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Non-Performing Loans in Nigerian Banks: Determinants and Macroeconomic Consequences

Kure E., M. Adigun and D. Okedigba*

Abstract

The paper investigated the determinants of non-performing loans (NPLs) and its feedback on the macroeconomy. The Pool Mean Group (PMG) estimator and a panel vector autoregressive (PVAR) distributed lag models were applied to quarterly data, spanning 2007 - 2016. Major drivers of NPLs were credit growth, inflation and the lending rate. Evidence of negative relationship between economic growth and NPLs was established, suggesting that improvement in the production environment can lower the growth of non-performing loans. The study further found moderate impact of NPLs on the economy: decline in credit and bank assets, increase in risk taking by banks and reduction in economic growth. Thus, the paper recommended the following policies to end the cyclical dynamics of NPLs: moderation of interest rate; enhanced bank's risk management practice; intensified efforts to expand employment; and improving productivity.

Keywords: Non-performing loans, Risks Management, GDP, Inflation

JEL Classification Numbers: G21, C23

I. Introduction

Non-performing loans (NPLs) as a proportion of total loans is one of the credit risk indicators financial regulators constantly monitor. A non-performing loan is defined as borrowed money for which the debtor has not made scheduled payments (principal or interest) for at least 90 days. Although other indicators, including loan loss reserves and default rates, are also tracked regularly by regulators, NPLs have gained the strongest appeal, being the most used measure of assets quality. NPLs are a burden for both the lender and borrower: they trap valuable collateral for borrowers and make it more difficult for them to obtain needed funds for investment. For lenders, the cost covers time for debt recovery and the need to make greater loan provisioning, which reduces profitability and capital resources for lending.

Identifying determinants of NPLs and their consequences on the macro-economy is necessary for small open economies, such as Nigeria, where banks are the major source of finance for business activities in the critical sectors. In Nigeria, NPLs, as a ratio of total loans, moved from 4.6 per cent in the first quarter of 2007 to double digits throughout 2009. Following this rise in NPLs, measures to mitigate NPLs included the establishment of the Asset Management Corporation of Nigeria (AMCON) in 2010 to buy eligible bad assets (EBAs), creation of private credit Bureaux and issuance of new prudential guidelines on margin Loans. Consequently, NPLs as a ratio of total loan, reduced to 3.0 per cent, in the third quarter of 2013. However, financial fragility had heightened overtime, with the NPLs ratio soaring to 12.9 per cent at the end of 2016, above the prudential threshold of 5.0 per cent. Although there is adequate provisioning for these loans, the rise in NPLs remained a significant drag on effective financial intermediation in Nigeria.

The objective of this paper is to identify the drivers of NPLs in Nigerian banks and examine the implications of NPLs on the macroeconomy. Following the literature and the widely

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used estimation procedures in various studies (Fofack, 2005; Khemraj and Pasha, 2009; Nkusu, 2011; Klein, 2013; Messai and Jouini, 2013; Škarica, 2013 and Ćurak, et al 2013; Love and Ariss, 2014 and Kimberley et al., 2016), including studies on NPLs in Nigeria such as Akinlo and Emmanuel (2014), Asekome and Agbonkhese (2014), Morakinyo & Sibanda (2016), Ogechi and Fredrick (2017), and El-Maude et al (2017), both macroeconomic and bank level data were analysed. Though, most of the studies considered aggregated data on macroeconomic, bank-specific and global factors, more information on behaviour of individual banks towards NPLs could be gotten from bank-level data. This study therefore, examined the determinants of NPLs with a model that recognised possible disproportionate response of individual banks to shocks. In addition, impulse responses were derived from a panel vector autoregressive (PVAR) model to confirm point estimates and detect how NPLs influence key macroeconomic variables in Nigeria.

Quarterly data on returns by banks to the Central Bank of Nigeria (CBN) and data from the National Bureau of Statistics (NBS) spanning 2007Q1 to 2016Q4 were employed. The study covered periods of non-volatilities in the sector (prior to the 2008 global financial crises), near-systemic banking crisis of 2009, return to stability post-2010 banking reform and afterwards. The choice of fifteen banks was based on their systemic relevance, as they dominated the market in terms of share in assets and deposits, as well as availability of continuous time series data.

The rest of the study is organised as follows. Following the introductory section, Section 2 reviewed relevant theoretical and empirical literature, while the stylised facts on evolution of NPLs from 2007 to December 2016 was presented in Section 3. The methodology in Section 4 covered the model specification, data description and analysis. Section 5 summarised the study and provided recommendation.

II. Literature Review

II.1 Determinants of Non-Performing Loan

A non-performing loan is defined as borrowed money, for which the debtor has not made scheduled payments (principal or interest) for at least 90 days. Historically, NPLs constitute major cost in the profit and loss account of banks and generally precede banking crises. Although banks that accumulate NPLs may be able to sell eligible ones at discount to dedicated asset management companies, such as the Asset management Company of Nigeria (AMCON), non-performing loans generally indicate bad business for banks and constitute risk to financial stability. Determinants of NPLs, generally, include macroeconomic, bank-specific, institutional and global factors.

Business cycle models, with explicit role for financial intermediation, offer a good background to modeling NPLs, as they highlight the cyclicality of credit risk and business failures. Minsky (1974) pioneered the financial instability hypothesis or "financial theory", which provided indicative explanation of the characteristics of financial crisis. He posited that in times of economic prosperity, increasing wealth of economic agents (individual/corporate) generated fortunes above what was needed to pay off liabilities and, therefore, caused speculative tendencies. Rising speculative behaviour would lead to excessive financial advantages, which would soon generate debts that exceeded what debtors could pay and eventually caused financial crisis.

The cyclical nature of bank credit clearly links business cycles to evolution of NPLs and loan loss provisioning. NPL ratio tends to be low and loan loss provisioning subdued during

an upturn. Competitive pressure and optimism about the macroeconomic outlook often lead to a loosening of lending standards, creating the climate for defaults. The severity of bad loans, however, depends on the institutional arrangements and the regulatory frameworks. Indeed, disparities in financial regulation and supervision affect banks' behaviour and risk management practices, which are important in explaining cross-country differences in the dynamics of NPLs (Nkusu, 2011).

II.1.1 Macroeconomic and Global Determinants

Macroeconomic determinants of non-performing loans are diverse but would normally revolve around factors, such as the growth of domestic production, GDP, inflation, exchange rate, unemployment, and changes in interest rates. These have also found validity in different empirical studies[1]. The macro environment typically affects balance sheets of business agents, which, in turn, affect capacity to honor debt obligations. Hence, proxies for the macroeconomic environment tend to have some form of relationship with NPLs. The impact of inflation on NPLs may either be positive or negative. Higher inflation reduces borrowers' repayment capacity and raises NPLs, whereas real value of debt service tends to decline with higher inflation, thereby driving down NPLs (Klein, 2013). Similarly, changing in interest rates (or policy rates) directly affect borrower's capacity, particularly if the share of variable-rate interest rate loans is significant (Nkusu, 2011). Like inflation, currency depreciation may have a negative or a positive effect on NPLs. Currency depreciation in a country with flexible exchange rate regimes and a large amount of lending in foreign currency, may have a positive effect on accumulation of NPLs (Fofack, 2005).

Espinoza and Prasad (2010) used world trade and an index for global risk aversion and tight financing conditions (VIX) in their analysis of non-performing loans in the GCC countries and found the VIX index to be a highly significant determinant of NPLs but not world trade. Specifically, NPLs increased with rising global risk. Similarly, oil price could be a significant determinant of NPLs in both oil-exporting and oil-importing countries. Oil prices transmit to the economy of an energy exporting country through the fiscal channel and export channel. Thus, an increase in oil export leads to larger capital inflows in the form of foreign currency, which leads to domestic exchange rate appreciation Domestic exchange rate appreciation causes a decline in the price of imported goods. High profits and income levels in the oil producing sector leads to decline in the number of defaults on loans. The opposite is expected for oil-importing countries, which may face reduced borrowers' income, resulting in high NPLs.

II.1.2 Bank-Specific Determinants

Essential bank-specific determinants are risk-taking tendencies that tend to be affected by moral hazard, agency problems, ownership structure, and regulatory actions (Espinoza and Prasad (2010). Other factors have included equity-to-asset ratios, profitability in banks, loans-to-asset ratios, bank size, capital ratios, market power, operation efficiency and exposure to local markets.

Berger and DeYoung (1997) drew attention to the links between bank-specific characteristics, efficiency indicators and loans problem. They formulated possible mechanisms, namely 'bad luck', 'bad management', 'skimping' and 'moral hazard', to

[1] Fofack, 2005; Espinoza and Prasad, 2010; Love, 2013; Klein, 2013; Nkusu, 2011; Skarica, 2014

relate efficiency with capital adequacy and, thereafter, tested the hypotheses for a sample of US commercial banks, spanning 1985 to 1994. The authors found that decreases in measured cost efficiency, generally, led to increased future problem loans. This coincided with the conclusion by Keeton and Morris (1987) on the analysis of 2,470 banks in the USA. The authors found that few banks had higher losses due, mainly, to chance, while some accumulated bad assets because of weak credit management process. Others, with well-diversified loan portfolios, were able to ease lending standards and keep total risk in low levels. They further found that high loan losses were generally connected with banks that were situated in areas with unfavourable economic conditions. Similarly, Keeton (1999) used data from 1982 to 1996 and a vector autoregressive model to analyse the impact of credit growth and loan delinquencies in the USA. The study showed evidence of a strong relationship between credit growth, associated with low credit standards and high loan losses in US banks during that time.

II.1.3 Review of Empirical Literature

Empirical investigation on the determinants of NPLs typically revolve around variants of standard macroeconomic, bank-specific and global factors, as well as institutional arrangements. Since Fofack (2005), analysis of determinants of non-performing loans has depended. These have mostly revolved around presentation and analysis of macroeconomic, bank-specific and global determinants.

In a panel study of European countries, Rinaldi and Sanchis-Arellano (2006) analysed household NPLs and provided empirical evidence that disposable income, unemployment and monetary conditions had a strong impact on NPLs. Grimes and Holmes (2008) investigated the determinants of loan losses in Australia, based on data from 32 banks spanning 1980 – 2005. The regression analyses used showed that GDP growth and change in unemployment rate had the expected effects on the NPLs, but with one-year lag. The stock and house price indices were found to be negatively related to loan losses, while the inflation rate was positively related NPLs.

Khemraj and Pasha (2009) tested empirically a fixed-effect panel data model for the determinants of non-performing loans in the Guyanese banking sector. The study found standard macroeconomic and bank specific factors to be relevant in the evolution of non-performing loans. Among the macroeconomic variables considered were annual inflation rate, real effective exchange rate and GDP growth rate. The authors also found banks, with relatively higher interest rates and excessive lending, incur higher levels of non-performing loans.

In a study of the Albanian banking system, Shijaku and Ceca (2010) related the NPL ratio to GDP growth, changes in Euribor and Libor[2], interest rate on loans, exchange rate (ALL1/Euro and ALL/Dollar) and the inflation rate. The regression coefficients had the expected signs. GDP growth rate was small in value but statistically significant. Also, Biabani et al., (2012) examined panel data spanning 2006 – 2011 to assess the effective determinants of NPLs level in Iran. The authors employed a regression model to test the relationship between the NPLs level and loan collateral, duration of granted facilities' payment, bounced check, another deposit and credit background. The results revealed

[2] Euro Interbank Offered Rate (Euribor) and London Interbank Offered Rate (Libor)

that all hypotheses were confirmed, except the outcome between the NPL levels and having another deposit, which was not significant.

In a study of the Spanish banking sector, Fernandez et al., (2013) analysed the widely perceived cyclical behaviour of bank credit, credit losses and credit provisions. The authors found a strong correlation between NPLs and economic cycle, and further suggested that NPLs tended to be low during economic boom but reached a relatively higher level when the economy experienced a downturn. The study also showed that credit expansion was one of the most important drivers of NPLs.

Akinlo and Emmanuel (2014), Asekome and Agbonkhese (2014), Amuakwa-Mensah and Boakye-Adjei (2015), Morakinyo & Sibanda (2016), Ogechi and Fredrick 2017, and El-Maude et al (2017) have presented empirical estimates determinants of non- performing loans in Nigeria, with emphasis on macroeconomic and bank-specific factors. We add global factors to these determinants given the sensitivity of domestic economies to global shocks and discuss macroeconomic effects of NPLs as well, using a robust data set from direct returns from banks for the analysis.

Overall, the studies were based, mainly, on aggregated data on macroeconomic and industry-level banking sector factors. No successful attempt had been made to explore the potential for more information from the behaviour of individual banks towards NPLs that could be gotten from bank-level data. This study is based on bank-level data and adopts a procedure that captures the possible disproportionate response of individual banks to the different determinants of NPLs. In addition, the study attempts to reveal the feedback effect of NPL on the macroeconomy, based on the impulse responses were derived from a panel vector autoregressive (PVAR) model, as an extension of the focus of previous studies on determinants.

II.2 Macroeconomic Effects of Non-Performing Loans

Generally, the impact of NPLs on the real economy is largely transmitted via the weakening borrower's capacity to repay the loan. NPLs are assumed to affect the real economy mostly through the credit supply channel either due to the high costs associated with managing high NPLs, or the lower capital that results from loan provisioning. Established literature on the feedback from NPLs to the real economy emphasised the effect on the supply side of banks' balance sheet (Espinoza and Prasad, 2010; Klein, 2013). The impact is reflected mostly in terms of constraints to the supply of credit for real sector production, due to high provisioning or reduced capital resources available for lending.

In sub-Saharan Africa, studies on the impact of NPLs on the economy have largely, focused on sector-specific impact of NPLs. Wangai et al., (2012) considered impact of non-performing loans on microfinance banks in Kenya. The authors utilised descriptive statistics and correlation matrix to establish a nexus of credit risk and financial performance in Nakura town. While the findings are robust, it is important to note that the analysis of macrofinancial-linkages goes beyond correlation analysis and involves deed structure relationships given the idiosyncrasies of banks. Joseph and Okike (2015) attempted to solve this problem in a study of implication of non-performing loans on profitability of firms in Nigeria where some regression analysis was conducted to connect NPLs and returns on Asset and Returns on equity. However, the utilisation of time series

data for econometric excise without preliminary investigation of stationarity properties of the variables in the model cast doubt on the reliability of the estimates for inferences.

Chude and Chude (2014) attempted to get around the problem in their analysis of implications of non-performing loans and Nigeria's economic growth. However, without an explicit statement on the source of data for the study, it becomes difficult to make concrete statements on the findings of this study. It should be noted that having the data from individual banks in Nigeria, which we have generated from banks' returns to the CBN, creates an important climate for effective analysis of bank-specific issues such as non- performing loans. This is clearly the mark of departure our research and those which have used aggregate data for analysis of non- performing loans in the past.

Kanu and Hamilton (2014) examined a functional relationship between levels of non-performing loans and lending rate, inflation rate and gross domestic product in Nigeria. Although the authors conducted some causality tests, the findings on the role of lending rate and inflation on NPLs in Nigeria still need to be cautiously interpreted as the results suffer the problems observed in Okike's (2015); Bismark and Chengyi (2015) and Chimkono et al., (2016).

Bismark and Chengyi (2015) examined NPLs and performance of banks in Ghana with ten universal banks applied analysis of variance (ANOVA) and a regression of delinquent loans on interest income and on banks' profitability between 2009 and 2013. However, the study suffers the problems of Okike's (2015) study of Nigerian banks cited above. Chimkono et al., (2016) attempted to escape this with their analysis of the variance inflation factor (VIF) before consideration of the regression of NPLs on the selected variables. But not conducting a test for unit root or cointegration analysis obviously creates a room for a cautious interpretation of those empirical estimates.

Beaton et al., (2016) provided a summary of the literature on feedback effect and further found NPLs to be a drag on the Caribbean economic growth. The study revealed strong macro-financial links -- a deterioration in asset quality, which hindered bank lending and dampened economic activity. This, in turn, undermined efforts to resolve problem loans, like the outcomes of the works by Espinoza and Prasad (2010), Nkusu (2011), Klein (2013) and Love and Ariss (2014).

Ozurumba (2016) looked at NPLs and commercial banks performance in Nigeria between 200 2013 and focused on the impact of NPLs on banks profitability, which they proxied with returns on assets (ROA) and returns on Equity (ROE). The authors extracted information from annual reports of two banks, namely United Bank for Africa Plc and Access Bank Plc., to derive their conclusions. Essentially, they found banks' profitability to be severely impacted upon by massive accumulation of non-performing loans, which is expected from a theoretical point of view. However, where there exist many banks in operation, substantial information will be lost when a larger number of banks are excluded in a study of bank-specific issues such non-performing loans. Indeed, two banks cannot capture the peculiarities of the banking system particularly when larger players are excluded.

