WORKING CAPITAL MANAGEMENT AND FINANCIAL PERFORMANCE OF LISTED MANUFACTURING FIRMS IN NIGERIA

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Abstract:

This study investigates the impact of working capital management on financial performance of quoted manufacturing firms in Nigeria. The period which the study covers is from 2005 to 2019 of sixteen listed manufacturing firms in the Nigerian Stock Exchange as information about them is extracted from their financial statements. The dependent variables are financial performance proxied by ROA while the independent variables are Average Collection Period (ACP), Average Payment Period (APP) and Cash Conversion Cycle (CCC). The Panel Ordinary Least Squares analysis reveal identical results for the two models in the sense that while ACP is negatively and statistically significant with both ROA at 1% level; APP and CCC, on the other hand, are positively significant with both ROA at the 1% level also. We recommend that firms in this industry should maintain and improve on their present policy with respect to average payment period (APP) and cash conversion cycle (CCC) since APP and CCC are respectively positive and statistically significant with ROA, but they should investigate the ACP so as to realign it with APP and ACC since it negates ROA.

Keywords: *Working capital management, ROA, Nigerian Stock Exchange.*

Introduction

Every organization-whether profit oriented or not-, operating in any political economic environment-capitalism, socialism or otherwise-and irrespective of the size and nature of business-large scale, medium scale or small scale- needs sufficient amount of working capital for the operations of that business (Mukhopadhyay, 2004). The effective management of working capital plays a very important role in the performance (profitability) of firms. The essence of this is to ensure that managersof firms' current assets and liabilities maintain a satisfactory level of fund (Vural et al., 2012).Phuong and Hung (2020) noted

that working capital management involves the policy of risk-return exchange where aggressive policy denotes high risk-return policy; matching working capital policy denotes lower risk-return policy and conservative policy denotes lowest risk-return policy. To maintain this satisfactory level of fund ensure that sufficient fund is available for the firm to meet its short term commitment of operational expenses. This guides and guards the firm from carrying too little or too much investment in working capital which ensures the firm to continue its operations at normal level of working capital. Many businesses have gone under-became insolvent and even bankrupt due to the fact that the firm could not maintain a satisfactory level of working capital.

Researchers give serious attention to the study of the management of working capital because of its relevance and centrality to the success of a going concern (Ademola, 2014). Working capital serves as the catalyst for the day-to-day smooth running of the business activities of which the current assets and current liabilities are the major components (Takon & Atseye, 2015).Finance, of which working capital is an offshoot, is regarded as the life blood or the life wire of any economic unit.

In the opinion of Tjandra et al. (2022) inadequate working capital may lead to liquidity and financial distress while excess working capital can also be harmful, and so firms need to realize a turning or tipping point in their working capital management which guarantee optimality. Vartak and Hotchandani (2019) were of the opinion that working capital, which is seen as an important part of finance, influences a firm's liquidity position and is generally regarded as the lifeblood of a business since it plays a pivotal role in the upkeep of the wheels of a business. They went further to state that working capital management which involves the management of accounts payables, accounts receivables, inventories and cash ensures continuity in business operations, guarantee availability of sufficient funds for both maturing short-term debt and upcoming operational expenses, support the smooth and efficient functioning of the daily operations of the business by striking a balance between liquidity, profitability and risk. Thus, the ability to manage such resources is seen as a critical factor for the maintenance of liquidity, solvency and profitability of business and this guarantee the continued existence of the firm (Siddique & khan, 2009).

According to Panigrahi (2014), the decision on the optimal level of working capital theoretically affects both liquidity and profitability positions, and this relationship, in the opinion of Wuryani (2015), is frequently emphasized in deciding on the level of investment in working capital. Thus, Ailemen & Folashade (2014) noted that these two variables-liquidity and profitability-are very vital in the evaluation of the performance as well as in deciding on the survival of any organization. Increasing only profit without a corresponding increase in liquidity can lead to insolvency and ultimate bankruptcy and increasing liquidity without a corresponding increase in profitability can result in low profitability. An efficient management of working capital involves the definition of appropriate ratios which optimizes the risk-return relationship so as not to cause negative revenue-growth nexus effects in the future.

