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Article

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Global Financial Crisis, Working Capital Management and Firm Value: Evidence from JSE Listed Non-Financial Firms

Emmanuel Kojo Oseifuah[1], Agyapong B Gyekye[2]

Abstract: This study used Richards and Laughlin's (1980) Cash Conversion Cycle (CCC) theory to analyse the relationship between working capital management and firm value for non-financial firms listed on the Johannesburg Securities Exchange (JSE) before, during and after the 2008/2009 global financial crisis. Panel data regression methodology was used to analyse accounting and market based secondary data obtained from I-Net Bridge/BFA McGregor database and the JSE for 75 firms covering the 10 year period, 2003 to 2012. The key findings from the study indicate the following. First, the average firm value (market capitalisation) decreased from R18.9 billion before the crisis to R16.3 billion during the crisis period, and thereafter increased to a high of R24.4 billion after the crisis. Second, the average firm's CCC was 28.4 days before the crisis and decreased to 12.5 days during the crisis period and later increased to 16.2 days after the crisis. Third, the study found an inverted U-shape relationship between working capital management (proxied by cash conversion cycle) and firm value before the financial crisis only. This implies that there exists an optimal level of investment in working capital for which the sampled firms' value is maximized. At this point, costs and benefits are balanced. Thus corporate managers should aim to keep as close to the optimal level as possible and try to avoid any deviations from it that destroy firm value. Based on the findings, it is recommended that managers should aim at keeping as close to the optimal working capital level as possible and try to avoid any deviations from it that may destroy firm value.

Keywords*:* Firm value; Global financial crisis; Johannesburg Securities Exchange; South Africa; Working Capital Management

Introduction

Since Richards and Laughlin's (1980) work in which they proposed the Cash Conversion Cycle (CCC) theory for analysing firms' working capital management efficiency, numerous studies have been conducted globally to measure the relationship between working capital management and performance of firms. So far there is no consensus in the findings in the existing empirical literature on the nature or the relationship between CCC and firm performance (profitability and firm value). The findings can be classified into two broad categories: 1) linear (positive or negative) relationship between CCC and both profitability and firm value (see for example, Smith, 1980; Deloof, 2003; Erasmus, 2010; Siame, 2012; Wasiuzzaman et al., 2013; Aktas et al., 2015; Daisuke, 2017), and 2) non-linear relationship between CCC and firm value (Garcıa-Teruel & Martınez-Solano, 2007; Baños-Caballero, García-Teruel & Martínez-Solano, 2014).

Empirical studies carried out in South Africa have exhibited similar ambivalence in respect of the link between WCM and firm value. With the exception of Kwenda (2014) who reported a non-linear relationship between WCM and firm value, all other studies supported the first group (see for example Smith and Fletcher, 2009; Erasmus, 2010; Ncube, 2011; Siame, 2012; Chirume, 2013). Further, and more importantly, studies analysing the impact of the global financial crisis on the relationship

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between WCM and performance of JSE-listed firms is lacking, and this gap needs to be filled. The present study thus aims to improve the understanding of how publicly listed firms manage working capital to respond to the global financial crisis in the South African environment. As pointed out by Kieschnick and Rotenberg (2016), crises create opportunities to observe firm behaviour that may be difficult or impossible to observe under stable business conditions.

The following research question consistent with Richards and Laughlin's (1980) CCC theory and other empirical work devoted to the analysis of the nexus between WCM and firm performance was addressed in this study: *What is the relationship between working capital management (proxied by cash conversion cycle (CCC) and its separate components (ICP, RCP and PDP) and performance of JSE- listed firms before, during, and after the global financial crisis?*

Objectives of the Study

The objective of the study are:

- To evaluate the relationship between aggregate working capital management before, during and after the 2008/2009 global financial crisis;
- To determine the association between inventory conversion period and firm value before, during and after the 2008/2009 global financial crisis;
- To analyse the relationship between accounts receivable period and firm value before, during and after the 2008/2009 global financial crisis;
- To ascertain relationship between accounts payable deferral period and firm value working before, during and after the 2008/2009 global financial crisis.

Brief Overview of the Global Financial Crisis (GFC)

The 2008/2009 global financial crisis is considered by many economists as the most severe economic crisis since the Second World War (Romer, 2009; Aiginger, 2010; Eigner & Umlauft, 2015). According to Foster and Magdoff (2009) the financial crisis started in mid-2007 when two hedge funds, belonging to the American firm Bear Stearns collapsed, and peaked with the collapse of US investment bank, Lehman Brothers, in September 2008. As a result of the ensuing panic and uncertainty, financial institutions became unwilling to lend to each other and liquidity in the interbank funding market dried up. Thus, governments worldwide were forced to provide extraordinary support to financial institutions by buying debt worth hundreds of billions of dollars and bailing out distressed companies (National Treasury, 2011). What is more, the financial crisis rocked financial markets worldwide negatively impacting firms' ability to access funds as more stringent measures were applied by banks to borrowers. In South Africa, the financial crisis had severe impact on the economy and hence financial performance of companies operating in the country (Te Velde, 2008; Bureau for Economic Research, 2009). The National Treasury (2011) noted that even though South Africa has sound macroeconomic fundamentals and a robust financial regulatory framework, the country suffered more proportionately from the financial crisis compared to other G-20 countries, with job losses of close to 1 million jobs; foreign investments were also adversely affected (Te Velde, 2008). According to Kesimli and Gunay (2011), some firms downsized their operations, slashed capital expenditure and

deferred expansion programmes. Kesimli et al. (2011) emphasise that firms can cushion themselves against credit crunch and reduced access to external funds by efficiently managing their working capital. This sentiment was echoed by Siddiquee and Khan (2009) who argued that during economic downturns, companies with efficient working capital management practices can implement counter-cyclical measures to build a competitive advantage using internally generated funds to finance their programmes and expansion.

