Relationship between Cash Conversion Cycle and Profitability Ratios

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Abstract

This study intends to empirically investigate the relationship between cash conversion cycle and profitability ratios for Forbes Global 2000 firms in selected industries before, during and after global financial crisis for the period of 2004-2015. The cash conversion cycle is defined as days of inventory outstanding plus days of accounts receivable outstanding minus days of accounts payable outstanding. For profitability ratios, we include return on sales and return on assets. The purpose is to better understand the relationships between important operational and financial measures of firms' survival and growth, cash flow, and profitability in different industries, using panel data analysis.

Keywords: Cash Conversion Cycle, Profitability Ratios, Forbes Global 2000 Panel Data

Introduction

Managing working capital is an important issue in corporate finance. It comprises a major portion of a financial part (Weston and Brigham, 1979). It has effects on the firm's profitability, risk, and value (Smith, 1980). In detail, working capital management contains a tradeoff between risk and profitability. Increasing the profitability tends to increase risk, and conversely, focusing on risk reduction tends to reduce potential profitability (Teruel and Solano, 2007). Cash conversion cycle is a key element in working capital management. It can reflect how much to invest in inventory and how much credit to take from suppliers (Gitman, 1974).

Prior research has analysed whether shortening the cash conversion cycle has a positive or negative effect on the firm's profitability. Numerous studies found that managing an efficient cash conversion cycle tends to lead to higher profits, suggesting its importance in corporate finance management (Jose et al., 1996; Shin and Soenen, 1998; Wang, 2002; Deloof, 2003; Lazaridis and Tryfonidis, 2006; Padachi, 2006; Teurel and Solano, 2007). Further, some studies have analysed the effect of the firms' cash conversion cycle in various industries in different countries (Raheman and Nasr, 2007; Uyar, 2009; Nobanee et al., 2011; Enqvist et al., 2014).

Different from extant studies, our study intends to empirically investigate the relationship between cash conversion cycle and profitability ratios for 'Forbes Global 2000' firms in automobile, electronic and electricity, and petrochemical industries before, during and after global financial crisis for the period of 2004-2015. Its purpose is to provide better understanding on managing cash conversion cycle in different industries and in different time periods with different characteristics.

The rest of this paper is organized as follows. In section 2, we present literature review. In section 3, we describe data and variables. In section 4, we explain the panel data analysis method use in this study. In section 5, we present and discuss analysis results. Finally, we conclude with implications and future research directions.

Literature Review

Managing working capital, typically known as inventory plus accounts receivable minus accounts payable, is an important issue for firms in corporate finance management. Firms in practice either decrease or increase working capital investment according to their policies to improve profitability. Shin and Soenen (1998) asserted that working capital management influences firms' profitability and liquidity. Jose et al. (1996) argued that active working capital management policies increase firms' profitability. Teruel and Solano (2007) found that reducing working capital investment has a positive effect on firms' profitability.

Hawawini et al. (1986) argued that firms can increase their profitability by managing the days of inventory outstanding to a reasonable minimum level. Later, Deloof (2003), by analysing large Belgian firms from 1992 to 1996, showed that these firms have improved their profitability by reducing both days of accounts receivable outstanding and days of inventory outstanding. Soenen (1993) asserted that managing effective cash conversion cycle requires taking cash inflow as fast as possible and delaying cash outflow as long as possible., Wang (2002), by studying Japanese and Taiwanese firms during 1985-1996, found that shorting cash conversion cycle increases operating performance. From these studies, we can infer that there may be industry benchmarks for firms to utilize in managing their working capital management policies.

Data and Variables

- *Data*

The data used in this study were acquired from the Datastream database, containing financial data of firms. We compiled the panel data for the period of 2004-2015 from the top 221 firms in the 'Forbes Global 2000' ranking in automobile, electronic and electricity, and petrochemical industries. Among 221 firms, 42 firms were from the automobile industry, 76 firms were from the electronic and electricity industry, and 103 firms were from the petrochemical industry. We divided the time period into three sub-periods, before (2004-2007), during (2008-2011) and after (2012-2015) the global financial crisis, in order to lessen the effect from the macro-economic conditions and better understand firms' working capital management practices in different situations.

