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Article

Cash Conversion Cycle theory and corporate profitability

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Cash Conversion Cycle Theory and Corporate Profitability: Evidence from Non-Financial Firms Listed on the Johannesburg Stock Exchange

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Abstract: This study uses Richards and Laughlin's (1980) Cash Conversion Cycle theory to investigate the impact of working capital management efficiency and its separate components on the profitabilityof a sample of 75 non-financial firms listed on the Johannesburg Stock Exchange (JSE). Panel data regression methodology was used to analyse financial data obtained from I-Net Bridge and BF McGregor for the 10 year period, 2003 to 2012 to determine the nexus between working capital management and profitability (proxied by return on assets). The study results are consistent with the CCC theory that: 1) there exists a negative relationship between working capital management and corporate profitability; 2) there exist a negative relationship between inventory conversion period and profitability; 3) there is a negative relationship between accounts receivables conversion period and profitability; and 4) there is a positive relationship between accounts payable deferral period (PDP) and profitability. The findings thus suggest that corporate managers can create value for shareholders by reducing the CCC to an extent that it enhances its profitability.

Keywords: cash convesrion cycle, inventory conversion period, receivables conversion period, payables conversion period, profitability, Johannesburg Stock Exchange

1. Introduction

Corporate finance theory contends that the primary objective of the firm is maximization of shareholder wealth (Arnold, 2010; Fabozzi and Drake, 2010; Block, Hirt, and Danielsen, 2011). The strong and widespread support for the shareholder wealth maximization objective is due to the fact that shareholders possess the property rights of the firm and are thus entitled to decide what the firm should aim for. Efficient working capital management is very imperative in the realization of the shareholder wealth maximization objective because it influences a firm's risk, profitability and ultimately shareholders' wealth (Smith, 1980; Deloof, 2003; Ganesan, 2007; Watson and Head, 2007; Kieschnicket al, 2013; Boyce, 2014; Aktas, Croci, and Petmezas, 2015).

Since the seminal work by Gitman (1974) in which he introduced the cash cycle concept as a means of managing a firm's working capital and its implications for firm liquidity, numerous studies have been conducted to measure the relationship between working capital management and performance of firms (Hager, 1976; Richards & Laughlin, 1980; Smith, 1980; Emery, 1984; Jose, Lancaster and Stevens, 1996; Weinraub and Visscher, 1998; Deloof, 2003). Richards and Laughlin (1980) subsequently operationalised the cash cycle concept into the Cash Conversion Cycle (CCC) theory for analysing firms' working capital management efficiency. The CCC theory posits that, ceteris paribus, efficient working capital management (i.e. a short cash conversion cycle) will increase a firm's liquidity,

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profitability and concomitantly its value, while inefficient working capital management (i.e. a long cash conversion cycle) will lead to lower profitability and lower firm value. In fact, Dell (cited in Corey et al, 2013) has highlighted CCC as a key performance metric in its financial statements. Empirical studies testing the efficacy of the CCC theory have been carried out in different economic environments. The findings can be classified into two broad categories: 1) linear (positive or negative) relationship between CCC and both profitability and firm value, and 2) non-linear relationship between CCC and both profitability and firm value. Studies carried out in South Africa have exhibited similar ambivalence in respect of the link between WCM and firm performance, with non supporting evidence for the second group (see Beaumont–Smith, 1991; Smith, 1998; Mohanlal, 2004; Le Roux, 2008; Smith and Fletcher, 2009; Erasmus, 2010; Ncube, 2011; Siame, 2012; Ngwenya, 2012; Chirume, 2013; Kwenda and Holden, 2013). The mixed national and international empirical evidence suggests that some fundamental questions about the link between CCC (and its components) and firm performance remain unanswered. The purpose of the present study was to contribute to the resolution of the controversy by providing empirical evidence for listed South African firms using panel data regression methodology.

OBJECTIVES

The objectives of the study are:

i) To determine the relationship between working capital management and profitability of JSE-listed firms
ii) To ascertain the relationship between inventory conversion period and profitability of JSE-listed firms
iii) To determine the relationship between accounts receivable conversion period and profitability of JSE-listed firms
iv) To measure the relationship between accounts payable conversion period and profitability of JSE-listed firms

2. Literature Review

Three streams of literature can be gleaned from the literature on the relationship between working capital management and corporate profitability. These are: 1) negative relationship between WCM and profitability, 2) positive relationship between WCM and profitability, and 3) concave relationship between WCM and profitability. These are discussed next.