Given that efficient working capital management enables firms to withstand the impact of economic upheavals (Reason, 2008), this study investigates how the global financial crisis affected working capital management and performance of JSE-listed firms. As pointed out by McGuinness (2015), understanding the decision making process by firms under financial constraints and economic contraction is important for informing policy makers and improving our understanding of businesses. In line with previous studies, the effect of the global financial crisis on South African firms can be categorised into three phases as follows: 2003-2006 (pre-crisis period), 2007-2009 (crisis period), and 2010-2012 (post-crisis period) (Thompson, Cassie & Joseph Cotton, 2010; Haron & Nomran, 2015; Daisuke, 2017).

Literature Review

A number of studies (e.g. Lamberg & Vålming, 2009; Kesimli & Gunay, 2011; Baveld, 2012; Rehn, 2012; Duggal & Budden, 2012; Enqvist, Graham & Nikkinen, 2014; Yenice, 2015; Daisuke 2017) have analysed the consequences of the global financial crisis, in particular, on the relationship between working capital management and firm performance in the context of developed economies. In their study, Lamberg and Vålming (2009) used panel data regression techniques to investigate the effect of the global financial crisis on liquidity practices for a sample of 34 Small and Mid-Cap Swedish firms listed on Stockholm's NASDAQ OMX stock exchange. Lamberg et al also investigated the relation between liquidity (measured by CCC) and profitability measured by return on assets (ROA). For the purposes of their study, Lamberg et al compared the WCM and firm performance variables before the crisis (identified as quarter 1 of 2008) and during the crisis (identified as first quarter of 2009). Using correlation and regression analyses, the findings suggested that the adaptation of liquidity strategies do not have a significant impact on profitability. Only increased use of liquidity forecasting and short-term financing during financial crisis had a positive impact on profitability, measured as ROA. Moreover, it was found that the importance of key ratios, which monitors companies' liquidity did not change between the two periods. Lastly, the results revealed that working capital ratio is the most commonly used liquidity measurement and in addition the use of working capital and accounts payable deferral metrics increased most during the financial crisis.

In another study, Kesimli and Gunay (2011) analysed the impact of the global financial crisis on the working capital of Turkish firms. Their results show that the most affected indicator was the receivables turnover ratio. They reach the conclusion that "companies which manage their working capital optimally during times of recession come out stronger after the recession period". The studies examining the relation between working capital management and the global financial crisis reach two conclusions: (1) firms with sound working capital management practices fared better during the crisis than others; and (2) the crisis has led to changes in working capital management practices. Duggal and Budden, (2012) also analysed a sample of 422 non-financial S&P 500 firms for two different periods, recession period (2007) and post-recession period (2010). The results showed that US firms retained

more cash and short-term investments in the post-recession period than during the recession, an indication that the recession has shifted the efficient frontier. On the basis of the results, Duggal *et al.* suggested it appears firms in general held more net working capital in order to face new economic challenges.

Ramiah, Zhao and Moosa (2012) documented the measures taken by Australian corporate treasurers in the areas of cash, inventory, accounts receivable, accounts payable and risk management to survive the 2008/2009 global financial crisis (GFC). Using qualitative techniques like interviews and a survey questionnaire, the study analysed the various measures adopted by working capital managers. The results showed that more than half of the participants in the survey altered their working capital management practices during the crisis. Capital expenditure was curtailed, as they aimed at preserving their cash levels while reducing inventory levels. Credit worthiness of institutions became more important, and there was a general decline in credit availability. The results also show that Australian working capital managers exhibit behavioural biases, particularly overconfidence.

Using regression and correlational analyses, Baveld (2012) investigated how public listed firms in The Netherlands managed their working capital during crisis periods. The sample for the study comprised 37 of the 50 largest listed firms in The Netherlands. The study compared the sampled firms' working capital policies during the non-crisis period of 2004-2006 and during the global financial crisis of 2008 and 2009. The purpose of the comparison was determine whether companies have to change their non-crisis working capital vis-à-vis when the economy is in recession. The results of the study indicated that, in crisis periods, firms do not need to change their working capital policy relating to accounts payables and inventory, if their goal is to enhance profit. However, the analysis revealed that this was not the case for accounts receivables, because during a crisis period, accounts receivables have a positive effect on a firm's profitability.

Denčić-Mihajlov (2012) investigated how public companies listed on the stock market in the Republic of Serbia manage their accounts receivables during recession times. A sample of 108 Serbian firms listed on the Belgrade Stock Exchange was used for this study. The accounts receivables policies were examined in the crisis period of 2008-2011. In order to explore the relation between accounts receivable and firm's profitability, the short-term effects were tested. The study found a positive but insignificant relation between profitability and accounts receivable. Based on the findings, Denčić-Mihajlov concluded that the impact of accounts receivable on firms' profitability changes in crisis periods.

