

THE MODERATING IMPACT OF FIRM SIZE ON THE RELATIONSHIP BETWEEN WORKING CAPITAL MANAGEMENT AND PROFITABILITY

Ilhan Dalci, Cem Tanova, Hasan Ozyapici, Murad A. Bein*

Abstract

This study investigates whether firm size moderates the relationship between cash conversion cycle and profitability over 8-year period for 285 German non-financial firms. The moderated regression results reveal that the relationship between cash conversion cycle and profitability is moderated by firm size. As the firm size gets smaller and the cash conversion cycle gets longer, the returns on assets decreases. When the firm size gets bigger and the cash conversion cycle gets longer, on the other hand, the returns on assets increases. In this context, reducing the length of cash conversion cycle has a positive impact on profitability for only small and medium-sized firms. Accordingly, this study concludes that small and also medium-sized firms, contrary to big firms, should reduce the length of cash conversion cycle in order to increase profitability.

Keywords: cash conversion cycle, firm size, small firms, profitability, working capital management

JEL Classification: M10, M41

1. Introduction

An effective Working Capital Management (WCM) system has been an important tool for companies in order to maximize profitability and gain a competitive advantage (Ruback and Sesia, 2003). Limitations of traditional working capital measures have led to the emergence of dynamic measures which analyse a firm's continuing liquidity (Hager, 1976; Richards and Laughlin, 1980; Emery, 1984). In this regard, the Cash Conversion Cycle (CCC) which is a dynamic measure has been introduced by Gitman (1974) as a powerful approach to WCM (Richards and Laughlin, 1980; Jose *et al.*, 1996; Ebben and Johnson, 2011). The CCC refers to the difference concerning the situation when a firm pays for its trade payables and collects trade receivables emerging from sale of goods to customers (Deloof, 2003). In other words, the CCC is a dynamic measure of time between the moment when a company collects its accounts receivable due from sales of inventories and when it pays for its accounts payable resulting from purchases (Richards and Laughlin, 1980; Deloof, 2003). Attempting to maintain a positive working capital may avoid running out of stock of inventories. However,

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an opportunity costs associated with having positive working capital may exist and result in a reduction in profitability (Singhania *et al.*, 2014). Therefore, an effective WCM aims at avoiding excessive investment in current assets, while maintaining a company's ability to find a healthy balance between liquidity and profitability (Filbeck *et al.*, 2007).

There have been a number of studies investigating the relationship between CCC and firm performance (*e.g.* Smith, 1987; Kamath, 1989; Jose *et al.*, 1996; Wang, 2002; Deloof, 2003; Padachi, 2006; Gill *et al.*, 2010; Aregbeyen, 2013). Most of these studies have been carried out in the US and European countries. To the best of our knowledge, however, there is no study exploring the relationship between CCC and profitability in Germany. Lind *et al.* (2012) assert that profitability problems and increased competition have necessitated the need for improving WCM for German companies. Accordingly, the results of this study are expected to address this issue. Additionally, Jose *et al.* (1996) assert that size differences should be taken into account when dealing with the relationship between CCC and profitability in order to see whether the observed relationship is affected by size. The previous studies which have investigated WCM-profitability relationship have focussed on total sample of firms (*e.g.* Jose *et al.*, 1996), large firms (*e.g.* Shin and Soenen, 1998), small firms (*e.g.* Ebben and Johnson, 2011), and/or small and medium-sized firms (*e.g.* Yazdanfar and Öhman, 2014). The literature review reveals only one study (Nobanee *et al.*, 2011) which has investigated WCM-profitability relationship by making comparisons among small, medium-sized, and large firms in Japan. The authors have found that the CCC influences profitability in the same directions for the firms of all sizes. However, this finding may be unique for the Japanese environment which has the “keiretsu” system as a dominant characteristic of the Japanese economy. The “keiretsu” may eliminate the effect of “size” factor on the relationship between CCC and profitability because this system creates a web of interlocking relationships and may lead to different considerations between buyer and supplier firms. Accordingly, we would expect that the inverse impact of CCC on profitability should be stronger for small firms because cost of external financing is higher for these firms (see Moss and Stine, 1993). In order to explore this issue, the current study investigates whether firm size has a moderating impact on the relationship between WCM and profitability. In this regard, this study is unique in the sense that it is the first attempt to investigate the moderating role of leverage, which is the measure of size, on the relationship between CCC and profitability.

