = \beta_0 \left(\frac{1}{\sigma_i^2}\right) + \beta_1(DTRDAYS_{it}/\sigma_i^2) + \beta_2(INVDAYS_{it}/\sigma_i^2) + \beta_3(CTRDAYS_{it}/\sigma_i^2) + \beta_4(CR_{it}/\sigma_i^2) + \beta_5(CLTOTA_{it}/\sigma_i^2) + \beta_6(FATOTA_{it}/\sigma_i^2) + \beta_7(SIZETA_{it}/\sigma_i^2) + \beta_8(ATR_{it}/\sigma_i^2) + (\varepsilon_{it}/\sigma_i^2) \tag{2}$$

Table III. Correlation Matrix

	DTRDAYS	INVDAYS	CTRDAYS	CCC	CR	CLTOTA	FATOTA	SIZETA	ATR	ROA
DTRDAYS	1.0000	0.0305	0.5610	0.1863	0.0133	0.0041	-0.0022	-0.0997	-0.0429	-0.0170
INVDAYS		1.0000	0.1715	0.6268	0.0347	-0.0148	-0.0066	0.0072	-0.0355	-0.0102
CTRDAYS			1.0000	-0.4185	-0.0532	0.0362	0.0065	0.0219	-0.0289	-0.0048
CR					1.0000	-0.0176	-0.0024	-0.0810	-0.0082	-0.0062
CLTOTA						1.0000	0.8990	-0.0372	0.9156	0.9298
FATOTA							1.0000	-0.0033	0.8954	0.9222
SIZETA								1.0000	-0.0464	-0.0204
ATR									1.0000	0.9334
ROA										1.0000

The analyses are conducted for (2) using Gretl software. Table IV shows the results of regression analysis. The coefficient of DTRDAYS is positive and implies that an increase in the number of days of accounts receivable by one day is associated with an increase of return on assets by 0.001%. Profitability and number of days of inventories (INVDAYS) has positive relationship with 99 percentage level of significance. This means that the increase in number of days of inventory will lead to increase in profitability and vice versa.

Table IV. Group wise Weighted Least Squares

Variables	Coefficient	std. error	t-ratio	p-value
Const	-0.0829744	0.00372311	-22.29	9.17e <sup>-106</sup> ***
DTRDAYS	1.34699e <sup>-05</sup>	1.31506e <sup>-05</sup>	1.024	0.3057
INVDAYS	0.000100219	1.08354e <sup>-05</sup>	9.249	3.08e <sup>-020</sup> ***
CTRDAYS	-0.000226323	1.53868e <sup>-05</sup>	-14.71	3.89e <sup>-048</sup> ***
CR	0.000250566	8.34307e <sup>-05</sup>	3.003	0.0027 ***
CLTOTA	0.230537	0.00647774	35.59	8.42e <sup>-252</sup> ***
FATOTA	0.569255	0.0156845	36.29	7.38e <sup>-261</sup> ***
SIZETA	0.00838910	0.000414112	20.26	2.62e <sup>-088</sup> ***
ATR	0.0761103	0.00182781	41.64	0.0000 ***

The regression model shows that CTRDAYS is inversely related to profitability. The relationship is also found significant at 99 percentages. Long number of days of accounts payable led the firm to a low level of profitability and vice versa. An alternate explanation is less profitable firms wait longer to pay their bills. ROA is positively related with all other variables with 99 percentage significance.

The F test proves that there is no possibility of getting zero values for all regression coefficients of variables or there is a possibility that at least one regression coefficient will get more than a zero value. The F test shows that the model has the possibility of predicting ROA with a high significant level since the p value is (0.00). The adjusted R<sup>2</sup> of the regressions are 64%, means that 64% of variability in variances are explained by the model.

A. Sensitivity Analysis

Sensitivity analysis is conducted to analyze the upper and lower bound of the coefficients of variables. By analyzing the lower and upper bound, we can identify the range of the dependent variable with respect to the lower and upper bound of the independent variables. Table V shows the results of sensitivity analysis at 95% confidence interval.