Enqvist, Graham, and Nikkinen (2014) also tested the role of business cycles on the working capital–profitability relationship using a sample of Finnish listed companies over an 18-year period. They found that the impact of business cycle on the working capital–profitability relationship is more pronounced in economic downturns relative to economic booms. Enqvist *et al*., further showed that the significance of efficient inventory management and accounts receivables conversion periods increase during periods of economic downturns. Based on the findings, Enqvist et al., concluded that active working capital management matters and, thus, should be included in firms' financial planning. Lastly, Daisuke (2017) investigated the relationship between working capital requirements and firm performance for Japanese firms during the global financial crisis. Data for the crisis period includes the period 2007 - 2010, compared to the non-crisis period data which covered the period, 2003 – 2006. The data generated 568,492 and 278,634 firm-quarter observations for 89,777 and 53,333 firms for the periods 2003 – 2010 and 2007–2010, respectively. Using correlation and panel data regression analyses, the results revealed the following. First, the level of excessive working capital increased

during the financial crisis after 2008. However, it decreased after late 2009 and returned to its pre-crisis level. Second, the adjustment speed in working capital requirement in late 2008 and early 2009 was slower than that in other periods, an indication that firms faced some constraints in adjusting their working capital level to its target during the financial crisis. Conversely, the adjustment speed after late 2009 was similar to that before the crisis, so firms could adjust their working capital requirements in only a year after the occurrence of the financial crisis. Third, the estimated negative relationship between firm performance and excessive working capital requirement is larger during the crisis. This implies that firms were unable to reduce their working capital during the crisis period.

In addition to the above studies, a number of studies have been conducted in a number of developing countries to investigate the relationship between working capital management and firm performance during the global financial crisis (Ncube, 2011; Kwenda, 2014; De Rozari, Sudarma, Indiastuti & Febrian, 2015; Shah, 2016; Silva & Miranda, 2016; Bhatia & Srivastava, 2016; Nobanee, 2017; Cetenak, Vural & Sokmen, 2017). In their study, De Rozari, Sudarma, Indiastuti, and Febrian (2015) analysed the association between working capital efficiency (CCC) and working capital policy on both profitability (return on assets) and firm value (measured by Tobin's Q) during and after the global financial crisis for 104 manufacturing firms listed on Indonesia Stock Exchange (IDX) over the period 2005-2013. Using panel data hierarchical regression analysis, the study reported significant differences in the effect of the cash conversion cycle (and its components) and working capital policy on profitability during the crisis period compared to the non-crisis period. In contrast, the study found no differences in the effect of the cash conversion cycle (and its components) and working capital policy on the firm value during the crisis and non-crisis period. On the basis of these findings, De Rozari *et al.* concluded that the sampled firms seemed to manage their working capital policy more efficiently during the global economic crisis than during the non-crisis period.

Shah (2016) analysed the influence of working capital management on firms' profitability under different business cycles for 65 Pakistani non-financial firms listed on Karachi stock exchange covering the 10 years period, 2004 to 2013. The panel data regression results revealed that there is a significant negative relationship between profitability and cash conversion cycle, and each CCC component in isolation. Moreover, business cycle affects the working capital management and firms' profitability relationship. Based on the findings, Shah (2016) concluded that efficient working capital management matters and hence should be included in financial planning. Bhatia and Srivastava (2016) used fixed- and random-effects model and generalized method of moments (GMM) to analyse a sample of 179 firms listed on the S&P BSE 500 Index of Bombay Stock Exchange (BSE) for the period 2000–2014. The results revealed that there is a significant negative relationship between working capital management and firm performance, necessitating the need to efficiently manage working capital for enhanced profitability.

In another recent study carried out in Brazil, Silva and Miranda (2016) compared the indicators of working capital management before and after the adoption of International Financial Reporting Standards (IFRS) for a sample of 500 Brazilian listed firms covering the ten years period, 2004 to 2013. The WCM indicators are Net Working Capital (NWC), Working Capital Requirement (WCR), Cash Balance (CB) and Liquidity Ratio (LR). The study year was divided in two periods: the first covered the four-year period before the adoption of the international standards, from 2004 to 2007; and the second covered the four years after the adoption from 2010 till 2013. The years 2008 and 2009 were not investigated, as that was the transition period, when the international standards were adopted. The Mann-Whitney nonparametric test was used to analyse the data. The results showed that, with the

exception of working capital requirement (WCR), the other working capital indicators – net working capital (NWC), cash balance (CB, and liquidity ratio (LR), have undergone significant changes after IFRS adoption. Based on these results, the authors concluded that the adoption of international accounting standards strongly affects financial items in the working capital than operational items. Thus, by using the financial statements for decision making, external users should be aware of the changes that have affected the financial elements of current assets and liabilities, since such fluctuations can change the indicators, thus affecting the decision-making process.