The paper progresses as follows: In the Section 2, the literature review and hypotheses are outlined. Then, the research methodology is presented in Section 3. This is followed by Section 4 the results of the study. The conclusions and implications are then outlined in the Section 5.

2. Literature Review and Hypotheses

2.1 Impact of CCC on profitability

Prior studies have demonstrated that WCM strongly influences profitability (*e.g.* Wang, 2002; Deloof, 2003; Eljelly, 2004). The previous studies which have investigated

the WCM-profitability relationship have generally found an inverse relationship between the two measures (e.g. Long *et al.*, 1993; Shin and Soenen, 1998; Eljelly, 2004; Hutchison *et al.*, 2007). For example, Jose *et al.* (1996) investigate the impact of CCC on profitability for 2,718 Compustat firms operating in seven industries in the US over a 20-year period. The result of that study demonstrates that the shorter the CCC the higher the profitability for some industries such as manufacturing, service, and retail/wholesale. Another study carried out in the US by Shin and Soenen (1998) reveals an inverse relationship between Net Trading Cycle (NTC), which is closely related to CCC, and profitability. Kamath (1989) finds that the NTC negatively influences firm performance for the Retail Grocery industry in general. In Japan and Taiwan, Wang (2002) explores the relationship among WCM, profitability, and corporate value for 1934 firms over an 11-year period. The authors come up with an inverse relationship between CCC and profitability. In Belgium, Deloof (2003) analyzes the impact of WCM on profitability for a sample of 1,009 large non-financial firms for the 1992–1996 period. The results of that study reveal a significant negative relationship between the two measures. Eljelly (2004) investigates the relationship between profitability and liquidity in Saudi Arabia. The results show an inverse relationship between profitability and liquidity. In another study, Padachi (2006) also finds that WCM has an inverse impact on profitability of small Mauritian manufacturing firms. In Spain, Garcia-Teurel and Martinez-Solano (2007) find similar results showing shorter CCC has a positive impact on ROA for small firms. By focussing on companies listed on Vietnam Stock Exchange, Dong and Su (2010) add evidence to a strong negative impact of CCC on profitability. In Japan, Nobanee *et al.* (2011) explore the impact of CCC on profitability measured by Return on Investment (ROI) for the period from 1990 to 2004. In that study, except for consumer goods and services companies, a strong inverse relation is found between the CCC and ROI. In Sweden, Yazdanfar and Öhman (2014) investigate the relationship between CCC and profitability for small and medium-sized companies and find a negative relationship between the two measures. Singhania *et al.* (2014) also report a negative CCC-profitability trade-off for manufacturing companies listed on the BSE-500 index of the Bombay Stock Exchange in India.

In contrast to the above studies, there are number of studies (e.g. Lyrouti and Lazaridis, 2000; Sharma and Kumar, 2011) which report that WCM positively influences profitability. For example, Lyrouti and Lazaridis (2000) examine the food industry in Greece and find that CCC has a positive influence on ROA. The other study conducted in the US by Gill *et al.* (2010) also reveals a positive influence of CCC on profitability. Similarly, Sharma and Kumar (2011) find that CCC positively influences profitability of non-financial firms in India.

On the other hand, two recent studies (Baños-Caballero *et al.*, 2014; Mun and Jang, 2015) find a concaved U-shaped relationship between the measures of working capital (NTC and Working Capital Rate) and firm performance. Baños-Caballero *et al.* (2014) analyse the impact of NTC on corporate performance for non-financial companies in the UK. That study is the first attempt to find an inverted U-shaped relationship between WCM and profitability. In the US, Mun and Jang (2015) analyse the impact of WCM on ROA

for restaurant firms. The authors also examine the moderating impact of firms' cash levels on the relationship between working capital and profitability. In line with Baños-Caballero *et al.* (2014), these authors also find a strong U-shaped working capital-profitability relationship. This study also demonstrates that a firm's cash level is an important factor for efficient WCM.