- *Variables*

This study intends to investigate the effect of cash conversion cycle on profitability ratios before, during and after global financial crisis for the period of 2004-2015. As for dependent variables, we used widely used profitability ratios including return on sales (ROS) and return on assets (ROA).

As for independent variables, we used the three components in cash conversion cycle (CCC), which is defined as days of inventory outstanding plus days of accounts receivable

outstanding minus days of accounts payable outstanding. The days of inventory outstanding (INV) was calculated as (inventories/cost of goods sold) x 365. This indicates average inventory investment for a specific level of operations. The days of accounts receivable outstanding (AR) was calculated as (accounts receivable/sales) x 365. This represents the average number of days taken for firms to receive sales payments from customers. The days of accounts payable outstanding (AP) was calculated as (accounts payable/purchases) x 365. This means the average number of days taken for firms to pay purchases and reflects payment commitments to their suppliers (Teruel and Solano, 2007).

Additionally, we used the logarithm of assets (lnassets) and the logarithm of sales (lnsales) as control variables.

Methodology

To test the effects of cash conversion cycle (INV, AR, AP) on profitability ratios (ROS, ROA), we employed a panel data analysis method. Estimates were acquired by the following equations:

$$ROS_{it} = \beta_0 + \beta_1 INV_{it} + \beta_2 AR_{it} + \beta_3 AP_{it} + \beta_4 lnassets_{it} + \eta_i + \lambda_t + \varepsilon_{it},$$

$$ROS_{it} = \beta_0 + \beta_1 INV_{it} + \beta_2 AR_{it} + \beta_3 AP_{it} + \beta_4 lnsales_{it} + \eta_i + \lambda_t + \varepsilon_{it},$$

$$ROA_{it} = \beta_0 + \beta_1 INV_{it} + \beta_2 AR_{it} + \beta_3 AP_{it} + \beta_4 lnassets_{it} + \eta_i + \lambda_t + \varepsilon_{it}, \text{ and}$$

$$ROA_{it} = \beta_0 + \beta_1 INV_{it} + \beta_2 AR_{it} + \beta_3 AP_{it} + \beta_4 lnsales_{it} + \eta_i + \lambda_t + \varepsilon_{it},$$

where dependent variables ROS = return on sales, ROA = return on assets; independent variables INV = days of inventory outstanding, AR = days of accounts receivable outstanding, AP = days of accounts payable outstanding; control variables lnassets and lnsales = logarithm of assets and sales, and ηi (unobservable heterogeneity) = measurement of each firm's characteristic, λt = time dummy variables, εit = error terms for subscripts i = firm and t = period (Teruel and Solano, 2007).

To perform the analysis, we first test whether there is correlation between unobservable heterogeneity of each firm and independent variables of the model. If the correlation is related to fixed effect, we can get the consistent estimation through the within-group estimator. Otherwise, we can use a more efficient estimator related to random effect (Teruel and Solano, 2007). Based on the results from Hausman test (1978), we adopted the fixed effect.

Results

Table 1 through 12 show the results obtained after regressing the equations. Table 1 through 4 present the results of the automobile industry. In table 1 and 2, ROS is reduced by lengthening INV (days of inventory outstanding) of Model 2, 3 and 7 and by lengthening AR (days of accounts receivable outstanding) of Model 1, 2, 5, 6 and 8 and by lengthening AP (days of accounts payable outstanding) of Model 7. It is increased by lengthening AP of Model 6. This result shows that firms increase their profitability by reducing INV and AR. Maintaining inventories for less time improves profitability (Teurel and Solano, 2007). Regarding control variables, ROS is negatively associated with log assets in Model 1 and 4 of Table 1 and positively associated with log assets in Model 2 of Table 1. It is negatively associated with log sales in Model 5 and 8 of Table 2 and positively associated with log sales in Model 6 of Table 2.