Negative relationship between WCM and profitability - This stream of research provides evidence of negative (inverse) relationship between working capital management (measured by CCC) and profitability. According to this body of literature a shorter cash conversion cycle indicates that a company manages its cash flows efficiently, as it generates more sales per unit of invested capital. This in turn would lead to higher profitability (seeSoenen, 1993; Jose, Lancaster, and Stevens, 1996; Shin and Soenen, 1998; Lyroudi and Lazaridis, 2000; Wang 2002; Deloof, 2003; Eljelly, 2004; Lazaridis and Tryfonidis, 2006; Hutchison/Farris II/Anders; 2007; Teruel and Solano, 2007; Mathuva, 2009). For example, in his seminal work Soenen (1993) examined the relationship between the net trade cycle (NTC) as a measure of working capital and return on assets. He found a negative relationship

between the length of net trade cycle and return on assets. Extending Soenen's (1993) study, Jose et al (1996) analyzed the relationship between two profitability measures (return on assets and return on equity), and liquidity (CCC) for 2718 US listed firms over a twenty-year period, 1974-1993. Correlation and multiple regression techniques were used to analyze the data. The results revealed that there is an inverse relationship between profitability and the cash conversion cycle. Shin and Soenen (1998) extended Soenen's (1993) work by analyzing the nexus between the Net Trading Cycle (NTC) found significant negative relationship between NTC and profitability. In an often cited study, Deloof (2003) examined the relationship between WCM and corporate profitability for a sample of 1009 Belgian listed firms. He found a significant negative relationship between gross operating income and accounts receivable, inventories and accounts payable. The negative relationship between accounts payable and profitability is consistent with the view that less profitable firms wait longer to pay their bills. On the basis of the findings, Deloof concluded that managers could create value for their shareholders by reducing the number of days' accounts receivable and inventories to a reasonable minimum. Raheman and Nasr (2007) employed a panel data regression analysis of cross-sectional and time series data for a sample of 94 Pakistani firms listed on Karachi Stock Exchange. The authors reported a significant negative relationship between net operating profit and the average collection period, inventory turnover in days, average payment period and cash conversion cycle.

Raheman and Nasr's (2007) study is similar to the present study in the sense that the authors analyzed the effect of different variables of working capital management including the average collection period, inventory turnover in days, average payment period, cash conversion cycle and current ratio on the net operating profitability of Pakistani firms. Debt ratio, size of the firm (measured in terms of natural logarithm of sales) and financial assets to total assets ratio were used as control variables. Pearson's correlation, and regression analysis (Pooled least square and general least square with cross section weight models) were used for the analysis. However, the present study goes beyond the quantitative analysis by exploring the qualitative dimensions of working capital management in South African listed firms. Questionnaires and interviews were used to collect data to help unearth the detailed mechanisms employed by listed firms in the management of the various working capital components. Other scholars such as Eljelly (2004), examined the relationship between profitability and liquidity, as measured by current ratio and cash gap (cash conversion cycle) on a sample of 929 listed firms in Saudi Arabia. Using correlation and regression analyses, the author found a significant negative relationship between the firm's profitability and its liquidity level, as measured by current ratio. In the case of Japanese firms, Nobanee et al. (2011) found a strong negative link between the CCC and ROA for all industries except for consumer goods and services.

Studies conducted in South Africa are consistent with the above results (see for example, Erasmus, 2010; Ngwenya, 2012, and Siame 2012). In particular, Erasmus (2010) investigated the relationship between WCM and profitability on a sample of 3924 (2275 listed and 1649 delisted) South African industrial firms over the 19 year period, 1989-2007. Regression and correlation techniques were used to analyze the data which resulted in a significant negative relationships between profitability (measured by ROA and Net Trade Cycle (NTC)). On the basis of the