Consequently, despite the fact that the results of previous studies concerning the CCC-profitability relationship are inconclusive, more evidence supports the existence of a negative relationship. Thus, the following hypothesis has been formulated:

H1: *There is a negative relationship between CCC and profitability of German non-financial firms.*

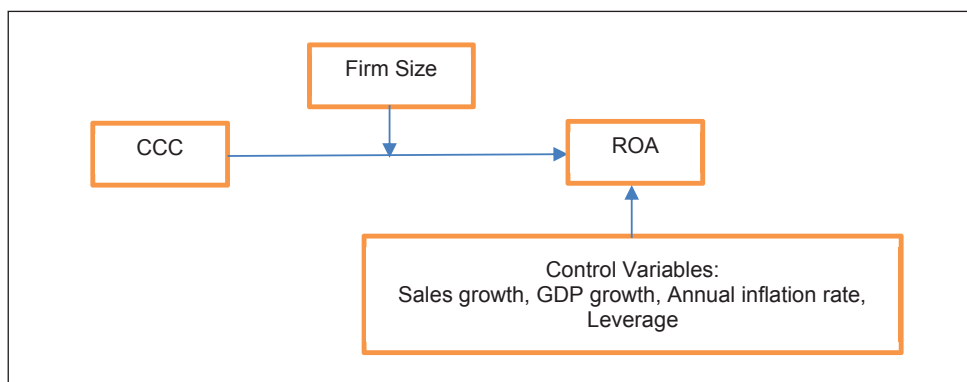
2.2 Moderating impact of firm size on the relationship between CCC and profitability

Long CCC leads to an increase in inventories and receivables which causes working capital to increase (Richards and Laughlin, 1980; Ebben and Johnson, 2011). In this case, accruals/payables, interest-bearing debt, and equity are used to fund receivables and inventories. Accordingly, expensive external sources reduce profitability due to high interest costs and tied-up funds which would otherwise be invested in profitable areas. It is important to emphasize that small firms may differ from large firms in many dimensions of performance (Storey, 1989). Previous studies (*e.g.* Stiglitz and Weiss, 1981; Rajan and Zingales, 1995; Berger and Udell, 1995; Shane and Cable, 2002; Cassar, 2004) have revealed that bigger firms have better opportunities to get external financing and they are not as financially constraint as small firms. This means that impact of CCC on profitability might be different for firms with different sizes. Parallel to this, Jose *et al.* (1996) note that size differences should be considered, while dealing with CCC-profitability relationship in order to see whether the observed relationship is affected by size. This means that, the impact of CCC on profitability is expected to be influenced by firm size. The reason that some research shows conflicting results on the relationship between CCC and profitability may be due to the impact of firm size. Based on these considerations, we expect that the CCC-profitability relationship may be moderated by firm size. Thus, the following hypothesis has been proposed:

H2: *Firm size has a moderating impact on the relationship between CCC and profitability of German non-financial firms.*

Based on the above theoretical framework and the hypotheses, the following conceptual model can be proposed:

Figure 1 | Conceptual Model



Source: Authors.

3. Research Methodology

3.1 Sample and data collection

This study uses German non-financial firms' data for the years 2006–2013. The data set including mainly statement of financial position and income statement is solicited from the DataStream. Some firms with missing data are eliminated from the sample. We consider all German non-financial firms that are listed in stock exchanges. However, since there were many firms with missing data and extreme value (perhaps due to firm specific structure changes and financial crisis), we had to eliminate some firms with such problems. Beside, we make use of strong balanced panel data that requires the presence of all observation. Accordingly, 285 firms are left with 2,280 observations due to these eliminations. Our sample period started 2006 because we took into account the period after adapting International Financial Reporting Standards (IFRS). The descriptive analysis presented in Table 1 provides information regarding the number of industries and number of firms in each industry in the total sample.

3.2 Study variables

This study adopts CCC as a measure of WCM. The CCC, which is an independent variable in this study, is measured as “Receivable collection period + Inventory conversion period – Payable deferral period”. In this case, the CCC is calculated as “[inventory×365]/sales + [accounts receivable×365]/sales – [accounts payable×365]/sales” (see Kamath, 1989; Eljelly, 2004; Charitou *et al.*, 2010; Sharma and Kumar, 2011; Engvist *et al.*, 2014). Consistent with the previous studies (*e.g.* Jose *et al.*, 1996; Wang, 2002; Garcia-Teurel and Martinez-Solano, 2007; Yazdanfar and Öhman, 2014; Engvist *et al.*, 2014), the current study uses ROA as a proxy for firm profitability. Firm size is used as the moderator variable in this study and it is measured as natural Logarithm of Total Assets (LTA) according to previous studies (*e.g.* Al-Najjar, 2015; Castro *et al.*, 2015; Ukaegbu, 2014; Pattitoni

et al., 2014; Mun and Jang, 2015). In addition, Sales Growth (SG), Leverage (LEV), annual GDP (Gross Domestic Product) growth rate, and annual inflation rate are used as control variables as specified in the previous studies investigating WCM-profitability relationship (*e.g.* Mun and Jung, 2015).