Nobanee (2017) recently examined the relationship between the efficiency of working capital management and profitability of construction firms listed in the United Arab Emirates stock markets, taking into account the global financial crisis. The results showed that there is a significant negative relationship between net trade cycle for all construction firms and large construction firms. However, the coefficient for small firms was positive and insignificant, an indication that small construction firms do not manage their working capital efficiently. The results further showed that there is a significant negative relation between the net trade cycle and profitability of construction firms during crisis period. Based on these results, Nobanee (2017) concluded that UAE construction companies are more efficient in managing their working capital during crisis periods. Lastly, in a comprehensive study, Cetenak, Vural and Sokmen (2017) examined working capital determinants at both firm-level, and industry-country level for a sample of 2453 manufacturing firms across 14 emerging markets[1] over the period, 2000 – 2014. The first level is the "irm" while the second is 'industry-country' combination. Working capital was used as the dependent variable while return on assets, Tobin's Q, and Altman's Z-score were used as the firm-level determinants of working capital. Herfindahl-Hirschman index (HHI) was used as industry-level determinant and four variables – exchange rate, Lerner index, inflation rate, and credit provided from financial sector – were country-level determinants. Macroeconomic data as obtained from the World Bank while financial information on each firm was collected from Datastream database. Using multilevel mixed-effects linear regression model to analyse the data, the results revealed that at firm level, return on assets has a significant negative relationship with working capital, while Tobin's Q and Altman's Z-score have significant positive relationship with working capital. At industry-country level, exchange rate, Lerner index (firm's market power), Herfindahl-Hirschman index (HHI) (measure of market concentration), and rule of law have positive relation with working capital levels, while credit from private sector is significantly negatively related to working capital levels.

In South Africa, Ncube (2011) investigated the association between working capital management components and profitability taking into account the 2008/2009 recession period. The sample consisted on 254 non-financial firms listed on the Johannesburg Securities Exchange (JSE) over the seven year period, 2004 to 2010. The data was obtained from I-Net Bridge/BFA McGregor database. Using the Pooled OLS regression method, the study examined how the influence of the selected working capital management components changes as macroeconomic conditions change. The results revealed the following. First, there exists a significant negative relationship between cash conversion cycle and profitability. Second, there exists a significant negative relationship between accounts receivables and profitability. Third, an increase in the length of a firm's cash (operating) cycle tends to increase profitability during an economic recession than during an economic boom. On the basis of the above results, the author concluded that firms adopt a more generous trade credit policy during an

[1] Argentina, Brazil, Chile, Egypt, Greece, Indonesia, Israel, Malaysia, Mexico, Philippines, Poland, Romania, South Africa, and Turkey.

economic recession than during a boom in an attempt to boost sales which would ordinarily dwindle during a recession. Lastly, the study reported that there exists a highly significant negative relationship between profitability and the following ratios: day's payables outstanding, current ratio, and capital structure. According to Ncube, the negative relationship found between profitability and debt to equity ratio (used as a proxy for capital structure) indicates that South African firms' profitability tends to decrease at excessively high and increasing levels of debt.

In another study, Kwenda (2014) investigated working capital investment and financing practices of a sample of 305 firms listed on the Johannesburg Stock Exchange (JSE) and also examined whether these practices play a role in alleviating financial constraints within the firms. Using the Generalised Method of Moments (GMM) the results suggest that despite operating in an environment with a well-developed financial system, South African firms use trade credit as a key short-term financing instrument. These firms pursue target trade credit and short-term financial debt levels and they quickly adjust towards their target. Furthermore, these firms have optimal working capital investment levels and they endeavour to adjust towards this optimal level. The study also found that the relationship between working capital investment and firm value is concave due to the benefits and costs associated with working capital investment. More importantly, the results showed that working capital management plays an important role in alleviating the impact of financial constraints. In light of these findings, Kwenda concluded that executives in South Africa should adopt efficient working capital management as part of their overall corporate strategy as this can improve cash flows, competitive advantage and can help them cope with financial constraints.

Methodology

The study employed panel data regression research design to analyse the relationship between working capital management and firm value for a sample of 75 non-financial listed firms over the ten year period, 2003 to 2010, divided into period before the financial crisis (2003 – 2006), during the financial crisis (2008 – 2009) and after the financial crisis (2010 – 2012).

Empirical Model

The following general empirical panel data model was employed to estimate the relationship between working capital management and firm value. The empirical model is stated as follows:

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

Where

Y_{it} = Firm value (Market Cap) for firm *i* in year *t*

X_{it} = RCP, ICP, PDP, CCC, GDPGR, CATA, DEBT, and SIZE

$\beta_o, \beta_1, \cdots$ = Regression co-efficients.

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

Models Specification

Five models were specified to answer the research question. The first group regress firm value (market capitalisation) 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:

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

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

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

$$MV = \beta_0 + \beta_1 PDP_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 CATA_{it} + \beta_5 GDP_{it} + \varepsilon_{it} + vit \quad (5)$$

Model specification (2) determines the impact of CCC, size, leverage, CATA, and GDP on firm value before (2003-2006), during (2007-2009) and after (2010-2012) the global financial crisis. Model specification (3) determines the impact of ICP, size, leverage, CATA, and GDP on firm value before (2003-2006), during (2007-2009) and after (2010-2012) the global financial crisis. Model specification (4) determines the impact of RCP, size, leverage, CATA, and GDP on firm value before (2003-2006), during (2007-2009) and after (2010-2012) the global financial crisis. Lastly, model specification (5) determines the impact of PDP, size, leverage, CATA, and GDP on firm value before (2003-2006), during (2007-2009) and after (2010-2012) the global financial crisis. The fifth model is similar to the first four models, except that CCC^2 was added to test for non-linear relationship between WCM and firm value (Sasabuchi, 1980; Lind & Mehlum, 2007; Knauer et al., 2013; Banos-Caballero et al., 2014; Atkas et al., 2015; Cumbie et al., 2017). The model is presented as follows:

$$MV = \beta_0 + \beta_1 CCC_{it} + \beta_2 CCC_{it}^2 + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 CATA_{it} + \beta_6 GDP_{it} + \varepsilon_{it} + vit \quad (6)$$

