“A reassessment of the relationship between working capital management and firm performance: evidence from non-financial companies in Nigeria”

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A REASSESSMENT OF THE RELATIONSHIP BETWEEN WORKING CAPITAL MANAGEMENT AND FIRM PERFORMANCE: EVIDENCE FROM NON-FINANCIAL COMPANIES IN NIGERIA

Abstract

This paper reassesses the relationship between working capital management (WCM) and firm performance in the Nigerian context. The study is motivated by the limited insights available on the impacts of WCM on firm performance in the country. To date, most studies from Nigeria have been largely descriptive and focused on a small sample size that is non-representative of the population. In addition, there are limited rigorous statistical analyses involved in such studies. This paper addresses the methodological limitations apparent in prior literature and provides a better understanding of the relationship between WCM and firm performance, revealing how firms can manage their operations more profitably. The paper adopts a panel data regression analysis on a sample of 75 non-financial firms listed on the Nigerian Stock Exchange from 2007 to 2015. The results of the analyses showed that WCM variables have an inconsistent relationship with the measures of performance adopted, which were return on assets and Tobin's Q. Specifically, accounts receivable management and inventory management were negatively associated with the return on assets, while accounts payable management, cash conversion cycle and cash conversion efficiency were positively associated with return on assets. Additionally, accounts receivable management and inventory management were positively associated with Tobin's Q, whereas accounts payable management, cash conversion cycle and cash conversion efficiency were negatively associated with Tobin's Q. These results were found to be robust using quantile regression. The results of the quantile regression showed inconsistency across the various quantiles used (0.10, 0.25, 0.50 and 0.75). These findings have two important implications. The first is that WCM variables influence the performance of firms. The second is that the mixed findings partly indicate that firms and managers must understand and formulate WCM policies that reflect their peculiar conditions.

Keywords working capital management, firm performance, financing constraints, methodological, limitations, Nigeria

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INTRODUCTION

In a world of resource scarcity and limited access to operating capital, firm performance has become a critical issue. Working Capital Management (WCM) makes a fundamental contribution to the performance of firms by providing adequate liquidity in the form of free cash flow to finance the operational activities of firms (Deloof, 2003; Eljelly, 2004) and enhances shareholders' wealth (Deloof, 2003; Filbeck & Krueger, 2005; Afrifa & Padachi, 2016). The importance of WCM is evidenced by the considerable amount of empirical research conducted on the relationship between WCM and firm performance (e.g., Deloof, 2003; Lazaridis & Tryfonidis, 2006; Abuzayed, 2012; Afrifa

& Padachi, 2016). Indeed, the growing empirical evidence from Nigeria (Festus, 2012; Owolabi & Alu, 2012; Ajibolade & Sankay 2013; Osundina, 2014; Aileman & Folashade, 2014) demonstrates that WCM is important and key to providing management and operational efficiency that can improve the liquidity and profitability of firms. However, these studies are constrained by methodological limitations, hence, undermining the implications of their findings on the relationship between WCM and firm performance in Nigeria. Some of these methodological limitations include an inadequate sample size, a poor sample selection procedure and the appropriateness of the statistical analysis.

The methodological shortcomings of the extant studies on WCM and firm performance from Nigeria motivated this empirical study to provide a more robust understanding of the relationship between WCM and firm performance in Nigeria. Also, motivation was drawn from the fact that Nigeria as a country has displayed high vulnerability to investable and operating capital due to the impact and exposure to the worldwide financial crisis of 2007–2008. Consequently, low financial development characterizes Nigeria. This is typified in the declining and inactive capital market operations and currency depreciation that has created instability in exchange rates that have negatively affected the economy (Akinlo, 2012). Subsequently, most firms in Nigeria have faced a myriad of challenges ranging from a scarcity of foreign exchange, to infrastructure deficits, to high banking charges and to lack of raw materials. Using a sample of 75 firms over the period of 2007–2015 and adopting the panel data regression analysis that corrects for potential unobserved variables that may be correlated with the variables, the results of this study offer insights into the practice of WCM for managers and firms for improving their cash flow and performance. Therefore, the paper contributes to WCM literature in many ways. First, the paper contributes to WCM literature by providing evidence from a large sample size. Second, the study used two alternative measures of firm performance, i.e. accounting (ROA) and market measures (Tobin's Q). A third contribution is that the paper demonstrates the importance of cash conversion efficiency as an important variable in explaining WCM. Finally, this paper advanced the quantitative technique by employing the panel data and quantile regression to determine the relationship between WCM and firm performance. Thus, the findings from such methods will also help managers improve the quality of their financing decisions to enhance their financial and management performance.

The rest of this paper is organized as follows. Section 1 discusses the literature review on the methodological weakness of previous WCM studies in Nigeria and the development of the proposed hypotheses. Section 2 presents the methodological approach adopted in this study. In Section 3, the results of analysis are presented with a general discussion of the findings of this study. The last Section concludes the paper.

1. LITERATURE REVIEW

1.1. Methodological weakness of WCM studies in Nigeria

WCM is essential to the success of all business sectors; however, the majority of the studies conducted in Nigeria are faced with problems resulting from an inadequate sample size and a short time period and are concentrated in the manufacturing sector. For example, Festus (2012) focused on determining how WCM could be used to resolve profitability and distress issues arising from e-business organizations in Nigeria using a sample of five non-financial firms from 2005 to 2007. The study found that WCM significantly influenced the success of the businesses. Barine (2012) studied WCM and the profitability of 22 banks and non-banking firms for the 2010 financial year. Findings showed that firms in Nigeria rely heavily on external financing thereby making them vulnerable to any financial crunch that comes along. The study encouraged an adequate WCM policy because such is critical in enhancing free cash flow for a firm. Takon and Atseye (2015) evaluated the effects of WCM on the profitability of 46 firms in Nigeria. The study found a significant relationship between measures of WCM and the return on assets of businesses. They concluded that the high cost of acquiring funds and the unstable economic

conditions have a great negative influence on firm performance in Nigeria. Meanwhile, Kurawa and Garba (2014) evaluated WCM and the profitability of four cement companies in Nigeria between 2001 and 2010. They found that all the dimensions of WCM significantly influenced the profitability of these cement companies using GLS regression. Similarly, Kolapo, Oke, and Ajayi (2015) conducted an empirical investigation on how corporate performance could be enhanced, used return on assets and looked at how WCM could drive gross working capital. They evaluated data from eight non-financial firms from 2001 to 2010. The findings revealed a significant influence of the average payment period and the cash conversion cycle on return on assets while none of the four measures of WCM showed a major impact on gross working capital.

In contrast to the findings of Festus (2012), Kurawa and Garba (2014), and Kolapo et al. (2015), Ogundipe, Idowu, and Ogundipe (2012) determined how WCM affected both profitability and the market valuation of 54 non-financial firms from 1995 to 2009. They found insignificant relationships (positive and negative) between measures of WCM and profitability as represented by return on assets and return on investment, while market valuation was determined using Tobin's Q. Similarly, Osundina (2014) found an insignificant relationship between WCM and the profitability of 12 firms. Osundina (2014), however, used a survey method to determine the relationship between WCM and profitability (Net Operating Profit) of food and beverage manufacturing firms in Nigeria. Aileman and Folashade (2014) investigated WCM and the profitability of manufacturing firms using data from Cadbury and Nestle Nigeria Plc between 2006 and 2012. The results revealed an insignificant relationship between the measures of working capital and ROE as a measure of profitability.