Morakinyo, and Sibanda (2016) applied an autoregressive distributed lag model on an endogenous growth model for Nigeria and found NPLs level and bank credits to the economy to have a negative but significant impact on economic growth. The authors also applied an error correction mechanism to establish a slow response to equilibrium in

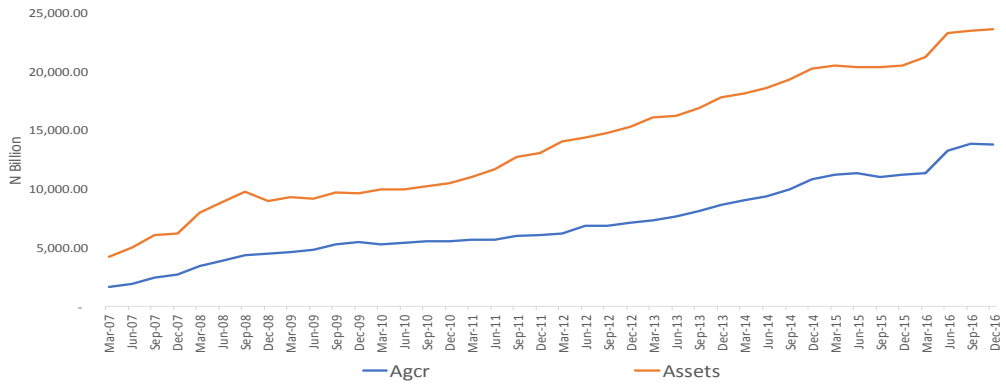
the next period, once the system was distorted. This study applied similar technique but extended the discourse through the two prone approach adopted for the analysis of non-performing loans and the economy. First, we estimated an autoregressive distributed lag (PARDL) model for analysis of determinants of non-performing loans, in a panel of fifteen banks Nigeria, using data extracted from banks' returns to the CBN. Thus, our data set is relatively credible. Then a Panel vector autoregressive (PVAR) model to model was applied for the macro-financial linkages. Secondly, because the implementation of a PARDL and PVAR requires preliminary scrutiny of the time series data for unit root, it is possible for us to generate relatively more reliable empirical estimates.

III. Some Stylised Facts on Non-Performing Loans in Nigeria

Since banking commenced in 1892, rising non-performing loans had been associated with banking crises in Nigeria. Initial episodes of increasing NPLs reflected, largely, the lack of appropriate regulation, weak governance and absence of professionalism, which led to poor risk management practices and low compliance levels. Consequently, the sector accumulated significant amount of low quality and high-risk assets, which crystalised into huge amount of bad assets that eroded the capital base, culminating in different episodes of bank distress, up until the early 1980s.

Between 1989 and 1998, the banking industry witnessed another round of systemic crises, attributed to the withdrawal of public sector deposits from the banks. The ensuing unbridled cutthroat competition led to competitive pricing and arbitrage opportunities, particularly in the foreign exchange market, to the detriment of traditional banking business. Thus, banks' hitherto weak and fragile financial condition, which had been concealed by a combination of public subsidy and improper accounting systems, among others, became exposed. Non-performing loans, therefore, reared its head again, as banks let down their guard, due to intense competition, leading to mass distress that laid the foundations for the bank consolidation exercise in 2004.

Figure 1: Banks Assets and Aggregate Loans in Nigeria (2007-2016)



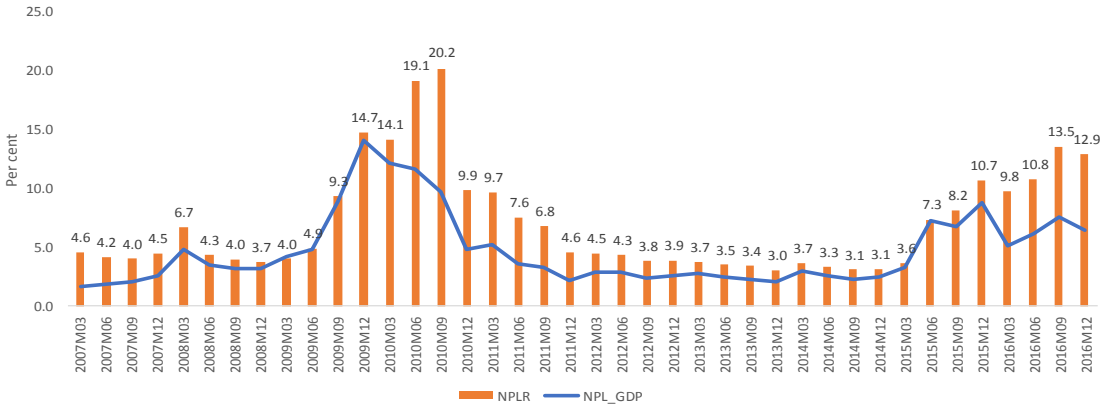
Source: CBN Statistical Data base

The sector witnessed dramatic growth post-consolidation with the total assets, deposits and loans increasing many folds (Figure 1). Apparently, the exercise induced a breath of new life into banks, by enhancing their capital base, thereby increasing their involvement in business activities. The drive towards margin loans in the capital market and credit to

the oil and gas sub-sector led to 149.0 per cent growth in industry assets by between 2007 and 2009. Moreover, players and regulators were not well prepared for the challenges, especially in terms of managing the excess liquidity and the need for enhanced risk management. The challenges, which were industry-specific and macroeconomic in nature, further exposed the vulnerabilities of the banking sector. The industry-specific factors included failures in corporate governance; lack of investor and consumer sophistication; inadequate disclosure and transparency about financial position of banks; critical gaps in regulatory framework and regulations; and uneven supervision and enforcement.

The 2007/2009 global financial crisis (GFC) impacted negatively on Nigeria, but largely through the second-round effects after the crises. The slow-down of the world economy and fall in oil prices exposed vulnerabilities of the banks. For example, the decline in foreign exchange receipts resulted in a de-accumulation of external reserves and created pressure on the naira. Thus, banks with foreign liabilities, were hit badly, coupled with the drying up of credit lines, owing form the recall of investment by international banks there were hit by the crisis. Reinforcing these was the reduction in the Federal Account Allocation Committee (FAAC) disbursement of oil revenue to the three tiers of government, usually routed through banks. In addition, there was significant deterioration in loans to the downstream oil and gas sector, owing to the rapid fall in global oil prices. Consequently, the vulnerability in the banking sub-sector was exposed, due to the short-lived rapid rise in asset prices, because of over concentration of bank shares in the stock market. The banks incurred huge losses on margin loans and share-backed facilities, following substantial decline in share prices and stock market capitalisation. The NPLs for the banks grew significantly to 20.2 per cent, as a ratio of total loans in the third quarter of 2010.

Figure 2: Non-Performing Loans as a Ratio of Total Loans and Nominal GDP (2007-2016)



Source: CBN Statistical Data base

Impaired loans threaten financial stability by jeopardising the solvency of the system and slowing credit growth. Businesses, depending on bank loans, would have to seek for alternative funding sources elsewhere at higher cost. Apparently, appropriate policy responce to address the deterioration in banks' assets quality is important for financial stability. The next section discusses essential determinants of NPLs and shows how loans default affect the economy.

Various reforms, including the establishment of the Asset Management Corporation of Nigeria (AMCON) and the introduction of the "New Banking Model" were put in place to

restore stability and confidence in the sub-sector. Consequently, non-performing loans to total loans ratio fell to 3.5 per cent in 2012, below the industry threshold of 5.0 per cent and further to 3.0 per cent in the third quarter of 2014. However, there has been a steady degeneration of asset quality in recent times, due to domestic and global factors. Non-performing loans to total loans ratio rose to 10.7 per cent and 14.1 per cent at end-June 2016 and end-December 2016, respectively (see Figure 2). The development indicated worsening quality of asset and heightened vulnerability in the banking system, exacerbated by deteriorating and tight macroeconomic conditions. This indeed calls for a review of policy to arrest further weakening of the sub-sector. It is important to stress that NPLs is not only detrimental to the ability of banks to effectively intermediate but also their capacity to withstand shocks.

IV. Empirical Methodology

IV.1 The Model and Variables Description

The study applied two complementary empirical methodologies. The first is a panel autoregressive distributed lag (PARDL) model, cast on assumption that cross-sections contain information about long-run relationships. The approach is meant to examine determinants of NPLs under the assumption of unidirectional relationship flowing from determinants to the dependent variable. The second model is a panel vector autoregressive (PVAR) model, meant to trace possible feedback of NPLs on the economy.

The PARDL model is based on a time-series panel[3], meaning that the stationarity property of the data is likely to be an issue. However, the pooled mean group estimator (PMGE) procedure, popularised by Pesaran, Shin, and Smith (1999) was adopted for the estimation because it accommodates the stationarity challenges of time series data, and accounts for common and idiosyncratic factors, as well as cross dependences. It is an intermediate estimator between mean group (MG) estimator, which averages the means of individual cross-sectional regressions, and the traditional fixed-effects and instrumental-variable estimators, such as generalised method-of-moments (GMM) estimator (Arellano and Bond, 1991), which allows intercepts to vary among cross-sections but constraints coefficients and variances to be the same for all the units. Pesaran and Smith (1995) show that under certain assumptions[4], cross-sections will provide consistent estimates of the average long run relations. Nonetheless, Pesaran and Smith (1995); Pesaran, Shin and Smith (1999); Philips and Moon (2000) and Im, Pesaran, and Shin (2003) have shown that where N and T are sufficiently large, the assumption of homogeneity of slope parameters becomes inappropriate. A panel of 15 banks, considered in a period of 40 quarters is sufficiently large to allow for the PMG estimation. While the banks are expected to exhibit disproportionate short-term responses to shocks, the fact that they operate on a given technology suggests that in the long run-run, how the banks respond to the fundamentals driving non- performing loans would converge.

The ARDL model relates a dependent variable to its lags as well as contemporaneous and lag levels of all other variables in the model. Given our panel structure, we adopt the basic structure of panel ARDL model (Pesaran, Shin and Smith, 1997) of the form.

[3] T is long enough such that an equation can be estimated for each of the cross-sections. That way, a simple arithmetic average of individual coefficients could be developed to produce the mean group (MG) estimators (Pesaran and Smith 1995).

[4]

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \boldsymbol{\delta}'_{it} \boldsymbol{x}_{it-j} + \mu_i + \varepsilon_{i,t} \quad (1)$$

with the cross-sections $i = 1, 2, \ldots, N$; the number of periods $t = 1, 2, \ldots, T$. $x_{i,t}$ is the $k \times 1$ vector of explanatory variables that vary both across time and the group; d_t is a vector of fixed regressors, such as intercepts and trends or those variables, which vary only with time; the coefficients of the lagged dependent variables, $\lambda_{i,j}$, are scalars, while $\delta_{i,j}$ and χ_i are the $k \times 1$ and $s \times 1$ coefficients of unknown parameters for the explanatory variables and the fixed regressors, respectively ; μ_i is the cross-section specific effects, while $y_{i,t-j}$ and $x_{i,t-j}$ are j period lagged values of the dependent variable and the explanatory variables, respectively, which can be fixed or chosen based on any lag selection criteria. The error term, $\varepsilon_{i,t}$ are expected to be independently-distributed across i and t, with expected zero means and constant variances, σ^2_i. They are also distributed independently of the regressors, X_{it} and d_t - a requirement for consistent estimation of the short-run coefficients. Where the variables in the model are almost I(1), such that the error term from their long run relationship is $I(0)$ for all i, it becomes more convenient to work with the error correction representation of Equation 1:

$$\Delta y_{i,t} = \emptyset_i y_{i,t-1} + \beta'_i \boldsymbol{x}_{it} + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta^*_{ij} \Delta \boldsymbol{x}_{it-j} + \mu_i + \varepsilon_{i,t} \quad (2)$$

Where $\emptyset_i = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right), \beta_i = \sum_{j=0}^{q} \delta_{ij}$, $\lambda^*_{ij} = -\sum_{m=j+1}^{p} \lambda_{im}, j = 1,2,\ldots p-1,$ and $\delta'^*_{ij} = -\sum_{m=j+1}^{q} \delta_{im}$ $j = 1,2,\ldots q-1$.

The parameter, $\emptyset_i$, is the error correction term that defines the speed of adjustment of short-run deviation to long-run equilibrium. It is expected to be negative and statistically significant, under the assumption of a natural tendency for stationary variables to return to long-run equilibrium once a deviation occurs. The vector β', contains the long-run coefficients relating the dependent and exogeneous variables in the model. λ^*_{ij} and δ^*_{ij} are short-run coefficients. The assumption that the model is stable requires the roots of $1-\sum_{j=1}^{p} \lambda_{ij} z^i, i=1,2,\ldots N,$ to lie outside the unit circle, which ensures $\phi_i < 0,$ and there exists a long run relationship between y_{it} and x_{it}, defined by $-(\beta_i / \phi_i) x_{it} + \upsilon_{it}$, for each $i = 1, \ldots N$, where υ_{it} is a stationary process.

For the analysis of determinants of non-performing loans, we assume that the relationship can be represented by the following long run equation:

$$Y_{i,t} = \alpha_{0i} + \alpha_{1i} X_{it} + \beta_{1i} K_{it} + \delta_{1i} Q_{it} + e_{i,t}; \; i = 1,2, \ldots N; \; t = 1,2, \ldots, T \quad (3)$$

where $y_{i,t}$, is the dependent variable, x, k and q are vectors of macroeconomic, bank-specific and global factors, respectively; α_{it} are a vector of deterministic variables such as the intercept term, time trends, seasonal dummies, or exogenous variables with the fixed lags; μ_i individual cross fixed effects and $e_{i,t}$ is a white noise error term.

We present the dynamic specification of the model as an ARDL (1,1,1,1) of the form:

$$Y_{i,t} = \alpha_{0i} + \alpha_{1i}X_t + \alpha_{2i}X_{t-1} + \beta_{1i}K_{it} + \beta_{2i}K_{it-1} + \delta_{1i}Q_{it} + \delta_{2i}Q_{it-1} + \gamma_i Y_{it-1} + e_{i,t}, i = 1,2, \dots N, t = 1,2, \dots, T \quad (4)$$

and the error correction re-parameterisation of Equation 4 is:

$$\Delta Y_{i,t} = \emptyset_i(Y_{it-1} - \alpha_{0i} - \alpha_{1i}X_{it} - \beta_{1i}k_{it} - \delta_{1i}Q_t) - \alpha_{2i}\Delta X_{it-1} - \beta_{2i}\Delta K_{it-1} - \delta_{2i}\Delta Q_{it-1} + e_{i,t}, i = 1,2, \dots N, t = 1,2, \dots T \quad (5)$$

where

$\alpha_{0i} = \frac{\alpha_i}{1-\gamma_i}$, $\alpha_{1i} = \frac{\alpha_{1i}+\alpha_{2i}}{1-\gamma_i}$, $\beta_{1i} = \frac{\beta_{1i}+\beta_{2i}}{1-\gamma_i}$; $\delta_{1i} = \frac{\delta_{1i}+\delta_{2i}}{1-\gamma_i}$; and $\emptyset_i = -(1-\gamma_i)$ is the error correction coefficient, is expected to be $\emptyset_i \neq 0$ and statistically significantly negative to ensure long-run adjustment from short-run dynamics. A non-zero mean of cointegrating relationship is allowed with the inclusion of θ_{it}. The $\theta_1 \dots \theta_3$ and $\beta_1 \dots \beta_3$ are long and short-run coefficients, respectively. Δ is a difference operator. The lag lengths of the variables are chosen endogenously from any of the standard selection criteria such as AIC, SC, HQ, depending on which of them provides the lowest lags.

The macroeconomic factors are: real rate of GDP growth (RY), inter-bank exchange rate (ER), banks' average prime lending rate (LR) and the yearly change in CPI (INF). Bank level variables are total assets of banks (TAS), total credit to the private sector (CRD) and a measure of risk (RISK). Global factor was proxied by the international oil price (OP) to reflect the oil-dependent nature of the Nigerian economy.

All the variables and their apriori expectations are presented in Table 1. For instance, it was expected that the coefficients of RY would be negative because strong growth in GDP usually reduces unemployment and translates into increased income that improves borrower's debt repayment capacity. The exchange rate was expected to have both positive and negative coefficients depending on the relative size of foreign currency component in the asset portfolios of banks; a positive sign was expected with a large foreign currency component. Both negative and positive coefficients were expected on inflation. Inflationary pressures can contribute to the growth of impaired loans positively when it erodes banks' equity real income, leading to a reduction in capacity to repay loans. On the other hand, inflation can make debt servicing easier by reducing the real value of outstanding loans. The average lending rate was expected to move positively with NPLs as it reduces loan repayment capacity of borrowers, while excessive credit expansion would likely cause adverse selection that might reduce asset quality. The size of banks, measured by stock of assets, was expected to improve capacity to screen borrowers and lead to reduced loan delinquencies. The variable, *risk,* captured the risk appetite of banks and represented by the loans/assets ratio. Along with changes in loans by individual banks, both measures were expected to increase NPLs positively. Oil price is important to both oil-exporting and oil-importing countries. The collapse of international oil price could raise loan delinquency in oil exporting countries but reduces it in oil importing countries, according to the level of exposure of local banks to the oil sub-sector. For Nigeria, which depends on oil export and where lending institutions are significantly exposed to the oil and gas subsector, a negative coefficient was expected of the oil price variable. Where appropriate, variables were considered in log form.