findings, Erasmus (2010) concluded that management can improve profitability by decreasing the overall investment in net working capital. Recently, Ngwenya (2012) empirically examined the nexus between WCM and profitability for a sample of 69 JSE-listed firms for the period, 1998 to 2008. The results revealed a statistically significant negative relationship among profitability (gross operating profit), the cash conversion cycle (CCC), and number of days accounts receivable (AR).Another recent study by Siame (2012) analyzed data from published financial statements of 120 JSE listed firms. The results suggest that there exists a negative relationship between profitability and liquidity (cash conversion cycle). The results further show that efficient liquidity management improves return to shareholders by reducing time taken from the moment that creditors/suppliers are paid until the moment cash is collected from customers/debtors. It is worth noting, however, that all the authors based their investigations on data available in the public domain, since the purpose of these studies was to examine correlations between working capital measures and firm performance. None of the authors used surveys to collect the requisite data. On the whole, the studies nevertheless conclude that effective working capital management has a positive impact on firm performance – a correlation that has been established in numerous studies by statistical methods. Compared to the above studies, the present study uses the mixed research design (mixing quantitative and qualitative methods) to provide a better understanding of the relationship between WCM and corporate profitability of JSE-listed South African firms.

Positive relationship between WCM and profitability - The second set of studies provides strong evidence of a strong positive relationship between the cash conversion cycle and corporate profitability. These studies argue that longer cash conversion cycles lead to lower profitability (Lyroudi and Lazaridis, 2000; Falope and Ajilore, 2009; Gill et al, 2010; Akoto et al, 2014). For example, Lyroudi and Lazaridis (2000) analyzed the association between the cash conversion cycle (CCC), current and quick ratios for a representative sample of major companies in the food and beverage industry in Greece. The authors also investigated the implications of the CCC in terms of profitability, indebtedness and firm size. Using regression and correlation analyses the results indicated that there is a significant positive relationship between the cash conversion cycle and the traditional liquidity measures of current and quick ratios. Additionally, the cash conversion cycle was positively related to the return on assets and the net profit margin but had no linear relationship with the leverage ratios.

Gill et al (2010) also examined the nexus between CCC and profitability for a sample of 88 US firms between 2005 and 2007. The study controlled for sales, financial debt ratio and fixed financial asset ratio. Using regression analysis, the authors found a significant positive relationship between cash conversion cycle and profitability. In another study, Sharma and Kumar (2011) analyzed the relationship between profitability and cash conversion cycle for a sample of 263 Indian firms listed on the Bombay Stock Exchange (BSE) between 2000 and 2008. The results provide a strong evidence for a positive relationship between cash conversion cycle and profitability. That is, the longer the CCC of a firm, the lower the profitability. On the basis of the above empirical studies the following hypotheses are

formulated to test the effect of WCM on the performance of a sample of 75 non-financial firms listed on the JSE.

Hypothesis 1: There is a negative relationship between the cash conversion cycle (CCC) and profitability of JSE-listed firms
Hypothesis 2: There is a negative relationship between the inventory conversion period (ICP) and profitability of JSE-listed firms.
Hypothesis 3: There is a negative relationship between receivables conversion period (RCP) and profitability of JSE-listed firms.
Hypothesis 4: There is a positive relationship between the payables deferral period (PDP) and profitability of JSE-listed firms

3. Methodology

The following empirical panel data model was employed to estimate the relationship between WCM, its discrete components and profitability. The empirical model can be stated as follows:

$$Y_{it} = \beta_0 + \beta_k X_{it} + v_{it} + \varepsilon_{it} \quad (1)$$

Where
Y_{it} = Profitability (ROA) for firm *i* in year *t*
X_{it} = RCP, ICP, PDP, CCC, GDPGR, CATA, LEV, and SIZE
$\beta_o, \beta_1, \cdots$ = Regression co-efficient.
v_{it} = individual error component (a particular characteristic of each firm)
ε_{it} = the idiosyncratic error (unobservable factors) that vary over time and affect profitability·
i = 1,2,3,…, 75 (firms)
t = 2003, 2004…, 2012 (time)
k = 1, 2, 3,..10

Population
The population for the study comprises all firms listed on the JSE over the period, 2003 to 2012. As at 31 December 2012, a total of 335 firms were listed on the main board of which financial firms represent 27.2 per cent (91 firms). The remaining 72.8% (244) non-financial firms were then segmented according to the JSE Industry Classification Benchmark (ICB) as shown in table 1.