Table 1

Independent Variables	Dependent variable = ROS			
	Model 1 (2004-2007)	Model 2 (2008-2011)	Model 3 (2012-2015)	Model 4 (2004-2015)
INV	0.045(1.53)	-0.048(-2.11)**	-0.127(-2.21)***	0.003(0.23)
AR	-0.034(-1.78)**	-0.044(-2.98)***	-0.010(-0.77)	-0.011(-1.57)
AP	-0.005(-0.23)	0.023(0.96)	-0.060(-1.48)	-0.011(-0.83)
Log Assets	-2.733(-3.75)***	3.202(2.75)***	1.888(1.32)	-1.244(-4.02)***
Log Sales				
R-squared	0.137	0.151	0.101	0.048
Observation	168	168	168	168

Notes: ROS = return on sales; INV = days of inventory outstanding; AR = days of accounts receivable outstanding; AP = days of accounts payable outstanding; *** p<0.01, ** p <0.05, * p <0.1

Table 2

Independent Variables	Dependent variable = ROS			
	Model 5 (2004-2007)	Model 6 (2008-2011)	Model 7 (2012-2015)	Model 8 (2004-2015)
INV	0.026(0.84)	-0.030(-1.31)	-0.118(-2.04)**	-0.004(-0.26)
AR	-0.040(-2.06)**	-0.033(-2.29)**	-0.005(-0.44)	-0.014(-1.98)**
AP	-0.014(-0.59)	0.038(1.70)*	-0.077(-1.86)*	-0.014(-1.10)
Log Assets				
Log Sales	-2.485(-3.44)***	3.673(4.20)***	-0.339(-0.24)	-1.176(-3.78)***
R-squared	0.123	0.151	0.088	0.045
Observation	168	168	168	168

Notes: ROS = return on sales; INV = days of inventory outstanding; AR = days of accounts receivable outstanding; AP = days of accounts payable outstanding; *** p<0.01, ** p <0.05, * p <0.1

In table 3 and 4, ROA is reduced by lengthening INV of Model 1 through 8 and by lengthening AR of all Models except Model 3. It is consistent with the results obtained by prior studies (Deloof, 2003; Shin and Soenen, 1998; Teurel and Solano, 2007). It is reduced by lengthening AP of Model 3 of Table 3 and Model 7 and 8 of Table 4. This result suggests that firms increase their profitability by reducing INV, AR and AP. Maintaining inventories for less time improves profitability (Teurel and Solano, 2007). Regarding control variables, ROA is negatively associated with log assets in Model 1 and 4 of Table 3 and positively associated with log assets in Model 2 of Table 3. It is negatively associated with log sales in Model 5 and 8 of Table 4 and positively associated with log sales in Model 6 of Table 4.

Table 3

Independent Variables	Dependent variable = ROA			
	Model 1 (2004-2007)	Model 2 (2008-2011)	Model 3 (2012-2015)	Model 4 (2012-2015)
INV	-0.173(-3.98)***	-0.142(3.63)***	-0.266(-3.97)***	-0.161(-7.61)***
AR	-0.071(-2.55)**	-0.095(3.80)***	-0.025(-1.60)	-0.045(-4.57)***
AP	0.035(0.98)	-0.077(-3.95)	-0.120(-2.58)**	-0.027(-1.49)
Log Assets	-5.647(-5.33)***	6.874(-1.94)***	-0.193(-0.12)	-2.496(-5.81)***
Log Sales				
R-squared	0.343	0.269	0.244	0.198
Observation	168	168	168	168

Notes: ROA = return on assets; INV = days of inventory outstanding; AR = days of accounts receivable outstanding; AP = days of accounts payable outstanding; *** p<0.01, ** p <0.05, * p <0.1