However, two key issues exist with respect to these studies. The first issue is sample size. For example, the findings of Festus (2012), Kurawa and Garba (2014) and Kolapo et al. (2015) were inappropriate for generalization because they used sample sizes of 5, 4 and 8 firms, respectively. These samples were not an adequate representation of firms in Nigeria. The insignificant relationships that Osundina (2014) and Aileman and Folashade (2014) found all shared the common characteristic of having a small sample. Osundina (2014) evaluated 12 firms, and Aileman and Folashade (2014) investigated two firms. The second issue is faulty methodology. Festus (2012) used chi-square to determine relationships, but chi-square has limitations because of the multicollinearity that might exist among the variables. Although, Ogundipe et al. (2012) utilized 54 non-financial firms, which is an appropriate sample, their study lacks rigorous statistical analysis in terms of normality, model fitness and serial correlation.

Several studies of working capital research have affirmed its relationship with profitability to be negative and significant. Amongst them was the study by Falope and Ajilore (2009). They evaluated WCM and corporate profitability using 50 non-financial firms in Nigeria from 1996 to 2005. The results of their analysis revealed that accounts payable, accounts receivable, inventory, and the cash conversion cycle all showed a significant and negative relationship with profitability as measured by net operating profit. They also confirmed that SMEs and large firms have similar needs for financing, as both experience the severe consequences of unfavorable economic conditions and the business environment. In alignment with Falope and Ajilore's (2009) findings, Barine (2012), Akinlo (2012), Owolabi and Alu (2012), Ajibolade and Sankay (2013), and Oladipupo and Okafor (2013) all found a negative relationship between working capital and the profitability of firms in Nigeria. While Barine (2012) used 22 listed financial and non-financial firms for only one year (2010), Akinlo (2012) used a sample of 66 non-financial listed firms in Nigeria and considered the period from 1997 to 2007. The study noted that the uncertainties associated with transaction costs, production and other new challenges brought by low technological development need to be complemented by optimizing the choice of WCM to improve profitability. That is because Nigeria's economy is characterized by a low sales volume and the interminable challenge of limited access to funding. He also commented that the macroeconomic conditions are central and critical for a mono-cultural economy like Nigeria that depends heavily on oil for survival at the expense of other sectors.

Others have studied the relationship of WCM with economic metrics. Owolabi and Alu (2012) said that the scarcity of resources (capital and equipment) has affected the extent to which firms in Nigeria can flourish. They evaluated a sample of five manufacturing firms from 2006 to 2010 and found a significant and negative relationship between measures of working capital and return on assets used as a proxy for profitability. Ajibolade and Sankay (2013) studied WCM and the financing decisions of firms and determined their synergy on the profitability of 35 manufacturing firms from 2011 to 2012. Ajibolade and Sankay (2013), like Akinlo (2012), found a significant and negative relationship between WCM components and debt structure and profitability. They affirmed that the economic crisis of 2007 and 2008 brought many adverse effects to the Nigerian economy, thereby affecting the profitability of firms. They further stressed that firms are now trying to regain synergy by focusing on optimizing the components of WCM. Oladipupo and Okafor (2013) established that WCM could contribute to the profitability and proportion of the dividends due to be paid out. They investigated 12 non-financial firms from 2002 to 2006 and used the Ordinary Least Squares technique. The results revealed that net trade cycle, current ratio, and leverage/debt ratio had significant and negative relationships with profitability, while working capital (net trade cycle) significantly influenced the dividend ratio. They observed that the net trade cycle and growth rate earnings had a negative but insignificant relationship. A major constraint of the studies of Owolabi and Alu (2012), Ajibolade and Sankay (2013) and Oladipupo and Okafor (2013) is that their samples are not representative of their population, while a few of them are faced with a second constraint of short time period.

The issue is, despite these constraints, these researchers have maintained that their results could be generalized to the entire population. Meanwhile, Lawal, Abiola, and Oyewole (2015) studied the effect of WCM on profitability of six selected manufacturing companies in Nigeria from 2006 to 2013, while Akindele and Odusina (2015) studied WCM and firm profitability using a sample of 25 non-financial firms. Lawal et al. (2015) and Akindele and Odusina (2015) found a significant and negative relationship between WCM and profitability. In contrast, Osundina and Osundina (2014) found a positive and significant relationship between all the measures of WCM and market value measured by Tobin's Q. This result was ascertained when they determined the effect of WCM on the market value of 12 manufacturing firms. Again, similar sample size and sample representation weakness are applicable to these studies.

Given the mixed findings and the declining performance of firms in Nigeria, Omolade and Mukolu (2013) and Toby (2014) emphasized that the Nigerian business environment was not conducive for business to strive and grow economically. Omolade and Mukolu (2013) found an insignificant relationship between all the dimensions of WCM and performance measured by return on capital employed (ROCE). They analyzed data of 10 listed firms (banking and non-banking sectors) using OLS. The results revealed that six firms showed a negative relationship between WCM and ROCE, while four showed a positive relationship. They ascribed the insignificant relationship to be the result of the Nigerian business environment, which is characterized by insecurity, unstable policies of the government and poor electricity, amongst others. Like Omolade and Mukolu (2013) findings, Toby (2014) studied the effect of WCM policy on corporate profitability. The study considered 107 firms spread across 23 sectors in Nigeria for the period 2003 to 2007. Toby (2014) operationalized WCM using the net current asset ratio (NCAR) on return on assets and net profit margin as measures of profitability. The result of the study revealed that most companies adopted aggressive working capital, which showed a negative relationship between NCAR and measures of profitability, while others revealed a significant and positive relationship between conservative NCAR and profitability. Thus, business firms must optimize the choice of either conservative or aggressive working capital policies, noting that a conservative policy enhances company value by focusing on current assets, which reduces a heavy reliance on borrowing. Uremadu, Egbide, and Enyi (2012) investigated working capital, liquidity and corporate profitability, using 25 Nigerian manufacturing firms from 2005 to 2006. They found a significant relationship and said that the global crises had brought about liquidity constraints that had incapacitated the ability of firms to source funds at

affordable rates. Abosede and Luqman (2014) evaluated two companies (Guinness Breweries and Consolidated Breweries) between 2009 and 2013 in Nigeria. Osundina (2014) studied 12 quoted food and beverage-manufacturing firms. Abosede and Luqman (2014) and Osundina (2014) determined the profitability of manufacturing firms using WCM.

