

Providing a New Model for Assessment of Working Capital Management: Evidence from Tehran Stock Exchange

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Abstract

Working Capital Management (WCM) is one of the key facets of financial management and organization management, for the direct effect it has on company liquidity and profitability. There is a probability of bankruptcy for companies with poor working capital management despite generation of positive return. Current paper explains the relationship of WCM with profitability-based indicators at the hand of a new model. For this purpose, 90 listed companies on Tehran Stock Exchange whose financial data for the period 2008 through to 2012 was available were selected. The results do not confirm significant inverse U-shape relationship of Cash Conversion Cycle (CCC) and Net Working Capital to Total Assets (NWC/TA) as indicators (predictors) of working capital with Return on Assets (ROA), but do indicate a significant inverse U-shape relationship of current ratio and quick ratio with ROA. From the findings, one might infer that each industry has its own optimum current and quick ratios maximizing its return.

Keywords: Working capital management (WCM), Cash Conversion Cycle (CCC), Current Ratio, Quick Ratio

1. Introduction

Working capital includes business unit's current assets and liabilities which due to sensitivity to core business activities are constantly on the change. Purchase and sales of goods, collection of accounts receivable, and payment of accounts payable contribute to either decrease or increase of different asset or liability items, or mutation in working capital. The ultimate purpose and the core function of a business unit is maximization of the firm value and shareholder wealth. Hence, all factors which influence achievement of this goal should be brought under control of the firm management. Changes in working capital are among these factors which contribute to this purpose.

WCM, profiting from a variety of tools, while tries to prevent disruption in the course of the core operation, helps improvement of the business unit core operation and profitability. Major components of working capital are cash, accounts receivable, inventory, and accounts payable which influence quality of business unit liquidity. The tools used by WCM include collection of accounts receivable as quick as possible, reduction in level of the invested resources on inventory as much as possible, and payment of accounts payable as slow and as late as possible. Of course, in use of these tools certain limits should be observed. Thus, a trade-off should be made between reduction of collection period and loss of credit customers, reduction of inventory cycle and letting go of sales opportunities (by running out of stock), and between extended length of payment period and losing one's trade credit and good name with suppliers.

One commonly used measure for evaluation of WCM is cash conversion cycle (CCC) which refers to the time interval between making expenses for purchase of raw materials and collection of the amounts on goods sold. The longer this interval takes, the more investment is made on working capital. A long CCC may, by increase of sales, result in higher return on assets. However, if costs of more investment on working capital exceed benefits from holding more inventories or granting more trade credit to customers, with increase of CCC, profitability of the business unit may decline.

To explain WCM in the Iranian companies on Tehran Stock Exchange (TSE), current paper provides a new model in which WCM is explored by examining CCC, current ratio, quick ratio, and NWC/TA in relation to ROA.

2. Research background

Mark Deloof[4] investigated the relationship of WCM with profitability on a sample consisted of 1009 non-financial Belgian companies during 1992-1996. He used number of days for collection of accounts receivable, inventory conversion cycle, and payment of accounts payable as indicators of trade credit and inventory procedures. In addition, he employed CCC as a comprehensive measure for evaluation of WCM, and gross profit as the indicator of profitability. The results of this study indicated lack of a significant relationship between profitability and CCC and a negative and significant relationship between accounts receivable collection period, inventory conversion cycle, and accounts payable payment period, and suggested that managers could increase profitability of their companies by reducing collection period and inventory conversion cycle.

Lazaridis and Tryfonidis[15], in a study on the relationship between WCM and profitability in the listed companies on Athens Stock Exchange (ASE), used CCC as the indicator of WCM, and operating income (OI) as the indicator of profitability. The result was a negative relationship between CCC and profitability which statistically was significant. Given the CCC model, the management by reducing accounts receivable collection period, extending accounts payable payment period and inventory conversion period succeeded in boosting profitability in the understudy companies.

Garcia and Martinez [7] examined the assumed significant effect of WCM on profitability of small and medium enterprises. They demonstrated that the companies' use of trade credit increased length of their payment period meanwhile cut down on their CCC and enhanced their ROA.