Table 1: Categories of firms listed on the JSE main board at 31 December 2012

No.	ICB Industry Long Name	No. of firms	% of population
1	Basic materials	74	22.1%
2	Consumer goods	26	7.8%
3	Consumer services	44	13.1%
4	Financials	91	27.2%

5	Healthcare	7	2.1%
6	Industrials	70	20.9%
7	Oil & Gas	4	1.2%
8	Technology	14	4.2%
9	Telecommunications	5	1.5%
	Total	335	100%

Source: JSE

Sample

A sample of 75 firms listed on the main board of the JSE was selected from the target population. To arrive at the sample, the study excluded financial firms. This is due to the fact that financial firms have different accounting regulations that are relatively different from those required by nonfinancial firms (Deloof, 2003). Also, and as argued by Falope and Ajilore (2009), financial services firms' financial characteristics and investment in working capital are fundamentally different from non-financial firms. Lastly, the exclusion of the financial services firms allows for easy comparability with prior studies, which also excluded financial services firms (e.g. Deloof 2003; Lazaridis and Tryfonidis 2006; Falope and Ajilore 2009; Kieschnick, Laplante, and Moussawi, 2013).To be included in the final sample, companies must have their complete financial statements for the entire period under consideration, that is, from 1 January 2003 to 31December 2012 inclusive. As a result of the application of the above criteria, the final sample was narrowed down to 75 non-financial firms which represent 22.4% of firms listed on the JSE as at 31 December 2012 shown in table 4**.**

Table 2: Listed non-financial firms with complete data (1 Jan 2003 to 31 Dec 2012)

	Industry	No. of firms	Percent of sample selected	Percent of population of JSE listed firms	Market CAP(R billion)
1	Basic materials	12	16.00%	3.58%	3939.49
2	Consumer goods	1	1.33%	0.30%	110.43
3	Consumer services	23	30.67%	6.87%	2756.457
4	Healthcare	3	4.00%	0.90%	515.46
5	Industrials	25	33.33%	7.46%	1635.488
6	Oil & Gas	2	2.67%	0.60%	1755.94
7	Technology	7	9.33%	2.09%	36.74
8	Telecommunications	2	2.67%	0.60%	2338.52
Total		75	100.00	22.4%	**13088.53**

Data analysis

The study uses secondary financial data obtained from both the I-Net Bridge/McGregor BFA data base at the University of Pretoria library and the Johannesburg Stock Exchange (JSE), covering 2003 -2012. The final sample is a

strongly balanced panel data of 750 firm-year observations, related to 75 different firms, during the period 2003-2012.

Models specification

Four models were employed to test the 4 hypotheses. The models regress firm profitability (return on assets) for firm *i* at time *t* on CCC and each component of CCC (ICP, RCP and PDP), in addition to the included control or conditioning variables as follows:

$$ROA = \beta_0 + \beta_1 CCC_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 CATA_{it} + \beta_5 GDP_{it} + \varepsilon_{it} \quad (1)$$

$$ROA = \beta_0 + \beta_1 ICP_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 CATA_{it} + \beta_5 GDP_{it} + \varepsilon_{it} \quad (2)$$

$$ROA = \beta_0 + \beta_1 RCP_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 CATA_{it} + \beta_5 GDP_{it} + \varepsilon_{it} \quad (3)$$

$$ROA = \beta_0 + \beta_1 PDP_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 CATA_{it} + \beta_5 GDP_{it} + \varepsilon_{it} \quad (4)$$

Results and Discussion

Descriptive statistics

The descriptive statistics for profitability, working capital variables, and the control variables are reported in table 3.

Table 3: Descriptive statistics for dependent and independent variables

Panel	Variable	Obs	Mean	Std. Dev.	Min	Max
Panel A	ROA	749	.2460481	.6118602	-0.95	14.7
Panel B (Main independent variables)	ICP	744	48.7661	48.11304	0	307.26
	RCP	749	51.84157	30.92044	0	242.54
	PDP	744	80.33298	64.01277	0	502.1724
	CCC	749	19.94004	66.22835	-393	297
Panel C (Internal Variables)	SIZE	749	14.45351	3.626404	0	89.88
	LEV	749	4.720521	54.16175	-181.71	1268.77
	CATA	749	.5892256	.2509238	0	1.00
Panel D External Variable)	GDP	750	3.51	1.991529	-1.5	5.6

Panel A describes the dependent variable – profitability (ROA). Panel B describes the main independent variables, while panels C and D describes the internal and external variables. The empirical results of the univariate analysis are presented and discussed next.