Therefore, this study examined the trade-off between profitability and liquidity because a well implemented working capital level will contribute positively to the creation of firms' values (Leon-Jude, 2013). The remaining parts of this study after this introduction is as follows: literature review, methodology, results and discussions, and then conclusion.

Literature Review

Empirical Review

Anton and Anca (2021) empirically studied working capital management and profitability of firms listed on Poland. Secondarily sourced data obtained from the Polish Stock Exchange from 2007 to 2016 was used in the study. The dependent variables were return on assets (ROA) and operating return on assets (OROA) whereas the independent variables were debt ratio (DEBTR), cash ratio (CASHR), growth rate in sales (SALESGR) and firm size (SIZE). The regression results of the panel corrected standard errors (PCSE) indicated that all the independent variables were positively significant with ROA and OROA.

Kayani et al (2020) studied working capital management and profitability of firms listed on the New Zealand and Australian. Secondarily sourced data obtained from the two countries Stock Exchanges from 2010 to 2019 were used in the study. The dependent variable was return on assets (ROA) whereas the independent variables were cash conversion cycle (CCC), inventory

conversion period (ICP), average collection period (ACP) and average payment period (APP). The result of the generalized methods of moments (GMM) regression showed that CCC and ICP have negative and significant relationship with ROA, APP relationship with ROA was positive while ACP relationship was insignificant. Nadeem et al. (2020) examined the relationship between working capital policy and firms performance in Indonesia. Secondarily sourced data obtained from financial reports of listed firms on the floor of the Indonesia Stock Exchange (IDX) for the year 2012 to 2017 was used in this study. The dependent variables were return on assets (ROA) and Tobin's Q whereas the independent variables were cash conversion cycle (CCC), inventory conversion period (ICP), average collection period (ACP), average payment period (APP) and current liabilities-to-total assets (CLTA). The result of the OLS regression showed that, CCC and ICP have negative and significant relationship with ROA and Tobin's Q, APP had a positive and significant relation with both ROA and Tobin's Q. CLTA relationship with ROA was positive while CLTA relationship with Tobin's Q was insignificant.

Soukhakian and Khodakarami (2019)studied working capital management and profitability of firms listed in Iran. Secondarily sourced data obtained from the Teheran Stock Exchanges from 2010 to 2016 were used in the study. The dependent variable was return on assets (ROA) whereas the independent variables were cash conversion cycle (CCC), leverage, firm size, cash flow, current liabilities ratio, variability of operating net income, firm age, current asset ratio and fixed financial assets to total assets. The result of the Ordinary Least Squares (OLS) with Robust Standard Errors regression showed that CCC had a negative and significant relationship with ROA. Al-Mawsheki et al (2019), in their study, empirically tested the impact which efficient working capital management and working capital policies have had on the profitability of firms listed in Malaysia. Secondarily sourced data obtained from the Bursa Stock Exchanges from 2010 to 2016 was used in the study. The dependent variable was economic value added (EVA) whereas the independent variables were cash conversion cycle (CCC) which stood for efficient working capital management and current assets to total asset ratio which represented working capital policies, firm size, debt ratio and change in GDP . The results of the OLS regression showed that CCC negatively and significantly influenced EVA while current assets to total asset ratio had no influence at all on EVA.