Hassanpour[10] examined the effect of WCM strategies on share return (defined as value appreciation per share relative to its price in the beginning of the period) on TSE. The results indicated significant difference in share return by different policies, where aggressive WCM policy had the highest return in the whole industry.

Dong and Su [6] in the study of the relationship between profitability and WCM in the listed companies on Vietnam's Stock Exchange chose gross profit as the indicator of profitability and CCC and its components as the indicators of working capital. The results indicated negative relationship of CCC, collection period, and inventory conversion cycle with profitability, and a positive relationship between payment period and profitability.

Gill et al [8], expanding on the findings of other researchers, examined the relationship of WCM with profitability in 88 listed companies on the NYSE for the period 2005 through to 2007. They held gross profit as the indicator of profitability and CCC and its constituents as the indicators of working capital. Their findings suggested negative and significant relationship of collection period with profitability, positive and significant relationship of CCC with profitability, and lack of any significant relationship between inventory conversion cycle and payment period on the one side, and profitability on the other side.

Caballero et al [2] examined the relationship between WCM and profitability in the small- and mid-sized Spanish companies. They used CCC as the indicator of WCM and ratio of operating income (profit) as the profitability indicator. Their results suggested a non-linear quadratic relationship between the two variables, indicating that the companies had an optimum level of working capital at which the company's profitability is maximized and a deviation from the optimum level would reduce its profitability.

Bieniasz and Golas[3] studied the influence of WCM on profitability of the food industry enterprises in Poland and the new Euro Zone member states. The results of this study suggested that the food industry with a shorter CCC helps achieving a higher rate of return (profit making).

Azam and Haidar[1] examined the impact of WCM on performance of the non-financial companies on Karachi Stock Exchange (KSE). The results indicated WCM impact on firm performance, suggesting that the company managers could raise their shareholder value by cutting down on the size of inventory, CCC, and net trading cycle.

Kaddumi and Ramadan [12], in the study of the effect of WCM on performance of the industrial firms listed on Amman Stock Exchange (ASE), found average collection period and average inventory cycle to be negatively correlated to profitability.

Kofi Akoto et al [14] in their research, Working Capital Management and Profitability of Ghanaian listed manufacturing firms, suggested positive and significant effect of CCC, current asset, and current asset turnover on profitability.

Jayarathne[11] in his study, Impact of Working Capital Management on Profitability of the Sri Lankan listed companies, suggested profitability to be negatively related to accounts receivable collection period, inventory conversion cycle and CCC.

Khodaei and Falahati[13] in a study titled “Relationship of Cash Conversion Cycle and Profitability in the Listed Companies on Tehran Stock Exchange” reported lack of a significant association between profitability (ratio of net operating profit to sales) and CCC. However, they maintained that a deviation from optimum level of CCC would inversely and significantly affect profitability, i.e. when a firm recedes from CCC optimum level, its profitability declines.

3. Research hypotheses

To investigate WCM (by its facets) in the Iranian companies, the following hypotheses are made:

First hypothesis: there is an inverse U-shape relationship between cash conversion cycle (CCC) and return on assets (ROA).

Second hypothesis: there is an inverse U-shape relationship between current (CR) ratio and return on assets (ROA).

Third hypothesis: there is an inverse U-shape relationship between Quick ratio (QR) and return on assets (ROA).

Fourth hypothesis: there is an inverse U-shape relationship between net working capital to total asset (NWC/TA) and return on assets (ROA).

4. Variable measurement

4.1 Dependent variable: return on assets (ROA) is the dependent variable in this study. This indicator appeared within a system known as the Du Pont framework in the years 1980s and became recognized as a basic indicator of company performance. One of the advantages of this ratio is having managers constantly keep an eye on their operating assets next to control of costs, rate of net profit, and sales volume. In most of the prior studies, this indicator (due to its information content) has been increasingly used in relation to other profitability (performance) indicators, as is evident in the works of SamadiLargani and Fathi[17] on the relationship between ROA and shareholder value added (SVA); Hajiabasi et al [9], between shareholder return (SR) and ROA; Montazeri[16], between market adjusted return (MAR) and ROA; and Dodd and Chen [5], on the relationship of economic value added (EVA) with ROA. ROA ratio is calculated from net profit divided by average total assets.