Like Uremade et al. (2012) findings, Abosede and Luqman (2014) noted that factors that affected the efficiency of working capital in Nigeria were divided into external and internal factors. The external factors included economic conditions, government regulations, competition and environmental factors, while the internal factors included skills, the workforce and financial management of the firm. They stated that a firm had absolute control over internal factors, but external factors are not within the control of the firm. Although several studies have investigated the relationship between working capital and firm performance in Nigeria, many suffer from flaws such as a small sample size or a short span of study, and most have issues with the analytical methods. With respect to a sample size, Abosede and Luqman (2014) studied two companies, Owolabi and Alu (2012) studied five manufacturing firms, Muhammed et al. (2015) studied seven manufacturing firms. Ailemen and Folashade (2014) studied two manufacturing firms, Kurawa and Garba (2014) studied four cement-manufacturing companies and Lawal et al. (2015) studied six manufacturing companies. Moreover, the span of time for some studies rendered them inconsequential. For example, Barine (2012) study was only for 2010; Uremadu et al. (2012) study covered 2005 to 2006. Ajibolade and Sankay (2013) study also covered two years from 2011 to 2012. Additionally, most of the analytical methods adopted were the OLS and simple regression techniques. Most techniques adopted by majority of the studies undertaken in Nigeria have not taken care of the multi-collinearity, serial and auto correlation effects of variables. In sum, a small sample size, a short period of study and the method of analysis make the findings of these studies unsuitable for generalization, especially for a country like Nigeria and because the samples were predominantly taken from the manufacturing sector, which is not representative of all the sectors in Nigeria. Thus, the present study adds to the few studies with a large sample size (e.g., Akinlo, 2012; Ogundipe et al., 2012; Toby, 2014; Takon & Atseye, 2015).

1.2. Hypotheses development

Considerable research exists on the relationship between WCM and firm performance from developed and other developing countries (e.g., Abuzayed, 2012). Deloof (2003) used 1,009 Belgian non-financial firms between 1992 and 1996 to determine the relationship between WCM and corporate profitability. Using correlation and regression analysis, he found a negative and significant relationship between the gross operating income of Belgian firms and working capital measures. The results also concluded that the manner in which working capital is managed will determine its impacts on firm profitability. Therefore, managers could bring additional value to a firm and its shareholders by appropriately managing the working capital components. Eljelly (2004) investigated the liquidity and profitability trade-off of companies in Saudi Arabia between 1996 and 2000. Using correlation and regression analysis, the study revealed a significant and negative relationship between profitability and liquidity measured by current ratio. The study gives credence to the notion that cash conversion and cash gap are more appropriate measures of liquidity than is current ratio. Firm size was found to be a significant factor, and analysis revealed that firms with a higher current ratio and a longer cash conversion cycle exhibit a higher negative relationship with profitability. Size is important to a firm and brings with it several benefits. In line with the findings of Eljelly (2004), Filbeck and Krueger (2005) revealed that the 960 firms from CFO Magazine's annual survey from 1996 to 1999 could reduce financing cost of operations or increase funds available for expansion through reducing the amount of resources tied up in current assets.

Lazaridis and Tryfonidis (2006) examined the relationship between WCM and profitability of 131 firms listed on the Athens Stock Exchange between 2001 and 2004. The study established that a significant relationship exists between the cash conversion cycle and profitability measured by gross operating profit. In line with Deloof (2003), Lazaridis and Tryfonidis (2006) concluded that

managers could create more profit and value for their firms by optimizing the cash conversion cycle and its components. Padachi (2006) found the same results using a sample of 58 small manufacturing firms from 1998 to 2003 in Mauritius to determine trends in WCM and its influence on firm performance. Padachi (2006) found a significant relationship between WCM (cash conversion cycle, inventory, receivables and payable) and profitability measured by return on assets. Shah and Sana (2006) found a negative relationship between gross operating income in the Pakistani oil-and-gas sector and the inventory period, sales growth, accounts receivable and the cash conversion period. Accounts payable had a positive relationship; however, the negative relationship found between sales and profitability might be associated with the sensitivity or peculiarities of the sector studied. Meanwhile, Mathuva (2010) studied the influence of components of WCM on the profitability of 30 firms listed on Nairobi Stock Exchange for the period 1993 to 2008. He found a significant and negative relationship between the account collection period, cash conversion and firm profitability. The results also revealed a significant and positive relationship of the inventory period and the payment period on profitability. Falope and Ajilore (2009), Nobanee and Al-Hajjar (2009), and Zariyawati et al. (2009) found a significant and negative relationship between WCM components and profitability. Falope and Ajilore (2009) used 50 non-financial firms listed on the Nigeria Stock Exchange between 1996 and 2005 and concluded that difference exists in the financial and working capital needs of both small and large firms in Nigeria. Nobanee and Al-Hajjar (2009) used return on investment for measuring the profitability of 2,123 non-financial firms listed on Tokyo Stock Exchange from 1990 to 2004, and Zariyawati et al. (2009) drew insights from 1,628 panel data from Malaysia from 1996 to 2006. The findings of Falope and Ajilore (2009), Nobanee and Al-Hajjar (2009), and Zariyawati et al. (2009) supported the findings of Deloof (2003).

In contrast, Arunkumar and Ramanan (2013), and Alam et al. (2011) studies all revealed a positive association between WCM requirements and measures of profitability evaluated. Arunkumar and Ramanan (2013) found a positive relationship between return on assets and debtors' days and inventory days, while creditors' days show a significant and negative relationship with return on assets. A sensitivity analysis can suggest the range of return on assets with the given independent variables. This result was obtained from a sensitivity analysis in an investigation of 1,198 listed manufacturing firms in the Indian economy from 2006 to 2010. Alam et al. (2011) confirmed this relationship, evaluating 65 randomly selected listed firms in Pakistan from 2005 to 2009. They found that the sustainability of firms, that had been neglected, was brought to the forefront by the liquidity squeeze of global economic crisis. The concept of liquidity has regained importance in the literature of finance and efficient working capital because it is key in providing the free cash flow that will enhance the operations of firms. In contrast, Afeef (2011) found that the cash conversion cycle and accounts payable were insignificantly associated with operating profit to sales while accounts receivable and inventory showed a negative and significant relationship with operating profit to sales. Afeef (2011) findings contradicted those of Sharma and Kumar (2011) and Ali (2011). Sharma and Kumar (2011) obtained their results from the data of 263 non-financial firms in India from 2000 to 2008. They found that the cash conversion cycle and accounts receivable were positively correlated with profitability, while accounts payable and inventory had negative correlations with profitability. Ali (2011) evaluated 160 textile firms in Pakistan for the period 2000 to 2005. Both the cash conversion cycle and inventory were positively correlated, but accounts receivable and payable were negatively correlated with profitability. The peculiarity of these results may be because of the differences in industry and sample sizes.

Knauer and Wohrmann (2013) found a positive relationship between accounts payable, accounts receivable, inventory and profitability, while Panigrahi and Sharm (2013) found a negative relationship between accounts payable, accounts receivable, inventory and profitability. The cash conversion cycle had a positive relationship with profitability. This finding aligned with those of Ali (2011), Sharma and Kumar (2011), Abuzayed (2012), Nyamao et al. (2012), and Akoto (2013) who found a positive relationship between the cash conversion cycle and profitability. In Jordan, Abuzayed (2012) examined WCM and firm per-

formance with a sample of 52 non-financial firms listed on the Amman Stock Exchange from 2000 to 2008. Findings revealed a positive relationship between WCM measures and gross operating profits, while the market determined variable, Tobin's Q, revealed a negative relationship. Confirming the findings of Abuzayed (2012), Nyamao et al. (2012) found comparable results when they investigated the effect of WCM on the financial performance of firms in Kenya. Their findings came from a sample of 113 small-scale enterprises evaluated between 2007 and 2010. They found a significant and positive relationship between the measures of performance (growth in profit, growth in sales, growth in assets and growth in market) and working capital measures (efficiency of cash management, efficiency of receivable management and efficiency of inventory management).