Variables

To explore the relationship between WCM and firm value within listed firms in South Africa, the study used two groups of variables listed in Table 1. These are firm value and control variables. Firm value is proxied by market capitalization. A number of independent variables, classified into main variables and control variables (which serve as control or conditioning variables) that may affect firm value are used. The main independent variables include the inventory conversion period (ICP), receivables conversion cycle (RCP) and the payables deferral period (PDP) and, the cash conversion cycle (CCC). The control variables include firm size, financial leverage, current assets to total assets ratio, and GDP growth rate (state of the economy). Measurement of these variables are presented in table 1.

Table 1. Variables definition and measurement

Variable	Definition	Measurement
DEPENDENT VARIABLE		
Firm value	Market Value (Market Capitalisation)	Market Value (MV) = Number of ordinary shares outstanding at end of year, *t* x closing price at end of financial year, *t* (Lai, 2012; Damodaran, 2013; Ghodrati et al., 2014)
INDEPENDENT VARIABLES		
CCC	Cash conversion cycle	Cash conversion cycle represents the length of time from the payment for the purchase of raw materials to manufacture a product until the collection of account receivable associated with the sale of the product (Besley & Brigham, 2005). CCC = ICP + RCP - PDP
RCP	Receivables conversion period	Receivables conversion period (RCP) is the average length of time to convert the firm's receivables into cash, that is, to collect cash following a sale. It is used as a proxy for the receivables policy and is calculated by dividing accounts receivable by the averages credit sales per day: RCP = [Accounts Receivable/Sales] x 365.
ICP	Inventory conversion period	The ICP is the average time required to convert materials into finished goods and then to sell those goods. It is calculated by dividing inventory by sales per day. That is: ICP = [Inventory / Sales x 365
PDP	Payables deferral period	Payables deferral period (PDP) is the average length of time between the purchase of materials and labour and the payment of cash for them. It is used as a proxy for the payment policy and is calculated as accounts payable divided by daily purchases as follows: PDP = [Accounts Payables/ purchases] x 365
CONTROL VARIABLES		
LEV	Leverage	Debt is used as a proxy for financial leverage and is calculated by dividing total debt by shareholders' equity, i.e. Leverage = Total debt/Equity
GDP	Change in GDP growth	$GDPGR=[GDP_t–GDP_{t-1}]/GDP_t$
CATA	Current assets to total assets ratio.	Current assets/Total assets, a measure of a firm's liquidity.
Size	Firm size	Firm size (SIZE) is measured by the natural logarithm of its total assets. That is, firm size (SIZE) = Log (value of total assets).

Source: Authors' own construction based on literature review

Population

The target population for the study comprises all firms listed on the main board of the JSE Securities Exchange 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).

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). 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 31 December 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 2**.** The sample is consistent with the proposed guidance on a representative sample by Sekaran and Bougie (2009) of between 30 and 500 firms.

Data Collection

Data for this study was collected through electronic retrieval of financial statements of 75 firms from both the I-Net Bridge/BFA McGregor data base at the University of Pretoria library and the Johannesburg Stock Exchange (JSE) respectively, covering the ten years period, 2003-2012. The I-Net Bridge/BFA McGregor database contains standardised financial information on firms' statement of financial position and statement of comprehensive income.

Data Analysis

This study employed a quantitative research method to address the research question. Bryman and Bell (2011) suggested three quantitative methods of data analyses that can be applied to examine variables and relationships between them. These are univariate analysis, bivariate analysis and multivariate analysis.

Univariate Analysis (Descriptive Statistics)

The descriptive statistics (mean) for firm value, working capital variables, and the control variables before, during and after the global financial crisis are reported in table 2.

Table 2. Descriptive statistics for dependent and independent variables before, during and after the global financial crisis

Variable	Pre-crisis period (2003-2006), (n=300)	During crisis (2007-2009), (n=225)	Post-crisis period (2010 - 2012), (n=225)
	Mean	Mean	Mean
CCC	28.3883	12.4978	16.1556
ICP	65.3436	29.4954	46.3756
RCP	48.3362	46.3145	62.0270
PDP	84.2230	63.3017	92.2814
MKTCAP	18.9356	16.2717	24.4236
SIZE	14.5843	14.6049	14.1284
LEV	0.5716	0.4496	.5452
Chgdp	3.51	3.5382	3.4818
CATA	0.5872	0.5328	.6484

Source: Authors' own calculations. Data obtained from I-Net/ BFA McGregor database and JSE (www.jse.co.za)

Firm Value (Market Capitalisation)

The descriptive statistics shows that the average market capitalisation decreased from R18.9 billion before the crisis to R16.3 billion during the crisis period, and thereafter increased to a high of R24.4 billion after the crisis. Again, the results suggest that the global financial crisis had a negative effect on the value of the sampled firms used in this study.

