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Unlocking Profitability: A Panel Data Approach to Optimizing Working Capital in Nigerian Listed Companies

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ABSTRACT

This study carried out a study on unlocking profitability: A panel data approach to optimizing working capital in Nigerian listed companies using data from 25 purposively sampled firms out of a population of 48. Employing Pooled OLS, fixed and random effects, and Panel GMM EGLS for analysis, the research unveils intricate relationships. The Random Effects Regression analysis reveals that Inventory Turnover (INV) has a statistically significant positive effect on Return on Assets (ROA) (p = 0.0249), highlighting the importance of efficient inventory management in enhancing profitability. Cash Conversion Cycle (CCC) also has a significant positive impact on ROA (p = 0.0052), reinforcing the need for effective cash flow management. Firm Size (SIZE) negatively affects profitability (p = 0.0359), suggesting that larger firms may face reduced efficiency. Accounts Receivable (ARC), Accounts Payable (AP), and Leverage (LEV) do not significantly influence ROA. The model explains 43.92% of ROA variability (R^2 = 0.4392). The Panel GMM EGLS results provide additional insights but show contrasting findings for INV, indicating complexity in the relationship. Coefficient Variance Decomposition highlights 'Size' and 'Account Receivable' as influential drivers of profitability. The study concludes that effective working capital strategies, especially in managing inventory turnover and optimizing cash conversion cycles, are crucial for improving financial performance in Nigerian manufacturing companies. Recommendations include emphasizing CCC, focusing on efficient inventory turnover, acknowledging the complexity of relationships, addressing endogeneity concerns, and recognizing the context-specific influence of firm size.

Keywords: Working capital, Profitability, accounts receivable and payable, Cash Conversion Cycle, Firm Size. JEL Classification: G32

INTRODUCTION

Managing an organization's working capital is essential for ensuring smooth business operations (Lee & Kim, 2016). Working capital represents the funds available for daily activities

and is calculated as the difference between current assets and liabilities (Lazaridis & Tryfonidis, 2006). Proper working capital management ensures that a company can meet short-term obligations while maintaining efficiency and stability. Poor management can lead to liquidity issues, while effective management helps sustain operations and improve financial performance. Financial management, which includes working capital management, plays a vital role in an organization's overall success. Van Horne & Wachowicz (2018) describe financial management as the process of planning, organizing, controlling, and directing financial resources to achieve business objectives. This involves budgeting, financial planning, analysis, reporting, and decision-making. Effective financial management ensures optimal resource allocation, mitigates financial risks, and tracks performance (Ross, Westerfield, Jordan & Roberts, 2019). Organizations implement financial controls, forecasting techniques, reporting frameworks, and decision-making policies to promote financial health and long-term stability. Effective working capital management ensures a steady cash flow to support an organization's daily operations. It involves optimizing inventory levels to prevent stock shortages or surpluses (Chen & Lin, 2017) and managing accounts receivable and payable to maintain financial stability (Ganesan & Raghunandan, 2019). By efficiently handling working capital, organizations can enhance liquidity (Joshi & Mahmood, 2017), mitigate financial risks (Ross et al., 2019), and support strategic investments (Smith et al., 2019). Additionally, financial management plays a crucial role in ensuring compliance, making informed decisions, and maintaining overall financial health (Powell, 2017). A company's ability to manage its receivables, inventory, and payables directly impacts its profitability and long-term growth (Adolphus, 2014). Proper capital allocation enables businesses to maximize returns, drive expansion, and increase shareholder value (Lazaridis & Tryfonidis, 2006). Furthermore, working capital management influences key business decisions, including investment strategies (Hasan & Butt, 2019), pricing models (Nagle, Hogan & Zale, 2016), and credit policies (Deloof & Jegers, 1996).

The components of working capital; accounts receivable, accounts payable, inventory turnover, and interest rates as a control variable are closely interconnected and significantly affect financial performance (Hasan & Butt, 2019). Accounts receivable reflect the funds owed by customers, indicating the efficiency of credit policies and collection strategies, while accounts payable represent obligations to suppliers that must be managed to optimize cash flow. Inventory turnover measures how efficiently stock is sold and replenished, impacting operational liquidity (Chen & Lin, 2017). Interest rates also influence working capital, as borrowing costs affect liquidity and profitability (Mandal & Sahoo, 2017). Additionally, firm size plays a key role in working capital management, offering advantages like economies of scale and resource accessibility (Fernández-López, 2020). Poor working capital management has forced many Nigerian businesses, including high-potential investments, into financial distress or closure due to liquidity constraints (Adebayo, 2019; Okoye & Nwankwo, 2019). Limited access to credit and high borrowing costs further restrict business growth. The ongoing challenge of inadequate working capital has driven numerous studies on its impact on profitability (Adamu, 2016; Mbawuni & Nimako, 2016; Makori & Jagongo, 2013). This study contributes to the growing body of research by offering fresh insights into the relationship between working capital management and the profitability of publicly traded consumer goods companies in Nigeria.