Table V. Sensitivity Analysis

VARIABLE	95% CONFIDENCE INTERVAL	
	Lower Bound	Upper Bound
Const	-0.0902730	-0.0756757
DTRDAYS	-1.23100e <sup>-005</sup>	3.92498e <sup>-005</sup>
INVDAYS	7.89781e <sup>-005</sup>	0.000121460
CTRDAYS	-0.000256487	-0.000196160
CR	8.70119e <sup>-005</sup>	0.000414120
CLTOTA	0.217839	0.243236
FATOTA	0.538508	0.600002
SIZETA	0.00757729	0.00920091
ATR	0.0725271	0.0796934

From the analysis, the lower bound and upper bound of ROA can be calculated by the (3) and (4) respectively.

$$ROA_{it} \text{ (Lower Bound)} = -0.0902730 - 1.23100e^{-005} DTRDAYS_{it} + 7.89781e^{-005} INVDAYS_{it} - 0.000256487 CTRDAYS_{it} + 8.70119e^{-005} CR_{it} + 0.217839 CLTOTA_{it} + 0.538508 FATOTA_{it} + 0.00757729 SIZE_{it} + 0.0725271 ATR_{it} + \epsilon_{it} \tag{3}$$

$$ROA_{it} \text{ (Upper Bound)} = -0.0756757 + 3.92498e^{-005} DTRDAYS_{it} + 0.000121460 INVDAYS_{it} - 0.000196160 CTRDAYS_{it} + 0.000414120 CR_{it} + 0.243236 CLTOTA_{it} + 0.600002 FATOTA_{it} + 0.00920091 SIZE_{it} + 0.0796934 ATR_{it} + \epsilon_{it} \tag{4}$$

To explain the effectiveness of sensitivity analysis, we consider the data for Siyarm Silk Mills LTD for the five financial years 2005 -2006 to 2009- 2010. The data of the company is given in Appendix I.

We find that the lower bound and upper bound of ROA calculated from (3) and (4) is in between the actual ROA for period under consideration. Table VI shows the lower bound ROA, actual ROA and upper bound of ROA.

Table VI. Group wise Weighted Least Squares

Period	Lower Bound ROA	Actual ROA	Upper Bound ROA
2005-06	0.092247536	0.123425	0.141518701
2006-07	0.081719451	0.096709	0.130087067
2007-08	0.05779893	0.060744	0.106037613
2008-09	0.071274184	0.074235	0.119966239
2009-10	0.105599685	0.143672	0.156798221

V. CONCLUSION

The analyses are conducted to identify the effects of short term financial management on short term and long term investments. The descriptive and regression analyses have identified critical management practices and are expected to assist managers in identifying areas where they might improve the financial performance of their operation.

The study has been conducted on manufacturing industries, irrespective of the business differences. The findings of the analysis show a positive relationship between return on assets and debtors' days and inventory days. Creditors' days shows a significant negative relationship with return on assets. The negative relationship between creditors days and profitability suggest that long number of days of accounts payable leads the firm to a low level of profitability and vice versa. The sensitivity analysis can suggest the range of return on assets with the given independent variables.