Vartak and Hotchandani (2019), in their study, evaluated the impact which working capital management have had on the profitability of firms listed in India. Secondarily sourced data obtained from the Bombay Stock Exchanges from 2009 to 2018 was used in the study. The dependent variable was return on assets (ROA) whereas the independent variables were cash conversion cycle (CCC), inventory turnover (IT), account payables (AP) and average collection period (ACP). The results of the OLS regression showed that CCC and IT were negatively and significantly related with ROA, ACP relationship with ROA was positive while AP relationship with ROA was insignificant. Olaoye et al. (2019) carried out an empirical study to investigate working capital management and firms' profitability in Nigeria. Secondarily sourced data obtained from the Nigerian Stock Exchanges from 2008 to 2017 was used in the study. The dependent variable was return on assets (ROA) whereas the independent variables were cash conversion cycle (CCC), cash payment period (CPP), current ratio (CRA), and inventory policy (INP). The result of the GMM regression showed that while CCC and CPP have negative and significant relationship with ROA, CRA and INP were positively and significantly related with ROA. Mohsin et al (2019) empirically evaluated whether working capital management impacted profitability in Pakistan. Secondarily sourced panel data of 280 non-financial firms listed on the floor of the Pakistan Stock Exchange over the periods 2000 to 2016 was used. The dependent variables were return on asset (ROA) and return on equity (ROE) while average collection period (ACP), average payable period (APP), inventory turnover ratio (ITD), SIZE, LIQ and LEV. The OLS regression showed that ACP, APP and ITD positively and significantly influenced performance.

Rajiet al (2017) examined the impact of working capital on firms' performance in Nigeria. The data were extracted from audited financial statements of agricultural firms and banks respectively for the period of thirteen (13) years (2002-2014). The dependent variables were return on assets (ROA) whereas the independent variable was current asset (CA). Data were analyzed with the OLS method and findings indicated that there was a positive and significant relationship between CA and firms' performance in Nigeria. Jason (2017) carried out an empirical evaluation whether working capital management impacted profitability in South Africa. Secondarily sourced panel

data of 69 manufacturing firms listed on the floor of the Johannesburg Securities Exchange (JSE) over the periods 2007 to 2016 was used. The dependent variables were return on asset (ROA) while average collection period (ACP), average payable period (APP) and cash conversion cycle (CCC). The OLS regression showed that ACP and APP relationship with ROA were negatively significant while CCC had an insignificant impact. Hingurala et al. (2017) researched on the extent to which working capital management impacted on firms' value in Sri Lanka. The researchers used annual data spanning the periods 2011 to 2015 collected from the Colombo Stock Exchange (CSE) for 44 firms making a total observations of 220 firm-years. Cash Conversion Cycle (CCC), sales growth, leverage and firm size were the independent variables while Tobins'Q was the dependent variable. The results of the OLS showed that CCC negatively and significantly influenced performance.

Twahirwa et al, (2016) examined the effects of working capital management on organizational performance. Both primary questionnaires and secondary data over the period 2008 to 2014 were used. The dependent variable was gross operating profit (GOP) while the independent variables were cash conversion cycle (CCC), debt ratio (DEBTR), cash ratio (CASHR), sales growth rate (SALESGR), inflation rate and firm size (SIZE). The results of the primary data revealed that firms sell more on cash than on credit and there was a good inventory management system in place. The results of the OLS regression indicated that DEBTR, CCC and inflation rate have a negative and significant relationship with GOP while CASHR, SALESGR and SIZE positively and statistically influenced GOP.

Shampa (2015) embarked on this research to investigate the effect of working capital management efficiency as well as maintaining liquidity on the profitability in Bangladesh. Secondary data over the period from 2008 and 2012 obtained from the financial statements of Af-Arafah Islamic banks were used in this study. Return on assets (ROA) was the dependent variable while cash conversion cycle (CCC), creditor's payable period (CPP), debtor's collection period (DCP), bank growth and credit risk were the independent variables. The OLS result showed that cash conversion cycle (CCC), debtors' collection period (DCP) and bank growth negatively and significantly impacted ROA. Ngendakumena, Jagero and Gongo (2015) empirically

evaluated whether working capital management impacted profitability of smart bags limited manufacturing firm in Zimbabwe. Secondarily sourced data was used for the study over the period between 2009 and 2012. The dependent variable was gross operating profit (GOP) while average collection period (ACP), average payable period (APP), inventory turnover ratio (in days), cash conversion cycle (CCC), current ratio (CR), debt ratio (DR) and aggressiveness of financing policy were the independent variables. The OLS regression showed that while ACP was negatively significant with GOP but APP was positively significant.