4.2 Independent variables

Independent variables include:

- Cash conversion cycle (CCC): cash conversion cycle refers to the time interval between payment for purchase of the inventory to be used in production process and collection of the receivable amounts from sales of the finished goods. This variable is calculated using the following relation:

$CCC = \text{Average Age of Inventory (AAI)} + \text{Average Collection Period (ACP)} - \text{Average Payment Period (APP)}$

Where,

$$AAI = \frac{360}{\text{Cost of Goods Sold} / \text{Average Inventory}}$$

$$ACP = \frac{360}{\text{credit Sales} / \text{Average Accounts Receivable}}$$

$$APP = \frac{360}{\text{Cost of Goods Sold} / \text{Average Account payable}}$$

- Current ratio (CR): this ratio indicates the ability to pay back current liabilities from current assets. Its calculation formula is as follows:

$CR = \text{Current assets} / \text{Current liabilities}$

- Quick ratio (QR): this ratio indicates the extent to which company is able to pay back its short-term liabilities from highly liquid assets. It is calculated from the formula below:

$QR = \text{Current assets} - (\text{Inventory} + \text{Prepayments}) / \text{Current liabilities}$

- Net working capital to total assets (NWC/TA): the amount of working capital is an indicator which serves to identify liquidity level of a company, especially when used relative to other financial indicators and ratios. In fact, the higher this ratio is the more solvent the company will be to pay back its debts. In addition, a high NWC/TA would suggest that organization management either has not made use of outside sources or has overly held in current assets. The ratio is calculated as follows:

$NWC/TA = (\text{Current assets} - \text{Current liabilities}) / \text{Total assets}$

4.3 Control variables

Control variables are:

- Firm size (SIZE); defined as natural logarithm of assets
- Financial leverage (LEV); defined as total liabilities to total assets
- Sales growth (SGR); defined as current year sales less last year sales divided by last year sales.

For explanation of working capital management and test of the research hypotheses, the following models are produced.

The first model (first hypothesis):

$$ROA_{it} = \alpha_0 + \alpha_1 CCC_{it} + \alpha_2 CCC_{it}^2 + \alpha_3 SIZE_{it} + \alpha_4 LEV_{it} + \alpha_5 SGR_{it} + \varepsilon$$

The second model (second hypothesis):

$$ROA_{it} = \alpha_0 + \alpha_1 CR_{it} + \alpha_2 CR_{it}^2 + \alpha_3 SIZE_{it} + \alpha_4 LEV_{it} + \alpha_5 SGR_{it} + \varepsilon$$

The third model (third hypothesis):

$$ROA_{it} = \alpha_0 + \alpha_1 QR_{it} + \alpha_2 QR_{it}^2 + \alpha_3 SIZE_{it} + \alpha_4 LEV_{it} + \alpha_5 SGR_{it} + \varepsilon$$

The fourth model (fourth hypothesis):

$$ROA_{it} = \alpha_0 + \alpha_1 NWC/TA_{it} + \alpha_2 NWC/TA_{it}^2 + \alpha_3 SIZE_{it} + \alpha_4 LEV_{it} + \alpha_5 SGR_{it} + \varepsilon$$

In each of the above models, given the research hypotheses, we expect α_1 to be significantly positive and α_2 to be significantly negative in which case the relationship of the independent variables with return on assets will be that of an inverse U-shape.

5. Research methodology

This study aims to explore WCM in the listed companies on TSE operating in one of the chemical, automotive and auto parts, machineries and equipment, pharmaceutical, food, and mining industries for the period 2008 through to 2012. This is an applied research, with semi-experimental design and post-event approach. For sampling, it is made use of discretionary (systematic elimination or filtering) method based on the following criteria:

1. The company had been admitted to the stock exchange before 2008;
2. Financial period of the company ended on 21 march; and
3. The company shares in the last quarter of the financial year had been at least once traded.