## VI. REFERENCES

- [1] Van Horne, J. C. & J. M. Wachowicz. *Fundamentals of Financial Management*. (Prentice Hall Inc.), 2000.
- [2] Smith K. V, "State of the art of working capital management", *Financial Management Autumn*, pp.50-55, 1973.
- [3] Richard V.D and Laughlin E.J, "A Cash Conversion Cycle Approach to Liquidity Analysis", *Financial Management*, Vol. 9, Issue 1, pp.32-38, 1980.
- [4] Gilbert E. and Reichert A, "The Practice of Financial Management among Large United States Corporations", *Financial Practice and Education*, Vol. 5, Issue 1, pp. 16-23, 1995.
- [5] Shamsud D. Chowdhury and James R. Lang, "Turnaround in Small Firms: An Assessment of Efficiency Strategies", *Journal of Business Research*, Vol. 36 Issue 2, pp.169-178, 1996.
- [6] Weinraub H. and Visscher S, "Industry Practice Related to Aggressive / Conservative Working Capital Policies", *Journal of Financial and Strategic Decisions*, Vol.11, Issue 2, pp. 39-46, 1998.
- [7] Shin H. H. and Soenen L, "Efficiency of Working Capital and Corporate Profitability", *Financial Practice and Education*, Vol. 8, Issue 2, pp.37-45, 1998.
- [8] Carole Howorth and Paul Westhead, "The Focus of Working Capital Management in UK Small Firms", *Management Accounting Research*, Vol. 14, pp. 94-111, 2003.
- [9] Deloof, D, "Does Working Capital Management affect Profitability of Belgian Firms?", *Journal of Business Finance and Accounting*, Vol. 30 Issue (3&4), pp. 573-587, 2003.
- [10] KeseevanPandachi, "Trends in Working Capital Management and Its Impact on Firm's Performance: An analysis of Mauritian Small Manufacturing Firms", *International Review of Business research papers*, Vol.2, Issue 2, pp. 45-58, 2006.
- [11] Abdul Raheman and Mohamed Nasr, "Working Capital Management and Profitability-Case of Pakistani firms", *International Review of Business Research Papers*, Vol. 3, pp. 279-300, 2007.
- [12] Pedro Juan Garcia-Teruel and Pedro Martinez-Solano, "Effects of Working Capital Management on SME Profitability", *International Journal of managerial finance*, Vol. 3, Issue2, pp. 164-177, 2007.
- [13] Sunday. E. Ogundipe, Abiola Idowu and Lawrencia. O. Ogundipe, "Working Capital Management, Firms' Performance and Market Valuation in Nigeria", *International Journal of Social and Human Sciences*, 6, pp. 143-147, 2012.
- [14] Akinlo, Olayinka Olufisayo, "The Effect of Working Capital on Profitability of Firms in Nigeria: Evidence from General Method of Moments (GMM)", *Asian Journal of Business and Management Sciences*, Vol. 1, No. 2, pp. 130-135, 2011.
- [15] Akinlo, Olayinka Olufisayo, "Effect of Working Capital on Profitability of Selected Quoted Firms in Nigeria", *Global Business Review*, Vol. 13, No.3, pp. 367-381, 2011.
- [16] David M. Mathuva, "The influence of Working Capital Management Components on Corporate Profitability: A Survey on Kenyan Listed Firms", *Research Journal of Business Management*, Vol.4, No. 1, pp. 1-11, 2010.
- [17] Amarjit Gill, Nahum Biger and Neil Mathur, "The Relationship between Working Capital Management and Profitability: Evidence from the United States", *Business and Economics Journal*, Volume 2010: BEJ-10, pp. 1-9, 2010.
- [18] Erik Hofmann and Herbert Kotzab, "A Supply Chain Oriented Approach of Working Capital Management", *Journal of Business Logistics*, Vol. 31, No. 2, pp. 305-330, 2010.
- [19] Wooldridge Jeffrey M. *Introductory Economics: A Modern Approach*. (SOUTH-WESTERN CENGAGE Learning), 2004.
- [20] Lee C. Adkins. *Using gretl for Principles of Econometrics*, 4th Edition Version 1.0411. 2012.

Appendix I. Data for Siyarm Silk Mills LTD

Period	DTR DAYS	INVDAYS	CTR DAYS	CR	CLTO TA	FATOTA	SIZE	ATR
2005-06	69.22	60.72011	48.06	2.963079	0.201825	0	5.757987	1.420858
2006-07	80.3	53.39902	43.85	3.013746	0.184857	$2.47e^{-05}$	6.004726	1.295604
2007-08	99.1	76.83579	45.84	3.650663	0.155734	0.001673	6.182415	1.006403
2008-09	85.61	68.80126	49.13	3.07196	0.176917	0	6.121571	1.16614
2009-10	64.17	51.9286	57.74	2.000324	0.255913	0.009647	6.177944	1.3711