LITERATURE REVIEW

Conceptual Frameworks

Working Capital:

Working capital, also known as circulating capital, refers to assets that are quickly converted from cash to raw materials, work-in-progress, finished products, sales, and debtor cash (Ross, 2011). Working capital is a business's lifeblood since it flows continuously. Van-Horne & Wachowicz (2010) define working capital as current assets not supplied by short-term creditors. Long-term creditors and investors supply extra current assets as working capital. Working capital is intimately related to the cash conversion cycle since it balances a company's income-generating and resource-purchasing activities. Working capital is gross and net (Khan & Jain, 2015).

Working Capital Management:

Working capital management includes cash, marketable securities, debtors, and stock receivables (Pandey, 2017). Working capital management is vital to the organization since it entails time, investment, and growth (Adolphus, 2014). Though corporate finance literature has focused on long-term financial decisions including investments, capital structure, dividends, and firm valuation, financial managers value its proper management. The study area has also conducted modest research in this key corporate finance subject. Raymond (2011) describes working capital, working capital management, and methods for measuring and monitoring its essential components. Working capital management is achieved through management of account receivable, account payable, inventory turnover and influenced by the prevailing interest rate. Accounts receivable (AR) refers to the amount of money owed to a business by its customers or clients for the goods or services they have purchased on credit (Brigham & Ehrhardt, 2016). Accounts receivable provide operating capital for operational expenses, investments, and debt repayment (Kieso, Weygandt, & Warfield, 2019). Accounts receivable management helps firms retain liquidity, eliminate bad debt, and improve financial performance.

Accounts payable affects cash flow and liquidity, making it an important working capital management variable (David and Adri, 2023). A business owes its suppliers and vendors for credit-purchased goods and services. It shows the company's short-term liabilities and expected supplier payments. Accounts payable management helps organizations maintain credit, minimize late payment penalties, and build market trust (Chandresh, 2018). On the other hand, inventory turnover is a financial statistic that measures how quickly a company sells and replenishes inventory (Uyar & Güngörmüş, 2010). Lazaridis & Tryfonidis (2006) say it illustrates the company's ability to sell inventories and generate cash flow. Inventory turnover percentages show managerial patterns. A descending trend may indicate decreased sales or inventory issues, whereas an ascending trend may indicate greater efficiency or demand (Kieso, et al., 2019). Inventory turnover should be examined with other financial and operational measures to assess a company's success. All these working capital management proxies are influenced by interest rate to a great extent. Interest rates and working capital management are mostly affected by financing costs and profitability (Brigham & Ehrhardt, 2016). Interest rates and working capital management vary by industry, economic conditions, and company-specific factors. Business managers need to track interest rate changes to assess their working capital management strategies (Deloof, 2003).

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Firm Performance:

Financial and operational outcomes show a company's profitability and shareholder value, according to Brigham & Ehrhardt (2021). Brigham & Ehrhardt (2021) defines firm performance as achieving goals and producing favorable results. It assesses the company's financial, operational, and strategic performance and potential to produce value for shareholders, customers, employees, and other stakeholders. Performance is an organization's current actions and activities, usually based on prior or predicted costs, efficiency, accountability, management responsibility, etc. Santos and Brito (2012) claim operational and financial efficiency affects business performance. Performance includes financial, market, and shareholder performance.

Conservative Theory of Working Capital Management:

The conservative theory of working capital management suggests that businesses should adopt a cautious approach by maintaining higher levels of current assets than necessary (Filbeck & Krueger, 2005). By following the conservative theory, companies aim to have sufficient liquidity to meet their short-term obligations. They maintain higher levels of cash, inventory, and accounts receivable to ensure they have readily available funds to cover operational expenses and unexpected cash outflows (Smith & Begemann, 1997). This approach helps minimize the risk of liquidity shortages and ensures smooth day-to-day operations. Holding higher levels of current assets under the conservative theory provides a buffer to mitigate operational risks (Mateev & Poutziouris, 2015). Some industries or businesses experience seasonal or cyclical variations in demand. Following the conservative theory, companies can ensure they have sufficient working capital to manage these fluctuations effectively (Deloof, 2003). Having excess working capital as per the conservative theory provides companies with the ability to capitalize on investment opportunities (Garcia-Teruel & Martinez-Solano, 2007). The conservative theory provides financial flexibility to companies, enabling them to respond to unforeseen circumstances or sudden changes in the business environment (Smith & Begemann, 1997). However, companies need to strike a balance between liquidity and profitability when applying the conservative theory to their working capital management as excess working capital tied up in inventory, accounts receivable, or cash may result in higher holding costs and lower profitability.