Table 1 | Descriptive Information Regarding Sample Data

Industry	TNIL	NIS	PSZP	PSZTS	NOP
Alternative Energy	24	14	58	5	112
Auto	20	11	55	4	88
Beverages	19	11	58	4	88
Chemicals	31	24	77	8	192
Construction and materials	30	16	53	6	128
Electronic	35	26	74	9	208
Household	23	15	65	5	120
Industrial engineering	56	38	68	13	304
Leisure goods	11	4	36	1	32
Personal goods	32	13	41	5	104
Hardware	28	24	86	8	192
Industrial transportation	15	12	80	4	96
Industrial metals and mining	6	4	67	1	32
Oil and gas	4	1	25	0	8
Pharma	29	10	35	4	80
Software	95	60	63	21	480
Aerospace and defense	3	2	67	1	16
Total	461	285	62	100	2,280

Note: the following abbreviation (TNIL), (NIS), (PSZP), (PSZTS) and (NOP) stand for total number of each Industry listed in Germany Stock exchange, Number of industries in sample, Percentage of sample size in a population, Percentage of sample size in total sample and Number of observations in Panel respectively

Source: Authors.

On the other hand, according to Jose *et al.* (1996), a relationship between working capital and profitability can be affected by industry characteristics such as production process and capital intensity. Thus, in order to analyse the industrial differences included in the sample, industry dummies are used. In this regard, 17 dummies as (0,1) are added to the dataset because there are 17 different industries in the sample.

3.3 Data analysis

In this study, descriptive statistics is first calculated for the variables. In order to test the correlation among the study variables, the correlation analysis is then used. We utilize three different panel data techniques to increase the consistency and efficiency of the results. In this regard, pooled OLS, fixed effects, and random effects are used to investigate the moderating impact of firm size on the relationship between CCC and ROA. We reported the results of the three methods since each of them has its strengths and weaknesses. Several authors have reported the results from the three techniques (Pollin and Zhu, 2006; Taş *et al.*, 2013). Nonetheless, the results of the methods are same (that is neither of the methods changes the main findings of the paper). Hausman (1978) and Breusch Pagan LM (Breusch and Pagan, 1980) tests are also carried out to choose the best model out of the three techniques for this study. Furthermore, to control endogeneity problem, Arellano-Bond's (1991) two-step Generalized Method of Moments (GMM) approach is used (Arellano and Bond, 1991). In order to test for autocorrelation for GMM, Arellano-Bond for zero autocorrelation in first differenced-errors is also conducted (Windmeijer, 2005). The results revealed no autocorrelation. The specific form that we have used for performing several regressions (based on fixed effect) is given below:

Model 1

$$ROA = \alpha_i + \beta_1 SG_{it} + \beta_2 LEV_{it} + \beta_3 GDP_{it} + \beta_4 INF_{it} + \varepsilon_{it}$$

Model 2

$$ROA = \alpha_i + \beta_1 SG_{it} + \beta_2 LEV_{it} + \beta_3 GDP_{it} + \beta_4 INF_{it} + \beta_5 CCC_{it} + \varepsilon_{it}$$

Model 3

$$ROA = \alpha_i + \beta_1 SG_{it} + \beta_2 LEV_{it} + \beta_3 GDP_{it} + \beta_4 INF_{it} + \beta_5 CCC_{it} + \beta_6 SIZE_{it} + \varepsilon_{it}$$

Model 4

$$ROA = \alpha_i + \beta_1 SG_{it} + \beta_2 LEV_{it} + \beta_3 GDP_{it} + \beta_4 INF_{it} + \beta_5 CCC_{it} + \beta_6 SIZE_{it} + \beta_7 (CCC * SIZE)_{it} + \varepsilon_{it}$$

where

$i = 1, \dots, n$ (n – the number of companies),

$t = 1, \dots, T$ (T – the number of periods),

α_i is fixed effect parameter that is allowed to vary across individual companies but does not vary over time. Whereas, under random effect all companies have a common mean value for the intercept,

ε_{it} = error term for each observation normally distributed with '0' mean and constant variance. However, under the Random effects model the error term ε_{it} has two components $\varepsilon_{it} = (\mu_i + \omega_{it})$. The first component (μ_i) is the time – invariant individual effect that is also uncorrelated with the independent variable. The second component (ω_{it}) which is individual time – varying across individuals and over time. Lastly, the independent variable is represented by ROA. In addition, SG, LEV, GDP and INF (inflation) are the four controlling variables.