Table 1: Variables and their Definitions

Variables	Definition	Apriori Expectations
NPL	Ratio of non-performing loans to total loans	Dependent variable
RY	Growth rate of real GDP	-
INF	Year on year change in all Items CPI	+/-
ER	Interbank exchange rate	+/-
LR	Average prime lending rate	+
CRD	Bank credit to the economy	+
OP	International oil price	-
TASS	Total assets of banks	-
Risk	Loans/ Assets ratio	+

IV.1.1 Feedback of NPLs on the Economy

A panel vector autoregressive (PVAR) model is estimated to elicit the feedback of NPLs on the economy. The objective is to establish possible interaction between financial variables and real sector activities. PVAR is an econometric procedure popularised by Love and Zicchino (2006) and became a work horse model for analysing different events (Canova and Ciccarelli, 2013). The technique combines the traditional VAR approach, which treats all the variables in the system as endogenous and interdependent, with panel-data structure that allows for unobserved individual heterogeneity. It is distinguished by its sectional heterogeneity, as well as dynamic and static interdependences.
The basic structure of the model takes the form:

$$y_{it} = \pi_0 + \sum_{i=1}^{p} \omega_i y_{it-i} + \upsilon_i + \varepsilon_{it} \quad (6)$$

where y_{it} is a stacked vector of $Nx1$ endogenous variables, $i=1,2,...,N$ observed over the period $t=1,2,...,T$, the vector of fixed-effects of individual cross sections, υ_i, ω is a vector of coefficients and $\varepsilon_i t=(\varepsilon_{1t},\varepsilon_{2t},...,\varepsilon N_t)$, is a vector of white noise error term. Of importance in a PVAR is the appropriate lag structure and its stability. The lag structure is determined by any of the standard lag section criteria, while stability of the VAR is satisfied when the roots of the characteristic polynomials lie inside the unit circle.

The dynamic behaviour of the model is captured by orthogonalised impulse-response functions. However, since the actual variance–covariance matrix of the errors in the scheme is unlikely to be diagonal, it becomes necessary to decompose the residuals in such a way that they become orthogonal, to isolate the impact of shocks to one of the variables from the system, while holding other variables constant. The usual convention is to adopt a Cholesky's ordering, which attributes exogeneity to the variables that comes first in the ordering. The identifying assumption is that the variables that come earlier in the ordering affect the following variables, contemporaneously, as well as with a lag, while the variables that come later affect the previous variables only with a lag. Thus, for the impact of macroeconomic, bank-specific and global factors on non-performing loans, the most endogenous variable in such a model would be the NPL ratio. However, in a model that expresses the response of the economy to non-performing loans, the NPL is the most exogenous and is ordered first in the VAR, followed by the bank specific variables, the proxy for the global factors and macroeconomic variables.

IV.1.2 Data

We used quarterly data spanning 2007Q1 to 2016Q4. The selection of scope was due primarily to availability of data and the need to capture periods with significant effects on banks' operations, including the post-bank consolidation period, the global financial and economic crises and a period of domestic economic recession. Information on bank specific variables were obtained from returns of banks to the CBN. However, complete information on all the variables were not available for some banks because of mergers, acquisition and new licenses. Consequently, we used data for fifteen commercial banks, accounting for over 80 per cent of the market, in terms of deposits and assets. Macroeconomic variables were obtained from the CBN's statistical database and the National Bureau of Statistics (NBS) of Nigeria. Oil price, which is average end-period[5], was used as proxy for the global variables, to determine the drivers of NPLs. Furthermore, a structural break dummy variable was introduced to capture the global financial crises and took the value of 1 from the second quarter of 2009 and 0 in all other periods.

IV.2.1 Summary Statistics and Cross Correlations

The descriptive statistics in Table 2 indicated that the NPL ratio exhibited some variability during the period of study but the mean is within the maximum and minimum values. Such variability would possibly depict credit policies and management styles of individual banks in the model. Nonetheless, the aggregate average NPL ratio stood at 2.6 per cent through the period was lower than the threshold ratio of 5 per cent.

Table 2: Summary Statistics

	NPL	RY	ER	LR	INF	TAS	CRD	RISK	OP
Mean	2.6	5.5	5.1	16.8	10.9	6.5	9.4	0.5	85.9
Med	2.8	6.3	5.1	16.8	10.3	6.5	9.6	0.5	88.0
Max	6.5	10.2	5.7	19.6	20.4	8.4	10.1	0.9	127.3
Min	-4.2	-2.3	4.8	14.8	4.1	4.6	8.0	0.1	33.4
Obs.	596.0	596.0	596.0	596.0	596.0	596.0	596.0	596.0	596.0

The cross correlations (Table 3) showed the NPL ratio to be highly correlated with major variables of interest with the expected signs but for the proxy for bank size, which showed a positive correlation. NPL correlated negatively with measures of economic performance, namely; the real growth rate of GDP. It also correlated negatively with the average international oil price, as expected. Though a positive correlation between credit and the exchange rate variable is observed, the panel data structure is expected to address the problem, without any significant impact on the parameter estimates.

[5] Extracted from http://markets.businessinsider.com/stocks

Table 3: Cross Correlations

	NPL	RY	ER	PLR	INF	TAS	CRD	RISK	OP
NPL	1								
RY	-0.19	1.00							
ER	0.32	-0.80	1						
PL	0.14	0.09	0.16	1.00					
INF	0.31	-0.33	0.47	0.18	1.00				
TAS	0.46	-0.34	0.40	-0.03	0.12	1.00			
CRD	0.28	-0.63	0.80	0.05	0.35	0.49	1.00		
RISK	0.59	-0.03	0.15	0.16	0.22	0.14	0.08	1.00	
OP	-0.21	0.32	-0.46	-0.42	-0.27	-0.04	-0.07	-0.21	1.00

IV.2.2 Unit Root Test

The panel unit root tests is based on the following dynamic structure:

$$y_{it} = \rho_i y_{it-1} + X_{it}\delta_i + \varepsilon_{it}; i=1,2,...,N; t=1,2,...,T \quad (7)$$

where y_{it} is a stacked value of the series in the model, $i=1,2,...,N$ represent the cross series that are observed over the period $t=1,2,...,T$, X_{it} is the exogenous variables in the model, including any fixed or individual time trends. The coefficient ρ_i, is the autoregressive coefficients, and ε_{it} are expected to be well-behaved errors with constant means and homoscedastic variances. If $\rho_i < 1$, y_i is said to be trend stationary, and y_i contains a unit root. On the other hand, if $\rho_i = 1$, then y_i contains a unit root. Unit root test of Levin, Lin and Chu (2002), Breitung (2000) and Hadri (2000) assume a common unit root process among cross-sectional variables, such that $\rho_i = \rho$ for all i. However, Im, Pesaran, and Shin (IPS) (1997), Fisher-ADF and Fisher-PP tests allow ρ_i to vary across cross-sections.

All tests are based on the ADF specification of the form:

$$\Delta y_{it} = \alpha y_{it-1} + \sum_{j=1}^{pi} \beta_{ij} \Delta y_{it-j} + X'_{it}\delta + \varepsilon_{it} \quad (8)$$

where for LLC and Breitung tests, the null and alternative hypotheses are $H_0: \alpha = 0$ and $H_i: \alpha < 0$ for all i, but IPS test holds its null hypothesis: $H_0: \alpha_i = 0,$ for all i, and the alternative $H_1: \alpha_i = 0$ for $i=1,2...,N_1$ and $\alpha_i < 0$ for $i=N+1,N+2,...,N$. The average t-Statistic for α_i from the ADF regression is

$$\bar{t} = 1/N \sum_{i=1}^{N} t_{iT} \quad (9)$$

where t_{iT} is the ADF t-statistic for the cross section i, with the t-Statistic assumed to be normally-distributed under OH.

For robustness of estimates however, we generated unit root test results from three standard tests, namely Levin, Lin & Chu t* (LL&C) (2002), Im, Pesaran, and Shin (IPS) (1997) and an ADF-Fisher chi-square. Results for the tests are presented in table 4. Decision on the nature of unit root is based on the associated probability values, providing grounds for rejection of the null hypothesis of unit root.

Table 4: Unit Root Test

Variable		L L & C	Prob	IP&S	Prob	ADF-Fisher	Prob	Decision
NPLs	Level	-	-	-	-	-	-	
	First Diff	-9.64	0.00	-12.91	0.00	199.74	0.00	I (1)
RY	Level	-	-	-	-	-	-	
	First Diff	-4.79	0.00	-9.65	0.00	149.24	0.00	I (1)
ER	Level	-	-	-	-	-	-	
	First Diff	-11.20	0.00	-11.36	0.00	181.05	0.00	I (1)
LR	Level	-2.10	0.02	-7.02	0.00	103.97	0.00	I (0)
	First Diff	-	-	-	-	-	-	
INF	Level	-	-	-	-	-	-	
	First Diff	-7.42	0.00	-7.11	0.00	105.47	0.00	I (1)
TAS	Level	-	-	-	-	-	-	
	First Diff	-14.58	0.00	-15.89	0.00	271.65	0.00	I (0)
CRD	Level	-	-	-	-	-	-	
	First Diff	-11.30	0.00	-7.47	0.00	111.35	0.00	I (1)
RISK	Level	-1.67	0.05	-2.50	0.01	50.25	0.01	I (0)
	First Diff							
OP	Level	-1.56	0.06	-2.84	0.00	45.88	0.03	I (0)
	First Diff							

The overall result was a mixture $I(0)$ and $I(1)$ variables, suggesting that model is amenable to long-run co-integration test between NPL and its sources. Given the data structure, two tests were applied, namely; Kao residual-based test for co-integration and Fisher (Johansen) tests. Both tests confirmed unequivocally that co-integration existed among the variables in the model. Indeed, the test results, reported in Table 5 suggested the presence of 1 to 5 co-integrating vectors with a p>01 for the Kao test and the Trace and Max-eigen values of Johansen Fisher test. There was enough justification for the PARDL and the PVAR models applied in the study.

Table 5. Test for long-run Co-integration

Table 5.1 Kao Residual Co-integration Test

	t-Stat	Prob.
ADF	-4.5	0.000
Residual variance	0.5.3	
HAC variance	0.33	

Table 5.2: Johansen Fisher Panel Cointegration Test

No. of CE(s)	Trace test	Prob.	max-eigen test	Prob.
None	606.50	0.00	414.70	0.00
At most 1	643.30	0.00	260.60	0.00
At most 2	367.90	0.00	190.20	0.00
At most 3	205.20	0.00	114.20	0.00
At most 4	107.30	0.00	61.95	0.00
At most 5	60.56	0.00	43.03	0.06

IV.3 Empirical Results

Empirical results were presented in two parts. The first part discussed long-run and short relationship of non-performing loans and macroeconomic, bank-specific and global factors, and the second discussed the impact of non-performing loans on the economy.

The ratio of non-performing loans to total loans (NPL) was the key endogenous variable, particularly in the model specifying determinants of NPLs.

IV.3.1 Short and Long-Run Determinants of Non-Performing Loans

The estimates of equations 3 to 5 were reported using the pool mean group (PMG) estimator, as against the traditional fixed or random effect (FE) models, or a combination of fixed-effects and instrumental-variable estimators. As stated in Section 4.1, FE and GMM estimators allow intercepts to vary among cross-sections but limit coefficients and variances to be the same for all the units. However, there is evidence that, with sufficiently large N and T, the assumption of homogeneity of slope parameters becomes inappropriate (Edward and Frank, 2007). The first part of Table 6 reported the long-run estimates and the second part report the average short run estimates along with the speed of adjustment to long run equilibrium. The individual short run estimates of the all the banks are reported in appendix 1.

IV.3.2 Determinants of NPLs

IV.3.2.1 *The Long-Run Estimates*

IV.3.2.1.1 Macroeconomic Determinants

A lag length of three was chosen for the estimates, and the major concern was long-run relationship between the NPLs ratio and specified determinants. Empirical estimates presented in table 6a generally confirmed the importance of macroeconomic, bank specific and global factors in the evolution of NPLs in Nigeria. Evidence of negative relationship with economic growth was observed, consistent with expectation, and suggested that the NPL ratio reduces with growth in real GDP. The result also confirmed the cyclical relationship of NPL and as observed in studies across other jurisdictions[6]. The idea is that increased economic activities lead to improvement in the prosperity of businesses and corporates, raising income level of agents and their loan repayment capacity. Apparently, policies to expand employment and improve productivity could raise domestic loan repayment capacity and reduce the growth in NPLs.

NPLs are positively sensitive to the average lending rate as expected. At an average maximum lending rate of 23.24 per cent in during the period under review, it is little surprise that loans repayment would be difficult under the circumstance. Although high lending rates is often justified from the stand point of cost of operations, the resources devoted to provisioning for bad debt and implications on capital would need to be benchmarked against revenues accruing from the lending cost. The positive coefficient of inflation was attributable to the stickiness of wages downwards and the real effects on businesses' balance sheets, which hampered debt servicing. The foreign exchange rate turned up with a negative coefficient and the plausible explanation is the relatively low volume of foreign currency denominated assets in banks' balance sheets, due to loss of foreign credit lines during a large part of study period. Besides, improvement in revenue flow from crude oil export meant that the foreign exchange rate would be stable during the period.

[6] Khenaraj and Pasha (2009 Jakubík & Reininger (2014); Klein, 2013; Nkusu, 2011; Skarica, 2014; Kimberly et al., 2016; Olayinka and Mofoluwaso, 2014; Akinola and Mabutho, 2016)

Table 6a: Empirical Results - Long-Run Equation

Long Run Equation				
Variable	Coef.	S.E.	t-Stat	Prob.
Macroeconomic Determinants				
RY	-0.09	0.04	-2.63	0.01
ER	-7.89	1.44	-5.47	0.00
LR	0.26	0.07	3.84	0.00
INF	0.05	0.02	2.28	0.02
Bank-Specific Determinants				
TAS	0.26	0.17	1.49	0.14
CRD	4.14	0.72	5.72	0.00
RISK	0.15	0.64	0.23	0.82
Global factors				
OP	-0.03	0.00	-6.25	0.00

Short Run Equation				
Variable	Coef.	S.E.	t-Stat	Prob.
ECM	-0.41	0.08	-5.37	0.00
D(RY)	-0.09	0.03	-3.16	0.00
D(ER)	-2.54	0.72	-3.55	0.00
D (PLR (-1))	0.21	0.08	2.60	0.01
D(INF)	0.09	0.03	3.32	0.00
D(CRD)	1.93	0.76	2.54	0.01
D (CRD (-1))	1.67	0.76	2.20	0.03
D (RISK (-2))	1.17	0.57	2.05	0.04
D(OP)	-0.02	0.00	-5.20	0.00
C	1.40	0.34	4.09	0.00

IV. 3.2.1.2 Bank-Specific Determinants of NPLs

Bank-specific variables in the evolution of non-performing loans are diverse, and generally include bank size, capital adequacy ratios, private credit, deposits and proxies for risk appetite. This study, however, focused on the proxy for size, risk appetite and individual bank credit to the private sector. It is expected that the variables would provide sufficient information on individual bank characteristics, especially their lending and loan behaviour, over time. The size of banks, defined by stock of assets, was expected to aid better assessment of borrowers and consequently reduced bad loans. However, the variables did not only turn up with a statistically insignificant coefficient, the sign is also counter intuitive. This was largely a consequence of credit practices that pushed for excessive risk taking by banks and inefficient risk management practice. This evidence was corroborated by the positive coefficients of risk appetite and credit growth. However, given that loans account for a significant proportion of profit, the evidence does not suggest an end in sight to the loan-default circle, despite the increase in provisioning. As expected, empirical evidence suggested that the most important long-run determinant of non-performing loans was the size of credit given.

IV. 3.2.1.3 Global Factors

Response of NPLs to oil price was consistent with the apriori expectation, which indicated the significant influence of oil export on the domestic economy. It further suggested that with volatilities in oil production and international price, high bank exposure to crude oil-

related sectors could lead to substantial growth in NPLs. This evidence was buttressed by the growth in NPLs attributable to excessive risky investments in the oil and gas sub-sector and capital market, after the bank consolidation exercise.

IV.3.2.2 Short-Run Estimates and Speed of Adjustment

The average short-run coefficients were also statistically significant, and the average speed of adjustment to long-run equilibrium was relatively moderate at 41.0 per cent. There was disparity in the speed of adjustments of individual banks to long-run equilibrium (see Table 6b), due majorly to the idiosyncrasies of the various banks in the model. In the long-run, however, all the banks were sensitive to specified factors. As observed in table 6a, the main forcing variables in the evolution of non-performing loans are the of economic growth, exchange rate, lending rate, inflation, credit growth, risk and the oil price.