Several assumptions have underscored this WCM literature. The first is that mixed and inconsistent findings are present in the literature. This has brought about variations in the conceptualization of WCM theory. The second is that the majority of the empirical evidence has been derived from developed countries, while the extant studies from developing countries, especially Nigeria, suffer from methodological flaws. The third is that the primary focus of prior studies has been on accounts receivable management, accounts payable management, cash conversion cycle and inventory management (e.g., Deloof, 2003; Lazaridis & Tryfonidis, 2006; Abuzayed, 2012; Abosede & Luqman, 2014). However, cash conversion efficiency introduced by Filbeck and Krueger (2005) that emphasizes the effectiveness and efficiency with which revenue (sales) are transformed into cash has been rarely studied.

Thus, by considering this additional variable in WCM main effect, this present study offers a more robust picture of the impact of WCM on firm performance. In addition, contrary to previous studies that have concentrated on measuring firm performance/profitability with only accounting measures such as return on assets, this present study departs from the emphasis on return on assets by shifting attention to a market measures such as Tobin's Q along with the others few authors who adopted it (Abuzayed, 2012; Ogundipe et al., 2012; Osundina & Osundina, 2014). Therefore, as the need for optimization of internal generated funds has heightened due to a liquidity squeeze, so does the need for an optimization of a WCM, with a large and representative sample that mitigates the methodological weakness identified in this study. Hence, the following hypotheses (*H1a-e* and *H2a-e*) are formulated:

H1a-e: There is a significant relationship between the WCM variables of accounts receivable management, accounts payable management, inventory management, cash conversion cycle, cash conversion efficiency and the ROA of firms in Nigeria.

H2a-e: There is a significant relationship between the WCM variables of accounts receivable management, accounts payable management, inventory management, cash conversion cycle, cash conversion efficiency and the Tobin's Q of firms in Nigeria.

2. RESEARCH METHOD

2.1. Data and sample

The data for this study were drawn from firms listed on the Nigerian Stock Exchange (NSE) for the period from 2007 to 2015. The sample of this study is restricted to the 124 non-financial firms listed on the NSE. Firms in the financial sector, such as banks and insurance companies, were excluded due to the peculiarities of their operations. The decision to evaluate the non-financial firms is consistent with Deloof (2003), Afrifa and Padachi (2016) and Simon, Sawandi, and Abdul-Hamid (2017) who stated that financial firms have an operational definition of WCM that is different from the one adopted in this study. The firms considered are large and important to the Nigerian economy. The selection criteria for sample determination are described in Table 1. In the initial stage, only firms that operated within the period from 2005 to 2015 were considered. Also, firms with substantial missing data and those that were delisted were dropped. The final sample of this study comprised 75 firms. Relevant data were collected from 2007 to 2015 leading to a total of 675 firm-year observations with usable data. The main source of data was the annual financial reports of the various firms.

Table 1. Sample selection distribution

Sample	Adjusted Numbers of Companies	Numbers of Companies
Total number of non-financial firms listed		130
Less: firms delisted between 2005 and 2015		15
Initial population of the study		115
Less: companies not listed between 2007 and 2010		19
Complete non-financial firms listed for the period		96
Less: firms with uncompleted data		
Missing annual report	35	
Replaced data using averaging method	–14	21
Useful data (total sample)		75

2.2. Variable measurements

The variables used in this study are described in Table 2 wherein the dependent variables comprise both accounting and market measures. They are: return on assets (ROA) and Tobin's Q (TQ), while the independent variables (WCM) are accounts receivable management (ARM), accounts payable management (APM), inventory management (INVM), cash conversion cycle (CCC) and the conversion efficiency (CCE). The control variables are firm size (FSz), sales growth (SGt) and the financial debt ratio (FDR).

Table 2. Summary of variables and measurements

Variable	Acronym	Measurement
Return on assets	ROA	Profit after tax divided by total assets
Tobin's Q	TQ	Equity market value + liability book value /equity book value + liability book value
Accounts receivable management	ARM	[(Account receivable/sales) x 365]
Accounts payable management	APM	[(Account payable / purchases) x 365]
Inventory management	INVM	[(Inventory/cost of sales) x 365]
Cash conversion cycle	CCC	[ARM + INVM – APM].
Cash conversion efficiency	CCE	[cash-flow from operations/ sales]
Firm size	FSz	Natural log of sales.
Sales growth	SGt	[Current year's sales – previous year's sales/ previous year's sales]
Financial debt ratio	FDR	Total liability divided by total assets

Note: *Equity market value is determined by multiplying share price by outstanding shares

2.3. Model specification

In this section, the models adopted to determine the relationship between WCM and firm performance are developed. Specifically, the following models are estimated for the panel data set:

$$ROA_{it} = \beta_0 + \beta_1 ARM_{it} + \beta_2 APM_{it} + \\ + \beta_3 INVM_{it} + \beta_4 CCC_{it} + \beta_5 CCE_{it} + \\ + \beta_6 FSz_{it} + \beta_7 SGt_{it} + \beta_8 FDR_{it} + e_{it}. \quad (1)$$

$$TQ_{it} = \beta_0 + \beta_1 ARM_{it} + \beta_2 APM_{it} + \\ + \beta_3 INVM_{it} + \beta_4 CCC_{it} + \beta_5 CCE_{it} + \\ \beta_6 FSz_{it} + \beta_7 SGt_{it} + \beta_8 FDR_{it} + e_{it}. \quad (2)$$

Where subscripts *it* represents the panel data notation and *i* is the firm (cross-sectional unit) while *t* is the time, i.e. from 2007 to 2015. *e* is the error term, while β is the regression slope coefficient. *ROA* and *TQ* are the dependent variables while *ARM*, *APM*, *INVM*, *CCC* and *CCE* are the independent variables. The control variables are *FSz*, *SGt* and *FDR*. These variable definitions remain as provided in Table 2.

To test the two hypotheses formulated, this study applied the fixed effect model. The choice of fixed effect model is determined following the result of the Hausman test (Green, 2008). The potential effect of outliers was reduced by winsorizing the data at 3rd and 97th percentile levels (Dahnel, 2014). Further diagnostic tests conducted for panel data estimation suggest the presence of heteroskedasticity for all the models. Similarly, the Wooldridge test for autocorrelation revealed that auto/serial correlation exists for model 2, whereas model 1 is free of such problem. Therefore, to remedy these problems of heteroske-

dasticity and auto/serial correlation and guarantee that the results of this study are free from any estimation bias, the *VCE* robust and cluster approach was adopted in both models as Baum (2006) suggested. The models in this study were all estimated using the STATA 13 statistical software.