Considering the above criteria, 90 companies were selected (of which, 16, 20, 14, 15, 12, and 13 companies were from chemical, automotive and auto parts, machinery and equipment, pharmaceutical, food, and mining industries, respectively).

Research data were taken from the Rahavard-e-Novin integrated database. The collected data using Excel software were organized as information files. Next, the respective variables were calculated and finally processed in SPSS environment. For test of the research hypotheses, multiple regression analysis was applied.

6. Findings

6.1 Descriptive statistics

To get a better insight into the nature of the understudy population and become more acquainted with the research variables, before analysis of the statistical data, a preliminary general description of their features and characteristics is often required. Besides, data statistical description is a necessary step towards identification of their overall pattern which lays the foundation for further exploration of the existing relationships between research variables. The research descriptive statistics are summarized in table 1.

Table 1: Results of the descriptive statistics

Variables		Minimum	Maximum	Mean	Standard division
Independent	CCC	-271.20	484.67	102.4	104.47
	CR	.28	4.70	1.29	.85
	QR	.06	3.71	.80	.44
	NWC/TA	-2.56	.86	.07	.45
Control	SIZE	10.03	15.58	13.32	1.51
	LEV	.16	1.94	.67	.23
	SGR	-.68	1.73	.13	.29
Dependent	ROA	-40.32	62.04	8.30	13.12

6.2 Test of hypotheses

First hypothesis: there is an inverse U-shape relationship between cash conversion cycle (CCC) and return on assets (ROA).

The results of the regression analysis for the first hypothesis are summarized in table 2.

Table 2: The results of the analysis for Model 1

Model 1	Automotive	Chemical	Machinery	Medical	Food	Mining	Firm total
a_0	20.107***	27.216***	18.599	36.687**	-1.449	50.909***	25.108***
CCC	.256*	-.088	.228	-.250	.022	.140	-.061
CCC ²	.142	.174	-.047	-.025	-.382	.126	.001
SIZE	.184***	.159*	.015	.096	.160	.150	.090**
LEV	.729***	-.839***	-.557***	-.846***	-.453*	-.627***	-.667***
SGR	.256***	.144*	.309**	.103	.240	.281***	.258***
F	26.519***	21.295***	4.90***	44.132***	2.848**	10.685***	68.089***
Sig	.000	.000	.002	.000	.028	.000	.000
R ² (Adj. -R ²)	.585(.563)	.663(.632)	.434(.345)	.818(.800)	.267(.174)	.484(.439)	.490(.482)

*. At the significance level of .10, **. At the significance level of .05, ***. At the significance level of .01

According to the results and F-test statistic in the above table, the estimated model in all industries is statistically significant (Sig. < 0.05). But, considering the sign of CCC² regression coefficients, the inverse U-shape relationship between CCC and ROA cannot be accepted.

Second hypothesis: there is an inverse U-shape relationship between CR and ROA.

The obtained results from the regression analysis of the second hypothesis are provided in table 3.

Table 3: The results of the analysis for Model 2

Model 1	Automotive	Chemical	Machinery	Medical	Food	Mining	Firm total
a_0	6.645	9.081	-88.704***	19.460	-40.879*	30.305**	5.610
CR	7.684	21.14***	41.646	-3.993	56.62***	17.037**	13.642***
CR ²	-1.816	-4.484***	-6.851***	4.481	-27.615***	-2.625	-3.081***
SIZE	.826***	.779	2.817**	1.275	1.751	-2.485**	.766***
LEV	-28.434***	-43.984***	18.745	-38.542**	-6.91	-14.929*	-30.391***
SGR	7.162***	6.63**	7.663**	6.675**	11.796**	11.244***	10.549***
F	25.24***	28.832***	9.108***	35.919***	6.174***	15.050***	77.613***
Sig	.000	.000	.000	.000	.000	.000	.000
R ² (Adj. -R ²)	.573(.550)	.727(.702)	.587(.523)	.786(.764)	.442(.370)	.569(.531)	.522(.516)

*. At the significance level of .10, **. At the significance level of .05, ***. At the significance level of .01