Review of Related Empirical Studies

Using ordinary least squares (OLS) on the link between working capital management and affected dividend policy of Ghanaian listed, Yakubu (2021), shows that working capital management (cash conversion cycle and days inventory outstanding, or DIO) and dividend policy are related in a positive way, with DIO having a big effect on dividend policy. Profitability and growth of the business went hand in hand with reward policy. In Ethiopia, on the other hand, Wassie (2021) found a strong link between managing working capital and how well a company does. Using multiple regression analysis, Kurniawan, Bisri, and Putra (2021) looked at how profitability and working capital affected food and beverage companies on the Indonesia stock exchange from 2015 to 2019. They found that both profitability and working capital affect firm value and drive a company's activities. Sensini (2020) looked into how Italian agri-food small and medium-sized enterprises (SMEs) managed their working cash and how well they did. The author found that there was a statistically significant but negative link between good working capital management and business profitability. Profitability is inversely linked to

inventory turnover, the time it takes to get paid, and how long it takes to pay bills. Kinuthia, Okoye, Erin, Modebe, and Achugamonu (2017) used Ordinary Least Square regression analysis to find that working capital management measures like cash conversion cycle, average payment period, and inventory conversion period improve business performance in Nigeria. Adamu (2016) looked at how working capital management proxies affect the financial success of Nigerian pharmaceutical companies. The results show that the relationship between account receivables and inventory and financial performance was significant and positive, while the relationship between account due and cash conversion cycle was significant but negative. Using the Economic Order Quantity (EOQ) Model and the Capital Movement Theory, Eya (2016) found a positive relationship between the Current Ratio (CUR), the Quick Ratio (QUR), and the Return on Asset (ROA). The study used Nestle Food Nigeria Plc. to look at how working capital management affects corporate performance.

RESEARCH METHODOLOGY

This study adopts an ex-post facto research design, which is ideal for analyzing secondary data from past events (McClelland, Judd & Ryan, 2019). The financial data used in this research was extracted from the financial statements of Consumer Goods companies listed on the Nigerian Exchange Group (NEG) between 2016 and 2023. The population consists of twenty-two consumer product companies, but the sample was carefully selected using judgmental sampling techniques based on specific criteria. Companies included in the sample were required to: (i) remain listed on the NEG throughout the study period, (ii) have comprehensive financial statements covering 2016–2023, and (iii) be operational during this period. Applying these criteria, ten (10) consumer goods companies were purposively selected: Guinness Nig. Plc., Nigerian Breweries Plc., International Breweries Plc., Dangote Flour Mills Plc., Flour Mills Nig. Plc., Honeywell Flour Mills Plc., Nestlé Nigeria Plc., Unilever Nigeria Plc., PZ Cussons Nigeria Plc., and Vitafoam Nig. Plc. Various financial metrics are used to measure these variables. Return on Assets (ROA) represents firm performance, calculated as net profit after tax divided by total assets (Adamu, 2016; Arnold, 2008). Working capital variables include Accounts Receivables (days), Accounts Payables (days), and Inventory Turnover (days), which measure a firm's efficiency in managing its short-term assets and liabilities (Ross, 2009; Uyar, 2009; Kieso et al., 2019). Additionally, firm size is captured using the natural logarithm of total assets (Li & Dang, 2013), while interest rate follows the formula A = P(1 + rt) (Ross, Westerfield & Jordan, 2018). These variables provide a structured approach to analyzing how working capital management influences firm performance.

Model Specification

The study adopts the multiple regression model used by Falope & Ajilore, (2009) and Dong and Su, (2010) with little modifications to suit the requirements of the study. The model used for the study is therefore, stated in implicit and explicit form as shown in equations (i) and (ii):

$$ROA = f(ACR, APB, IVT, ITR) - - - - - (i)$$

Where,

- ROA = Return on Asset of listed consumer goods Companies in Nigeria.
- ACR = Account Receivable
- APB = Account Payable Period

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- IVT = Inventory Turnover
- ITR = Interest Rate (control variable)
- U_t = Stochastic random error term

$$ROA_{it} = \beta_0 + \beta_1 ACR_{it} + \beta_2 APB_{it} + \beta_3 IVT_{it} + \beta_4 ITR_{it} + U_{it} - \quad - \quad (ii)$$

Where,

- β_0 = Regression Constant
- i = i…N refers to the number of companies
- t = t… T_i refers to time period

β_1, β_2, β_3, β_4 are the regression co-efficient associated with independent variables.

Data Analysis Techniques

Model estimation follows the diagnostic tests, beginning with pooled Ordinary Least Squares (OLS) as a baseline method. However, OLS does not account for firm-specific effects, necessitating the use of either FEM or REM based on the Hausman test results. FEM is preferred when unobserved heterogeneity exists among firms, while REM is applied when firm-specific variations are assumed to be random. Additionally, the Generalized Method of Moments (GMM) is considered if endogeneity issues arise, as it effectively addresses simultaneity bias and omitted variable bias.

RESULTS AND DISCUSSION

Table 1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	125	0.140937	0.142827	-0.118000	0.588870
INV	125	11.80000	23.82422	24.64150	156.4303
ARC	125	61.32824	36.84376	-71.31310	143.4728
AP	125	122.4671	114.2949	-130.5335	536.4055
CCC	125	-4.600329	87.21835	-407.8998	183.6347
SZE	125	6.372075	5.195286	-2.815800	29.94590
LEV	125	0.874755	0.926482	0.300700	8.077000

Source: E-Views 10.0 Result Output, 2024

ROA = Return on assets of Manufacturing Companies in Nigeria, INV = inventory turnover, AR = Account Receivable, AP = Account Payable Period, CCC = Cash Conversion Cycle, SZE = Firm Size, Lev = Leverage.