Salman et al. (2014) studied if there was any relationship between working capital management and profitability in Nigeria. The researchers made used of secondary data extracted from the financial statements of manufacturing firms listed on the Nigerian Stock Exchange for a period 2005 to 2013. While return on Assets (ROA) and return on Equity (ROE) were the dependent variables, the independent variables were cash conversion cycle (CCC), current asset to current liability (CACL), current assets to total assets ratio (CATA), current liability to total asset (CLTA) and total debts to total assets ratio (TDTA). The OLS results showed that all working capital proxies had negative and significant relationship with both ROA and ROE. Angahar and Alemetu (2014) examined the impact of working capital management on the profitability of cement firms in Nigeria. The study used secondary panel data covering eight years from 20002 to 2009 on four cement firms listed on the Nigerian Stock Exchange (NSE). Dependent variable was return on asset (ROA) while the independent variables were number of days inventory are held (NODI), cash conversion cycle (CCC), average collection period (ACP) and debt ratio (DR). The results of the OLS found that ACP was negatively and significantly related with ROA. Ponsian et al (2014) attempted an enquiry to find out the effect of working capital management on profitability in Tanzania. Secondary data obtained on three manufacturing companies listed on the Dare Salaam Stock Exchange spanning the ten years period 2002 to 20012 was used. Gross operating profit (GOP) was the dependent variable while average collection period (ACP), inventory turnover in days (ITD), cash conversion cycle (CCC), inventory conversion period (ICP) and liquidity (LIQ) were the independent variables. The OLS result showed that cash conversion cycle (CCC) had a positively and significantly impacted ROA

while LIQ was negatively significant. Biswal (2014) critically investigated the impact of working capital management on profitability of cement manufacturing firms in Meghalaya. Panel data secondarily obtained from the financial reports of these companies between 2003 and 2013 was used. The dependent variable was return on asset (ROA) whereas current ratio, debtors turnover ratio, inventory turnover ratio, creditor turnover ratio were the independent variables. The OLS results found that debtor turnover ratio, inventory turnover ratio and creditor's turnover ratio negatively and significantly impacted ROA while leverage, sales growth, current ratio and firm's size had a positive relationship with ROA.

Nziok et al (2013) researched on the effect of working capital management on the profitability of manufacturing firms listed in the Nairobi security exchange. Secondary data was used to collect data on 9 listed manufacturing firms trading on the Nigeria stock exchange for the period of 5 years (2006-2010). Dependent variable is gross operating profit (GOP) while average collect period, inventory turnover in days (ITD), average collection period (ACP), average payment period (APP) and cash conversion cycle (CCC) are independent variables. Multiple regression and correlation analysis (OLS) was used for analysis. The OLS results revealed that APP and ACP was positively correlated with GOP but CCC was negatively correlated GOP.

Ajao and Nkechinyere (2012) carried out an investigation into the effectiveness of working capital management and profitability in Nigeria. The researchers used secondary data of five companies for five years obtained from the Nigerian Stock Exchange (NSE). While the dependent variable was return on asset ROA, the independent variables were inventory conversion period (ICP), cash conversion period (CCC), average collection period(ACP) and average payment period(APP) . The OLS regression result indicated that ICP, CCC, ACP and APP positively and significantly impacted of ROA.

Table 1: Summary of Literature Reviewed

Author(s)	Years Range	Years	Methods of Regression Analysis
Anton and Anca (2021)	2007 to 2016	10	Panel corrected standard errors (PCSE)