Table 4

Independent Variables	Dependent variable = ROA			
	Model 5 (2004-2007)	Model 6 (2008-2011)	Model 7 (2012-2015)	Model 8 (2004-2015)
INV	-0.192(-3.98)***	-0.090(-2.69)***	-0.266(-4.05)***	-0.147(-6.39)***
AR	-0.076(-2.52)**	-0.066(-3.16)***	-0.027(-1.81)*	-0.049(-4.80)***
AP	0.001(0.03)	-0.045(-1.39)	-0.094(-1.98)*	-0.038(-2.04)**
Log Assets				
Log Sales	-3.223(-2.89)***	9.771(7.67)***	2.532(1.59)	-1.001(-2.25)**
R-squared	0.242	0.453	0.259	0.149
Observation	168	168	168	168

Notes: ROA = return on assets; INV = days of inventory outstanding; AR = days of accounts receivable outstanding; AP = days of accounts payable outstanding; *** p<0.01, ** p <0.05, * p <0.1

Table 5 through 8 present the results of the electronic and electricity industry. In Table 5 and 6, ROS is reduced by lengthening INV of Model 1 through 8 and it is increased by lengthening AP of Model 3, 4, 7 and 8. This result shows that firms increase their profitability by reducing INV and by increasing AP. Maintaining inventories for less time improves profitability (Teurel and Solano, 2007). Regarding control variables, ROS is positively associated with log assets in Model 3 of Table 5. It is negatively associated with log sales in Model 5 and 8 of Table 6.

Table 5

Independent Variables	Dependent variable = ROS			
	Model 1 (2004-2007)	Model 2 (2008-2011)	Model 3 (2012-2015)	Model 4 (2004-2015)
INV	-0.138(-1.99)**	-0.169(-2.13)**	-0.289(-3.43)***	-0.122(-3.39)***
AR	-0.013(-0.43)	0.026(0.83)	0.022(0.60)	-0.006(-0.39)
AP	0.003(0.14)	-0.029(-0.92)	0.042(2.26)**	0.026(2.48)**
Log Assets	1.185(0.70)	2.333(1.16)	10.055(3.20)***	0.636(0.98)
Log Sales				
R-squared	0.021	0.030	0.224	0.026
Observation	304	304	304	304

Notes: ROS = return on sales; INV = days of inventory outstanding; AR = days of accounts receivable outstanding; AP = days of accounts payable outstanding; *** p<0.01, ** p <0.05, * p <0.1

Table 6

Independent Variables	Dependent variable = ROS			
	Model 5 (2004-2007)	Model 6 (2008-2011)	Model 7 (2012-2015)	Model 8 (2004-2015)
INV	-0.149(-2.15)**	-0.142(-1.88)**	-0.282(-3.28)***	-0.125(-3.50)***
AR	-0.021(-0.70)	0.019(0.59)	0.022(0.58)	-0.005(-0.36)
AP	0.011(0.50)	-0.021(-0.68)	0.067(3.19)***	0.021(2.02)**
Log Assets				
Log Sales	-3.141(-1.89)*	-0.867(-0.41)	3.957(1.33)	-2.627(-3.88)***
R-squared	0.034	0.025	0.195	0.043
Observation	304	304	304	304

Notes: ROS = return on sales; INV = days of inventory outstanding; AR = days of accounts receivable outstanding; AP = days of accounts payable outstanding; *** p<0.01, ** p <0.05, * p <0.1

In table 7 and 8, ROA is reduced by lengthening INV of Model 1 through 8 and by lengthening AR of Model 3 and by lengthening AP of Model 3, 4, 8. This result shows that firms increase their profitability by reducing INV, AR and AP. Maintaining inventories for less time improves profitability (Teurel and Solano, 2007). Regarding control variables, ROA is negatively associated with log assets in Model 4. It is positively

associated with log sales in Model 6 and 7 of Table 8 and negatively associated with log sales in Model 8 of Table 8.