3. RESULTS

3.1. Descriptive statistics and correlation

Descriptive statistics for the variables in their natural metric are presented in Table 3, while the transformed variables are presented in Table 4 to facilitate interpretation and understanding. Several items are of note. First, substantial variance existed between the accounting and market measures of performance adopted. Second, the descriptive statistics are consistent with other WCM studies (e.g., Mathuva, 2010). Third, the data for this study were normally distributed as the skewness and kurtosis ranged from –0.06 to 1.8 and 1.7 to 9.4, respectively. This shows that the data were within the expected range for a normal data. This is because the skewness and kurtosis fell below the threshold value of +/–3 and +/–10, respectively, as Kline (2011) suggested. To bring the data to a closer range, ARM and APM were logged. Their new values and effect are shown in Table 4. Thus, the subsequent analysis will be based on the

Table 3. Descriptive statistics

Variables	Mean	Median	Std. dev.	Min.	Max.	Skewness	Kurtosis
ROA	0.0539211	0.0511312	0.0974374	–0.2003407	0.2857245	–0.2054961	4.097238
TQ	1.935865	1.343815	1.511531	0.5261765	6.852686	1.727627	5.366354
ARM	65.81284	33.98553	85.91416	1.614762	404.844	2.511986	9.408382
APM	71.40689	42.26579	79.66378	1.691966	335.38	1.846047	5.923211
INVM	100.0844	82.88017	83.46253	1.989002	358.2027	1.339954	4.699067
CCC	98.03848	69.8113	120.9543	–121.1655	469.8565	1.217954	4.880861
CCE	0.1064187	0.1023664	0.2442265	–0.6259259	0.7416459	–0.3135631	5.377915
FSz	9.878679	9.860165	0.8014258	8.269192	11.26919	–0.0638473	2.308822
SGt	0.1325887	0.0856619	0.340373	–0.5409587	1.264393	1.192165	5.809239
FDR	0.5731376	0.5613916	0.2724106	0.0767562	1.399866	0.7752867	4.23238

Notes: Sample = 675 firm-year observations. Values are in their natural metric and winsorized at 3%.

Table 4. Descriptive statistics of logged variables

Variables	Mean	Median	Standard deviation	Min	Max	Skewness	Kurtosis
ARM	3.49006	3.525935	1.26605	0.4791876	6.003502	–0.31009	2.910008
APM	3.635119	3.743978	1.258196	0.525891	5.815264	–0.53268	3.003485

Notes: Sample = 675 firm-year observations. Values are transformed to ensure normality.

Table 5. Correlations

Variables	ROA	TQ	ARM	APM	INVM	CCC	CCE	FSz	SGt	FDR
ROA	1.0000									
TQ	0.2514***	1.0000								
ARM	–0.2532***	–0.1161***	1.0000							
APM	–0.0744*	0.0880 **	0.2633***	1.0000						
INVM	–0.1442***	–0.0321	0.1696***	0.3077***	1.0000					
CCC	–0.1643***	–0.1009***	0.4364***	–0.1012***	0.6465***	1.0000				
CCE	0.1739***	–0.0154	–0.1793***	0.0145	–0.0624	–0.1222***	1.0000			
FSz	0.3264***	0.0624	–0.3273***	–0.1485***	–0.3743***	–0.3418***	0.0189	1.0000		
SGt	0.2276***	–0.1040***	–0.0695*	–0.1008***	–0.1058***	–0.0960**	–0.0371	0.0647*	1.0000	
FDR	–0.2183***	0.1458***	0.0868**	0.0879**	–0.0302	–0.0290	–0.0754*	0.0751*	–0.0259	1.0000

Notes: Variables were winsorized at 3% to mitigate the effect of outliers in this study, while *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

logged data. The transformed data in Table 4 show that ARM now had a mean value of 3.49, while the APM mean was now 3.63. Their skewness and kurtosis are –0.31 and –0.53 and 2.91 and 3.00, respectively. Table 5 presents the correlation, and no correlation coefficients between a pair of variables in this study exceeded the threshold of 0.80 that Field (2005) suggested to indicate a problem of multicollinearity. Thus, the conclusion can be made that the choice of these variables would not result in misspecification; this was also confirmed by the results of the variance inflation factor (VIF), which show a value 1.7 (though not tabulated), but less than the threshold of 10 to suggest no serious problem of multicollinearity according to Field (2005).

3.2. Regression analysis results

Table 6 presents the results estimating the relationship between *WCM* variables and firm performance. The results are presented separately, wherein dependent variables proxied by *ROA* and *TQ* are reported in column 1 and column 2, respectively. The results were obtained using the panel data regression (fixed effect model) with the *VCE* robust and cluster estimate to control for heteroskedasticity and auto/serial correlation. The results presented in Table 6 show that *ARM* was negative but insignificantly associated with *ROA* ($\beta = -0.0014091$, $p > 0.10$). The negative relationship between *ARM* and *ROA* implies that shorter account receivable periods were associated with ROA. Thus, a decrease in the *ARM* periods by one percent increases *ROA* by 0.0014091. It can be inferred from this result that early collection of debt from customers increases the performance through the supply of cash flow that meets both the operational and financing activities of firms. Contrary to *Hypothesis 1a*, the negative relationship between *ARM* and *ROA* was not significant and, therefore, does not support the hypothesis. With regards to *TQ*, the results showed that a positive and significant relationship exists between *ARM* and *ROE* ($\beta = 0.1514978$, $p < 0.10$), indicating support for *Hypothesis 2a*. The positive relationship means that an increase in ARM will lead to an increased *TQ* of firms. This suggests that a percentage increase in *ARM* was associated with a 0.1514978 increase in *TQ*. The result with respect to *ROA* supports the assumption of *WCM*, which states that a shorter account collection period is beneficial but provides no statistical evidence to support the results found as the relationship was statistically insignificant. However, this finding was consistent with Deloof (2003), and Lazaridis and Tryfornidis (2006), whereas the later relationship (*ARM* and *TQ*) contradicts the previous studies undertaken.

In *Hypotheses 1b* and *2b*, a significant relationship was predicted between *APM* and firm performance precisely measured by *ROA* and *TQ*. The results presented in Table 6 (model 1) reveals support for *Hypothesis 1b*, as the result indicates that *APM* was positive and significantly related to *ROA* ($\beta = 0.0080847$, $p < 0.10$). This implies that extending payment periods to suppliers was associated with a higher *ROA*. Thus, a percentage increase in *APM* increases *ROA* by 0.0080847. This result reveals that delaying a payment gives firms the opportunity to overcome financing constraints by using cash that would have been paid to suppliers for operational activities. This result is consistent with the findings of Mathuva (2010), Azam and Haider (2011), which emphasize extending payment periods enables firms to take absolute advantage of such cash. In model 2, *APM* was found to be negative and insignificantly associated with *TQ* ($\beta = -0.0602374$, $p > 0.10$), implying that early payments to suppliers have advantages that lead to increased performances. Therefore, a percentage decrease in *APM* will lead to an increase in *TQ* by 0.0602374. This result is similar to the findings of Deloof (2003). Deloof argued that only unprofitable firms wait longer to pay debts, whereas profitable firms pay early and enjoy discounts and many other benefits. However, the result is not substantively supported, as *Hypothesis 2b* is not supported. Like the results of *ARM*, mixed support was present for the hypothesized influence of *APM* on firm performance. Supporting *Hypothesis 1c*, inventory management ($\beta = -0.0002009$, $p < 0.10$), the coefficient was found to be negative and significantly associated with *ROA*. The coefficient indicates that a one-day decrease in the *INVM* period was associated with a 0.0002009 increase in *ROA*. This result is also consistent with *WCM* Theory, the Pecking Order Theory and the findings of Deloof, (2003) and Lazaridis and Tryfornidis (2006). In contrast, the relationship between *INVM* and *TQ* was positive and insignificant ($\beta = 0.0029773$, $p > 0.10$),