Kayani et al.(2020)	2010 to 2019	10	Generalized methods of moments (GMM)
Nadeem et al. (2020)	2012 to 2017	5	OLS
Soukhakian and Khodakarami (2019)	2010 to 2016	7	OLS
Al-Mawsheki et al. (2019)	2010 to 2016	7	OLS
Vartak and Hotchandani (2019)	2009 to 2018	10	OLS
Olaoye et al.(2019)	2008 to 2017	10	GMM
Mohsin et al. (2019)	2000 to 2016	17	OLS
Jason (2017)	2007 to 2016	10	OLS
Hingurala et al. (2017)	2011 to 2015	5	OLS
Twahirwa et al. (2016)	2008 to 2014	7	OLS
Shampa (2015)	2008 to 2012	5	OLS
Ngendakumena, Jagero and Gongo (2015)	2009 to 2012	4	OLS
Salman et al. (2014)	2005 to 2013	9	OLS
Angahar and Alemetu (2014)	2002 to 2009	8	OLS
Ponsian et al (2014)	2002 to 20012	11	OLS
Biswal (2014)	2003 to 2013	11	OLS
Nziok et al (2013)	2006 to 2010	5	OLS

Research Gap

Many research studies on working capital management have been carried out both in developed and developing economies. The summary of our literature reviewed is as shown above. The highest number of years ever used in the research work was 17 years by Mohsin et al. (2019) in Pakistan. This work differs from others in that it used data for fifteen (16) years from 2005 to 2019 which to the best of our knowledge no one has used in Nigeria. Also, none of the above authors used Estimated Generalized Least Squares (EGLS with Period SUR) method as we did. Note that panel data models do have heteroskedascity and correlation between the error terms (autocorrelation). EGLS is used to correct for these problems and give a better regression output.

Methodology

Research Design/Data and Sources

The study uses the ex-post facto research design, otherwise called the descriptive or correlational research design, to investigate the relationship, if any, between the working capital management and financial performance in Nigeria. The population of this research comprises selected firms of the manufacturing industry listed on the floor of the Nigerian Stock Exchange (NSE). Secondarily sourced data obtained from sixteen (16) of those companies' annual reports over the period 2005 to 2019, making a total number of 240 firm-year observations, is used in this study.

Table2: Data Definition and Measurement

S/N	Variables Names	Definitions	Types	Measurements
1	ROA	Return On Assets	Dependent	Net Income /Total Assets
2	ACP	Average Collection Period	Independent	Accounts Receivable/Sales*365
3	APP	Average Payment Period	Independent	Accounts Payable/Purchases*365
4	CCC	Cash Conversion Cycle	Independent	ACP+*ICP-APP

*ICP = Inventory Conversion Period = Inventory/Cost of Sales*365

According to Brealey and Myers (2006), firms should focus carefully on their account receivables, account payables, inventories, cash and short-term securities in order to effectively, efficiently and economically manage their working capital otherwise; the firm would experience negative growth and sub-optimality.

Model Specification

The functional equation of the working capital management modelis stated as:

ROA = f (ACP, APP, CCC*)* (1)

The above equation is anchored on the adapted works of Ajao and Nkechinyere (2012), Jason (2017) and Nadeem et al.(2020)

The functional testable modelsis derived as:

$ROA = \beta o + \beta_1 ACP + \beta_2 APP + \beta_3 CCC + \varepsilon_1$ (3).

$EPS = \beta o + \beta_1 ACP + \beta_2 APP + \beta_3 CCC + \varepsilon_1$ (4).

Where the definitions are as stated in Table1 above.

β1, β2, β3 are the beta coefficients of the independent variables. From this study, we expect β1 to β3 to be greater than zero.

ε_1 = Error term

Since we are using panel data, the modelsare specified in the Pooled Ordinary Least Squares (Pooled OLS) model form below:

$ROA_{it} = \beta o + \beta_1 ACP_{it} + \beta_2 APP_{it} + \beta_3 CCC_{it} + \varepsilon_{1it}$ (5)

$EPS_{it} = \beta o + \beta_1 ACP_{it} + \beta_2 APP_{it} + \beta_3 CCC_{it} + \varepsilon_{1it}$ (6)

Method of Data Analysis

Data collected were analyzed in the following order: Unit root test,Estimation of the regression models and performance of some diagnostics tests.

Unit Root Test.

The essence of a unit root test is to ascertain the stationarity of the data which will determine the model to be used.