Independent Variables

The descriptive statistics of the main independent variables, ICP, RCP PDP and CCC, are discussed in this section.

Inventory Conversion Period (ICP)

The results in Table 2 shows that inventory conversion period (ICP) before the crisis is 65 days. This indicates that, prior to the crisis, it takes the average firm within the sample about two months and 5

days to turnover inventory. This improved to 29.5 days (about 30 days or exactly one month) during the financial crisis, an indication of efficient inventory management. These findings are consistent with some prior studies which suggest that during crisis periods, firms tend to manage working capital more efficiently to counter the negative effects of financial contractions (Love et al., 2007; KPMG, 2009; Kesmli et al., 2011).

Accounts Receivable Conversion Period (RCP)

It can be seen from Table 2 that, before the crisis, it took the average firm 48.3 days (about one month and 18 days) to collect accounts receivables. This dropped (i.e. improved) to 46.3 days (about one month 16 days) during the crisis period and jumped to 62 (about two months and two days) after the financial crisis. These findings also suggest that firms become more efficient in managing their accounts receivables by tightening credit terms to their customers during periods of economic contractions and relaxes them during non-crisis periods (Nia et al., 2016; Love et al., 2007).

Accounts Payable Deferral Period (PDP)

Table 2 shows that average firm's PDP decreased from 84.2 days (about 2 months and 24 days) during the pre-crisis period to 63.3 days (about 2 months and 13 days) during the crisis period; and then increased to 92.3 days (a little above three months) after the crisis. The plausible reason for these findings is that the sampled firms had not been given favourable credit terms by their suppliers, hence the shorter payment period during the crisis period, compared to favourable credit terms during the non-crisis periods.

Cash Conversion Cycle (CCC)

It can be seen from the table that the average firm's CCC was 28.4 days before the crisis and dropped to 12.5 days during the crisis period and later increased to 16.2 days after the crisis. The shorter average CCC shows that JSE listed firms manage their working capital efficiently during crisis periods 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 took an average about two 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 during the crisis period.

Bivariate (Correlational) Analysis

Tables 3 to 5 present the Pearson product-moment correlation coefficient matrix for all the variables that were used in the regression model before, during and after the global financial crisis.

Table 3. Correlation matrix of profitability (ROA), firm value, WCM components and control variables (pre- crisis period)

	MKTCAP	CCC	ICP	RCP	PDP	SIZE	LEV	GDP	CATA
MKTCAP	1.0000								
CCC	0.2318**	1.0000							
ICP	0.3157**	0.6043**	1.0000						
RCP	0.1567**	0.3383**	0.1966**	1.0000					
PDP	0.0599	-0.5621**	0.1564**	0.3055**	1.0000				
SIZE	0.0859	0.1809**	0.1308**	0.0798	-0.0626	1.0000			
LEV	-0.2950**	-0.1500	-0.2376**	0.0516	0.0476	0.1045	1.0000		
GDP	-0.1135	-0.0231	-0.0332	0.0678	0.0343	-0.0629	0.1543	1.0000	
CATA	0.0163	-0.0011	0.3007**	0.1405**	0.3084**	0.0641	-0.0789	0.0395	1.0000

*, ** and *** denote significant at 10%, 5% and 1% respectively. Source: Authors' o*wn calculations using a balanced panel data over the period 2003-2012. Data obtained from I-Net/BFA McGregor database*

It can be inferred from Table 3 that the correlation between MKTCAP (firm value) and CCC, ICP and RCP are all positive and significant in the periods before the global financial crisis.

Table 4. Correlation matrix of profitability (ROA), firm value, WCM components and control variables (Crisis period)

	MKTCAP	CCC	ICP	RCP	PDP	SIZE	LEV	GDP	CATA
MKTCAP	1.0000								
CCC	-0.3421**	1.0000							
ICP	0.0270	0.0980	1.0000						
RCP	-0.0803	0.2858**	0.1160	1.0000					
PDP	0.2705**	-0.6700**	0.5480**	0.2575**	1.0000				
SIZE	0.4763**	-0.1214	0.0929	0.2100**	0.2483**	1.0000			
LEV	-0.5374**	-0.3176**	-0.0072	0.4614**	0.4604**	-0.0146	1.0000		
GDP	-0.0832	-0.0120	0.0098	-0.0020	0.0151	-0.0982	0.1365	1.0000	
CATA	-0.2191**	0.1131	0.2281**	-0.0336	0.0216	-0.2422**	0.3802**	-0.0089	1.0000

*, ** and *** denote significant at 10%, 5% and 1% respectively. Source: Authors' o*wn calculations using a balanced panel data over the period 2003-2012. Data obtained from I-Net/BFA McGregor database*

Table 4 shows that there is a significant negative relationship between profitability and accounts receivable conversion period as predicted, while the relationship between profitability and CCC is negative but insignificant during the global financial crisis. Further, as expected there is a significant negative relationship between MKTCAP and CCC and PDP, and also a significant positive relationship between MKTCAP and PDP, during the financial crisis.