Table 6b: Speed of Adjustment for Individual Cross-sections

Banks	Variable	Coeff.	S.E.	t-Stat	Prob
1	ECM	-0.01	0.00	-8.31	0.00
2	ECM	-0.05	0.00	-17.47	0.00
3	ECM	-0.56	0.01	-48.51	0.00
4	ECM	-0.61	0.02	-34.64	0.00
5	ECM	-0.29	0.00	-153.83	0.00
6	ECM	-0.33	0.01	-52.30	0.00
7	ECM	-0.18	0.01	-12.55	0.00
8	ECM	-0.36	0.01	-43.97	0.00
9	ECM	-0.83	0.01	-68.12	0.00
10	ECM	-1.06	0.01	-108.95	0.00
11	ECM	-0.11	0.03	-3.91	0.03
12	ECM	-0.22	0.01	-33.75	0.00
13	ECM	-0.63	0.04	-17.15	0.00
14	ECM	-0.43	0.03	-16.31	0.00
15	ECM	-0.43	0.01	-37.10	0.00

IV.4 Non-Performing Loans and the Economy: Some Macro-Financial Linkages

This section attempted to consider the consequences of non-performing loans on the economy. The starting point was the estimate of an unrestricted panel vector autoregressive (PVAR) model in Equation 6. The model contained variables estimated in Equations 3 to 5, which comprised the macroeconomic variables: the average prime lending rate (LR), foreign exchange rate (ER), real GDP growth rate (RY), and inflation (INF); Bank-specific variables: bank credit to the private sector (CRD), bank assets (TASS), and proxy for risk (RISK). Global economy factor was proxied by the international oil price (OP). For the impulse responses, we adopt a Cholesky's ordering, which attributes exogeneity to the variables that come first in the ordering. Thus, for response of the NPL to shocks from macroeconomic variables, the NPL is ordered last in the VAR, it is however, the most exogeneous in the model, explaining broad macroeconomic effects of NPLs.

Lag selection criteria, such as the Final Prediction Error (FPE), the Schwarz Information Criteria (SIC) and the Hannan Quinn(HQ) suggested a lag length of one (1) for the VAR, while the Akaike Information criteria (AIC) recommended a lag of three (3). However, at lag three (3), the VAR did not satisfy the stability condition. Thus, we estimated the VAR with lag one (1), and the stability was confirmed by the presence of all roots within the unit

cycle. The response of the NPL ratio to shocks from the economy was conducted for a two-year period. Figure 3a reports the impulse responses and Figure 3b reveals the response of the economy to non-performing loans.

IV.4.1 Responses of NPLs to Macroeconomic Shocks

Results on Figure 3a and Table 7 showed broad consistency with the average estimates in table 6a. NPL ratio responded to own shocks cumulatively by 2.5 per cent in two years. A standard deviation shock to economic growth reduces NPL ratio by 0.07 per cent in the first four quarters but raises the NPL level by 0.23 per cent in the next four quarters, resulting a two-year cumulative increase of 0,17 per cent. Consistent with the point estimates, NPL declined by 0.27 per cent in two years following a one standard deviation shock to the exchange rate. The positive effect of inflation on NPL occurred only in the first quarter but declined in the second year. Consistent with the point estimates, the average lending rate exerted a positive effect on the NPL ratio in the first and the second year any cumulatively by 0.44 per cent in two years.

The evidence on bank assets remained a puzzle but credit accumulation caused a 0.04 per cent rise in NPL in two years. Generally, the results appeared consistent with the point estimates and indicated that the main drivers of NPLs were lending rates, credit growth and the risk adventures by banks.

Figure 3a: Impulse Responses of NPLs to Macroeconomic Shocks

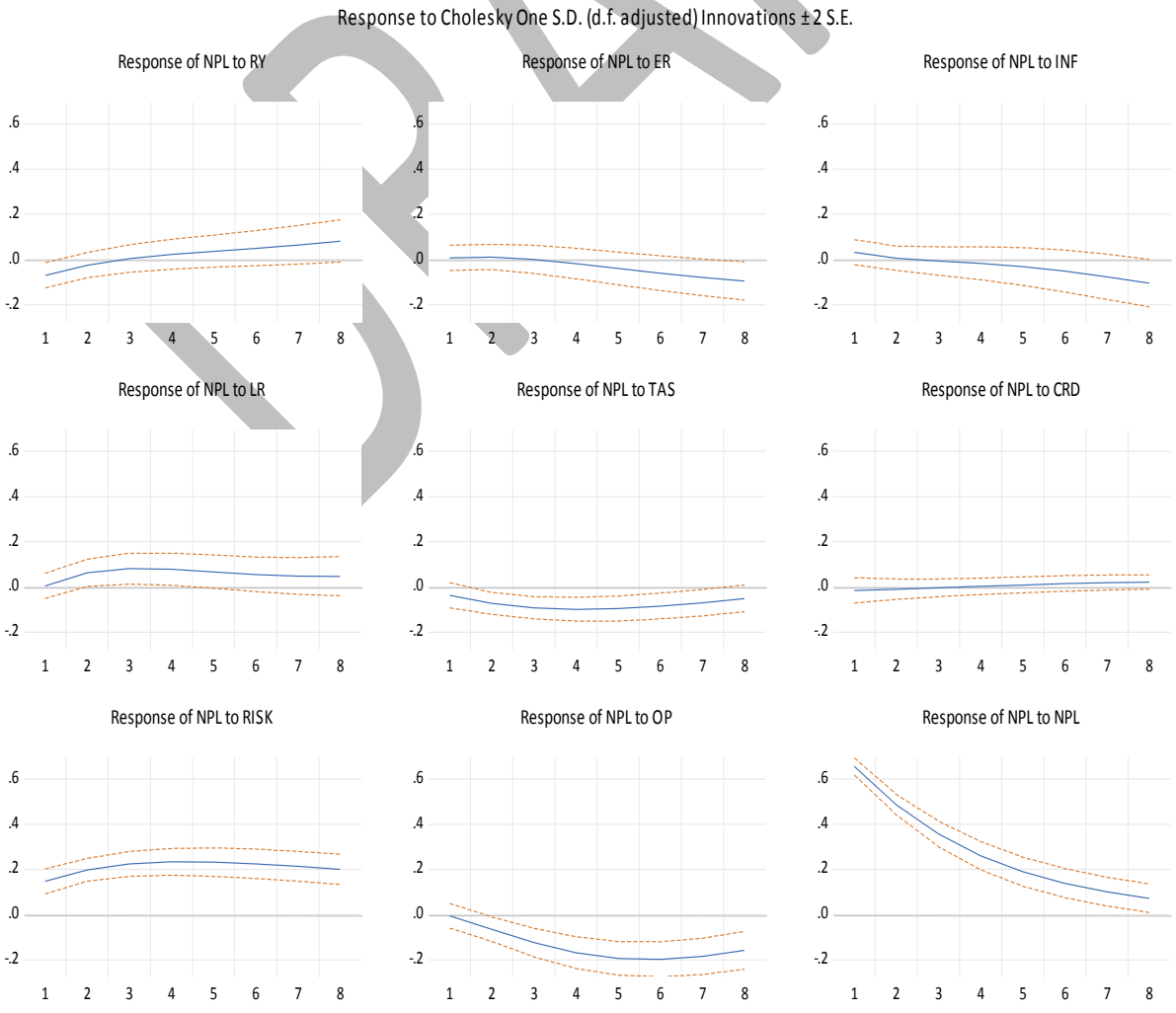


Table 7: Response of NPL to Cholesky (d.f. adjusted) one S.D Innovation

Period	RY	ER	INF	LR	TAS	CRD	RISK	OP	NPL
1	-0.07	0.01	0.03	0.00	-0.04	-0.02	0.15	0.00	0.65
2	-0.02	0.01	0.01	0.06	-0.07	-0.01	0.20	-0.06	0.49
3	0.00	0.00	-0.01	0.08	-0.09	0.00	0.22	-0.12	0.36
4	0.02	-0.02	-0.02	0.08	-0.10	0.00	0.23	-0.17	0.26
5	0.04	-0.04	-0.03	0.07	-0.10	0.01	0.23	-0.19	0.19
6	0.05	-0.06	-0.05	0.06	-0.08	0.01	0.22	-0.20	0.14
7	0.06	-0.08	-0.08	0.05	-0.07	0.02	0.21	-0.18	0.10
8	0.08	-0.09	-0.10	0.05	-0.05	0.02	0.20	-0.16	0.07
Cholesky Ordering: RY ER INF LR TAS CRD RISK OP NPL									
1st year	-0.07	0.00	0.01	0.23	-0.30	-0.03	0.80	-0.36	1.76
2nd year	0.23	-0.27	-0.26	0.22	-0.30	0.06	0.87	-0.73	0.50
Cum Effects	0.17	-0.27	-0.25	0.44	-0.60	0.04	1.67	-1.09	2.26

IV.4.2. Response of Macroeconomic Variables to an increase in the NPL Ratio

We report impulse responses of the response of macroeconomic variables, following shock to the NPL ratio. For that purpose, the VAR was reordered to make the NPL ratio the most exogenous in the model, followed by the bank-specific, global factors and macroeconomic variables. Figure 3b and Table 8 report the impulse responses. An important finding is that the NPL ratio responded positively to its own shock with a cumulative effect of 2.5 per cent. This reflects the decline in assets, and a rise in credit risk. There was evidence of depreciation of the exchange rate and a rise in inflation. Ultimately the growth rate of the economy falls cumulatively by 0.64 per cent in two years with on standard deviation shock to the NPL ratio. Overall, the consequences of an increase in the NPL ratio was a further growth in NPL, decline in bank assets, a depreciation of the foreign exchange rate and a rise in domestic inflation. Consequently, the growth rate of the economy falls.

Figure 3b. Impulse Responses of Economic Variables to Shocks to the NPL

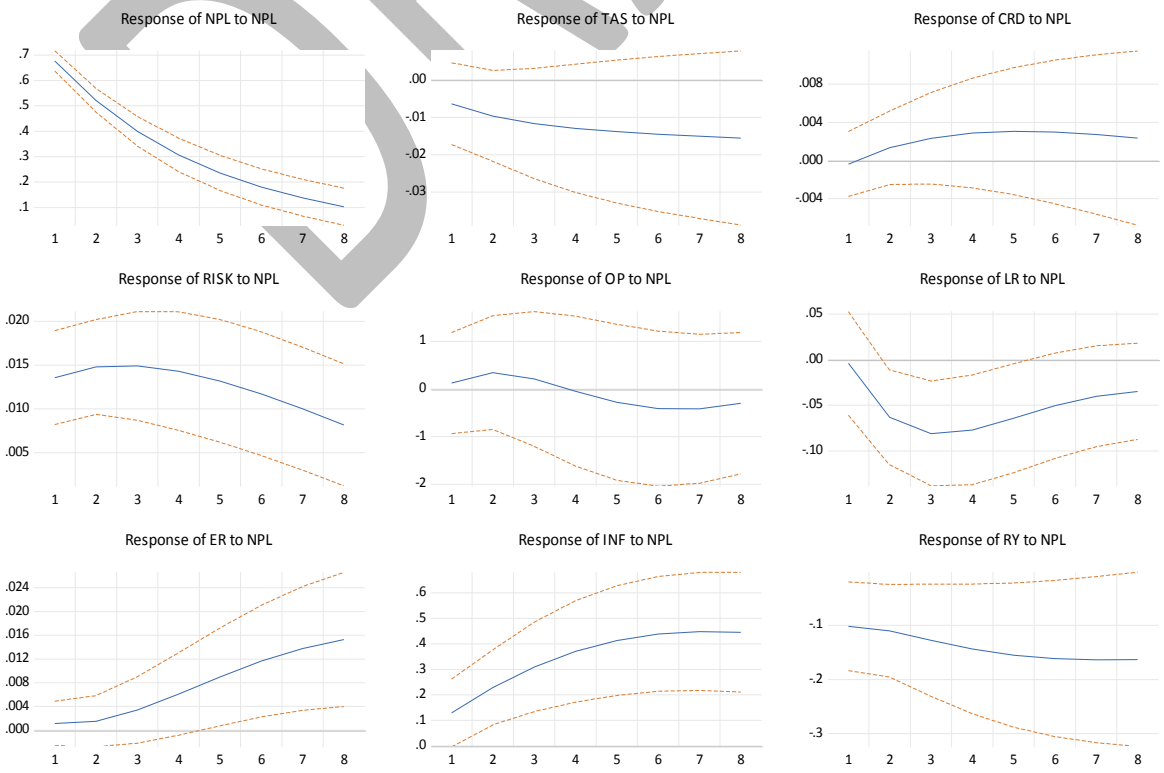


Table 8: Effect of Cholesky (d.f adjusted) one SD NPLR Innovation

Period	NPL	TAS	CRD	RISK	OP	LR	ER	INF	RY
1	0.68	-0.01	0.00	0.01	0.12	0.00	0.00	0.13	-0.10
2	0.52	-0.01	0.00	0.01	0.34	-0.06	0.00	0.23	-0.11
3	0.40	-0.01	0.00	0.01	0.21	-0.08	0.00	0.31	-0.13
4	0.31	-0.01	0.00	0.01	-0.05	-0.08	0.01	0.37	-0.14
5	0.24	-0.01	0.00	0.01	-0.28	-0.06	0.01	0.41	-0.16
6	0.18	-0.01	0.00	0.01	-0.41	-0.05	0.01	0.44	-0.16
7	0.14	-0.02	0.00	0.01	-0.42	-0.04	0.01	0.45	-0.16
8	0.10	-0.02	0.00	0.01	-0.30	-0.03	0.02	0.45	-0.16
Cholesky Ordering: NPL TAS CRD RISK OP LR ER INF RY									
1st year	1.90	-0.04	0.01	0.06	0.63	-0.23	0.01	1.04	-0.48
2nd year	0.66	-0.06	0.01	0.04	-1.41	-0.19	0.05	1.74	-0.64
Cum. Effects	2.56	-0.10	0.02	0.10	-0.79	-0.41	0.06	2.78	-1.13

V. Summary and Policy Recommendations

The paper considered issues of non-performing loans in Nigeria with a focus on the determinants of NPLs and the feedback effect of NPLs on the economy. Analysis covered the period before and after the global financial crisis, which spanned 2007 to 2016. The study was motivated by the rapid increase in NPLs and the associated cost of its mitigation over time. A panel regression analysis was carried out to investigate the determinants of NPLs in Nigerian banks; and a panel vector autoregressive model was employed for the feedback of NPLs on the economy. Using a pool mean group (PMG) estimator procedure, the study found NPLs to be sensitive to both macroeconomic and bank-specific factors.

Specifically, NPLs were negatively with the growth rate of output, which was consistent with expectation. This means that increase in the fortune of businesses generally improves debtors' repayment capacity and causes a reduction in non-performing loans. Other variables affecting non-performing loans were bank lending rate, inflation rate, and the exchange rate. The risk appetite of banks and growth in loans were the critical bank-specific factors that influenced loans. The increase in oil price was also found to be negatively related to NPLs. The study also found support for the impact of NPLs on the macroeconomy. Although the impact was moderate, it was due largely to a reduction in credit, economic activities, rise in inflation and a depreciation of the Naira exchange rate. Moderating the prevalence of NPL would support growth of the economy.

Overall, there is need to intensify implementation of prudential regulations to keep up with evolving business environment and improved surveillance to ensure compliance and track vulnerabilities, as they emerge. Moreover, macroeconomic policies and measures that would raise economic productivity, stabilise the foreign exchange market and reduce inflation rate, could help in reducing the prevalence of non-performing loans of banks in Nigeria.

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Analysis of Public Debt-Threshold Effect on Output Growth in Nigeria

Eboreime, M. and B. Sunday*

Abstract

The history of debt accumulation by the Nigerian government shows that the bursts and booms in the domestic business cycle is well correlated to debt levels. . Moreover, the recent build-up of government debt tends to raise concern. Therefore, it becomes necessary to examine the public debt threshold effects on output growth in Nigeria. The study applies the ordinary least squares method and the global optimisation procedures on data spanning 1981 to 2015. The empirical results showed that optimal domestic debt-GDP threshold for Nigeria was 13.6 per cent, implying that a significant threshold effect of domestic debt on output growth exist, once the 13.6 per cent threshold was exceeded. Also, the study revealed that there was no external debt-induced threshold effect on output growth in Nigeria up to 50 per cent of GDP. Finally, there was supporting evidence that the optimal total public debt-GDP threshold for Nigeria was 55.2 per cent. The paper concluded that caution should be exercised in the accumulation of domestic debts, while encouraging more external borrowings at advantageous terms.