Dependent variables

***Return on assets (ROA)* (Profitability) -** Profitability (ROA) ranges from -0.95% to 14.7% with a mean of 24.6% and volatility of 61.2% respectively. The average overall profit of 24.6% indicates that majority of the firms included in the sample are making profit.

Independent variables - The descriptive statistics of the main independent variables are found in panel C of table 3. These comprises ICP, RCP PDP and CCC. It can be seen from the table that inventory conversion period (ICP) is on average 49 days which indicates that it takes the average firm within the sample

about one month and 19 days to turnover inventory. It has a range of 0 day minimum 307 days maximum. The standard deviation of 48.1 days shows that the sample firms have a close variation of inventory turnover. The minimum inventory turnover of zero is due to the fact that some firms do not have inventory, hence have no inventory turnover days. The RCP ranges from a minimum of 0 day to a maximum of 243 days with an average collection period of 51.8 days. This means that it takes approximately 1 month and 3 weeks for the sampled firms to collect monies owed by customers. As with ICP, the minimum RCP of 0 means that some firms do not have debtors. A standard deviation of 30.9 days suggests that there is less variation of accounts receivable period between the firms. The average PDP is 80.2 days and a minimum and maximum of 0 and 502.2 days respectively. The results show that firms take on average 2 months and 3 weeks to pay their creditors/suppliers. A standard deviation of 64 days suggests that suppliers' payment patterns varies widely. The CCC ranges from -393 days to 297 days with a mean of approximately 20 days. The shorter average CCC shows that JSE listed firms manage their working capital efficiently by converting inventory into goods for sale as possible and also collecting monies owed by customers quickly but pay their suppliers as late as possible. In practical terms, this means that it takes an average about 3 weeks' time for the sampled JSE-listed firms to convert a rand of cash disbursements back into a rand of cash inflow from their regular course of operations.

Control Variables - The descriptive statistics of the control variables are presented in panel C and D. Panel C indicates that firm size (measured by the logarithm of sales) of the sampled firms ranges from a minimum of R0 to R89.99 billion with an average size of R14.4 billion. Since turnover was used as a proxy for firm size, then a size of R0 means that a firm did not make any sales in a particular year. The average financial leverage ratio of the sampled firms is 0.54 and ranges from a minimum of 0 to a maximum of 0.99. The mean leverage of 0.54 means that most of the sampled firms are using approximately 54% of debt to finance their businesses. The current assets to total assets ratio (CATA) ranges from a minimum of 0 to a maximum of 1.0 with a mean of 0.59. This key ratio is important from the view point of liquidity. The higher the CATA, the higher the liquidity and vice versa. Thus the reported CATA of 0.59 implies that, on average, 59% of the sampled firms' total investment was made for working capital. GDP indicates annual real GDP growth rate and is being introduced in order to control for the evolution of the economic cycle. That is, to capture economic factors that may affect firms' profitability that vary over time but remain constant across firms. The reported GDP growth rate ranges from -1.5% minimum to 5.6% maximum with a mean of 3.51%. The range shows that the economy moved from recession (-1.5%) to boom over the 10 year period. The recession occurred in 2009 due to the global financial and crises. The effect of the recession is therefore expected to reflect in the performance of the firms in terms of lower profitability and firm value.

Correlation analysis - Table 4presents the Pearson product-moment correlation coefficient matrix for all the variables that were used in the regression model.