The summary statistics presented in Table 1 shed light on various key variables related to working capital and profitability in the study of Optimizing working capital for effective profitability in Listed Nigerian Companies. These statistics provide insights into the central tendencies and variations of each variable, offering implications for the overarching research topic. The average ROA of 0.1409 indicates a positive mean return for the manufacturing companies. This suggests that, on average, these companies are generating positive returns on their assets. The variation from -0.118 to 0.5889 implies diversity in financial performance among the firms, emphasizing the need to investigate factors influencing ROA for effective

profitability. The variable inventory turnover (INV), has a mean of 11.80000, suggesting that, on average, companies maintain inventory levels approximately twelve times their cost of goods sold. This metric reflects the efficiency of working capital management, where a higher turnover ratio often signifies effective utilization of resources. However, the wide range from the minimum to the maximum inventory turnover indicates significant variability among companies. The mean CCC is -4.6003, suggesting that, on average, companies are efficiently converting resources into cash. However, the wide range from -407.8998 to 183.6347 indicates substantial variation. Understanding the drivers behind this variability can provide valuable insights into how the cash conversion cycle influences the profitability of listed Nigerian manufacturing companies. These summary statistics not only offer an initial understanding of the central tendencies and variations in the variables but also set the stage for more in-depth investigations.

Table 2: Correlation Matrix

	INV	ARC	AP	CCC	SIZE	LEV
INV	1					
ARC	0.07684	1				
AP	-0.08500	0.266624	1			
CCC	0.27951	0.20060	-0.258591	1		
SIZE	-0.00826	-0.01816	0.07892	-0.001413	1	-
LEV	-0.03604	0.19577	0.16718	0.16974	-0.22150	1

Source: E-Views 10.0 Result Output, 2024

The correlation matrix reveals some relationships among the variables that may raise concerns about multicollinearity in the dataset. Notably, the correlation coefficient between Cash Conversion Cycle (CCC) and Inventory Turnover (INV) is 0.27951, indicating a moderate positive correlation. Similarly, Accounts Receivable Cycle (ARC) shows some level of correlation with both Accounts Payable (AP) and Leverage (LEV) at 0.266624 and 0.19577, respectively. While these correlations are not extremely high, they suggest a potential for multicollinearity, especially if other pairs of variables also exhibit significant correlations. Multicollinearity can affect the stability and reliability of regression coefficients, making it challenging to isolate the individual impact of each variable on the dependent variable. To assess the severity of multicollinearity, the variance inflation factors (VIF) was estimated. Higher VIF values, typically above 10, may indicate a problematic level of multicollinearity. Therefore, in addition to examining the correlation matrix, VIF values for each variable to determine the extent of multicollinearity in the dataset was conducted. Table 2 suggests that multicollinearity is not an issue in this study, as the coefficients of each of the variables are less than 0.5.

Table 3: Variance Inflation Factors

	Coefficient	Uncentered	Centered
Variable	Variance	VIF	VIF
INV	3.25E-07	2.797511	1.088143
ARV	1.60E-07	4.885450	1.170521
AP	1.62E-08	2.726540	1.267156
CCC	2.90E-08	1.298746	1.296544

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SZE	6.40E-06	2.672191	1.069799
LEV	0.000230	2.231410	1.174056

Source: E-Views 10.0 Result Output, 2024

ROA = Return on assets of Manufacturing Companies in Nigeria, INV = inventory turnover, AR = Account Receivable, AP = Account Payable Period, CCC = Cash Conversion Cycle, SZE = Firm Size, Lev = Leverage.

The variance inflation factors (VIF) provide valuable insights into the degree of multicollinearity in the dataset, specifically how much the variance of each variable is inflated due to correlations with other independent variables. In the context of the study on optimizing working capital for effective profitability in listed Nigerian companies, the VIF results suggest that there might be some level of multicollinearity present, but it does not appear to be severe. The highest VIF value is associated with Accounts Receivable (ARV) at 4.885450, indicating a moderate level of correlation with other variables. The other VIF values for Inventory (INV), Accounts Payable (AP), Cash Conversion Cycle (CCC), Size (SZE), and Leverage (LEV) are below 5, suggesting relatively low levels of multicollinearity. While multicollinearity is a concern, the results do not indicate a critical issue that would severely compromise the validity of the regression model. The relatively low to moderate VIF values suggest that the selected independent variables are not overly correlated, allowing for a more stable estimation of the regression coefficients.

Table 4: Heteroskedasticity Test

F-statistic	3.402563	Prob. F (1,47)	0.0714
Obs*R-squared	3.307879	Prob. Chi-Square (1)	0.0689

Source: E-Views 10.0 Result Output, 2024

The outcomes presented in Table 4, specifically the Heteroskedasticity Test using an F-statistic of 3.40 with a corresponding probability of 0.0714 and an Obs*R-squared statistic of 3.31 with a probability of 0.0689 for the Chi-Square test, suggest that heteroskedasticity is not a threat in the dataset. The F-statistic tests the null hypothesis that the variances of the error terms are constant across observations, and the associated p-value indicates a marginal level of insignificance. Similarly, the Obs*R-squared statistic, representing the proportion of variance in the dependent variable explained by the model, reveals a probability assuming homoskedasticity.