Keywords: Public Debt, Threshold, Output Growth, Least Squares, Global Optimisation
JEL Classification:

I. Introduction

The basic argument underlying the acquisition of debt capital was that private and public savings were inadequate to finance critical social and economic overheads such as roads, ports, irrigation, railways, power, health and education which are germane to rapid economic development. The growth-enhancing attribute of public debt has important policy implications for employment and poverty reduction. According to economic theory, if the price level remain relatively unchanged, the rise in government spending through borrowed funds leads to an increase in aggregate demand, output and employment.

Furthermore, Cecchelti, Mohanty, and Zampoli (2011) aver that public debt matters to the government because it complements tax revenues when there is surge in expenditures; it helps to smooth consumption not only in the lifetime of people who are currently alive but also across generations. Thus, a transfer of resources from future to current generations can raise the society's inter-temporal welfare; and government debt crowds in investment through the provision of liquidity services which eases the credit conditions faced by firms and household

The history of public debt accumulation in Nigeria shows that the bursts and booms in the domestic business cycle is well correlated to debt levels. Between 1970 and 1977, the foreign debts contracted were on concessional terms from bilateral and multilateral sources with long repayment periods and low interest rates. However, the accumulation of public debt in Nigeria took a significant turn for the worse after the collapse of crude oil prices in 1978 as an increasing portion of borrowings from private oversea lenders was on non-concessionary terms involving shorter maturities and market determined rate of interest (Rahman et al., 2010). As the years went by, the scheduling of debt on harder terms led to a steep rise in debt service payment for Nigeria.

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The above scenario, which indicates uncontrolled borrowing, may have adverse consequences on the economy. For instance, a steep rise in public debt may have serious policy implications for domestic price stability and foreign exchange management, as fiscal injections often lead to liquidity surfeit that ultimately fuel inflation. Also, public borrowing crowds-out private investment by putting pressure on loanable funds. Moreover, a more glaring problem associated with public debt relate to its misapplication, maladministration and corrupt misuse (Izedonmi and Ilaboya, 2012; Babu et al., 2015 and Adejuwon et al., 2010). The financing of persistent government deficits and associated fiscal expansion, over the years, has posed serious challenge to the Management of the Bank.

The problem of debt overhang calls for caution in public debt management. Debt overhang dissuades current investment and limits the capacity of a sovereign nation to repay its stock of existing debts. With the onset of global economic recession in early 1980's, Nigeria began to default on its debt service obligations, which caused further lines of credit to dry up. Consequently, the economy experienced severe downturn that necessitated the introduction of austerity measures and, eventually, the Structural Adjustment Programme (SAP) in 1986. In 2016, Nigeria began to experience a similar scenario as in 1980s, such as severe threat to the accretion of external reserves. The nation's total debt stock rose to US$61.45 billion (over ₦16 trillion) as at June 2016, (DMO 2016). To compound the issues at stake, the 2016 budget for Nigeria clearly indicated that government borrowing for the year would be directed principally to fund capital projects of ₦1.8 trillion, while ₦1.36 trillion would be earmarked for foreign and domestic debt service. Thus, the available information points to the imminent problem of another debt overhang.

At this juncture, we need to ask the following questions: If we agree that indeed public debt is a useful tool in economic management, what is the saturation point beyond which public debt begins to exert a negative effect on output growth? What are the optimum levels for both the domestic and foreign debt components? These are some of the crucial policy questions that this paper attempts to answer. Therefore, the specific objectives of this study is to: determine the optimal total public debt threshold for Nigeria beyond which output growth declines; to assess the saturation points for domestic and foreign debts in Nigeria; and make appropriate policy recommendations, based on empirical findings.

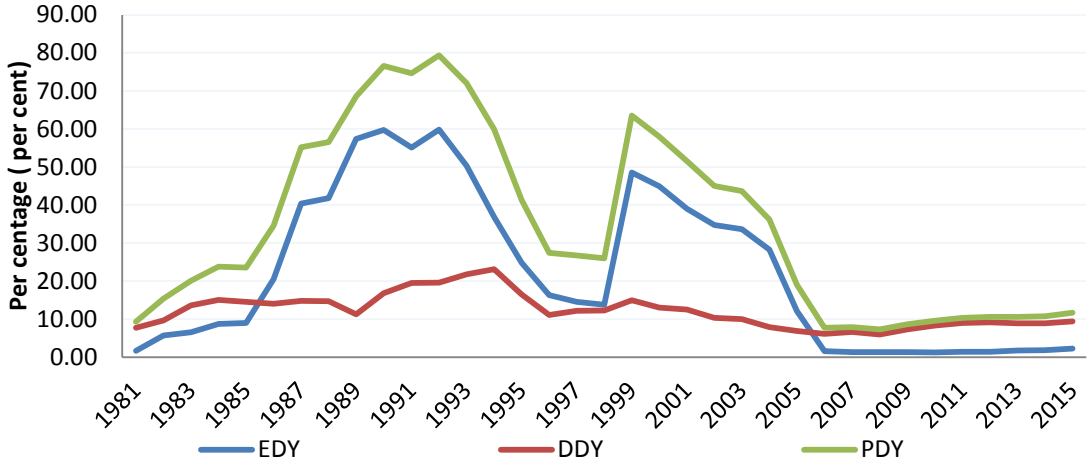
Following the introduction, the rest of the paper is structured as follows: Section 2 highlights the trend in government debt and economic growth in Nigeria; Section 3 focuses on the review of literature; Section 4 dwells on the methodology; Section 5 presents the results and discussion; and Section 6 concludes the paper.

II. Trends in Government Debt and Economic Growth in Nigeria

The debt and growth trends are depicted in Figure 1. The total debt-GDP ratio rose from 9.34 per cent in 1981 to 23.53 per cent in 1985. The global economic recession, during this period, led to a decline in the demand for the nation's crude oil, which notably reduced official revenue receipts, thereby constraining the government to rely, heavily, on borrowed off-shore funds. According to Todaro and Smith (2009:679), "massive debt service obligations accumulated, so that countries like Nigeria were experiencing negative economic growth in the 1980s and consequently faced severe difficulties in

paying even the interest on their debts out of export earnings. They could no longer borrow funds in the world's private capital markets". This was buttressed by Ogbe (1992) (cited in Rahman et al., 2010), that the debt stock grew rapidly from $3.4 billion in 1980 to $17.3 billion in 1985.

Figure 1: Debt Indicators in Nigeria (1981 – 2015)



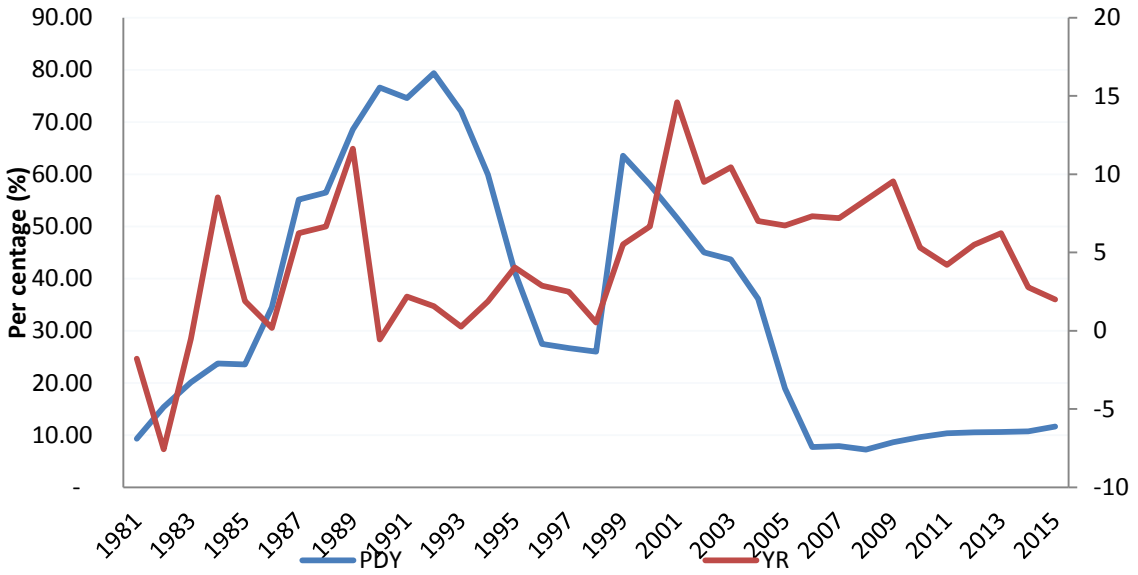
Note: EDY – External Debt-GDP (per cent); DDY – Domestic Debt-GDP (per cent); PDY – Total Public Debt-GDP (per cent)

The situation became so bad that private lending dried up by 1984. The negative economic growth rate during the period aggravated the debt problem. Thereafter, the total public debt-GDP ratio jumped from 55.16 per cent in 1987 to an all-time high of 79.38 per cent in 1992. This situation partly reflected the development during the period of structural adjustment programme (SAP) when Nigeria accepted the International Monetary Fund (IMF) conditionality in order to secure further loans.

In 1998, total Public Debt-GDP nose-dived to 26 per cent before rising to the second all-time peak of 64 per cent in 1999, when the Paris Club component alone was US$21.6 billion and remained high all through the succeeding years up to 2004. Thus, in April 2006 the Nigerian government sought and secured Africa's largest debt relief from the Paris Club of creditors and the creditors wrote off a total debt of US$30 billion after Nigeria agreed to repay the balance of US$12.4 billion in one swoop. Following the debt relief, total Public Debt-GDP fell to 8 per cent in 2006 and did not exceeded 12 per cent between 2006 and 2015. It should be noted that the external debt-GDP ratio (EDY) was the major driver of the trend observed for the total debt-GDP ratio (PDY) for the period 1981 to 2006. However, beyond 2006, the domestic debt-GDP became the dominant force, propelling PDY.

After the period of negative growth in the early 1980s, there was notable growth in national output from 1984 to 1990. This period corresponds to the time when the public-debt to GDP ratio was high. However, due to the problem of debt overhang, there was slower growth between 1990 and 1998, but growth picked up afterwards, because of large public borrowing. The growth momentum slowed down from 2010 to 2015, due likely to the precipitous decline in external funding.

Figure 2: Public Debt and Economic Growth in Nigeria



Note: PDY – Total Public Debt-GDP (per cent): YR –Real GDP Growth Rate

Generally, the trend analysis of public debt and economic growth in Nigeria indicates that debt financing and growth are often directly related but in few instances, the perceived proportionate relationship becomes blur or outrightly negative. Thus, it becomes an empirical question as to whether the long-run impact of public debt on economic growth is positive or not. Similarly, it is an empirical issue as to which short-run dynamics prevailed.

III. Review of Literature

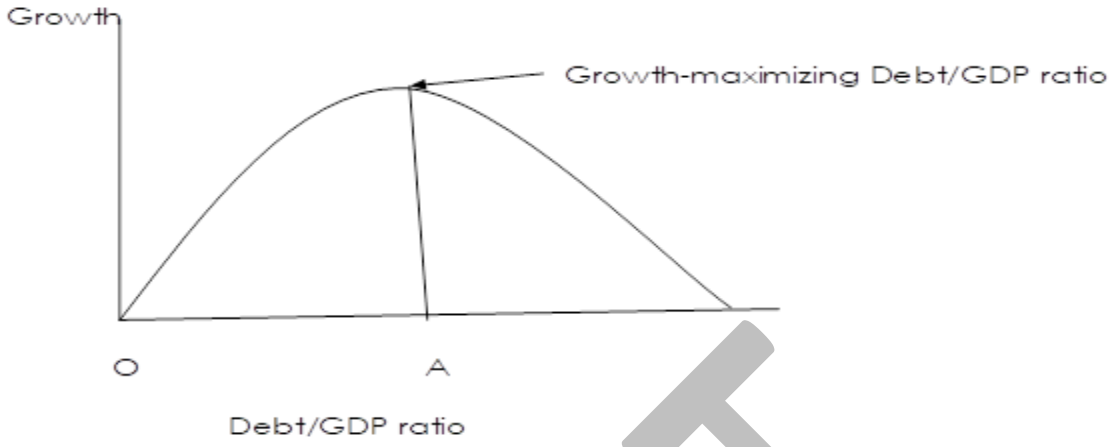
III.1 Theoretical Review

In general, economic theory provides the rationale that reasonable levels of borrowing (debt capital) would be expected to enhance economic growth, which in turn would allow for timely debt repayment as marginal product of capital exceeds its cost (Pattillo et al., 2011). However, following the debt crisis suffered by developing countries in the 1980s, a new paradigm emerged that explained how excessive debt accumulation could be inimical to economic growth. For instance, high debt stock may be perceived as a future tax on returns to investment, which, in turn, dissuades investors, lowers output and growth (Krugman 1988 and Sachs 1989, cited in Nasa 2009). Furthermore, high level of indebtedness translates into high debt servicing costs, which may engender inflationary financing of budget deficits and currency devaluation, thereby declining growth (Nasa, 2009).

It has also been argued that debt-growth relationship may be nonlinear; implying that debt is growth-enhancing at lower debt-GDP segment and growth-reducing at higher levels (Mupunga and le Roux, 2016; and Nasa, 2009). Figure 3, showed that an increase in the debt-GDP ratio up to point A was associated with a corresponding rise in economic growth, at a decreasing rate, until the optimal growth-maximising threshold was reached. An increase in the debt ratio beyond point A causes a decline in the growth rate. According to Mupunga and le Roux (2015), before the tipping point (region OA), public debt is growth enhancing due to the fact that the crowding-in effect dominates the

crowding-out effect, and increases in the public debt to GDP ratio promote economic growth

Figure 3: The Growth Maximising Public Debt Threshold



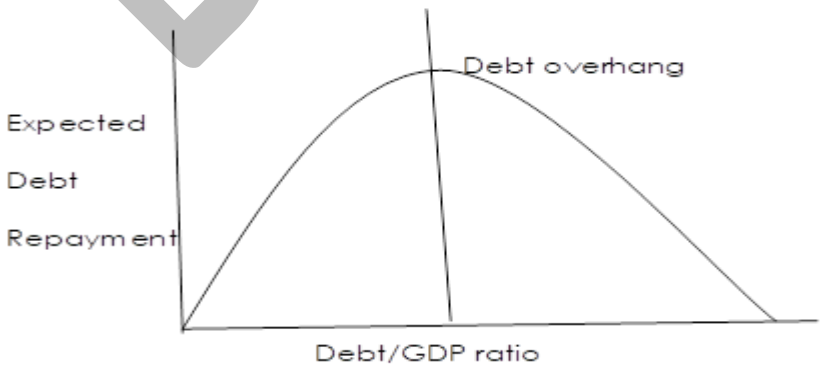
Source: Mupunga and le Roux (2016)

However, beyond this threshold, public debt will have a negative effect on growth, as the crowding-out effect outweighs the crowding-in effect. The crowding-out effect refers to a situation where government borrowing to finance the deficit reduces the quantum of loanable funds available to the private sector, and vice versa for the crowding in effect. Thus, it is imperative to determine the turning point at which further borrowing becomes inimical to growth, especially in Nigeria.

The theoretical and empirical plausibility that large levels of accumulated debt will result in subdued growth is best explained by the "debt overhang" theory, which posit that in the future, as debt capital rises, a country's repayment ability may be compromised as the burden of debt service hinders growth (Pattillo, Poirson and Ricci 2002). In Figure 4, the right hand side of the vertical line is the region of unsustainable debt or debt overhang.

Figure 4 is commonly referred to as the Laffer-type debt curve and the basic information conveyed is that higher public borrowings or debt ratios correspond to lower repayment probabilities.

Figure 4. The Laffer-type Debt Curve



Source: Adapted from Pattillo, Poirson and Ricci (2002)

III.2 Empirical Review

Omotosho et al., (2016) employed quarterly data spanning 2005 to 2015 to empirically test for an inverted U-shape relationship between public debt types and economic growth in Nigeria. The findings showed that the debt-growth thresholds were 73.70, 49.40 and 30.90 per cent for total public, external and domestic debt-GDP ratios, respectively. The drawback of this study was that a different data set, other than the one stated, was employed in the analysis.

Mupunga and le Roux (2015) estimated the optimal growth-maximising public debt threshold for Zimbabwe, based on data spanning the period 1980 to 2012. A quadratic econometric model was applied to estimate the relationship between public debt and growth. For robustness checks, different functional forms for polynomials, ranging from 1.2 to 3, were applied to assess the sensitivity of the results to different functional forms. The findings indicated that there existed an inverted U-shape relationship between debt and growth, with the optimal growth-maximising public debt threshold determined at a public debt-to-GDP ratio of between 40 and 50 per cent. The sensitivity analysis conducted, using different functional forms, did not change the debt-growth threshold for Zimbabwe, significantly. Also, the finding revealed a threshold of 80 – 120 per cent for the selected low income countries in Sub-saharan Africa in the period under consideration.