Table 7

Independent Variables	Dependent variable = ROA			
	Model 1 (2004-2007)	Model 2 (2008-2011)	Model 3 (2012-2015)	Model 4 (2004-2015)
INV	-0.158(-3.63)***	-0.168(-3.78)***	-0.169(-4.19)***	-0.123(-6.80)***
AR	0.012(0.64)	-0.009(-0.52)	-0.040(-2.26)**	-0.0089366(-1.10)
AP	-0.018(-1.22)	-0.007(-0.44)	-0.016(-1.84)*	-0.016(-3.01)***
Log Assets	-1.214(-1.15)	-1.527(-1.36)	2.073(1.37)	-2.351(-7.18)***
Log Sales				
R-squared	0.076	0.113	0.124	0.139
Observation	304	304	304	304

Notes: ROA = return on assets; INV = days of inventory outstanding; AR = days of accounts receivable outstanding; AP = days of accounts payable outstanding; *** p<0.01, ** p <0.05, * p <0.1

Table 8

Independent Variables	Dependent variable = ROA			
	Model 5 (2004-2007)	Model 6 (2008-2011)	Model 7 (2012-2015)	Model 8 (2004-2015)
INV	-0.155(-3.56)***	-0.179(-4.29)***	-0.157(-4.06)***	-0.133(-7.19)***
AR	0.016(0.89)	0.004(0.22)	-0.019(-1.07)	-0.009(-1.14)
AP	-0.023(-1.62)	-0.017(-1.00)	0.006(0.67)	-0.022(-4.01)***
Log Assets				
Log Sales	1.539(1.48)	2.900(2.50)**	6.169(4.59)***	-0.991(-2.82)***
R-squared	0.080	0.130	0.192	0.095
Observation	304	304	304	304

Notes: ROA = return on assets; INV = days of inventory outstanding; AR = days of accounts receivable outstanding; AP = days of accounts payable outstanding; *** p<0.01, ** p <0.05, * p <0.1

Table 9 through 12 present the results of the petrochemical industry. In table 9 and 10, ROS is reduced by lengthening INV of Model 1, 4, 5, 6 and 8 and by lengthening AR of Model 3, 4, 7 and 8 and by lengthening AP of Model 4, 6 and 8. This result shows that firms increase their profitability by reducing INV, AR and AP. Maintaining inventories for less time improves profitability (Teurel and Solano, 2007). Regarding control variables, ROS is positively associated with log assets and log sales in Model 3 of Table 9 and Model 7 of Table 10.

Table 9

Independent Variables	Dependent variable = ROS			
	Model 1 (2004-2007)	Model 2 (2008-2011)	Model 3 (2012-2015)	Model 4 (2004-2015)
INV	-0.046(-1.80)*	-0.059(-0.56)	-0.088(-0.45)	-0.095(-2.35)**
AR	0.023(0.71)	-0.044(-1.59)	-0.304(-2.72)***	-0.092(-2.61)***
AP	-0.024(-0.69)	-0.052(-1.36)	-0.261(-1.47)	-0.089(-2.11)**
Log Assets	0.732(0.80)	-0.731(-1.53)	28.460(4.69)***	-1.162(-1.34)
Log Sales				
R-squared	0.017	0.043	0.118	0.026
Observation	412	412	412	412

Notes: ROS = return on sales; INV = days of inventory outstanding; AR = days of accounts receivable outstanding; AP = days of accounts payable outstanding; *** p<0.01, ** p <0.05, * p <0.1

Table 10

Independent Variables	Dependent variable = ROS			
	Model 5 (2004-2007)	Model 6 (2008-2011)	Model 7 (2012-2015)	Model 8 (2004-2015)
INV	-0.047(-1.80)*	-0.061(-1.65)*	-0.121(-0.61)	-0.098(-2.41)**
AR	0.019(0.57)	-0.043(-1.31)	-0.216(-1.83)*	-0.096(-2.70)***
AP	-0.018(-0.53)	-0.056(-1.69)*	-0.187(-1.06)	-0.092(-2.17)**
Log Assets				
Log Sales	-0.427(-0.43)	0.529(0.41)	24.635(3.91)***	-1.245(-1.35)
R-squared	0.016	0.043	0.099	0.026
Observation	412	412	412	412