Table 4: Correlation matrix of profitability (ROA), WCM components and control variables

	ROA	CCC	ICP	RCP	PDP	SIZE	LEV	GDP	CATA
ROA	1.0000								
CCC	-0.0750* (0.0401)	1.0000							
ICP	-0.0571 (0.1197)	0.4443* (0.0000)	1.0000						
RCP	-0.0373 (0.3076)	0.2417* (0.0000)	0.0881* (0.0000)	1.0000					
PDP	0.0189 (0.6075)	-0.5848* (0.0000)	0.3310* (0.0000)	0.2986* (0.0000)	1.0000				
SIZE	-0.0496 (0.1754)	0.1579* (0.0000)	0.1214* (0.0009)	0.0574 (0.1166)	-0.0399 (0.2767)	1.0000			
LEV	-0.1172* (0.0492)	-0.0691 (0.2475)	-0.0340 (0.5730)	0.1994* (0.0008)	0.1810* (0.0025)	0.1169* (0.0499)	1.0000		
GDP	0.0553 (0.1304)	-0.0274 (0.4540)	-0.0251 (0.4939)	0.0428 (0.2421)	0.0283 (0.4415)	-0.0838* (0.0218)	0.1333* (0.0252)	1.0000	
CATA	0.0219 (0.5496)	-0.0191 (0.6018)	0.1832* (0.0000)	0.1498* (0.0000)	0.2258* (0.0000)	-0.1027* (0.0049)	0.1117 (0.0609)	0.0147 (0.6883)	1.0000

Significant at 1% (***), 5% (**), and 10% (*) levels respectively; P-Values in parentheses

As expected the correlation between CCC and ROA is negative and significant suggesting that when CCC decreases, profitability increases and vice versa. Also, as expected, the correlations between ROA and both ICP and RCP are negative but insignificant. Lastly, as predicted by the theory, there is a positive relationship between ROA and PDP. The relationship is, however, insignificant. Regarding firm value and working capital management variables, it can be observed that there is a significant positive relationship between firm value and both CCC and ICP, and an insignificant positive relationship between firm value and RCP. Moreover, there is a negative relationship between firm value and PDP. In order to obtain more robust results, the study applied variance inflation factor (VIF) technique to measure the level of potential multi co linearity among the independent variables in the regression models. The VIF command computes a VIF for each variable and for the overall regression. The results of the variance inflator factor (VIF) analysis for both linear and non-linear regression models are presented in table 3. The general rule of thumb is that VIFs exceeding 10 and tolerance values less than 0.1 are signs of serious multi co linearity requiring correction (Field, 2005; Hair et al, 2006; Kennedy, 2008; Butler et al, 2012). The VIF analyses reported in table 3 shows that the explanatory variables of the regression models do not satisfy the criteria stated above because the VIFs are less than 10 in all instances and also the tolerance values are all greater than 0.1. The largest VIF is 1.17 and the smallest tolerance is 0.2, confirming that multi co linearity is not present among the independent variables.

Table 3: Variance Inflator analysis for linear regression models

	Model 1		Model 2		Model 3		Model 4	
Variables	VIF	Tolerance (1/VIF)	VIF	Tolerance (1/VIF)	VIF	Tolerance (1/VIF)	VIF	Tolerance (1/VIF)
CCC	1.07	0.934626	---	---	---	---	---	---
ICP	---	---	1.16	0.860625	---	---	---	---
RCP	---	---	---	---	1.17	0.852770	---	---
PDP	---	---	---	---	---	---	1.11	0.897855
SIZE	1.05	0.952009	1.04	0.958767	1.04	0.965253	1.02	0.978385
GDP	1.03	0.966425	1.04	0.963262	1.03	0.966756	1.04	0.962988
LEV	1.06	0.941761	1.06	0.940249	1.08	0.928263	1.08	0.929012
CATA	1.06	0.946887	1.17	0.858156	1.13	0.882054	1.11	0.904549
Mean VIF	1.05		1.09		1.09		1.07	

Multiple regression analysis(MRA) - MRA analysis was performed using two tests: 1) Pooled OLS regression and 2) Random effect (RE) regression methodology. First, the OLS regression analysis was carried out followed by Hausman's test to determine whether to use fixed effects or random effects as the appropriate multiple regression model. The results of Hausman's test are presented in table 4.