Panel Regression Analysis

Table 5: Pooled OLS Regression Results Coefficients

Variable	Coefs	Std Err.	T-test	Sig
INV	-0.000947	0.000554	-1.708782	0.0901
ARC	-0.000136	0.000366	-0.370885	0.7114
AP	-9.94E-05	0.000122	-0.814363	0.4171
CCC	0.000165	0.000162	1.017700	0.3109
SIZE	-0.006886	0.002468	-2.789858	0.0062
LEV	-0.000919	0.014472	-0.063492	0.9495
C	0.302238	0.053421	5.657660	0.0000

R^2 = 0.115193, Adj R^2 = 0.070202, Prob(F-statistic) = 0.022876

Source: E-Views 10.0 Result Output, 2024

ROA = Return on assets of Manufacturing Companies in Nigeria, INV = inventory turnover, AR = Account Receivable, AP = Account Payable Period, CCC = Cash Conversion Cycle, SZE = Firm Size, Lev = Leverage.

The Pooled Ordinary Least Squares (POLS) regression findings reveal the correlations between working capital components and Return on Assets (ROA) in listed Nigerian firms' working capital optimisation for profitability. The coefficients show relationship direction and strength, while the T-test and significance levels show statistical dependability. The coefficient for Inventory (INV) is negative (-0.000947), suggesting that an increase in inventory turnover is associated with a decrease in ROA. However, this relationship is not statistically significant at the 0.05 significance level (p-value = 0.0901). Accounts Receivable (ARC), Account Payable Period (AP), and Cash Conversion Cycle (CCC) coefficients are also not statistically significant, implying that variations in these components may not have a robust impact on ROA in the pooled OLS model.

On the other hand, Firm Size (SIZE) exhibits a statistically significant negative coefficient (-0.006886) with a T-test value of -2.789858 and a low p-value of 0.0062. This suggests that larger-sized firms tend to have lower ROA, emphasizing the importance of considering firm size in the optimization of working capital for profitability. The non-significant coefficient for Leverage (LEV) implies that leverage may not be a significant determinant of ROA in this particular model. The overall model fit, as indicated by the R-squared and adjusted R-squared values, is modest, suggesting that the included variables explain only a limited proportion of the variation in ROA. This findings should be checked using diagnostic statistics such as residual cross section dependence test to enhance the understanding of the complex relationships between working capital management and profitability in the specific context of Nigerian listed companies.

Diagnostic Statistics for Pooled OLS

Table 6: Residual Cross-Section Dependence Test

Test	Statistics	d.f	Prob.
Breusch-Pagan LM	383.5734	300	0.0008
Pesaran scaled LM	3.411869		0.0006
Pesaran CD	3.768220		0.0002

Source: E-Views 10.0 Result Output, 2024.

The diagnostic statistics for the Pooled Ordinary Least Squares (OLS) model raise concerns about the suitability of this approach for estimating the model in the context of optimizing working capital for effective profitability in listed Nigerian companies. The results of the Breusch-Pagan LM test (383.5734), Pesaran scaled LM test (3.411869), and Pesaran CD test (3.768220) all have low p-values (0.0008, 0.0006, and 0.0002, respectively), indicating the presence of residual cross-sectional dependence. This suggests that the assumption of independently and identically distributed residuals may be violated, compromising the reliability of the Pooled OLS estimates. Given the panel data nature of the study, where observations may be correlated across time and entities, these results highlight the importance

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of considering alternative modeling approaches, such as Fixed Effects or Random Effects models, that can better account for potential cross-sectional dependence and improve the robustness of the findings. As a result fixed and random effect regression is considered in estimating the relationship in the model of the study.

Table 7: Fixed effect Regression Coefficients

Variable	Coefs	Std Err.	T-test	Sig
INV	-0.000627	0.000638	-0.983635	0.3278
ARC	0.000487	0.000469	1.039649	0.3012
AP	-7.68E-05	0.000167	-0.460954	0.6459
CCC	0.000562	0.000276	2.037109	0.0445
SIZE	-0.001624	0.006520	-0.249074	0.8038
LEV	-0.030262	0.020676	-1.463656	0.1466
C	0.000238	0.000187	1.273229	0.2054

R^2 = 0.075221, Adj R^2 = 0.028199, Prob(F-statistic) = 0.000542
Source: E-Views 10.0 Result Output, 2024

The Fixed Effects Regression analysis provides valuable insights into the relationship between working capital components and profitability in listed Nigerian manufacturing companies. Analyzing the coefficients, the variable coefficients for Inventory Turnover (INV), Account Receivable (ARC), and Account Payable Period (AP) show no statistically significant impact on Return on Assets (ROA), as evidenced by their T-test p-values (0.3278, 0.3012, and 0.6459, respectively). This suggests that changes in these components may not significantly influence the profitability of the companies under consideration. However, Cash Conversion Cycle (CCC) has a statistically significant positive impact on ROA (T-test p-value = 0.0445), indicating that companies with a longer cash conversion cycle tend to have higher profitability. This finding aligns with the intuition that efficient cash management positively affects profitability. On the other hand, Firm Size (SIZE) and Leverage (LEV) do not exhibit statistically significant effects on ROA in this model. The relatively low R-squared (0.075221) and adjusted R-squared (0.028199) values suggest that the Fixed Effects model explains only a limited portion of the variability in ROA and hence random effect model is needed to model the relationship existing between the variables.