Table 5. Correlation matrix of profitability (ROA), firm value, WCM components and control variables (post- crisis period)

	MKTCAP	CCC	ICP	RCP	PDP	SIZE	LEV	GDP	CATA
MKTCAP	1.0000								
CCC	0.0967	1.0000							
ICP	-0.1294	0.3471**	1.0000						
RCP	-0.1778**	0.0051	-0.1350**	1.0000					
PDP	-0.2505**	-0.6666**	0.3739**	0.2713**	1.0000				
SIZE	0.6052**	0.3345**	0.1440**	-0.1070	-0.2427**	1.0000			
LEV	0.2112	0.2242	0.1158	0.3187**	0.0395	0.3471**	1.0000		
GDP	0.0077	-0.0490	-0.0331	0.0574	0.0420	-0.1391**	0.1547	1.0000	
CATA	-0.3932**	-0.1804**	-0.0258	0.2579**	0.2450**	-0.3276**	0.0720	0.0148	1.0000

*, ** and *** denote significant at 10%, 5% and 1% respectively. Source: *Own calculations using a balanced panel data over the period 2003-2012. Data obtained from I-Net/BFA McGregor database*

It can be inferred from Table 5 that the relationship between MKTCAP and PDP is negative and significant.

Panel Data Regression Analysis

To further establish the relationship between CCC and market value, panel data regression estimation procedures of Fixed Effect (FE) and Random Effect (RE) were used. Hausman's test was performed to confirm whether FE or RE was the appropriate estimation procedure. The results of the Hausman's test showed that the $p>0.05$, an indication that the RE model is the best model to represent the data. The results obtained for regression equations (2) to (5) using the RE method for all the three different periods (before the crisis, during the crisis and after the crisis) are reported in Tables 6 to 8.

Table 6. Panel data regression results (MKTCAP as dependent variable) (Before the crisis)

	(1) MKTCAP	(2) MKTCAP	(3) MKTCAP	(4) MKTCAP
CCC	0.101			
	(0.191)			
SIZE	0.575	0.467	0.603	0.585
	(0.475)	(0.577)	(0.437)	(0.475)
LEV	-86.01***	-76.83***	-91.37***	-97.82***
	(0.003)	(0.009)	(0.001)	(0.001)
GDP	-5.604**	-5.237*	-5.856**	-5.090*
	(0.048)	(0.083)	(0.031)	(0.080)
CATA	-37.06	-45.86	-66.38*	-36.77
	(0.223)	(0.112)	(0.049)	(0.257)
ICP		0.265**		
		(0.021)		
RCP			0.536***	
			(0.004)	
PDP			0.118	
				(0.221)
_cons	99.86***	84.76***	92.60***	100.1***
	(0.000)	(0.004)	(0.001)	(0.001)
N	137	132	137	132

P-values in parentheses; *, ** and *** denote significant at 10%, 5% and 1% respectively

Regression models 1 and 4 in Table 6 show that there is a positive insignificant relationship between MKTCAP and CCC and also between MKTCAP and PDP. Surprisingly, regression models 2 and 3 provide evidence of a significant positive relationship between MKTCAP and both ICP and RCP. The next table presents the regression results of the relationship between WCM and its separate components and firm value during the crisis period.

Table 7. Panel data regression results (MKTCAP as dependent variable) (crisis period)

(1) MKTCAP	(2) MKTCAP	(3) MKTCAP	(4) MKTCAP	
CCC	0.00255			
(0.978)				
SIZE	2.827***	2.922***	2.604*	2.885***
(0.011)	(0.002)	(0.025)	(0.008)	
LEV	-22.96	-26.26**	-24.51*	-22.75
(0.119)	(0.054)	(0.095)	(0.119)	
GDP	1.154	1.194	1.163	1.178
(0.166)	(0.151)	(0.150)	(0.152)	
CATA	-10.12	-5.066	-9.467	-10.43
(0.594)	(0.776)	(0.605)	(0.565)	
ICP		-0.120		
(0.336)				
RCP			0.0895	
(0.556)				
PDP				-0.0126
(0.859)				
_cons	-11.67	-11.31	-11.37	-11.85
(0.338)	(0.316)	(0.350)	(0.323)	
N	52	52	52	52

P-values in parentheses; *, ** and *** denote significant at 10%, 5% and 1% respectively

Regression models 1 to 4 in Table 7 show that the relationship between MKTCAP and all four WCM variables are insignificant. Moreover, the results indicated a significant positive relationship between firm size and MKTCAP for all the four regression models. The plausible reason for these results is that

during the financial crisis larger firms tend to perform better in managing their working capital than their smaller counterparts.

Table 8. Panel data regression results (MKTCAP as dependent variable) (Post-crisis)

	(1) MKTCAP	(2) MKTCAP	(3) MKTCAP	(4) MKTCAP
CCC	-0.118			
	(0.438)			
SIZE	8.126***	8.415***	8.225***	7.716***
	(0.001)	(0.001)	(0.002)	(0.002)
LEV	-102.7***	-90.52***	-99.62***	-100.4***
	(0.000)	(0.000)	(0.000)	(0.000)
GDP	2.384	1.962	2.349	2.095
	(0.233)	(0.364)	(0.248)	(0.307)
CATA	-4.876	-21.89	-14.50	-12.05
	(0.874)	(0.452)	(0.640)	(0.695)
ICP		-0.0539		
		(0.829)		
RCP			-0.0825	
			(0.779)	
PDP				0.0488
				(0.737)
_cons	-28.99	-28.76	-23.62	-26.64
	(0.365)	(0.374)	(0.458)	(0.401)
N	56	56	56	56

P-values in parentheses; *, ** and *** denote significant at 10%, 5% and 1% respectively

Regression models 1 to 4 in table 8 show that there is an insignificant negative relationship between firm value and CCC, ICP and RCP while providing evidence of a positive and insignificant relation between firm value and PDP. The two set of findings are inconsistent with the theory that there is a significant negative relation between firm value and all three variables – CCC, ICP and RCP, as well as a significant positive relation between firm value and PDP. Further, the results show that a significantly high negative relationship exists between firm value (MKTCAP) and financial leverage (LEV) for all the four models. Lastly, the empirical results show that a significantly high relationship exists between firm value and firm size.