Chudik et al., (2015) applied the autoregressive distributed lag (ARDL) and the distributed lag (DL) approaches to investigate the debt-threshold effect in a panel, comprising both developing and advanced countries. Estimates of threshold ranged between 60-80 per cent for full sample; 30-60 per cent for developing countries; and 80 per cent for the advanced economies. However, when cross-sectional error dependence was accounted for, the authors were unable to find a universally applicable threshold effect.

Ikudayisi et al., (2015) used instrumental variable analysis to study the non-linear (inverted U-shape) relationship between economic growth and domestic/external debts in the Nigerian economy. The data set covered the period 1981 to 2011 and the findings showed that debt-to-GDP ratios of 21.4 per cent existed for domestic debt and 26.9 per cent for external debt.

Babu et al., (2015) used an augmented Solow model to assess the effect of domestic debt on economic growth in the East African Community (EAC) from the period 1990 to 2010. The findings revealed that domestic debt expansion had a significant and positive effect on economic growth of the EAC member countries. Specifically, a 10 per cent rise in domestic debt-to-GDP ratio generated a 1.17 per cent increase in economic growth. The authors noted that the favourable effect of domestic debt on growth was due to the sustainable level of domestic debt in the EAC countries.

Megersa (2014) employed a sample of twenty-two low-income sub-Saharan African economies (excluding Nigeria) to examine the existence of 'Laffer curve-type' relationship between public debt and economic growth, with date spanning 1990 to 2011. The study drew from the debate in the literature on the widespread view that high debt levels are a drag to economic growth but, on the other hand, poor countries need to borrow in order to finance their development. The study employed a typical neo-classical non-linear growth regression to test whether or not an inverted U-shape relationship existed between debt and growth. The study provided robust evidence that the contribution of debt to growth was positive at lower levels and negative at higher levels.

Pescatori et al., (2014) investigated the threshold between debt and growth, using the IMF database on gross government debt to GDP ratios for 24 advanced economies. The study concluded that there was no simple threshold for debt to GDP ratios beyond which medium-term growth prospects were severely compromised. Nonetheless, they found that higher debt levels tended to correlate with higher output growth volatility, which could hurt economic growth.

Tuffour (2012) employed annual data, spanning 1970 to 2009, to study the external debt threshold for Ghana. The author employed the least square estimation technique to test the presence of a long-run U-shaped relationship between economic growth and external debt. The study found out that the effect of external debt to GDP ratio was positive and that of the square of external debt to GDP ratio negative. The result established a non-linear effect of foreign debt on growth and suggested that the optimal external debt threshold for Ghana was 46.2 per cent.

Obademi (2012) analysed the impact of public debt on economic growth in Nigeria, based on data spanning 1975 to 2005. The study used the Engle and Yoo three-stage co-integration technique and found that the impact of public debt on economic growth was positive in the short-run, while it was negative but statistically significant in the long-run,

Izedonmi and Ilaboya (2012) examined the nexus between public debt and economic growth in Nigeria over the period 1980 to 2010, using the two-stage Engle Granger technique. The authors established a significant but negative relationship between public debt and growth in the long-run.

Panisza and Presbitero (2012) used the instrumental variable approach to determine if public debt had a causal impact on economic growth in some selected OECD countries. The variables used included GDP, national gross savings, population growth, schooling, trade openness, foreign currency debt, exchange rate and banking crisis. The data spanned 1946 to 2009. Their findings revealed a negative relationship between debt and economic growth, even though the link faded when an instrument that accounts for valuation effect of exchange rate was used. Greenidge et al., (2012) analysed the threshold effect between public debt and economic growth in the Caribbean, using a panel of annual data of 12 countries from the period 1980 to 2010. They employed the threshold estimation and found the tipping point of public debt to GDP ratio to lie between 30 to 55 per cent of GDP for the 12 Caribbean countries surveyed.

Reinhart and Rogoff (2010) studied the relationship between high public debt and growth in advanced economies using long time series that spanned 200 years. The findings indicated that the debt-growth link was relatively weak at "normal" debt levels but strong otherwise. For instance, when debt was low (below 30 per cent), the average growth rate was 3.7 per cent; when debt levels ranged from 30 to 90 per cent, the mean growth rate, for the countries in the data set, declined to 3 per cent. However, at high debt-GDP levels (in excess of 90 per cent) the growth rate was found to decelerate significantly to 1.7 per cent.

Cane et al., (2010) examined the optimal debt threshold of developing and developed countries with data spanning 1980 to 2008. Their result showed a debt to GDP threshold ratio of 77.1 per cent, for developed and developing countries. The public debt to GDP threshold ratio, however, for emerging markets alone, was estimated at 64 per cent.

Adegbite et al., (2008) investigated the effect of external debt servicing on economic growth in Nigeria, employing the neoclassical growth model on GDP, public capital expenditure, foreign debt stock, exports, debt servicing, savings, exchange rate and public investment, using annual data covering the period 1975 to 2005. Employing both OLS and GLS approaches, they found a negative effect of debt on growth in Nigeria. Also, the author established a positive contribution of external debt to growth up to a threshold after which its contributions become inimical to growth.

The research gap based on the empirical literature review revealed that the few studies on debt-growth threshold in Nigeria focused, either on total public debt or one of its components. The only study known to us that dwelt holistically on total public debt and its components is the work of Omotosho et al., (2016) who obtained optimal thresholds of 73.7, 49.4 and 30.9 per cent for total public, external and domestic debt types, respectively. However, this study differ from that of Omotosho et al., (2016) in the application of the global optimisation technique in the determination of optimal threshold.

IV. Methodology

IV.1 Data Sources and Description

The study employed annual data spanning 1981 to 2015. The data were obtained from the 2015 Statistical Bulletin of the Central Bank of Nigeria (CBN). Variables that comprise the basic data include: real gross domestic product (GDP) at 2010 constant prices, nominal GDP; Nigeria's total debt, external debt, domestic debt, inflation and trade openness.

The three debt variables were expressed as a percentage of GDP and these were: external debt to GDP, domestic debt to GDP and total public debt to GDP. Except for inflation, the data on trade openness was log-transformed and in first differences. In line with Hansen (2015), all the debt variables and log of real GDP were in first differences.

IV.2 Model Specification and Estimation Procedure

The basic non-linear threshold model may be specified as:

$$g_t = \begin{cases} \alpha_1 d_t + \varepsilon_{1t} \;\; if \; d_t > \pi \\ \alpha_2 d_t + \varepsilon_{2t} \;\; if \; d_t \leq \pi \end{cases} \qquad (1)$$

Where g represents economic growth is represented by g and $d_t = \pi$ is the assumed threshold. There were two regimes in *(1)*. The sequence g=$\alpha_1 d_t + \varepsilon_{1t}$ depicted the scenario where the debt-GDP ratio (d_t) was above the threshold while $\alpha_2 d_t + \varepsilon_{2t}$ showed the situation when the debt-GDP ratio fell below the threshold. ε_{1t} and ε_{2t} are the stochastic disturbance error terms.

If we assume the variance of the two error terms to be equal, the basic threshold model would be given as:

$$g_t = \alpha_1 I_t d_t + \alpha_2 (I - I_t) d_t + \varepsilon_t \qquad (2)$$

In Equation (2), all other symbols were as previously defined, except for I_t, which stood for threshold dummy or an indicator function. I_t=1 if d_t >0 and I_t=0, if $d_t \leq 0$.

Furthermore, Equation (2) may be re-written as:

$$g_t = I_t[\alpha_{10} + \alpha_1 d_t] + (1 - I_t)[\alpha_{20} + \alpha_2 d_t] \quad (3)$$

When the threshold model is in regime 2 (below the threshold) the coefficient of the debt-GDP variable measures the effect on economic growth. However, when the model is in regime 1 (above the threshold) the sum of coefficients of the debt-GDP ratio and the threshold dummy measures the effect on growth as indicated in Equation 4.

$$g_t = \alpha_0(\alpha_1 + \theta_1 I_t) + \varepsilon_t \quad (4)$$

Where I_t =1 if $d_t > \pi$ and I_t=0 if $d_t \leq \pi$

Following Chudik, et al., (2015), the specific form of the augmented basic threshold model employed in this study is given as:

$$\Delta ln g_t = \alpha_1 I_t[d_t > (\pi)] + \alpha_2 I[d_t \leq (\pi)] + \sum_{i=3}^{n} \alpha_i \Delta ln x_t + \varepsilon_t \quad (5)$$

Δlng_t represented the first differences of the logarithm of real GDP and Δlnx_t was the first differences in the logarithm other regressor(s).

Alternatively,

$$\Delta ln g_t = \alpha_0 + (\alpha_1 + \theta I_t) d_t + \sum_{i=2}^{n} \alpha_i \Delta ln x_t + \varepsilon_t \quad (6)$$

Other regressors aside the debt and dummy variables are represented by x_t. The additional regressors used in the basic threshold model included inflation and trade openness. In Equation (6), α_1 measured the effect of debt-GDP on economic growth when $d_t \leq \pi$, while $\alpha_1 + \theta$ measured debt effect when $d_t > \pi$ (Enders 2010).

Furthermore, empirical investigations were carried out with the global optimisation procedures of Bai and Perron (1998) (see IHS Global Inc. 2015). The procedure aimed to minimise the sum of squares residuals for the set of potential thresholds, using standard least squares method. For *d* potential thresholds, there is *d + 1* regimes. Thus, for two regimes with a threshold π, the following representation applies:

$$g_t = a_t' \beta + b_t' \vartheta_1 + \varepsilon_t if - \infty < d_t < \pi_t \quad (7)$$
$$g_t = a_t' \beta + b_t' \vartheta_2 + \varepsilon_t if \ \pi_t \leq d_t < \infty \quad (8)$$

Where g_t is the growth rate in real GDP; a_t' is a k x 1 vector of regressors whose parameters do not vary across regimes (the constant term does not vary across regimes); b_t' was a vector of regressors that were regime specific; d_t was the threshold regressor; π_t is the assumed threshold, while β *and* ϑ are parameters.

V. Results and Discussion

V.1 Stationarity Test

The unit root test was conducted based on the Phillips-Perron (PP) method. The outcome of the PP tests showed that PDY, DDY, EDY, LTOP, and LY were integrated of order one, that is, I(1). While DPDY, DDDY, DEDY, DLY and INFL were I(0). The variables were clearly defined in Appendix 2. Some of the variables were significant at the 1 per cent level and others at the 5 per cent level.

Table 1: Unit Root Test

Variable	*Phillips-Perron* Test Statistic		
	Level	First Difference	Order
DDY	-2.7755	-4.6498***	I(1)
EDY	-1.1320	-4.2983***	I(1)
LTOP	-1.2243	-7.1564***	I(1)
LY	-2.3113	-3.2202**	I(1)
PDY	-0.8666	-4.1314***	I(1)
INFL	-2.9853**		I(0)
DPDY	-4.1314***		I(0)
DEDY	-4.2983***		I(0)
DDDY	-4.6498***		I(0)
DLY	-3.2202**		I(0)
DLTOP	-6.92468***		I(0)

*** Significant at 1 per cent level ** significant at 5 per cent level

V.2 Estimation Results

This section presented the estimation results of the thresholds for domestic, external and total public debts.

Table 2: Domestic Debt Threshold

Threshold (per cent)	Parameter/Statistic (Basic Model)				
	C	DDDY (α_1)	INFLA	D (θ)	SSR
6	0.0774*	-0.0057*	-0.0008**	-0.0177	0.0472
8	0.0801***	-0.0052*	-0.0006*	-0.0272	0.0441
10	0.0675***	-0.0056*	-0.0006	-0.0191	0.0449
12	0.0683***	-0.0038	-0.0005	-0.0280*	0.0423
14	0.0617***	-0.0052	-0.0007	0.0100	0.0469
16	0.0613***	-0.0062*	-0.0009*	0.0118	0.0470
18	0.0599***	-0.0055*	-0.0007	-0.0049	0.0474
20	0.0632***	-0.0064*	-0.0010*	0,0248	0.0468
22	0.0614***	-0.0059*	-0.0008*	0.0137	0.0473

Source: Authors' computation ***significant at 1 per cent level ** significant at 5 per cent level *significant at 10 per cent

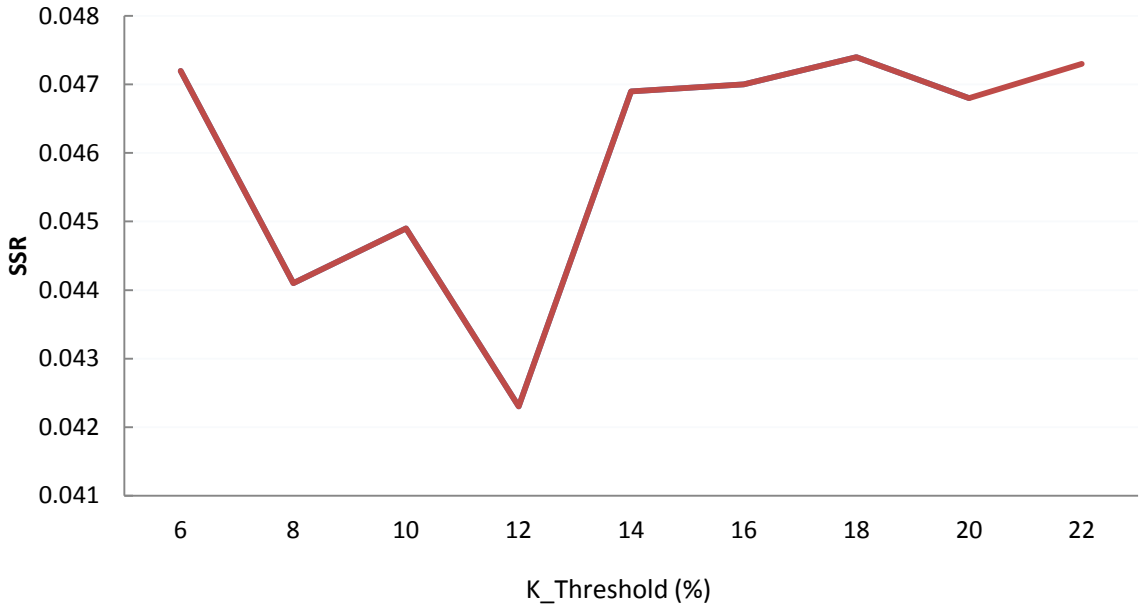
V.2.1 Estimation of Domestic, External and Total Public Debts' Thresholds

The estimation results in respect of the domestic debt threshold were presented in Table 2. The results showed that there was a negative relation between domestic debt and economic growth. The domestic debt-GDP threshold was found to be in the range of 12 - 14 per cent (12 per cent< π<14 per cent) and it corresponded to the minimum of the sum of squared residuals but was not statistically significant (Table 2 and Figure 5). Several studies had found that public debt was negatively correlated with growth (Panisza and Presbitero, 2012).

The estimation results for the determination of the external debt threshold in Nigeria, using the ordinary least squares technique, was reported in Table 3 and Figure 6. The external debt-GDP threshold fell within the range of 20 - 30 per cent (20 per cent< π<30 per cent) at which the sum of squared residuals was minimised. This result was statistically significant

at the 5 per cent level. However, beyond this threshold, output growth increased significantly by 0.0348 per cent, being the sum of α1+ θ. Thus, the hypothesis of an external debt threshold effect could not be established. If external debt threshold effect exists, output growth would have declined after the optimal tipping point. Beyond the threshold, output growth rose by 0.002 per cent and 0.006 per cent, thus providing further evidence of the non-existence of external debt threshold effect on output growth in Nigeria up to 50 per cent of GDP (as the potential thresholds considered ranged between from 10 - 50 per cent).

Figure 5: Domestic Debt Threshold (Basic Model)



The external debt-GDP data for Nigeria (see Appendix 1) supported the above finding. We noted that between 2004 (shortly before Nigeria was granted the Paris Club debt relief of $18 billion) and 2015, the external debt-GDP ratio fell precipitously from 28.23 per cent to 2.24 per cent. Furthermore, World Bank (2012) noted that, following the successful exit of Nigeria from the Paris and London clubs in 2006, there has been a strong reluctance to public borrowing, which resulted in low debt levels, especially external debt. For instance, the total FGN debt to GDP ratio stood at 17.4 per cent of GDP at the end of 2011 and the external debt to GDP was recorded as 2.4 per cent while domestic debt marginally grew to 15.1 per cent of GDP. Consequently, Nigeria can accommodate additional prudent external borrowing.

The basic least squares results for total public debt-GDP threshold were displayed in Table 4 and Figure 7. Once again, the hypothesis was that high debt-to-GDP ratio had an adverse effect on growth after a certain level was exceeded. An optimal total public debt threshold, π, of between 35 and 55 per cent (35 per cent< π<55 per cent) was identified. At a threshold value of 35 per cent, the sum of squares residuals was minimised. However, a significant debt threshold effect on output growth was observed only after the 45 per cent threshold value, given that α1+ θ became negative (because θ is not statistically different from zero). Furthermore, the sum of squares residual at 0.444 persisted from the 45 to 55 per cent threshold levels. Thus, the actual total public debt-GDP threshold hovered between 35 and 55 per cent. Moreover, from 45 to 55 per cent threshold values, output growth rate declined significantly at 5 per cent level.