Table 4: Hausman Specification test results

```
              ---- Coefficients ----
         |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
         |      fe           re         Difference          S.E.
-------------+----------------------------------------------------------------
       ccc |   -.0013566    -.0016569       .0003003       .0014555
    sizeta |   -.0032679     .0008781      -.0041459       .0076095
      levg |   -.4422972    -.5112373       .0689401       .4189549
     chgdp |    .0536713     .0415958       .0120754       .0107181
      cata |    1.412045     .3713095       1.040735       .5851128
------------------------------------------------------------------------------
 b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg
 Test:  Ho:  difference in coefficients not systematic
 chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
           =       6.64
 Prob>chi2 =      0.2488
```

The Hausman's test compares the parameters of the fixed and random effects model and concludes on the correlation between errors and regressors.

H_0: Random Effects model preferred

H_1: Fixed Effects model preferred

The test is based on two estimates, one coefficient from the fixed effects model (b) and one from the random effects specification (B). The fixed effects coefficient (b) under the H_0 hypothesis is consistent and inefficient and inconsistent under H_1 while random effect estimator (B) under H_0 is consistent and efficient and inconsistent under H_1. As mentioned in section 3.4.2.3.3, the decision rule is that, if

we get a statistically significant p-value (i.e. $p < 0.05$) we reject the null hypothesis that RE model is appropriate, and accept the alternative hypothesis that FE model is the appropriate. In other words, if we get a statistically insignificant p-value (i.e. $p>0.05$) we accept the null hypothesis that FE model is appropriate and reject the alternative hypothesis that FE model is the appropriate. From table 4, the Hausman's test shows that $p > 0.05$, therefore we fail to reject Ho that random effect (RE) model is the best model to represent the data. Consequently, the main panel data results are obtained by the random effects methodology using STATA Perpetual application version (14). The estimates using RE methodology are obtained for equation (1) to (4). Equation (1) is estimated according to hypothesis (1) in order to analyze the impact of WCM on profitability. Equations (2) to (4) are estimated to test, respectively, hypotheses (2) to (4). These estimates are carried on to analyze the impact of working capital accounts on profitability. The estimations using Pooled OLS methodology are obtained for equations (1) to (4) below:

$$ROA = \beta_0 + \beta_1 CCC_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 CATA_{it} + \beta_5 GDP_{it} + u_i + \varepsilon_{it} \quad (1)$$

$$ROA = \beta_0 + \beta_1 ICP_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 CATA_{it} + \beta_5 GDP_{it} + u_i + \varepsilon_{it} \quad (2)$$

$$ROA = \beta_0 + \beta_1 RCP_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 CATA_{it} + \beta_5 GDP_{it} + u_i + \varepsilon_{it} \quad (3)$$

$$ROA = \beta_0 + \beta_1 PDP_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 CATA_{it} + \beta_5 GDP_{it} + u_i + \varepsilon_{it} \quad (4)$$

In the equations above *i* refers to firms and *t* to time periods. The dependent variable ROA measures profitability. $\beta_0$is the intercept term; $\beta_1$is the slope (coefficient or parameter estimate) of CCC; β_2 is the slope (coefficient or parameter estimate) of SIZE; β_3 is the slope of Leverage; β4is the slope of CATA; β_5 is the slope of GDP. The u_i measures the unobservable heterogeneity of the individual specific effects of each firm, and ε_i is the error term. The following independent variables are considered to analyze their impact on profitability. CCC measures the average number of days-sales which the company has to finance its working capital needs (CCC = ICP + RCP – PDP). RCP measures the average number of days-sales of accounts receivable. ICP measures the average number of days-sales on inventories. PDP measures the average number of days-sales of accounts payable. The control variables are as follows: Size is firms' size proxy measured by the logarithm of assets, CATA is the ratio of current assets investment to total assets investment, and GDP is the annual real GDP growth rate in South Africa.

Panel data regression results - The results obtained for equations (1) to (4), using the RE method is reported in Table 5.