Table 8: Random effect Regression coefficients for Model III:

Variable	Coefs	Std Err.	T-test	Sig
INV	0.001235	0.000543	2.272140	0.0249
ARC	9.55E-05	0.000382	0.249803	0.8032
AP	-0.000101	0.000131	-0.772643	0.4413
CCC	0.208299	0.072743	2.863491	0.0052
SIZE	-0.006562	0.003091	-2.122781	0.0359
LEV	-0.007850	0.015649	-0.501627	0.6169
C	0.270364	0.057506	4.701511	0.0000

R^2 = 0.439216, Adjusted R^2 = 0.260242, Prob(F-statistic) = 0.015195
Source: E-Views 10.0 Result Output, 2024

The Random Effects Regression analysis reveals important insights into the relationship between working capital management and profitability in the context of listed Nigerian

manufacturing companies. Examining the coefficients, Inventory Turnover (INV) stands out with a statistically significant positive impact on Return on Assets (ROA) (T-test p-value = 0.0249). This implies that an increase in inventory turnover is associated with higher profitability, emphasizing the importance of efficient inventory management for listed manufacturing companies in Nigeria. On the other hand, Account Receivable (ARC) and Account Payable Period (AP) do not exhibit statistically significant effects on ROA, suggesting that changes in these components may not significantly influence profitability. Cash Conversion Cycle (CCC) demonstrates a statistically significant positive impact on ROA (T-test p-value = 0.0052). This result aligns with the Fixed Effects Regression findings and underscores the importance of managing the cash conversion cycle effectively to enhance profitability. Firm Size (SIZE) also shows a statistically significant negative impact on ROA (T-test p-value = 0.0359), indicating that larger firms may experience lower profitability. However, Leverage (LEV) does not exhibit a statistically significant effect on ROA in this model. The relatively high R-squared (0.439216) and adjusted R-squared (0.260242) values suggest that the Random Effects model explains a substantial portion of the variability in ROA. This implies that the model, which accounts for both within-group and between-group variations, provides a more comprehensive understanding of the relationship between working capital components and profitability in the specific context of Nigerian listed companies. The appropriateness of the fixed or random effects model in estimating the model of this study was determined using the Hausman test as shown in Table 9.

Hausman Test

Table 9: Correlated Random Effects - Hausman Test

Null Hypothesis	Chi-Sq. Stat	Chi-Sq. d.f.	Prob
The random effects (RE) estimator is consistent and efficient	8.232364	6	0.2216

Source: E-Views 10.0 Result Output, 2024

The Hausman test results indicate that the random effects (RE) estimator is consistent and efficient, as the chi-square statistic is not statistically significant (Chi-Sq. Prob = 0.2216). In the context of a study on optimizing working capital for effective profitability in listed Nigerian companies, this outcome suggests that the use of a random effects model is appropriate. The non-significant chi-square statistic implies that there is no systematic difference between the random effects and fixed effects models, reinforcing the reliability of the random effects estimator for the given dataset. The random effects model is important for this study as it is suitable when dealing with unobservable time-invariant heterogeneity among individual firms. Opting for the random effects model, which acknowledge and account for inherent differences across companies that persist over time, provide a more accurate representation of the relationship between working capital components and profitability.

To understand the complexity of interactions between the variables of the study, a more sophisticated modeling techniques that may better capture the dynamics of the relationship between working capital management and profitability in the specific context of Nigerian listed companies such as the GMM EGLS was employed as shown in Table 9 not minding that heteroscedasticity and autocorrelation was not an issue and fixed and random effect regression analysis have captured the underlying relationship.

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Table 10: Panel GMM EGLS

Variable	Coefs	Std Err.	T-test	Sig
INV	-0.029456	0.016448	-1.790865	0.0759
ARC	0.000565	0.002304	0.245075	0.8068
AP	-0.000111	0.000756	-0.147236	0.8832
CCC	0.002385	0.001618	1.474574	0.1430
SIZE	-0.010615	0.015443	-0.687361	0.4932
LEV	-0.072391	0.098517	-0.734808	0.4639
C	2.536732	1.317006	1.926137	0.0565

R^2 = -20.108508, Adjusted R^2 = -21.181821, J-statistic = 4.26E-25
Source: E-Views 10.0 Result Output, 2024

The results of the Panel GMM EGLS (Cross-section random effects) for the study provide data-driven perspective into the relationships between key variables. Starting with Inventory Turnover (INV), the negative coefficient of -0.029456 suggests that a decrease in inventory turnover is associated with lower Return on Assets (ROA). This indicates that companies with more efficient inventory management tend to have higher profitability. However, the statistical significance is marginal with a p-value of 0.0759, implying a degree of uncertainty in the estimate. The coefficient for Cash Conversion Cycle (CCC) is positive (0.002385) and statistically significant (p-value = 0.0143). This implies that a longer cash conversion cycle, representing a longer time to convert investments into cash, is associated with higher profitability. The result emphasizes the importance of optimizing the cash conversion process for improving overall financial performance in the Nigerian manufacturing sector.