Table 3: External Debt Threshold

Threshold (%)	Parameter/Statistic Basis Model				
	C	DEDY (a)	INFL	D (θ)	SSR
10	0.0550***	-0.0014*	-0.0011**	0.0186	0.0459
20	0.0556***	-0.0020**	-0.0014***	0.0364**	0.0406
30	0.0558***	-0.0020**	-0.0014***	0.0368**	0.0408
40	0.0611***	-0.0018*	-0.0011**	0.0192	0.0468
50	0.0623***	-0.0014*	-0.0010**	0.0179	0.0472

Source: Authors' computation *** Significant at 1 per cent level ** significant at 5 per cent level *significant at 10 per cent

Table 4: Total Public Debt Threshold

Threshold (per cent)	Parameter/Statistic (Basic Model)				
	C	DPDY(α_1)	INFL	D(θ)	SSR
10	0.0818***	-0.0013*	-0.0008**	-0.0248	0.0442
15	0.0684***	-0.0013**	-0.0008**	0.0107	0.0459
20	0.0622***	-0.0014*	-0.0009**	0.0016	0.0466
25	0.0565***	-0.0016**	-0.0011***	0.0191	0.0441
30	0.0562***	-0.0019***	-0.0014***	0.0357**	0.0389
35	0.0569***	-0.0018***	-0.0014***	0.0384**	0.0377
40	0.0592***	-0.0019***	-0.0015***	0.0365**	0.0394
45	0.0621***	-0.0019**	-0.0012**	0.0222	0.0444
50	0.0621***	-0.0019**	-0.0012**	0.0222	0.0444
55	0.0630***	-0.0120**	-0.0013**	0.0247	0.0444
60	0.0624***	-0.0018**	-0.0011**	0.0205	0.0451
65	0.0630***	-0.0016**	-0.0011**	0.0219	0.0449
70	0.0628***	-0.0014**	-0.0009**	0.0057	0.0465
75	0.0618***	-0.0016**	-0.0010**	0.0394	0.0438

Source: Authors' computation *** Significant at 1 per cent level ** significant at 5 per cent level *significant at 10 per cent

Figure 6: External Debt Threshold

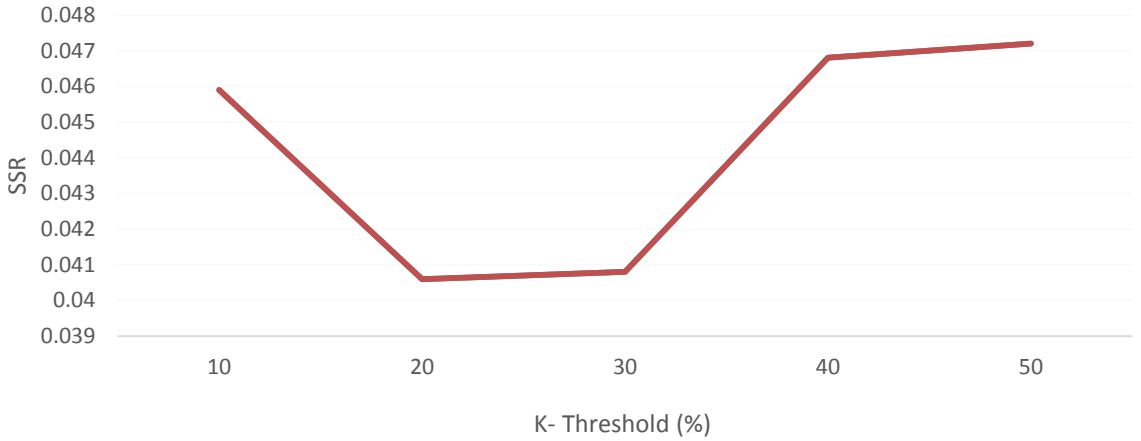
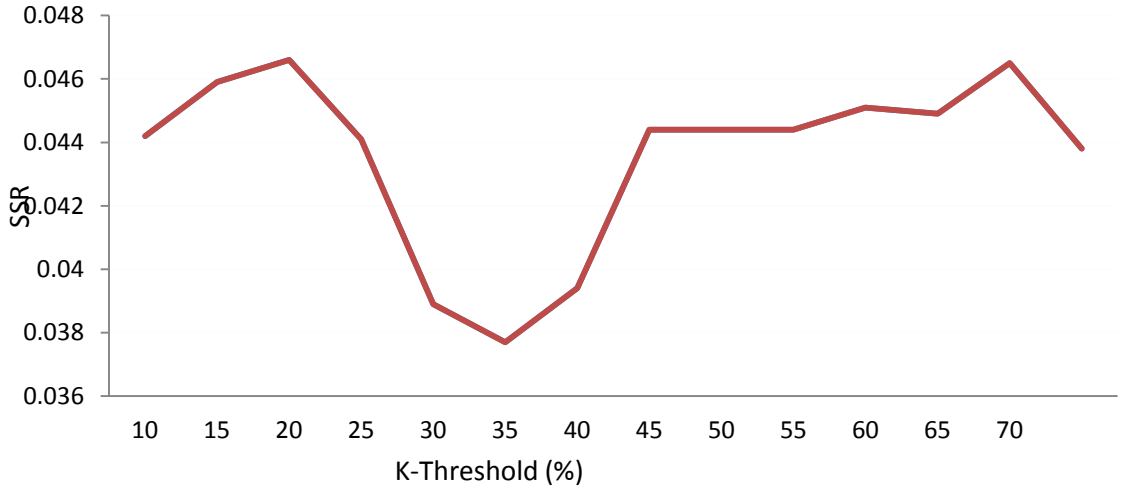


Figure 7: Total Public Debt Threshold (Basic Model)



V.2.2 Estimation of Domestic, External and Total Debt Thresholds (Global Optimisation Method)

In addition to the basic threshold analysis in Section V.2.1, we applied the global optimisation procedure to threshold estimation (see IHS Inc. 2015). The focus was on the threshold regression with the minimum sum of squared residuals. The relevant regimes were presented in Tables 5, 6 and 7. The analysis indicated that all the public debt types were negatively correlated with growth. The estimates of domestic debt threshold in Table 5 showed that the hypothesis of a threshold effect could not be rejected, as there was a significant decline in real GDP growth rate between regimes 1 and 2, at the 1 per cent level of significance. The regime change resulted in growth deceleration of 0.0251 per cent. This finding agreed with the theory that a 'Laffer-curve' scenario exist between domestic debt and economic growth in Nigeria. The contribution of debt to growth was positive at lower level of debt. It is however negative but significant at higher debt levels. Thus, on the average, growth declined once the domestic debt-GDP ratio exceeded the 13.6 per cent threshold.

It would be recalled that Nigeria' domestic debt increased significantly after Nigeria secured the Paris Club debt relief of US$18 billion in 2005. The domestic debt level rose from ₦1, 525.91 billion in 2005 to ₦8, 837 billion in 2015, representing an increase of 479 per cent. Concurrently, the domestic debt-GDP ratio rose from 6.85 per cent to 9.39 per cent during the 10-year period. From these findings, the threshold effect of domestic debt on growth turned negative but significant as the trend in domestic debt accumulation continued unabated. This result differed from with the optimal domestic debt threshold of 21.4 per cent obtained by Ikudaysi et al., (2015) and 30.9 per cent reported by Omotosho et al., (2016).

Table 5: Global Optimisation Estimates of Domestic Debt Threshold

	DDDY	INFL
Regime 1	-0.0005	0.0003
Regime 2	-0.0256***	-0.0002
SSR 0.0127		
Threshold (13.6 per cent)		

Source: Authors' computation *** Significant at 1 per cent level

Table 6 presented the external debt threshold effect on output growth. It was observed that the change in output growth between regimes 1 and 2 was -0.0017 per cent. This finding provided a weak evidence of an external debt-GDP threshold effect, if the optimal threshold of 20.5 per cent was exceeded at the 10 per cent level of significance.

Table 6: Global Optimisation Estimates of External Debt Threshold

	DEDY	INFL
Regime 1	-0.0018	-0.0042***
Regime 2	-0.0035*	-0.0016***
SSR 0.0151		
Threshold (20.5 per cent)		

Source: Authors' computation *** Significant at 1 per cent level *significant at 10 per cent

Table 7 depicted the global optimisation estimates for total public debt-GDP threshold in Nigeria. The change between the two regimes resulted in a decline in growth rate of 0.0015 per cent, implying that the decline in economic growth would be statistically significant at 1 per cent, if the total public debt-to-GDP exceeded the optimal threshold of 55.2 per cent.

Table 7: Global Optimisation Estimates of Total Public Debt Threshold

	DPDY	INFL
Regime 1	-0.0006	-0.0009
Regime 2	-0.0021***	-0.0010***
SSR 0.0151		
Threshold (55.2 per cent)		

Source: Authors' computation *** Significant at 1 per cent level

V.2.3 Model Diagnostics (Global Optimisation Tests)

The diagnostics tests of the global optimisation method was presented in Table 8. In all the tests, the null hypothesis of no heteroscedasticity, no serial correlation, normally distributed errors were established. The p-values indicated that the models employed in the estimation of the domestic, external and public debt thresholds passed all the diagnostic tests. The Cusum and Cusum Squares for public debt types in Figures 8, 9 and 10 provided evidence of model stability.

Table 8: Model Diagnostics

Test	Test Statistic	p-Value	Conclusion
Domestic Debt-GDP			
Breusch-Pagan_Godfrey	1.531	0.190	Homoscedasticity
Breusch-Godfrey LM test	1.136	0.342	No Serial Correlation
Jarque-Bera	0.924	0.630	Normally Distributed
Ramsey RESET	0.163	0.873	No misspecification
External Debt-GDP			
Breusch-Pagan_Godfrey	1.700	0.735	Homoscedasticity
Breusch-Godfrey LM test	0.491	0.250	No Serial Correlation
Jarque-Bera	0.966	0.617	Normally Distributed
Ramsey RESET	1.800	0.433	No misspecification
Total Debt-GDP			
Breusch-Pagan_Godfrey	0.826	0.624	Homoscedasticity
Breusch-Godfrey LM test	0.301	0.743	No Serial Correlation
Jarque-Bera	3.603	0.165	Normally Distributed
Ramsey RESET	0.912	0.373	No misspecification

Figure 8: CUSUM and CUSUM Squares for Domestic Debt-GDP

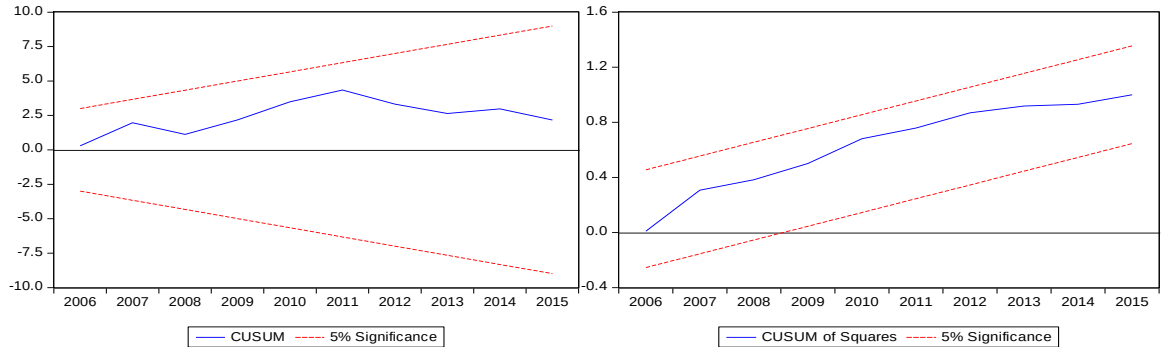


Figure 9: CUSUM and CUSUM Squares for External Debt-GDP

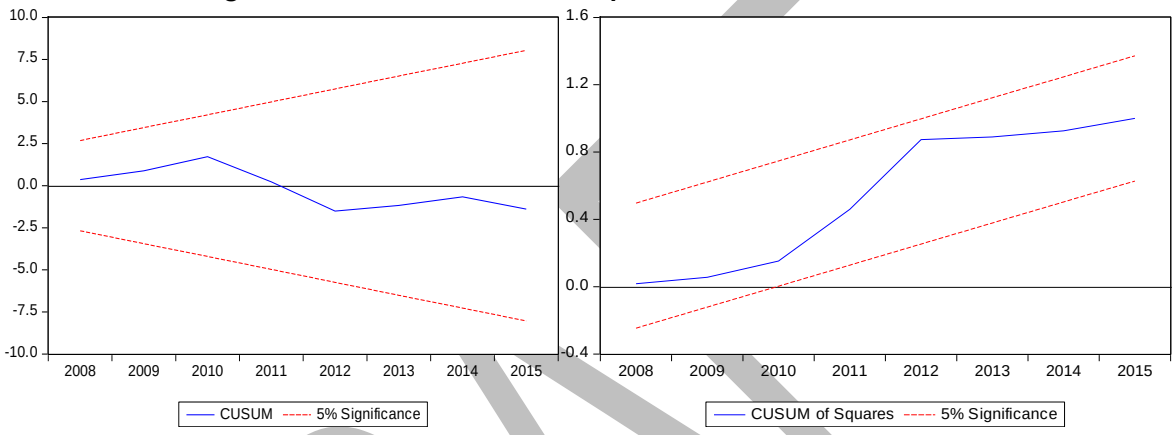
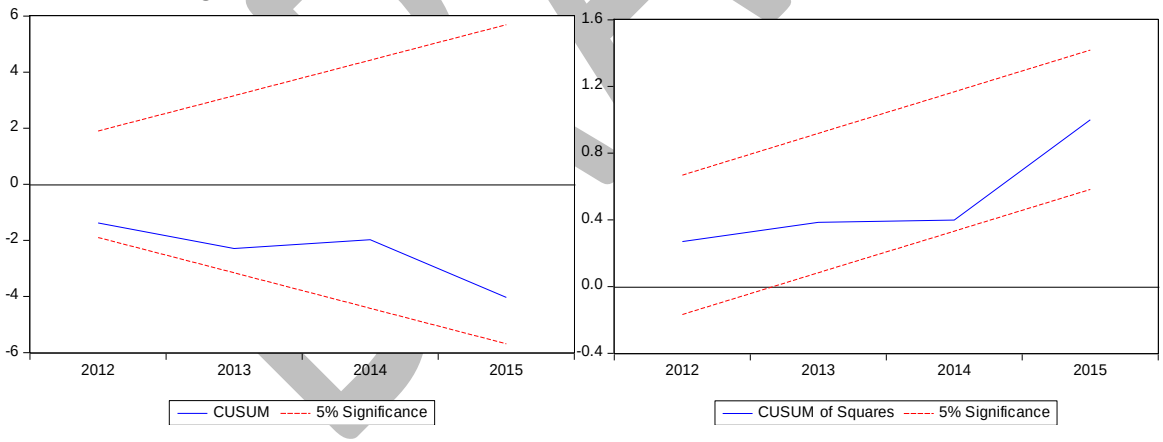


Figure 10: CUSUM and CUSUM Squares for Total Public Debt-GDP



V.2.4 Sensitivity of Debt Thresholds to Regressor (Global Optimisation Method)

Further robustness checks showed that when an additional regressor – trade openness – was added, the optimal threshold results remained unchanged (Table 9).

Table 9: Sensitivity of Debt Threshold to Additional Regressor

Debt Type	DEBT[1], INFL, DLTOP
Total Debt	55.2 per cent*
External Debt	20.5 per cent***
Domestic Debt	13.6 per cent***

1. Debt refer to either total debt, external debt or domestic debt
2. *** significant at 1 per cent level * significant at 10 per cent level

V.2.5 Summary of Debt Threshold Findings (Basic Threshold Regressions and Global Optimisation Tests)

The major outcomes of threshold analysis in this study were presented in Table 10. The table provided a statistically significant evidence (1 per cent level) that the optimal domestic debt-GDP (DDY) ratio for Nigeria was 13.6 per cent under the global optimisation method. Thus, output growth fell when the 13.6 per cent threshold was exceeded. However, the basic least squares outcome gives a threshold range of 12 per cent and 14 per cent, but not statistically significant.

The basic least squares approach provided a statistically significant evidence (5 per cent level) that there was no external debt threshold effect on output growth in Nigeria. The outcome of the external debt-GDP threshold analysis, based on the global optimisation method, corroborated the findings that there was no external debt-induced threshold effect on GDP growth. At the 5 per cent level of significance, the external debt-GDP threshold of 20.5 per cent was not statistically different from zero. Consequently, there was evidence to support the fact that external debt-induced threshold effect on output growth did not exist in Nigeria. This outcome differed from that of Ikudaysi et al., (2015) who found an external debt threshold effect of 26.9 per cent using GDP data before rebasing. The findings also differed from Omotosho et al., (2016) who found an external debt threshold effect of 49.4 per cent of GDP.