Table 5: Regression analysis using RE methodology (ROA as dependent variable)

	(1) roa	(2) roa	(3) roa	(4) roa
ccc	-0.00166**			
	(0.060)			
size	0.000878	0.000332	-0.00142	-0.00332
	(0.936)	(0.976)	(0.897)	(0.763)
levg	-0.511*	-0.547*	-0.441*	-0.493*
	(0.015)	(0.010)	(0.039)	(0.023)
gdp	0.0416	0.0477	0.0427	0.0467
	(0.178)	(0.126)	(0.168)	(0.138)
cata	0.371	0.531*	0.354	0.343
	(0.109)	(0.031)	(0.142)	(0.157)
icp		-0.00271*		
		(0.019)		
rcp			-0.00151	
			(0.409)	
pdp				-0.000171
				(0.872)
_cons	0.304	0.337	0.327	0.316
	(0.211)	(0.168)	(0.183)	(0.202)
R-sq				
F				
N	282	277	282	277

p-values in parentheses
*** p<0.05, ** p<0.01, *** p<0.001**

Working capital management (CCC) - The empirical result in Model 1 indicates that there exist a significant negative relationship between working capital management (cash conversion cycle) and profitability (ROA) (b =-0.00166, p<0.1). This result supports the WCM theory that the cash conversion cycle is negatively related to profitability. Thus, we fail to reject *Hypothesis* 1. The results are consistent with findings of prior studies (Lazaridis and Tryfonidis, 2006; Garcia-Teruel and Martinez-Solano, 2007; Mathuva, 2010; and Silva, 2011), but contradicts (Deloof, 2003; Ganesan, 2007; Samiloglu and Demirgunes, 2008). The negative relationship between WCM and profitability indicates that shortening the CCC by reducing the time cash is tied up in working capital and by speeding up collections results in high return on assets. Nobanee *et al* (2011) argued that a possible explanation to this finding is that when the cash conversion cycle is relatively shorter, the firm may not need external financing, which results in incurring less borrowing costs and interest expense, hence increasing profitability. Mathuvha (2010) also opined that by minimizing investment in current assets,

firms boosts their profits because liquid cash, which has low returns, is not maintained in the business for too long as it is used to generate profits for the firm.

Inventory Conversion Period (ICP) - According to Model 2 in Table 24, there is a significant negative relationship between ICP (b = -0.003, p<0.05) and ROA. This result is consistent with Padachi (2006) but contradicts (Samiloglu and Demirgunes, 2008; Falope and Ajilore, 2009; Gill et al., 2010; Raheman et al., 2010; Stephen and Elvis, 2011). The result suggests that a decrease in the number of days of inventory leads to an increase in profitability which is consistent with hypothesis 2. Thus, we fail to reject *Hypothesis* 2.

Accounts Receivable Conversion Period (RCP) - The results from Model 3 reveals a negative relationship between ICP (b =-0.00151, p>0.05) and ROA which is consistent with Deloof (2003), Lazaridis and Tryfonidis (2006), Padachi (2006), Garcia-Teruel and Martinez-Solano (2007). It supports the argument that firms with shorter accounts receivable (AR) period are able to improve their profitability since shorter accounts receivable period frees up cash for firms. This cash could be used to make payment of bills on time in order to enjoy early payment discounts without the need for the firm to seek external source of funding which often tend to be very expensive customers (Martinez-Sola et al., 2013). This finding, however, contradicts studies of Ramachandran and Janakiraman (2009), Raheman et al. (2010).

Accounts Payable Deferral Period (PDP) - Model 3 provides evidence of a negative but insignificant relationship between payables deferral period (PDP) (b = 0.000171-, p> 0.05) and ROA. This suggests that delaying payments to suppliers tends to decrease profitability. Thus we reject Hypothesis 4 that there is a positive relationship between PDP and profitability. This result is consistent with Silva (2011) but is contrary to the studies of (Mathuva, 2010; Karaduman et al., 2011; and Karaduman et al., 2011). Abuzayed (2012) opined that the most plausible explanation for the for the negative relation between accounts payable and profitability is that less profitable firms wait longer to pay their bills. The above findings are consistent with Abuzayed (2012) study in which all of the cash conversion cycle and its components are not significantly affecting the listed firms' profitability. Abuzayed (2012) opined that this may be due to less than enough transparency which affects investors' decisions or the inability of investors to efficiently translate received information and market signals.

4. Discussion and conclusion

In summary, we may conclude that the results of the study are consistent with Richards and Laughlin's theory of working capital management. That is, efficient working capital management leads to higher profitability and vice versa. Thus, JSE-listed firms should focus on reducing inventory conversion period, accounts receivable period, and increase accounts payable period, in order to increase profitability and firm value.

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