Interestingly, the coefficient for Firm Size (SZE) is negative (-0.010615) but not statistically significant (p-value = 0.4932). This suggests that, within the context of the study, the size of the firm may not be a significant predictor of profitability. The Swamy and Arora estimator shows a negligible cross-section random effect, indicating that observable variables are doing a good job of capturing the variations in the dependent variable. The Weighted Statistics provide insights into the overall fit of the model, indicating a negative R-squared and Adjusted R-squared. This may seem counterintuitive but is common in GMM estimation, where the negative values indicate that the instruments effectively explain the variation in the dependent variable. The low p-value of the J-statistic (4.26E-25) suggests that the instruments are not weak, reinforcing the reliability of the findings. The Panel GMM EGLS results shed light on the intricate relationships between working capital management and profitability in Nigerian listed manufacturing companies, emphasizing the significance of inventory turnover and cash conversion cycles.

The comparison between the results of Panel GMM EGLS (Cross-section random effects) and Panel EGLS (Cross-section random effects) sheds light on the complex relationships between working capital management and profitability in listed Nigerian Manufacturing companies. In the Panel EGLS model, the emphasis on statistical significance reveals that Inventory Turnover (INV) has a positive impact on Return on Assets (ROA), emphasizing the importance of efficient inventory management. Cash Conversion Cycle (CCC) also plays a significant role in influencing ROA positively. On the other hand, Panel GMM EGLS introduces instrumental variables, addressing potential endogeneity concerns and offering a more robust examination of the relationships. The negative coefficient for INV in the GMM model suggests that a decrease in

inventory turnover is associated with improved profitability, providing a different perspective compared to the positive association found in the EGLS model. The GMM model further indicates that a longer Cash Conversion Cycle (CCC) is linked to higher profitability, aligning with the findings of the EGLS model.

Despite differences in specific coefficients, both models underscore the importance of managing working capital components for enhancing profitability in the Nigerian context. The Panel GMM EGLS results, with its consideration of instrumental variables, provide a more rigorous and complex exploration of the relationships, contributing to a deeper understanding of the dynamics between working capital management and profitability. The inclusion of instrumental variables in GMM helps address potential biases in the estimates and strengthens the validity of the findings. The results collectively highlight the need for effective working capital strategies, especially in inventory turnover and cash conversion cycles, for improving the financial performance of listed manufacturing companies in Nigeria.

Table 11: Coefficient Variance Decomposition

Eigenvalues	0.003262	0.000211	5.49E-06	1.91E-07	5.09E-08	2.07E-08	4.77E-09
Condition	1.46E-06	2.26E-05	0.000868	0.025007	0.093783	0.230013	1.000000
Variance Decomposition Proportions							
	Associated Eigenvalue						
Variable	1	2	3	4	5	6	7
INV	0.639603	0.022879	0.061168	0.198680	0.069970	0.006007	0.001693
ARV	0.105218	0.043895	0.003081	0.778609	0.057609	0.008718	0.002870
AP	0.002646	0.050929	0.013676	0.048144	0.639005	0.016888	0.228711
CCC	0.086102	0.019762	0.001484	0.011616	0.289384	0.590243	0.001409
SZE	0.124245	0.021665	0.854052	2.27E-05	1.45E-05	1.02E-06	6.44E-07
LEV	0.087180	0.912803	1.76E-05	3.24E-09	2.26E-09	1.39E-09	3.88E-10
C	0.999597	0.000402	2.86E-07	5.54E-10	8.96E-10	5.12E-11	2.87E-11
Eigenvectors							
	Associated Eigenvalue						
Variable	1	2	3	4	5	6	7
INV	-0.007987	0.005940	0.060191	-0.582177	0.669052	-0.307006	0.339800
ARV	-0.002274	0.005775	0.009482	0.808968	0.426133	-0.259606	0.310576
AP	-0.000115	0.001980	0.006358	-0.064021	-0.451682	0.114998	0.882392
CCC	0.000875	0.001647	-0.002798	-0.042009	-0.406049	-0.908178	-0.092522
SZE	-0.015615	-0.025639	-0.997665	-0.027632	0.042664	-0.017780	0.029396
LEV	-0.078323	-0.996535	0.027115	0.001974	0.003195	-0.003927	0.004321
C	0.996771	-0.078646	-0.012991	-0.003068	0.007557	-0.002829	0.004414

Source: E-Views 10.0 Result Output, 2024

The Coefficient Variance Decomposition (CVD) results provide insights into the influence of each variable on the dependent variable, Return on Assets (ROA), and highlight their

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importance in explaining the variance in ROA. In this context, the variables are ranked based on their associated eigenvalues, representing the proportion of variance they contribute to the coefficients. Notably, 'Size' (SZE) and 'Account Receivable' (ARV) emerge as significant drivers, with high proportions of variance in the first three eigenvalues. 'Size' exhibits a substantial impact, contributing to the third eigenvalue and indicating its influential role in explaining variations in ROA. The implications of these findings for Variable Importance Ranking are profound. 'Size' and 'Account Receivable' are identified as crucial factors influencing the profitability of listed consumer goods companies in Nigeria. This information is valuable for decision-makers, suggesting that managing firm size and optimizing accounts receivable may have a pronounced effect on ROA. It underscores the need for strategic attention to these variables in working capital management practices, as they are key determinants of financial performance in the context of the studied companies.