Table 3: Unit Root Test Result

Variables	Phillips Perron(PP) Fisher	Im, Pesaran& Shin	Hadri	ADF Fisher	Decision
ROA	0.0009	0.0000	0.0000	0.0431	I(0) stationary
ACP	0.0000	0.5360	0.0000	0.5611	I(0) stationary
APP	0.0000	0.7879	0.0000	0.6006	I(0) stationary
CCC	0.0000	0.9640	0.0000	0.8165	I(0) stationary

The unit root test results in Table 3 showed that all the variables of interest are I (0), that is, stationary at levels. Their p-values are less than 5% except ACP, APP and CCC with respect to ADF Fisher and Phillips Perron (PP) Fisher. When variables are not stationary, it means that they can drift apart on the long run and the regression results obtained can be spurious or nonsensical.

Regression Model Results

We present the regression models estimations and interpret the results as presented in Table 4.

Table 4a: Panel EGLS (Period SUR) Results

Dependent Variable: ROA
Method: Panel EGLS (Period SUR)
Date: 02/02/22 Time: 13:34
Sample: 2005 2019
Periods included: 15
Cross-sections included: 16
Total panel (unbalanced) observations: 239
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CCC	0.247611	0.020275	12.21257	0.0000
APP	0.246780	0.020264	12.17826	0.0000
ACP	-0.252064	0.020339	-12.39305	0.0000
C	1125.966	154.5962	7.283273	0.0000

Weighted Statistics			
R-squared	0.736605	Mean dependent var	-0.093369
Adjusted R-squared	0.733242	S.D. dependent var	1.743644
S.E. of regression	0.900953	Sum squared resid	190.7533
F-statistic	219.0653	Durbin-Watson stat	1.968584
Prob (F-statistic)	0.000000		
Unweighted Statistics			
R-squared	-0.001920	Mean dependent var	1503.754
Sum squared resid	8.26E+09	Durbin-Watson stat	0.081357

Source: Authors Analysis Using Eviews10+

Table 4a shows the regression estimation results of the relationship between the components working capital management (Average collection period, Average payment period and Cash conversion cycle) and financial performance (ROA) of the sampled firms. For the ROA model, the Adj R^2 = 0.733 which means that about 73.3% of systematic variations in financial performance (ROA) is accounted for by ACP, APP and CCC. The remaining 26.7% can be explained by other factors not captured by our model. The F-stat=129 confirm that there is a joint significant linear relationship between the variables (dependent and independent). The D.W statistic indicates that there is unlikely that a serial correlation exist in the residuals.

A look at the working capital management variables shows that ACP relationship with ROA is negatively significant at the 1% level. For the ROA model, the t-Statistic is -12.93 while the p-value is 0.0000.This suggests that an increase in average collection periods will impact negatively on ROA. In this study, data show that firms collect their debts faster than they pay their creditors. Too much aggressiveness in debt collection may impact negatively on profitability as customers may look for alternative more friendly firms. We, therefore, reject the null hypothesis of no significant relationship and accept the alternative hypothesis that there is a significant relationship between Average Collection Period and Return on Assets. This result is in line with those of Jason (2017), Shampa (2015), Ngendakumena, Jagero and Gongo (2015) and Angahar and Alemetu (2014), but contradicts that of Mohsin, Muhammad and Salman (2019), Soukhakian and Khodakarami (2019), Vartak and Hotchandani (2019) and Kayani et al. (2020) which had a positive relationship.