Based on the test results and F-statistic in the above table, it can be inferred that the estimated model is statistically significant in all industries. Considering the sign of CR² regression coefficients, an inverse U-shape relationship between CR and ROA in chemical, machinery, food, and across industries in aggregate is confirmed. Regression equation of the chemical industry can be written as follows:

$$ROA_{it} = 21.14 CR_{it} - 4.484 CR_{it}^2 - 43.984 LEV_{it} + 6.63 SGR_{it}$$

Having the above equation differentiated, the optimum level of current ratio in this industry is obtained:

$$0 = 21.14 - 8.968 CR_{it}$$

$$CR_{it} = 2.357$$

Regression equation of the machinery industry is as follows:

$$ROA_{it} = -88.704 + 41.646 CR_{it} - 6.851 CR_{it}^2 + 2.817 SIZE_{it} + 7.663 SGR_{it}$$

By differentiating the above equation, the optimum level of current ratio for this industry is

obtained at 3.04.

Regression equation of the food industry can be written as follows:

$$ROA_{it} = -40.879 + 56.62CR_{it} - 27.615CR_{it}^2 + 11.796SGR_{it}$$

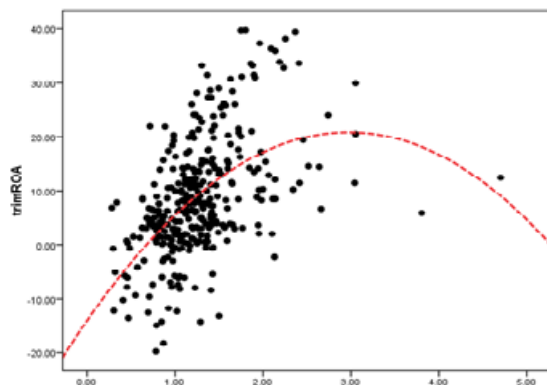
Having the above equation differentiated, the optimum level of current ratio for this industry is obtained at 1.03.

Regression equation across industries in aggregate can be written as follows:

$$ROA_{it} = 13.642CR_{it} - 3.081CR_{it}^2 + 0.766SIZE_{it} - 30.391LEV_{it} + 10.549SGR_{it}$$

Having the above equation differentiated, the overall optimum level of current ratio across industries is obtained at 2.21.

The following figure shows the scatter plot of ROA against the CR for all firms:



Third hypothesis: there is an inverse U-shape relationship between QR and ROA. The results of the regression analysis for the third hypothesis are provided in table 4.

Table 4: The results of the analysis for Model 3

Model 3	Automotive	Chemical	Machinery	Medical	Food	Mining	Firm total
a_0	18.857***	13.082	18.962	52.709***	-44.978**	38.617***	13.207***
QR	.644	21.13***	-.434	-4.746	56.74***	14.971	13.809***
QR ²	.326	-5.822***	-1.066	-2.669	-40.48***	-.728	-4.292***
SIZE	.612**	.82	.277	1.299	2.623*	-2.501**	.556**
LEV	-32.068***	-39.891***	-26.531***	-77.086***	-4.594***	-18.729***	-31.579***
SGR	7.080***	6.949**	8.734**	8.163***	15.274***	10.545***	10.015***
F	24.516***	25.37***	4.839***	35.288***	4.089***	16.152***	76.984***
Sig	.000	.000	.002	.000	.004	.000	.000
R ² (Adj. -R ²)	.556 (.543)	.701(.674)	.431(.342)	.783(.760)	.344 (.260)	.586(.550)	.520 (.513)

*. At the significance level of .10, **. At the significance level of .05, ***. At the significance level of .01

According to the test results and F-statistic in the above table, the estimated model in all industries is statistically significant, and considering the obtained sign for coefficients of the chemical, food, and all industries in aggregate, the assumed inverse U-shape relationship between QR and ROA is confirmed.

Regression equation of the chemical industry can be written as follows:

$$ROA_{it} = 20.13QR_{it} - 5.822QR_{it}^2 - 39.891LEV_{it} + 6.949SGR_{it}$$

Having the above equation differentiated, the optimum level of quick ratio is obtained at 1.73.