4. Empirical Results

Table 2 presents descriptive statistics and correlations for German non-financial firms. Considering the correlations among the variables, it is observed that ROA is positively correlated with LTA and negatively correlated with LEV. Both CCC and leverage are negatively correlated with ROA. The CCC and leverage are also not correlated. On the other hand, variance inflation factor is computed to check for multicollinearity among independent variables. Accordingly, the results in Table 2 reveal that all independent variable variances are below five (5) that demonstrates there is no multicollinearity in the model (see Studenmund, 1997).

Table 2 | Means, Standard Deviations and Correlations

	Means	SD	VIF	CCC	SG	LTA	LEV	ROA	GDP
CCC	102.247	99.969	1.022	–	–	–	–	–	–
SG	2.518	61.816	1.004	–0.039	–	–	–	–	–
LTA	12.020	2.242	1.016	0.049**	–0.022	–	–	–	–
LEV	0.537	0.267	1.031	–0.125***	–0.027	0.107***	–	–	–
ROA	0.011	0.271	–	–0.026	0.012	0.133***	–0.175***	–	–
GDP	1.319	3.025	1.473	–0.004	0.028	–0.003	–0.031	0.081***	–
INF	1.689	0.688	1.471	–0.010	0.002	0.006	–0.014	0.012	0.566***

Note: CCC represents the cash conversion cycle; SG the sales growth; LTA is logarithm of total asset; LEV the leverage; ROA the return on asset; GDP the annual gross domestic product growth rate; INF the annual inflation rate.

*** Represents significance at 1% level. ** Represents significance at 5% level.

Source: Authors.

In Table 3 (Panels A–C) there is presented the moderating impact of firm size on the relationship between CCC and ROA using four methods (Fixed in Panel A, Random in Panel B, OLS in Panel C, and GMM in Panel D). In this regard, first, four control variables SG, LEV, GDP, and INF are investigated, and the results of the methods show strong association of firm performance with LEV, GDP, and INF. The results also show LEV and INF have statistically significant negative association with ROA. Particularly, coefficients for leverage (–0.26969 under Fixed Effects in Panel A, –0.198846 under Random Effects in Panel B, –0.175134 under OLS in Panel C, and –1.124223 under GMM in Panel D) and coefficients for INF (–0.01914 under Fixed Effects in Panel A, –0.019284 under Random Effects in Panel B, –0.019332 under OLS in Panel C, and –0.0050213 under GMM in Panel D) are all highly statistically significant at 5 *per cent* or better using each method. The GDP, on the other hand, has a positive impact on ROA. The coefficients for GDP (0.00896 under Fixed Effects in Panel A, 0.0091912 under Random Effects in Panel B, 0.009265 under OLS in Panel C, and 0.0018723 under GMM in Panel D) are also highly statistically significant under all methods. The SG, however, does not show any statistically impact on ROA.