Table 6. Regression results of WCM and firm performance

Variables	Model 1	Model 2
	ROA	TQ
ARM	–0.0014091(–0.25)	0.1514978 (1.92)*
APM	0.0080847 (1.71)*	–0.0602374 (–1.02)
INVM	–0.0002009 (–1.85)*	0.0029773 (1.59)
CCC	0.0000805 (1.42)	–0.0014703 (–1.69)*
CCE	0.0281825 (1.83)*	–0.0649369 (–0.24)
FSz	0.0087515 (0.51)	–1.012187 (–3.72)***
SGt	0.0569127 (3.91)***	0.3248868 (2.24)**
FDR	–0.0504328(–2.37)**	0.2924548 (0.97)
CONSTANT	–0.0264322(–0.16)	11.26755 (4.20)***
R^2	0.1228	0.1058
F-probability	6.35***	2.42**
rho	0.50423232	0.69331271

Notes: The first regression result for Model 1 is presented in the column labelled ROA, where return on assets was used as the dependent variable; while the second regression result for Model 2 is presented in the column labelled TQ where Tobin's Q was used as the dependent variable. Variable results begin with their coefficients and t-statistics are in parentheses, while *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. Results were obtained using the FE model with robust cluster estimates.

suggesting that higher profitability in terms of *TQ* is dependent on a longer inventory conversion period or a larger inventory. Increasing *INVM* conversion periods by one day was associated with a 0.0029773 increase in firm performance in terms of *TQ*. The result of *INVM* and *TQ* was insignificant and does not support *Hypothesis 2c*, the assumptions of *WCM* Theory and the findings of Deloof, (2003) and Lazaridis and Tryfornidis (2006), but supports the findings and arguments of Abuzayed (2012).

Next, the impact of *CCC* on firm performance was examined (*Hypotheses 1d* and *2d*). Model 1 reveals that *CCC* was positive and insignificant (β = 0.0000805, $p > 0.10$); this indicates that a longer *CCC* is associated with higher *ROA*. Thus, an increase in *CCC* by one day was associated with a 0.0000805 increase in *ROA* of firms. Thus, because the relationship was statistically not significant, *Hypothesis 1d* was not supported. Whereas in Model 2, *CCC* was negative and significantly related *TQ* (β = –0.0014703, $p < 0.10$), providing strong support for *Hypothesis 2d*. This depicts that, when a firm shortens its *CCC* by one day, a profit of 0.0014703 will accrue. This result supports the WCM Theory and the Pecking Order Theory as well. Similarly, the result is consistent with the findings of Deloof (2003). Finally, *Hypotheses 1e* and *2e* predicted that *CCE* would have a significant impact on firm performance measured by *ROA* and *TQ*. In Model 1, *CCE* was positive and significantly associated with *ROA* (β = 0.0281825, $p < 0.10$), indicating support for *Hypothesis 1e*. The result is consistent with expectations and suggests that the performance of firms is dependent on the efficient method adopted in managing their production and cash cycle. Specifically, the coefficient means that a one percent increase in *CCE* was associated with a 0.0281825 profit in the form of ROA. For Model 2, *CCC* was found to be negative and insignificantly associated with *TQ* (β = –0.0649369, $p > 0.10$), which does not support *Hypothesis 2e*. Meaning that efficiency in some instances does not translate into higher profits for firms. For the control variables, *FSz* was positive and insignificantly associated with *ROA* (β = 0.0087515, $p > 0.10$) but negative and significantly associated with *TQ* (β = –1.012187, $p < 0.01$). These findings suggest that the size of a firm brings advantages that enhance the profitability of firms in some situations, whereas in other situations, it is inconsequential. *SGt* was positive and significantly associated with *ROA* (β = 0.0569127, $p < 0.001$) and *TQ* (β = 0.03248868, $p < 0.05$). What these findings suggest is that firms are more likely to increase their profits when their sales increase. *FDR* was negative and significantly associated with *ROA* (β = –0.0504328, $p < 0.10$) but was positive and insignificantly associated with *TQ* (β = 0.2924548, $p > 0.10$).

4. DISCUSSION OF RESULTS

This paper reassesses the relationship between WCM variables and firm performance to address the methodological limitations evident in prior WCM studies in Nigeria. The paper explores one of the largest samples ever used to study listed non-financial firms in Nigeria. Overall, the findings of this study reveal that optimization of investment in WCM enhances profitability and the market value of firms. Furthermore, the relationship between WCM variables and firm performance was mixed and inconsistent. For example, ARM was negative and insignificantly related to ROA but positive and significantly related to TQ. The negative result between ARM and ROA highlights the importance of realizing accounts receivable early from customers, and it is consistent with the findings of Deloof (2003) and Lazaridis and Tryfornidis (2006). Whereas, the positive result between ARM and TQ broadly leads to the consideration of extending accounts receivable or credit periods to customer when opportunities for higher sales are envisaged. This finding also extends past studies that found extending receivable periods as essential for improving firm performance (e.g., Sharma & Kumar, 2011). The results of *ARM* provide a nice link that can help firms attract additional financing. It indicates that the way in which *ARM* impacts firm performance may depend on evaluating substantially whether allowing shorter accounts receivable periods increases a firm's performance than do longer accounts receivable periods. It is thus possible that the negative result is associated with higher performance for firms that have large market acceptability, while the positive result may be driven by firms seeking to penetrate the market and deplete their stock of finished. This is possible, as noted by Sharma and Kumar (2011), that in India, competition reduced the rate of patronage and that firms had to offer good packages to earn the continuing patronage of customers. Hence, firms need to understand both the needs and impact of their decisions, so that they can make a viable policy. The results provide more understanding of managing WCM in contrast to prior studies, because they provide a more dynamic view of WCM. According to the results between *ARM* and *TQ*, the p-values reveal that firm performance is maximized by granting a longer credit period to customers in Nigeria because it is statistically significant. This result is consistent with the findings of Sharma and Kumar (2011).

Another insightful result of this study is that *APM* was positive and significantly related to ROA but was negative and insignificantly related to *TQ*. Indeed, *APM* offers a direct way to increase the performance of firms. The mixed results again suggest that *APM* is highly specific to context. The positive relationship between *APM* and *ROA* implies that extending payments is a tactical decision to provide free cash flow for financing the operational activities of firms. It supports the notion that a longer *APM* is associated with higher profitability and is consistent with the findings of Falope and Ajilore (2009). While the negative relationship between *APM* and *TQ* underscores the importance of evaluating the cost and benefits of early payment. Hence, whilst extending *APM* or paying late deprives firms of the leverage to bargain for better pricing and reduces their reputation and opportunity to earn discounts, at the end suppliers may view such practices as a sign of insolvency. This may have the implication of depriving firms access to produce and reach out to their customers with the products or services of the suppliers without making immediate payments for such.

In this context, one useful and transferable lesson from the mixed findings is the importance of analyzing and navigating the shoals between early payment and late payment to determine which could reduce the risk of insolvency and influence firm performance, noting that both extending and early payments have benefits and consequences. Thus, this mixed result advances prior studies by highlighting not only the need to extend payment periods to suppliers as most prior studies argue (Mathuva, 2010; Azam & Haider, 2011) but also to recognize and make sense of opportunities to pay early when discounts and other economic benefits are offered to enhance firm performance. In this study, the p-value between *APM* and *ROA* is statistically significant and shows that extending payment to suppliers increases firm performance in Nigeria. This is consistent with the findings of Mathuva (2010), and Azam and Haider (2011).