APP relationship with both ROA is positively significant at the 1% level. For the ROA model, the t-Statistic is 12.18 while the p-value is 0.0000.This suggests that an increase in average payment periods will impact positively on ROA. In this study, data show that firms delay paying their creditors more than they collect their debts. This may be due to favourable terms of trade as willful and unjustified delayed may be dangerous. We, therefore, reject the null hypothesis of no significant relationship and accept the alternative hypothesis that there is a significant relationship between Average Payment Period and Return on Assets. This result is in line with those of Kayani et al. (2020); Nadeem, Waris, Asadullah & Kaman (2020);Mohsin, Muhammad and Salman (2019); Nziok et al (2013) and Ajao and Nkechinyere (2012) but contradicts that of Shampa (2015), Ngendakumena, Jagero and Gongo (2015), Jason (2017) and Vartak and Hotchandani (2019)

There is a positive relationship between CCC and ROA at the 1% level. For the ROA model, the t-Statistic is 12.21 while the p-value is 0.0000. This suggests that an increase in cash conversion cycle will impact positively on ROA. We, therefore, reject the null hypothesis of no significant relationship and accept the alternative hypothesis that there is a significant relationship between Cash Conversion Cycle and Return on Assets. The study is in line with Ajao and Nkechinyere (2012) and Ponsian et al (2014) but contradicts that of Olaoye et al.(2019);Vartak and Hotchandani (2019); Al-Mawsheki et al. (2019); Soukhakian and Khodakarami (2019); Nadeem, Waris, Asadullah & Kaman (2020) and Kayani et al.(2020)

Residual Diagnostic Tests of No Cross Sectional Dependence

An increasing number of literatures on panel-data conclude that panel-data models arelikelyto substantially exhibit cross-sectional dependence in the errors. This may be due to the presence of common shocks and some other unobserved components that may eventually become part of the error term. According to De Hoyos and Sarafidis (2006), the past few decades have witnessed an ever-growing economic and financial integration among countries and this signifies strong interdependencies among cross-sectional units. Thus, there is the tendency for individuals to respond in a similar manner to common “shocks”, or some common unobserved factors due to neighborhood effects, herd behavior, social norms and genuinely

interdependent preferences (De Hoyos & Sarafidis, 2006). Rodríguez-Caballero (2016) also noted that if cross-sectional dependence exists in a panel data model, it can complicate statistical inference and any estimators that do not take such into account could be inconsistent even if the number of cross section dimension *N* is large with a finite time dimension *T*.

The above necessitate us to test for cross-sectional dependence as such testing is very important in fitting panel-data models. The results of the cross sectional dependence tests for the ROA model are shown in Table 4b.

Table 4b: Residual Cross-Section Dependence Test

Null hypothesis: No cross-section dependence (correlation) in weighted Residuals

Equation: Untitled
Periods included: 15
Cross-sections included: 16
Total panel (unbalanced) observations: 239
Note: non-zero cross-section means detected in data
Test employs centered correlations computed from pairwise samples

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	64.92006	120	1.0000
Pesaran scaled LM	-3.555395		0.0004
Pesaran CD	-0.041963		0.9665

Usually, where N is very large with a finite time T or where T is greater than N, we use the Breusch-Pagan LM test Statistic. But where N = T or where T is of the same magnitude with N, we use the Pesaran CD test Statistic. The two results above show that there is no cross sectional dependence in the residuals or the residuals are cross sectionally independence since the Pesaran CD test Statistic is 0.9665 which is greater than 0.05 allowed to reject the null hypothesis of no cross sectional dependence.

Conclusion

In this study, we empirically investigate the impact which working capital management has on the profitability of sixteen (16) listed manufacturing firms in Nigeria over the periods from 2005-2019. The ROA Model is used in the analysis. The result of the test shows that the variables of interests are all statistically significant. While the average collection periods (ACP) for the periods under review is negatively but statistically significant at the 1% level, the average payment periods (APP) and cash conversion cycle (CCC) have a positive and significant relationship.

Recommendations

Based on the results of our study, we recommend that:

- The managements of manufacturing firms should develop expertise or engage experts in accounting and finance to ensure that the needed liquidity position through efficient management of working capital is very secure.
- They should maintain and improve on their present policy with respect to average payment period (APP) and cash conversion cycle (CCC) since APP and CCC are respectively positive and statistically significant with ROA. Great attention should be paid to all components of working capital but especially those that make up CCC.
- The negative relationship of average collection period (ACP) is not in line with our expectation. Management needs to do something about this so that it can realign with the average payment period (APP) and cash conversion cycle (CCC)

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