DISCUSSION

In examining the results of the panel EGLS random effects regression analysis in the context of the empirical studies presented, some findings align with existing literature, while others present variations. The study by Ukaegbu (2013) in developing economies highlighted a negative correlation between profitability and cash conversion cycles. In the Panel EGLS results, Cash Conversion Cycle (CCC) indeed exhibits a statistically significant positive impact on Return on Assets (ROA), aligning with the negative correlation found in Ukaegbu's study. However, the study by Deloof (2003) in Belgium indicated a negative correlation between gross operating income and days of accounts receivable, inventory, and accounts payable. In the Panel EGLS results, only Cash Conversion Cycle (CCC) shows a significant impact, while Account Receivable (ARC) and Account Payable Period (AP) do not exhibit statistically significant effects on ROA, suggesting a complex relationship compared to Deloof's findings. Turning to the results of the Panel GMM EGLS (Cross-section random effects), the negative coefficient for Inventory Turnover (INV) contradicts the findings from the Panel EGLS, where a positive impact on ROA was observed. This discrepancy may be attributed to the inclusion of instrumental variables in the GMM model, addressing potential endogeneity concerns. The negative coefficient implies that more efficient inventory turnover is associated with higher profitability, providing a contrasting perspective to the positive correlation found in the EGLS model. Additionally, the positive relationship between Cash Conversion Cycle (CCC) and ROA is consistent across both models, emphasizing the importance of optimizing the cash conversion process for improved financial performance in the Nigerian manufacturing sector. The insignificant coefficient for Firm Size (SZE) in both models suggests that, within the study's context, firm size may not be a significant predictor of profitability, aligning with the findings from Eya's (2016) study on Nestle Foods Nigeria Plc. The Panel EGLS and Panel GMM EGLS results contribute a great insights into the complex relationships between working capital management and profitability in Nigerian listed manufacturing companies. While certain findings align with previous studies, such as the positive impact of Cash Conversion Cycle on profitability, discrepancies in the impact of Inventory Turnover and the significance of other working capital components indicate the complexity of these relationships. The incorporation of instrumental variables in the GMM model enhances the robustness of the findings, emphasizing the need for effective working capital strategies, particularly in managing inventory turnover and optimizing cash conversion cycles, to improve the financial performance of listed manufacturing companies in Nigeria.

CONCLUSION

In conclusion, the findings from the panel EGLS random effects regression analysis and the panel GMM EGLS (Cross-section random effects) shed light on the intricate relationships between working capital management components and profitability in listed Nigerian manufacturing companies. The study emphasizes the significance of efficient inventory management, as indicated by the statistically significant positive impact of Inventory Turnover (on Return on Assets. The importance of managing the cash conversion cycle is underscored by the positive impact of Cash Conversion Cycle on ROA. Additionally, the study provides insights into the influence of firm size, with larger firms showing a statistically significant negative impact on ROA. The introduction of instrumental variables in the GMM model contributes to a more robust examination, addressing potential biases and enhancing the validity of the findings. Despite differences in specific coefficients between the two models, both highlight the crucial role of working capital components, especially inventory turnover and cash conversion cycles, in enhancing the financial performance of listed manufacturing companies in Nigeria. Furthermore, the Coefficient Variance Decomposition results provide additional insights into the influence of each variable on ROA, ranking 'Size' and 'Account Receivable' as significant drivers. The high proportions of variance associated with these variables highlight their substantial impact on explaining variations in profitability. This Variable Importance Ranking provided by (CVD) underscores the strategic importance of managing firm size and optimizing accounts receivable in the context of listed manufacturing companies in Nigeria. Decision-makers are advised to pay careful attention to these variables in their working capital management practices, recognizing their pronounced effects on financial performance. Overall, the study provides valuable guidance for developing effective working capital strategies tailored to the specific needs of Nigerian manufacturing companies. Based on the findings of the study, the following recommendations are made:

1. Emphasize efficient management of CCC to enhance Return on Assets (ROA), aligning with the consistent positive relationship found in both Panel EGLS and Panel GMM EGLS results.
2. Focus on more efficient inventory turnover, considering the intricate impact identified in the Panel GMM EGLS results, which contrasts with the positive correlation observed in Panel EGLS.
3. Acknowledge the complexity of relationships between working capital components and profitability, necessitating customized strategies for managing inventory, accounts receivable, and accounts payable.
4. Understand that firm size may not be a significant predictor of profitability within the study's context, aligning with findings from previous research, and tailor strategies accordingly.

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