This study also found a mixed result for the *INVM* model. *INVM* was negative and significantly re-

lated to *ROA* but was positive and insignificantly related to *TQ*. The discrepancies in the result of *INVM* again suggest that firms need to weigh the costs and benefits associated with holding large inventory when making a choice. This is important for providing uninterrupted production and minimizing costs associated with holding a large inventory. Precisely, such answers the question of the level of inventory that a firm should hold. Unfortunately, the inability of previous studies to highlight the importance evaluating the benefits and costs between holding a large inventory and small inventory prevents greater utility being made of prior studies and could account for the failure of firms in Nigeria. Nevertheless, the p-values of the results show that the negative relationship between *INVM* and *ROA* is statistically significant, indicating that minimizing inventory level was associated with higher performance for Nigerian firms. The result reflects the Nigerian condition, suggesting that under conditions of high inflation and unfavorable macroeconomic conditions as Nigeria faces now, the benefits of holding optimal (small) inventory levels that guarantee uninterrupted production do outweigh the potential of large inventory under this condition. This is because once inflation reduces and the economy improves, prices will be adjusted, and holders of large inventory will be faced with adverse shocks. The result is consistent with Deloof (2003) findings.

For *CCC* and *CCE*, the results show that both were positively associated with ROA but negatively associated with *TQ*. The *CCC* was insignificantly related to *ROA* but was significantly related to *TQ* whereas CCE was significantly related to *ROA* but was insignificantly related to *TQ*. Unlike prior studies that emphasized that a negative *CCC* is associated with higher performance (Deloof, 2003; Murugesu, 2013; El-Maude & Shuaib, 2016) or positive as the case with Abuzayed (2012) and Nijam (2016), the result of this study advances prior studies by emphasizing that *CCC* impacts are firm-driven. Accordingly, the conversion cycle of large firms differs from that of small firms. In the light of this, for example, a road construction company may have a longer *CCC* because of the nature of its activities than a manufacturing company that produces sugar. The differences in firm operations are important and manifested in the mixed findings. Noting this demonstrates one of the complex issues this study clears to overcome managerial and policy problems that arise when firms adopt recommendations from studies that do not note differences in their operations. Regarding the *CCE*, limited evidence exits on its association with firm performance. However, the results of this study show that firm performance is significantly associated with higher *CCE*.

5. ROBUSTNESS TEST

To check for the consistency of the findings between WCM and firm performance across various scales and gain a deeper understanding of WCM for inclusive firm policymaking, this study employed the Quantile Regression. This was due to the fact that the relationship between WCM variables and firm performance may not be homogeneous across units (firms) as measured by most prior studies using Ordinary Least Square (OLS) regression, but possibly heterogeneous (that is the impact may be on upper or lower bounds) (Shawtari et al., 2016). Hence, Quantile Regression provides the capability to describe the relationship at different quantiles. This study also examines the consistency or dynamism of the measures of performance such as *ROA* and Tobin's Q under different quantiles, such as the first (0.10), second (0.25), third (0.50) and forth (0.75) quantiles. The models used to test the quantiles are represented by the following equations:

$$\begin{aligned} ROA_{it}^{(q)} &= \beta_0^{(q)} + \beta_1^{(q)} ARM_{it} + \\ &+ \beta_2^{(q)} APM_{it} + \beta_3^{(q)} INVM_{it} + \\ &+ \beta_4^{(q)} CCC_{it} + \beta_5^{(q)} CCE_{it} + \beta_6^{(q)} FSz_{it} + \\ &+ \beta_7^{(q)} SGt_{it} + \beta_8^{(q)} FDR_{it} + e_{it}^{(q)}. \end{aligned} \quad (3)$$

$$\begin{aligned} TQ_{it}^{(q)} &= \beta_0^{(q)} + \beta_1^{(q)} ARM_{it} + \\ &+ \beta_2^{(q)} APM_{it} + \beta_3^{(q)} INVM_{it} + \\ &+ \beta_4^{(q)} CCC_{it} + \beta_5^{(q)} CCE_{it} + \beta_6^{(q)} FSz_{it} + \\ &+ \beta_7^{(q)} SGt_{it} + \beta_8^{(q)} FDR_{it} + e_{it}^{(q)}. \end{aligned} \quad (4)$$

The results of the quantile regressions are presented in Tables 7 and 8 for *ROA* and *TQ* models, respectively. The results indicate that firm performance measured by *ROA* and TQ differ consider-

ably between the quantiles. For example, the result presented in Table 7 shows that there is heterogeneity over the different quantiles on the relationship between *APM*, *APM*, *INVM*, *CCC* and *ROA*. At the 0.10 and 0.50 quantiles, the coefficients of *ARM* were negative but insignificant and are consistent with the Fixed Effect result. Nevertheless, at the 0.75 quantile, the coefficient of *ARM* was negative and significant at 1%. Contrarily, at the 0.25 quantile, the coefficient of *ARM* was positive but insignificant. *APM* has positive and insignificant coefficients at the 0.10 and 0.50 quantiles, which were not consistent with the Fixed Effect, whereas at the 0.75 quantile the result obtained was consistent with the Fixed Effect result (because the coefficient of *APM* was positive and significant at 10%). The result from Table 7 also show that at lower bounds (the 0.10 and 0.25 quantiles) and the 0.50 upper level, the coefficients of *INVM* were positive but insignificant, therefore contradicting the Fixed Effect result. Similarly, at the 0.75 quantile, the coefficient of *INVM* was negative but insignificant and inconsistent with Fixed Effect result. Additionally, at lower bounds of the 0.10 and 0.25 quantiles, the coefficients of *CCC* were negative but insignificant. These results were not consistent with those in the Fixed Effect results. However, at the upper levels of the 0.50 and 0.75 quantiles, the coefficients of *CCC* were positive but statistically insignificant, which were all consistent with Fixed Effect results. With regards to *CCE*, the coefficients were positive and statistically significant across the different quantiles, thereby confirming the Fixed Effect results. More importantly, all the control variables, *FSz*, *SGt* and *FDR*, confirm the results obtained in the Fixed Effect at different quantiles. In summary, the results obtained from the Fixed Effect model reported in Table 6 differ considerably from the Quantile Regression reported in Table 7. In large part, the results reflect the dynamism of WCM variables, and have important implications for understanding the performance of firms in terms of *ROA*.