Table 3 | The Moderating Role of Firm Size

Panel A: Fixed Effects				
	Model 1	Model 2	Model 3	Model 4
Intercept	0.176630***	0.203753	−0.186975	−0.042700
Sale growth	0.000040	0.000035	0.000041	0.000039
Leverage	−0.269690***	−0.277952***	−0.264565***	−0.269184***
GDP	0.008960***	0.008962***	0.009212***	0.009286***
Inflation	−0.019140**	−0.019457**	−0.020607**	−0.021224**
CCC	–	−0.000216**	−0.000222**	−0.001355***
LTA	–	–	0.032089**	0.018997
LTA×CCC	–	–	–	0.000107**
F-statistic	21.15***	18.06***	15.77***	14.42***
Panel B: Random Effects				
	Model 1	Model 2	Model 3	Model 4
Intercept	0.138543***	0.158455***	−0.069803*	0.004237
Sale growth	0.000030	0.000022	0.000031	0.000029
Leverage	−0.198846***	−0.205860***	−0.215261***	−0.216586***
GDP	0.009191***	0.009184***	0.009282***	0.009360***
Inflation	−0.019284**	−0.0195058**	−0.020200**	−0.020795**
CCC	–	−0.000154**	−0.000173***	−0.001010***
LTA	–	–	0.019657***	0.013080***
LTA×CCC	–	–	–	0.000074**
Wald chi2	90.02***	95.80***	136.35***	142.98***
Panel C: OLS				
	Model 1	Model 2	Model 3	Model 4
Intercept	0.125790***	0.142953***	−0.073202**	−0.007250
Sale growth	0.000025	0.000016	0.000030	0.000026
Leverage	−0.175134***	−0.181371***	−0.199712***	−0.200756***
GDP	0.009265***	0.009260***	0.009326***	0.009397***
Inflation	−0.019332**	−0.019520**	−0.020190**	−0.020737**
CCC	–	−0.000132**	−0.000158***	−0.000910***
LTA	–	–	0.019116***	0.013353***
LTA×CCC	–	–	–	0.000066**
F-statistic	22.54***	19.17***	26.35***	23.54***
Panel D: GMM				
	Model 1	Model 2	Model 3	Model 4
Intercept	0.125795***	0.142954***	−0.073202	−0.007250
Sale growth	0.000025***	0.000016**	0.000028***	0.000026***
Leverage	−0.175134***	−0.181371***	−0.199713***	−0.200756***
GDP	0.009266***	0.009260***	0.009326***	0.009397***
Inflation	−0.019333	−0.019520	−0.020190	−0.020737
CCC	–	−0.000132**	−0.000159***	−0.000910**
LTA	–	–	0.019116***	0.013353***
LTA×CCC	–	–	–	0.000066**
Wald chi2	169.40	223.10	220.00	178.10
Arellano-Bond test:				
Arellano-Bond test lag 1	2.7750 [0.006]	2.7880 [0.005]	2.9750 [0.003]	3.0150 [0.003]
Arellano-Bond test lag 2	0.8547 [0.393]	0.8395 [0.401]	0.7030 [0.482]	0.6726 [0.501]

Note: CCC represents the cash conversion cycle; SG the sales growth; LTA is logarithm of total asset; LEV the leverage; ROA the return on asset; GDP the annual gross domestic product growth rate; INF the annual inflation rate.

***, **, and * donate statistical significance at 1%, 5%, and 10% respectively.

Source: Authors.

Table 4 | Impact of Industry Dummies

	OLS	Random Effects	GMM
SG	0.000014	0.000021	0.000014
LEV	−0.206801***	−0.219548***	−0.206801***
GDP	0.009422***	0.009385***	0.009422***
INF	−0.020990**	−0.020997**	−0.020990
CCC	−0.001146***	−0.001181***	−0.001146**
LTA	0.014133***	0.014135***	0.014133***
CCC×LTA	0.000084***	0.000088***	0.000084***
Dummy 1	−0.032445	−0.035874	−0.032440
Dummy 2	0.039339	0.036677	0.039339
Dummy 3	0.101489	0.101290	0.101489***
Dummy 4	0.017435	0.015927	0.017435
Dummy 5	0.129393	0.126706	0.129393**
Dummy 6	0.126835	0.123823	0.126835***
Dummy 7	0.097586	0.096271	0.097586***
Dummy 8	0.082282	0.079630	0.082282***
Dummy 9	0.077729	0.076238	0.077729**
Dummy 10	0.107874	0.104863	0.107874***
Dummy 11	0.066072	0.062930	0.066072***
Dummy 12	0.069392	0.068632	0.069392***
Dummy 13	0.058101	0.054405	0.058101**
Dummy 15	−0.039242	−0.043223	−0.039240
Dummy 16	0.069418	0.066586	0.069418***
Dummy 17	0.122137	0.121886	0.122137***
Intercept	−0.081519	−0.073012	−0.081520
	F = 10.05***	Wald Chi2 = 187.54	Wald (joint) = 2,712***
Joint test for dummies	F(16;2,256) = 3.93***	chi2(16) = 40.67***	–
Arellano-Bond test:			
Arellano-Bond test lag 1	–	–	2.5880**
Arellano-Bond test lag 2	–	–	0.3432

Note: CCC represents the cash conversion cycle; SG the sales growth; LTA is logarithm of total asset; LEV the leverage; ROA the return on asset; GDP the annual gross domestic product growth rate; INF the annual inflation rate. Joint test for dummies under OLS and Random Model reject the Null Hypothesis that dummies are equal to zero.

*** **, and * donate statistical significance at 1%, 5%, and 10% respectively.

Source: Authors.