Regression equation of food industry can be composed as follows:

$$ROA_{it} = -44.978 + 56.74QR_{it} - 40.48QR_{it}^2 + 2.623SIZE_{it} + 15.274SGR_{it}$$

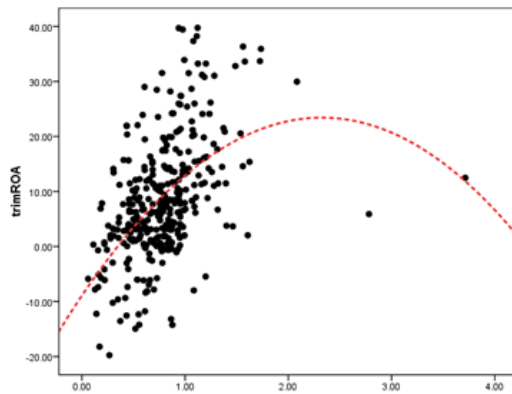
By differentiating the above equation, the optimum level of quick ratio for this industry is obtained at 0.7.

And regression equation of industries in aggregate can be written as follows:

$$ROA_{it} = 13.207 + 13.809QR_{it} - 4.292QR_{it}^2 + 0.556SIZE_{it} - 31.579LEV_{it} + 10.015SGR_{it}$$

After differentiation of the above equation, the optimum level of quick ratio across industries is obtained at 1.6.

The following figure shows the scatter plot of ROA against the QR for all firms:



Fourth hypothesis: there is an inverse U-shape relationship between NWC/TA and ROA. The results of the regression analysis for the fourth hypothesis are summarized in table 5.

Table 5: The results of the analysis for Model 4

Model 4	Automotive	Chemical	Machinery	Medical	Food	Mining	Firm total
a_0	12.274*	29.505***	-68.754***	34.291	-23.080	40.358***	16.427***
NWC/TA	4.072	8.457**	-9.795	4.733	4.981	13.418***	6.541***
NWC/TA ²	-.28	2.318	18.857***	13.208	-.547	4.609**	2.205**
SIZE	.853***	.562	2.914**	.753	2.156	-2.056*	.752***
LEV	-28.472***	-43.77***	33.377**	-49.471***	-1.33	-15.115**	-30.266***
SGR	7.146***	4.215	6.923**	6.593**	14.17**	10.777***	9.797***
F	25.322***	20.418***	9.621***	31.225***	4.415***	15.794***	73.033***
Sig	.000	.000	.000	.000	.003	.000	.000
R ² (Adj. -R ²)	.574(.551)	.654(.622)	.601(.538)	.761(.737)	.361(.280)	.581(.544)	.507(.500)

*. At the significance level of .10, **. At the significance level of .05, ***. At the significance level of .01

According to the test results and F-test statistics in the above table, the estimated model in all industries is statistically significant. However, given the obtained sign for NWC/TA^2 regression coefficients, the assumed inverse U-shape relationship between NWC/TA and ROA cannot be confirmed.

7. Discussion and conclusion

The results of present research indicate lack of an inverse U-shape relationship between CCC and NWC/TA (as the predictors of working capital) and ROA in the Iranian companies classified by industry, whereas the relationship of current ratio (CR) and quick ratio (QR) with ROA is that of a significant inverse U-shape one. Having differentiated the significant regression equations, the optimum level of current and quick ratios were found to differ from the desirable levels agreed upon by most analysts. Therefore, one might suggest that none of the current theories and models alone is universally applicable to WCM decisions in all companies. Hence, according to the research findings, a satisfactory level of current and quick ratios which earlier used to serve investors and financial institutions as a base for evaluation of WCM relative merits cannot be recommended to managers as a reliable measure to rank companies in terms of liquidity and short-term solvency. Thus, the results of the current study refute universal applicability of the desired ratios to all types of companies.

In regard to future research on working capital management, the followings suggestions are made:

- Assessment of working capital management in other industries and over longer time periods;
- Comparative study of working capital management of Iranian companies and companies from other developing countries;
- Elaborating on the current research model at the level of CCC components, i.e. (accounts receivable) collection period, inventory conversion cycle, and (accounts payable) payment period.

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