Table 8 presents the Quantile Regression result between WCM and *TQ* at the 0.10, 0.25, 0.50 and 0.75 quantiles. In general, the coefficients were significantly different across the quantiles. For example, *ARM* was negative and statistically significant across the different quantiles apart from the result of the 0.10 quantile that is insignificant. These results are considered different and not in line with the Fixed Effect result reported in Table 6. At the lower bounds of the 0.10 and 0.25 quantiles, the

Table 7. Result of quantile regression (QR) for the ROA model

Variables	1st (0.10)	2nd (0.25)	3rd (0.50)	4th (0.75)
	Quartile	Quartile	Quartile	Quartile
ARM	–0.00695	0.00254	–0.00635	–0.0201***
	(0.00484)	(0.00442)	(0.00436)	(0.00742)
APM	0.00128	–0.000592	0.000519	0.00756*
	(0.00871)	(0.00402)	(0.00344)	(0.00430)
INVM	0.000160	3.22e–05	1.42e–05	–6.76e–05
	(0.000206)	(9.85e–05)	(6.11e–05)	(6.27e–05)
CCC	–0.000124	–2.21e–05	2.99e–05	6.73e–05
	(0.000136)	(6.86e–05)	(3.44e–05)	(7.17e–05)
CCE	0.0602***	0.0489**	0.0410**	0.0385**
	(0.0209)	(0.0199)	(0.0203)	(0.0157)
FSz	0.0528***	0.0443***	0.0286***	0.0259***
	(0.0121)	(0.00465)	(0.00587)	(0.00864)
SGt	0.0527***	0.0383***	0.0379***	0.0622***
	(0.0125)	(0.0121)	(0.0125)	(0.0210)
FDR	–0.126***	–0.112***	–0.0727***	–0.0509***
	(0.0204)	(0.0174)	(0.0171)	(0.0146)
Constant	–0.492***	–0.385***	–0.184***	–0.0961
	(0.129)	(0.0509)	(0.0680)	(0.0910)
R^2	0.2513	0.1376	0.0957	0.1120
Observations	675	675	675	675

Notes: Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

Table 8. Result of quantile regression (QR) for the TQ model

Variables	1st (0.10)	2nd (0.25)	3rd (0.50)	4th (0.75)
	Quartile	Quartile	Quartile	Quartile
ARM	–0.0370	–0.0682***	–0.0840*	–0.248**
	(0.0244)	(0.0223)	(0.0503)	(0.104)
APM	–0.00942	–0.0108	0.00156	0.186**
	(0.0123)	(0.0280)	(0.0417)	(0.0763)
INVM	0.000434	0.000906**	0.00107	0.00284
	(0.000312)	(0.000407)	(0.000737)	(0.00295)
CCC	–6.31e–05	–0.000323	–0.000753**	–0.00127
	(0.000242)	(0.000241)	(0.000355)	(0.00171)
CCE	–0.0194	0.0329	–0.0694	–0.586*
	(0.0568)	(0.0734)	(0.149)	(0.320)
FSz	–0.0120	–0.0318	0.0744	0.145
	(0.0395)	(0.0260)	(0.0532)	(0.111)
SGt	–0.0163	0.0809	0.233***	0.890***
	(0.0291)	(0.0760)	(0.0806)	(0.316)
FDR	0.630***	0.676***	0.794***	0.874***
	(0.0654)	(0.126)	(0.112)	(0.287)
Constant	0.689	1.107***	0.406	0.407
	(0.438)	(0.329)	(0.505)	(1.145)
R^2	0.0821	0.0507	0.0444	0.0715
Observations	675	675	675	675

Notes: Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, and * $p < 0.1$.

coefficients of *APM* were negative but statistically insignificant, these results gave support to relationship between *APM* and *TQ*. However, at upper levels of the 0.50 and 0.75 quantiles, the coefficients of *APM* were positive. The results contradict the relationship between *APM* and *TQ* but were quite similar to the results of Quantile Regression for *ROA* at the 0.50 and 0.75 quantiles, respectively. There exists evidence that over the different quantiles studied, the coefficients of *INVM* were negative but statistically insignificant (except for the 0.25 quantile that is significant at 5%) and are like the Fixed Effect results reported between *INVM* and *TQ*. The negative relationship of *CCC* across all the quantiles with dependent variable *TQ*, confirms the Fixed Effect results reported between *CCC* and *TQ*. In terms of *CCE*, the result is largely consistent with the Fixed Effect results reported between *CCE* and *TQ* at the 0.10, 0.50 and 0.75 quantiles because the coefficients were negative and statistically insignificant. With regards to the control variables, *FSz*, *SGt* and *FDR*, the results obtained were different across the different quantiles except the coefficient of FDR that is consistent across all quantiles and supports the findings reported in Table 6. In effect, the results presented in Table 8 show that the relationship between WCM and TQ is somewhat mixed across all the quantiles. Hence, a major conclusion to be drawn from the quantile regression is that firms must strive for a greater flexibility when managing WCM as an effective contributor of cash flow that enhances firm performance. This is because WCM is largely dependent on several other factors that change frequently. Such may include firm's operations, customers perceptions, competitions, environmental factors and many others.

CONCLUSION

The findings of this study provide practical insights into the management of working capital by firms, specifically in Nigeria. Two important findings emerged: First, the mixed results highlight the point that WCM variables need to be understood and managed in the context of a firm's peculiar conditions to provide the cash-flow for financing operational activities of firms and increase their performance. Therefore, a knowledge of the business environment, customers, suppliers and market conditions are essential to achieving this

goal. Second, the existing literature on WCM in Nigeria is insufficient to guide policy-making by firms in Nigeria. This is because the sample sizes of most studies were small and predominantly taken from one sector, yet, their results were generalised. The implication of this is that policies may be formulated and implemented based on such recommendations whereas these firms are not part of the sample studied. This may lead to a policy mismatch and could have detrimental effects on the performance of firms in Nigeria. Additionally, the findings of this study were derived from the application of rigorous analytical tools and the use of a larger sample size that is representative of non-financial firms in Nigeria (see appendix A), thereby extending the significance of its results beyond the study's universe. Therefore, this paper is deemed important not just to non-financial firms in Nigeria, but to similar firms in the developing world and beyond.

Theoretically, this study advances WCM knowledge by addressing the methodological limitations evident in WCM literature in Nigeria. Broadly, the study integrates the WCM literature by substantiating the mixed results in prior studies. The findings of this study imply that WCM needs to be understood in the context of a firm's specific condition to increase performance. In this way, the study contributes to WCM literature by emphasising the focus on the importance of recognising differences in operational activities of firms. Moreover, previous studies overlook the issue of heterogeneity and its effect. Using the quantile regression at the 0.10, 0.25, 0.50 and 0.75 quantiles, this study shows a presence of heterogeneity across these various quantiles for the relationship between WCM and firm performance in Nigeria. Therefore, this study contributes to WCM literature in terms of methodological approach and showing that WCM is dynamic even at short interval.

Future research may re-examine the impact of WCM on the performance of firms in the financial sector using an expanded sample size because this study only considered non-financial firms. Another research avenue is to extend this study by determining the sensitivity of the findings in this study through other methodological approaches. Finally, a new framework that incorporates the effect of operational activities of firms on WCM variables needs to be examined.

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APPENDIX A

Table A1. Industry classification of a sample

Source: Insight from the Nigerian Stock Exchange.

Distribution of sample of firms by industry	Number of firms listed	Available firms (usable)	Percentage of firms used
Agriculture	5	4	5.33
Conglomerates	6	6	8.00
Construction/real estate	7	3	4.00
Consumer goods	22	17	22.67
Healthcare	11	5	6.67
ICT	7	2	2.67
Industrial goods	17	15	20.00
Natural resources	4	3	4.00
Oil and gas	12	9	12.00
Services	24	11	14.67
Total	115	75	100.00