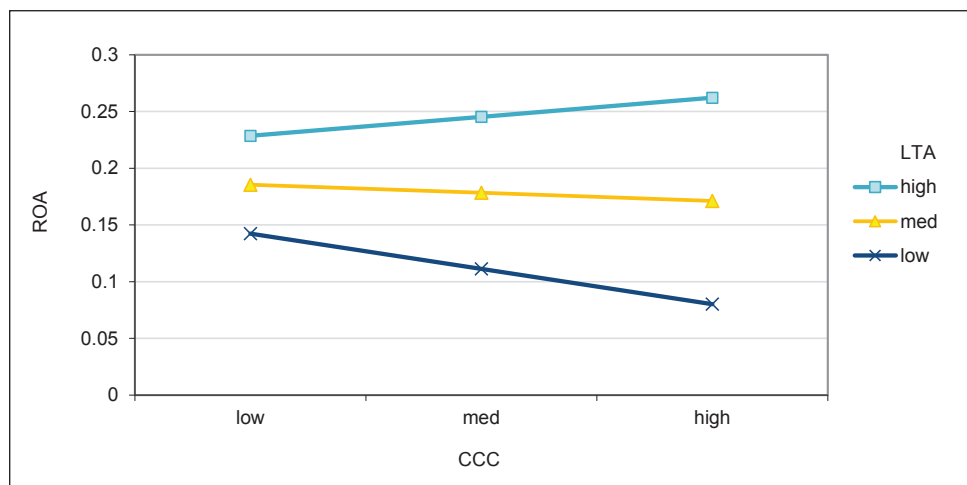
After the control variables, the CCC is included into the model, and the coefficients (−0.0002163 in Panel A, −0.000154 in Panel B, −0.0001317 in Panel C, and −0.0002163 in Panel D) that are computed are highly statistically significant at 5 *per cent* or better under each method. After confirming the fit of Model 2, firm size is included in the following model which is Model 3, and its estimated coefficients (0.032089 in panel A, 0.0196567 in panel B and 0.0191163 in panel C) are all highly statistically significant at 5 *per cent* or better. Finally, in Model 4, the interaction between CCC and firm size is incorporated, and the estimated coefficients (0.000106 in panel A, 0.0000744 in panel B and 0.0000658 in panel C) are highly statistically significant at 5 *per cent* or better. Consequently, the computed F-statistics (in panel A and C) and Wald Chi2 (in panel B) are all highly significant meaning that all the model(1–4) are non-zero and selected control variables are appropriate. Hausman test is also applied to check which model is more suitable, and the result ($\chi^2 = 6.69$; $\text{prob} > \chi^2 = 0.4617$) shows that random effects model is appropriate (see Baltagi, 2005). In addition, Bruesch Pagan LM test is applied to make comparison between random effects and OLS (Breusch and Pagan, 1980). Accordingly, the results ($\text{Chibar2} (01) = 66.59$; $\text{prob} > \text{Chibar2} = 0.000$) reveal that random effect model is better.

In addition to Fixed Effects, Random Effects, and OLS, we utilize the GMM method to have greater control of endogeneity and multicollinearity of independent variables (Arellano and Bond, 1991). As can be seen in Panel D in Table 3, the GMM method produces similar results found under the other methods. In addition, according to Arellano-Bond statistics (AR-2, z value = 0.6726, $p < 0.501$), the null hypotheses indicating the nonexistence of first- and second-order autocorrelation is accepted. These results reveal that there is no first and second-order autocorrelation and the instrument is valid (Arellano and Bond, 1991). Based on these results, both H1 and H2 are supported.

In order to test the industry effects on the moderating role of firm size on CCC-ROA relationship, we integrated industry dummies into the analyses under the methods (OLS, Fixed Effects, Random Effects, and GMM). However, dummies are not tested with fixed effects because in fixed effect model the variables that are not time varying such as industry dummies cannot be tested (Wooldridge, 2006). As we can see in Table 4, after the integration of industry dummies into the analyses, the interaction effect of CCC and firm size on ROA continues to be significant under all of the methods. In addition to this, the statistically significant negative relationship between CCC and ROA continues to exist. These results imply that industrial differences do not influence the moderating role of firm size on CCC-ROA relationship.

Figure 2 shows the ROA changes for small, medium-sized, and large firms as the length of CCC varies. As can be seen in Figure 2, the ROA is better for large firms compared with the small and medium-sized ones. Among small firms, as CCC gets longer, the ROA gets worse. This is also the case in medium-sized firms even though the rate of decline in profitability is not as large as it is in small firms. For the large firms, on the other hand, the ROA becomes better as the CCC gets longer.