Panel Data Regression Analysis: Inverted U-Shape Relationship, WCM And Firm Value

The study investigated for a possible invested U-shape relation between MKTCAP (firm value) and CCC by regressing MKTCAP against CCC and its squared (CCC^2) term in addition to the control variables as shown in equation 7:

$$MV = \beta_0 + \beta_1 CCC_{it} + \beta_2 CCC_{it}^2 + \beta_3 SIZE_{it} + \beta_4 LEV_{it} + \beta_5 CATA_{it} + \beta_6 GDP_{it} + u_i + \varepsilon_{it} \quad (7)$$

The main reason for this analysis is to establish whether there is an optimal level of CCC that maximizes firm value for the sampled JSE-listed firms. It is anticipated that CCC and MKTCAP (firm value) have a positive association at low levels of working capital investment and negatively at higher levels. Thus, the hypothesis is that β_2 should be negative, an indication that firms have an optimal working capital level that balances costs and benefits of holding working capital and maximises firm value (Banõs-Caballero et al., 2014; Soykan et al., 2016). Dependent, independent and control variables are specified as before. The difference is the inclusion of the square value of the CCC. To

test for existence of an optimal level of CCC that maximizes firm value, the coefficient β_2 (related to CCC^2) should be significant and negative, while the coefficient β_1 (related to CCC), should be positive. According to Banõs-Caballero *et al* (2014), this optimal level occurs where CCC = $-\beta_1/2\beta_2$, the breakpoint that makes the derivative of market capitalisation with respect to CCC equal to 0. The relationship between CCC and firm value is an inverted U-shape if β_2 is negative. Thus, β_2 should be significant and negative.

From Table 9, it can be observed that β_1 is positive and β_2 is negative and significant before the global financial crisis. This is consistent with some prior empirical studies that there is an inverted U-shape relationship between CCC and firm value.

Table 9. Regression results testing for inverted U-shape relationship between firm value (MKTCAP) and CCC before, during and after the financial crisis

Pre-Crisis MKTCAP	Crisis MKTCAP	Post-Crisis MKTCAP	
CCC	0.0804	0.0683	0.616***
(0.123)	(0.659)	(0.000)	
CCCSQD	-0.000628*	0.0000871	0.00257***
(0.036)	(0.939)	(0.000)	
SIZE	5.852***	5.870*	0.527
(0.000)	(0.065)	(0.536)	
LEV	-5.724	-30.79	-56.49*
(0.520)	(0.406)	(0.035)	
GDP	3.954*	-2.582	9.660
(0.070)	(0.429)	(0.505)	
CATA	-27.05***	-44.26	-75.99***
(0.007)	(0.236)	(0.008)	
_cons	-70.12***	-12.08	30.61
(0.000)	(0.799)	(0.536)	
N	93	63	89

P-values in parentheses; *, ** and *** denote significant at 10%, 5% and 1% respectively

The optimum CCC that generates this maximum value for firm value can be calculated as follows: CCC = $-\beta_1/2\beta_2$ = -0.0804/ (-2 x 0.000628) = 64.02 days. This means that the sampled firms on average optimize their firm value when the cash conversion cycle is about 2 months and 4 days.

Conclusion

The study examined the nexus between WCM (and its separate components) and firm value (measured by market capitalisation) before, during and after the global financial crisis. The CCC theory predicts a negative relationship between firm value and WCM, ICP and RCP respectively, and a positive relationship with PDP. The empirical results, however, are inconsistent with the CCC theory before the crisis because the results show that there exist a significant positive relationship between firm value and both ICP and RCP, while providing an insignificant positive relationship between CCC and firm value. Nevertheless, the results are consistent with the theory that there is a positive relationship between firm value and payables deferral period, but the relation is insignificant.

Second, it has been observed that during the crisis period, there is a positive and insignificant relation between firm value and both CCC and RCP, while the relationship between firm value and both ICP and PDP are negative and insignificant. Third, the results showed a negative but insignificant relation

between firm value and CCC as well as ICP and RCP. Furthermore, the relationship between MKTCAP and PDP is negative but insignificant.

Lastly, an important aspect of this study is the investigation of an inverted U-shape relationship between working capital management (WCM) and firm value. The results pertaining to the nexus between WCM and profitability is consistent with the hypothesis that there is an optimal CCC level that maximises firm value before the crisis period only. This optimal level is approximately 64 days, which means that firm value is at the maximum level at this point and will start to diminish after two months and four days. The findings of this study suggest firm managers adjust accounts receivable, accounts payable, and inventory levels in search for an optimal level of working capital.

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