Notes: ROS = return on sales; INV = days of inventory outstanding; AR = days of accounts receivable outstanding; AP = days of accounts payable outstanding; *** p<0.01, ** p <0.05, * p <0.1

In table 11 and 12, ROA is reduced by lengthening INV and AR of Model 1 through 8 and by lengthening AP of Model 2, 4, 6, 7 and 8. This result shows that firms increase their profitability by reducing INV, AR and AP. Maintaining inventories for less time improves profitability (Teurel and Solano, 2007). Regarding control variables, ROA is negatively associated with log assets in Model 1, 2, and 4 of Table 11. It is positively associated with log sales in Model 7 of Table 12 and negatively associated with log sales in Model 8 of Table 12.

Table 11

Independent Variables	Dependent variable = ROA			
	Model 1 (2004-2007)	Model 2 (2008-2011)	Model 3 (2012-2015)	Model 4 (2004-2015)
INV	-0.055(-1.81)*	-0.101(-2.66)***	-0.221(-2.72)***	-0.124(-5.45)***
AR	-0.115(-2.86)***	-0.203(-6.08)***	-0.192(-4.16)***	-0.127(-6.37)***
AP	-0.056(-1.30)	-0.070(-2.02)**	-0.099(-1.35)	-0.059(-2.48)**
Log Assets	-6.745(-6.23)***	-6.794(-5.14)***	1.075(0.43)	-6.278(12.87)***
Log Sales				
R-squared	0.190	0.290	0.131	0.209
Observation	412	412	412	412

Notes: ROA = return on assets; INV = days of inventory outstanding; AR = days of accounts receivable outstanding; AP = days of accounts payable outstanding; *** p<0.01, ** p <0.05, * p <0.1

Table 12

Independent Variables	Dependent variable = ROA			
	Model 5 (2004-2007)	Model 6 (2008-2011)	Model 7 (2012-2015)	Model 8 (2004-2015)
INV	-0.063(-1.94)*	-0.127(-3.22)***	-0.159(-2.02)**	-0.130(-5.36)***
AR	-0.090(-2.12)**	-0.205(-5.86)***	-0.128(-2.74)***	-0.135(-6.38)***
AP	-0.106(-2.37)	-0.106(-2.99)***	-0.130(-1.85)*	-0.080(-3.18)***
Log Assets				
Log Sales	-0.415(-0.33)	1.741(1.26)	11.202(4.49)***	-2.915(-5.31)***
R-squared	0.087	0.232	0.184	0.115
Observation	412	412	412	412

Notes: ROA = return on assets; INV = days of inventory outstanding; AR = days of accounts receivable outstanding; AP = days of accounts payable outstanding; *** p<0.01, ** p <0.05, * p <0.1

Conclusions

This study investigated the effects of cash conversion cycle components (days of inventory accounts receivable and accounts payable outstanding) on profitability ratios (ROS, ROA) for firms in automobile, petrochemical, and electronic and electricity

industries using the panel data for the period of 2004-2015. Our findings provide new theoretical and practical insights into the relationship between cash flow and profitability measures unlike previous operations-finance interface studies focusing mainly on profitability. As such, it advances the existing knowledge on the relationship between cash flow and profitability measures not only by economic upturn and downturn periods but also by different industries.

Nonetheless, this study has limitations, which can serve as future research directions. Since the data for this study were from large firms in Forbes Global 2000 rankings in selected industries, future study of investigating firm size effect is desired. Moreover, this study can be replicated for firms in other industries with different product and process characteristics in order to secure generalizability.

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