Figure 2 | Two-Way Interaction EFFECT of FIRM SIZE and CCC on ROA



Note: CCC represents the cash conversion cycle; LTA is logarithm of total asset; ROA the return on asset.
Source: Authors.

To sum up, the current study may identify the reason behind inconclusive results of the previous studies because it demonstrates that firm size has a moderating role in the relationship between CCC and profitability.

5. Conclusions and Implications

The current study investigated whether firm size moderates the relationship between CCC, which is a measure of WCM, and ROA. Accordingly, the results have proved the moderating role of firm size on the relationship between CCC and profitability for the German non-financial firms regardless of the industry in which they operate. In this regard, the results have revealed that as the firm size gets smaller, the negative impact of CCC on ROA becomes stronger for the firms. It is a well-known fact that a move towards a longer CCC results in holding more inventories and receivables which necessitate a greater need for expensive external financing (Richards and Laughlin, 1980). In this regard, this finding of the current study can be supported by the notion that outside financing is difficult and expensive to obtain for small firms, which are more financially constrained. In addition, small firms encounter higher information asymmetry and agency costs (for example, Almeida *et al.*, 2004; Carpenter *et al.*, 1994; Faulkender and Wang, 2006; Stiglitz and Weiss, 1981; Rajan and Zingales, 1995; Berger and Udell, 1995; Shane and Cable, 2002; Cassar, 2004). This finding is also supported by the prior studies which have revealed that small firms have stronger relationship between WCM and profitability since they have only limited access to sources (Moss and Stine, 1993). In this context, the other finding of the current study has shown that the negative impact of CCC on ROA of the medium-sized firms is not as sharp as it is for the small ones. Further, the last finding of the current study has disclosed that

as the firm size gets bigger and the CCC gets longer, the ROA does not decrease but increases. This finding indicates that profitable large firms have long CCCs. This might have resulted from the fact that larger firms, contrary to smaller ones, can more easily finance increasing working capital at low cost and they invest more in working capital by lengthening CCC. This can also be supported by the assertion of Baños-Caballero *et al.*, (2010) which implies that companies having greater internal financing opportunity and better access to resources have a higher level of working capital.

Consequently, several implications can be derived from the findings of this study. First, the findings imply that effective WCM has a significant effect especially on the profitability of small and medium-sized firms operating in different industries. Thus, managers of small and medium-sized German non-financial companies and others operating in similar contexts should strive to i) delay the payment for payables to vendors, ii) turn over inventories quickly, and iii) speed up collections of account receivables to reduce the cash kept in working capital to increase profitability and competitiveness. In this regard, managers should tailor appropriate strategies. For example, they can offer discounts to the debtors for their early payments. However, the findings suggest that WCM strategies of medium-sized firms do not need to be as aggressive as the ones implemented by the small firms.

Second, managers of large German non-financial firms and others operating in similar contexts can ease the CCC by offering generous credit policies to their clients, making investment in inventories, and paying trade payables more quickly which in turn lead improvements in profitability by: (1) encouraging customers to buy goods when demand is low and increasing firms' sales, (2) reducing supply costs and the risk of interruptions during delivery, (3) preventing lost sales and additional production costs, (4) getting important discounts when paying for accounts payable earlier (Emery, 1987; Petersen and Rajan, 1997; Schiff and Lieber, 1974; Blinder and Maccini, 1991; Wilner, 2000). However, managers of these firms should keep in mind that lengthening CCC excessively might have an adverse impact on profitability starting from a particular level due to excessive cost of borrowing, inventory maintenance such as rent and insurance, as well as financial resources tied up in unprofitable areas (Baños-Caballero *et al.*, 2014).

To sum up, firm size has a moderating effect on the relationship between CCC and profitability. The main implication that can be drawn from this finding is that managers, who make strategic decisions especially regarding the working capital management, should first consider the size of their firms because, due to the firm size effect, successful strategies determined and applied by large firms may not be appropriate for small and medium-sized ones.

The results and implications of the current study should be interpreted in light of the following limitations. First of all, this study is conducted in a single country. Second, it focuses only on non-financial firms. Third, the sample size is low. Therefore, the future studies should investigate the moderating role of firm size in CCC-ROA relationship in other countries as well as in Germany by using larger samples to provide comparable results to the ones found in the current study.

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