In summary, there was evidence to support the assertion that the optimal total public debt-to-GDP ratio for Nigeria did not exceed 55.2 per cent. Again, the results did not support the 73.7 per cent threshold computed by Omotosho et al., (2016).

Table 10: Summary of Findings

Public Debt Types[1]	Basic	Global
Domestic	**12-14 per cent[2]**	**13.6 per cent*** **
External	**20-30 per cent*** [3]**	**20.5 per cent***
Total Debt	**35-55 per cent****	**55.2 per cent *** **

1. Debt referred to either total debt, external debt or domestic debt
2. Result not statistically significant
3. Beyond the threshold, output growth increased significantly by 0.0348 per cent. Therefore, it was clear that the hypothesis of an external debt threshold effect could not be supported by empirical findings (section V.2.1)
4. *** significant at 1 per cent level **significant at 5 per cent *significant at 10 per cent

VI. Conclusion and Policy Recommendations

The data on debt accumulation in Nigeria indicated that the bursts and booms in the domestic business cycle is significantly correlated to debt levels. The implication is that debt accumulation up to a certain limit may have salutary effects on the economy. Consequently, there is the need to examine the threshold effect of public debt types on output growth in order to ensure moderation and avoid harmful excesses.

The findings from the study showed that the optimal domestic debt-GDP threshold for Nigeria was 13.6 per cent. This implied that a significant threshold effect of domestic debt on output growth would exist above 13.6 per cent threshold; and there was no external debt-induced threshold effect on output growth in Nigeria up to 50 per cent of GDP.

The study has important policy implication for government's fiscal policy. It showed that government could rely on foreign borrowings, as leverage on debt capital, to finance critical social and economic projects to engender rapid economic development. Also, the findings of this study have policy implication for domestic borrowing. With 13.6 per cent as the optimal domestic debt-GDP threshold, it becomes glaring that the actual figure of 11.63 per cent for 2015 is close to the optimal threshold.

Based on the study outcomes, the following recommendations are proffered: There is need for the Federal government to exercise caution in the accumulation of domestic debts to avoid the possibility of crowding out effect, as domestic debt has grown quite significantly over time. The government is urged to focus more on external borrowings to finance economic development, since external debt ratios are quite low and the study did not find any threshold effect of external debt on output growth in Nigeria up to 50 per cent of GDP.

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Appendix 1: Debt Statistics for Nigeria

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	GDP_2010 Const.	Real GDP	Nominal GDP	External Debt	Domestic Debt	Total FGN Debt
Year	N' billion	Growth	N' billion	to GDP (EDY)	to GDP (DDY)	to GDP (PDY)
1981	15,258.00	-1.79	144.83	1.61	7.73	9.34
1982	14,985.08	-7.58	154.98	5.69	9.68	15.37
1983	13,849.73	-0.51	163.00	6.49	13.63	20.12
1984	13,779.26	8.52	170.38	8.69	15.07	23.76
1985	14,953.91	1.90	192.27	9.00	14.54	23.53
1986	15,237.99	0.17	202.44	20.48	14.05	34.52
1987	15,263.93	6.23	249.44	40.41	14.75	55.16
1988	16,215.37	6.66	320.33	41.82	14.68	56.50
1989	17,294.68	11.63	419.20	57.35	11.22	68.57
1990	19,305.63	-0.55	499.68	59.76	16.83	76.59
1991	19,199.06	2.19	596.04	55.11	19.49	74.60
1992	19,620.19	1.57	909.80	59.82	19.56	79.38
1993	19,927.99	0.26	1,259.07	50.29	21.75	72.04
1994	19,979.12	1.87	1,762.81	36.81	23.12	59.93
1995	20,353.20	4.05	2,895.20	24.76	16.50	41.26
1996	21,177.92	2.89	3,779.13	16.33	11.11	27.45
1997	21,789.10	2.50	4,111.64	14.49	12.20	26.70
1998	22,332.87	0.52	4,588.99	13.79	12.22	26.02
1999	22,449.41	5.52	5,307.36	48.56	14.98	63.54
2000	23,688.28	6.67	6,897.48	44.91	13.02	57.93
2001	25,267.54	14.60	8,134.14	39.05	12.50	51.55
2002	28,957.71	9.50	11,332.25	34.71	10.29	44.99
2003	31,709.45	10.44	13,301.56	33.67	10.00	43.66
2004	35,020.55	7.01	17,321.30	28.23	7.91	36.14
2005	37,474.95	6.73	22,269.98	12.10	6.85	18.95
2006	39,995.50	7.32	28,662.47	1.58	6.12	7.69
2007	42,922.41	7.20	32,995.38	1.33	6.58	7.91
2008	46,012.52	8.35	39,157.88	1.34	5.93	7.26
2009	49,856.10	9.54	44,285.56	1.33	7.29	8.62
2010	54,612.26	5.31	54,612.26	1.26	8.33	9.60
2011	57,511.04	4.21	62,980.40	1.42	8.93	10.35
2012	59,929.89	5.49	71,713.94	1.43	9.12	10.55
2013	63,218.72	6.22	80,092.56	1.71	8.89	10.60
2014	67,152.79	2.79	89,043.62	1.83	8.88	10.71
2015	69,023.93		94,144.96	2.24	9.39	11.63

Source: CBN Statistical Data Base (EDY, DDY and PDY computed by authors)

Appendix 2. Definition of Variables

Variable	Definition
DDY	Domestic Debt-GDP (%)
EDY	External Debt-GDP (%)
PDY	Total Public Debt-GDP (%)
INFL	Inflation (%)
DPDY	First difference of total public debt-GDP ratio
DEDY	First difference of external debt-GDP ratio
DDDY	First difference of domestic debt-GDP ratio
DLY	First difference of log of real GDP
DLTOP	First difference of log of trade openness
DLEXR	First difference of log of exchange rate

Exchange Rate and Manufacturing Sector Performance in Nigeria

Udeaja, E. A. and E. A. Udoh*

Abstract

This study examined the impact of exchange rate on the performance of manufacturing subsector in Nigeria. The study employed the bounds testing approach of co-integration based on the auto-regressive distributed lag (ARDL) modeling using annual time series data spanning 1970 to 2015. The result of the bounds test to co-integration showed an existence of co-integration, hence a long-run relationship among the variables. The result of the ARDL long-run estimation showed that naira depreciation had a positive effect on manufacturing output in the long-run. This means that a depreciation of the naira enhanced productivity in the manufacturing subsector in Nigeria. Testing for structural breakpoint showed that naira depreciation had a positive effect on manufacturing output both in the fixed and flexible exchange rate regimes in Nigeria. The study recommended the need to implement and manage a robust exchange rate policy regime that would promote manufacturing sector performance in Nigeria.

Keywords: Exchange Rate, Manufacturing Sector, Nigeria

JEL Classification Numbers: *E52, F31, L60*

I. Introduction

The effect of exchange rate on the real sector continues to be a subject of discussion among monetary and international economists. This is because behaviour of exchange rate has serious implication for the industrial sector of an economy. In Nigeria, after independence up until 1970s, the economy was dominated largely by agriculture, small scale manufacturing and solid mineral extraction. Government industrial policy was largely import substitution industrialisation (ISI) strategy, associated with: the implementation of various incentive schemes to attract foreign direct investment; pursuance of inflationary public investment policies with selective allocation of resources to priority sectors; and keeping of fixed exchange rate regime (Vaz & Bear, 2014). The import substitution industrialisation (ISI) strategy, resulted in the overvaluation of the naira, which affected activities in the industrial sector of the Nigerian economy. For instance, manufacturing share of GDP declined from 7.17 per cent in 1970 to 5.45 per cent in 1975; but increased to 10.40 per cent in 1980. In the early 1980s, Nigeria adopted neoliberal policies, which comprised, among other things, the opening of the economy by reducing, drastically, the ISI protective measures, implementing macroeconomic stabilisation policies, and allowing foreign direct investment into areas, which were hitherto not allowed.

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By the middle of 1980s, the Nigerian economy was characterised by the following: The naira was fast depreciating against the dollar as a result of the introduction of managed float and dollar-pegged exchange rate regime. During this period, ₦0.61 was exchanged for $1 in 1981; ₦0.72 to $1 in 1983 and ₦0.89 to $1 in 1985. The appreciation of the naira was seen as a threat to activities in the industrial sector by making manufactured goods from Nigeria expensive and less competitive externally. This encouraged imports of manufactured goods that were becoming cheaper relative to those manufactured domestically. This resulted to a declined in the production of domestically manufactured goods. This is because the manufacturing sector in Nigeria, like in many other developing countries, depends exclusively on the import of non-labour input required for production. For instance, manufacturing share of GDP fluctuated between 8.13 per cent and 10.44 per cent from 1981 to 1985. The continued appreciation of the naira resulted in distortion in the domestic economy, leading to balance of payments disequilibrium, arising from capital flight and the depletion of external reserves.

The search for a way out of the domestic macroeconomic distortions led to the implementation of the structural adjustment programme (SAP) in 1986, which caused the devaluation of the Nigerian naira against the dollar. The devaluation of the naira was, among other things, meant to restructure the productive base of the Nigerian economy, via non-oil sector and boost export of manufactured commodities (Adubi & Okunmadewa, 1999; Joseph & Akhanolu, 2011). As observed by David et al., (2010), the benefits of devaluation were not realised, in spite of the fact that the country embarked on devaluation to promote export and stabilise the exchange rate. Manufacturing sector continued to record poor performance during this period. For instance, manufacturing share of GDP fluctuated between 4.92 and 7.92 per cent from 1987 to 1996 and then fell consistently from 5.14 per cent in 1997 to 3.67 per cent in 2000, and declined further from 4.21 per cent in 2001 to the lowest point at 1.85 per cent in 2011. However, it increased sharply to 7.79 per cent and 9.75 per cent in 2012 and 2014, respectively (CBN, 2014).

Following the crash in oil prices in 2015, the naira exchange rate suffered substantial depreciation. In 2015, ₦193.28 was exchanged for US$1. The depreciation of the naira also affected the performance of manufacturing sector as the share of manufacturing in total GDP declined from 9.75 per cent in 2014 to 9.53 per cent in 2015 (CBN, 2015).The rapid depreciation of the naira during this period was caused by falling dollar receipt, occasioned by falling global oil prices. As dollar receipt fell, due to falling oil prices, the naira also weakened. The fall in the dollar receipts, resulted to the scarcity of dollars, which made it difficult for manufacturers to import non-labour production input. Furthermore, the shortage of dollar created parallel dollar market, which aggravated the worsening situation in the formal foreign exchange market. Arising from scarcity in the dollar market, the Central Bank of Nigeria (CBN) floated the exchange rate in June 20, 2016. This was done to prevent imports originating from the parallel market. As expected, naira depreciated against the dollar, exchanging ₦253.49 for US$1 in 2016. The depreciation of the currency caused a decline in the share of manufacturing in total gross domestic product to 8.77 per cent in 2016 (CBN, 2016).

Whether or not exchange rate management has enhanced or inhibited manufacturing sector performance in Nigeria has remained an empirical puzzle. This is so because findings from empirical studies produced mixed results in Nigeria. While studies such as Owolabi and Adegbite (2012), Enekwe et al., (2013), Lawal (2016), among others, had found positive impact of exchange rate on manufacturing sector performance. Other studies such as David et al., (2010), Ayinde (2014), Okolo et al., (2016) had established a negative influence of exchange rate on manufacturing sector performance in Nigeria. However, a careful examination of the previous studies on Nigeria showed that most of these studies covered the era of flexible exchange rate regime. As they did not examine the effect of exchange rate on the performance of manufacturing sector in the era of fixed exchange rate regime. Covering both the fixed and flexible exchange rate regimes is a great departure from the previous studies on the effect of exchange rate on the performance of manufacturing sector in Nigeria.

The main objective of this study, therefore, is to examine the effect of exchange rate on manufacturing sector performance in Nigeria. The specific objectives was to examine the impact of exchange rate movements on manufacturing output in Nigeria and to test for structural break arising from fixed and flexible exchange rate regimes. The study was segmented into six sections. Introduction was section 1. Section 2 presented exchange rate regimes and manufacturing sector performance in Nigeria. Section 3 comprised the literature review and theoretical framework while the methodology of the study was presented in Section 4. Analysis of the result was conducted in Section 5, and Section 6 concluded the study and proffered policy recommendations.

II. Literature Review

II.1 Theoretical Literature

The Mundell-Fleming model provides a useful tool for the analysis of policy effectiveness in an open economy setting. The Mundell-Fleming model analyses the effectiveness of monetary and fiscal policies, under different exchange rate regimes and assumptions of capital mobility. Basically, the Mundell-Fleming model is an extension of the basic IS-LM model to an open economy context by two eminent economists, Mundell (1963) and Fleming (1962). In addition to the equilibrium of the goods (given by the IS curve) and financial markets (given by the LM curve), the Mundell-Fleming model incorporates an analysis of the balance of payments (given by the BP curve). The BP curve shows the points of equilibrium balance of payments. Put differently, it shows combinations of aggregate output and interest rates that ensure that the volume of net capital outflows is consistent with the volume of net exports. Depending on the mobility of capital, we may have an upward sloping BP curve or a flat curve.

The original analysis by Mundell assumed that capital is perfectly mobile, in which case the BP curve is a flat curve. The points above the BP curve indicate balance of payments surplus while points below show points of balance of payments deficits. Also, the points above the BP curve shows that the exchange rate is appreciating while points below indicate depreciation. Under this framework, Mundell demonstrated that fiscal policy will

be more effective in expanding aggregate output in a fixed exchange rate regime and ineffective in a flexible exchange rate regime. With regards to monetary policy, Mundell demonstrated that monetary policy will be more effective in a flexible exchange regime that in a fixed exchange rate regime. A major conclusion from the Mundell analysis was the discovery that no economy can have perfect capital mobility, fixed exchange rates and an independent and efficient monetary policy. In order to achieve an efficient monetary policy under the perfect capital mobility assumption, the exchange rate must be flexible. Otherwise, policymakers can maintain a fixed exchange rate and allow inefficient monetary policy. This is the origin of the impossible trinity.

Fleming (1962) in his imperfect capital mobility model extended the analysis to different shapes of the BP curve (relatively elastic and inelastic). Fleming demonstrated using the IS-LM-BP model that under a fixed exchange rate regime, an expansionary monetary policy will be ineffective no matter how great or small the capital mobility. An expansionary monetary policy will result in a balance of payments deficits which the government will have to fix by purchasing domestic currency and selling foreign currency until the money supply curve adjust to ensure the initial equilibrium in the goods and financial markets are restored. With respect to expansionary fiscal policy, Fleming model indicated that the fiscal policy is more efficient with higher capital mobility.

Under a flexible exchange rate regime, Fleming analysis demonstrated that an expansionary monetary policy would lead to balance of payments deficits and a depreciation of the local currency. This would stimulate net exports and push upward the IS curve to a new equilibrium point corresponding to greater output. In other words, monetary policy is efficient under a flexible exchange rate regime. The monetary policy will actually be more effective the higher the mobility of capital.

II.2 Empirical Literature

In the literature, a number of studies examined the effect of exchange rate management on manufacturing sector performance in Nigeria. For instance, David et al., (2010) examined the effect of exchange rate fluctuations on the Nigerian manufacturing sector for the period spanning 1986 to 2005. The methodology adopted was the ordinary least squares (OLS) technique. Manufacturing gross domestic product was captured as the dependent variable and the independent variables were manufacturing foreign private investment, exchange rate, represented by market parallel exchange rate, and manufacturing employment rate. The results of the study revealed that exchange rate had negative and insignificant effect on manufacturing output in Nigeria.

Owolabi and Adegbite (2012) and Enekwe et al., (2013) evaluated the effect of exchange rate variation on the growth of the manufacturing sector in Nigeria. Employing OLS on annualised time series data for the period spanning 1986 to 2010, the results showed that the depreciation of the naira had no significant impact on manufacturing sector productivity in Nigeria. This study found that naira appreciation had a significant positive effect on manufacturing sector performance in Nigeria.

Ayinde (2014) investigated the impact of exchange rate volatility on the performance of manufacturing firms in Nigeria. The author employed quarterly data spanning 1986 to 2012. Employing the generalised autoregressive conditional heteroscedasticity (GARCH) estimation method, the results revealed that exchange rate had negative but significant impact on manufacturing output in Nigeria. Lawal (2016) analysed the impact of exchange rate fluctuations on manufacturing sector output in Nigeria for the period 1986 to 2014. Adopting the auto-regressive distributed lag (ARDL) bounds testing estimation technique, the results revealed that exchange rate fluctuation had a positive but insignificant relationship with manufacturing output in Nigeria. In real terms, a 1 per cent depreciation of the naira increased manufacturing output by 114 per cent.

Okolo et al., (2016) adopted the vector autoregression techniques and vector error correction mechanism in analysing the impact of the exchange rate fluctuation on manufacturing sector output in Nigeria using time series data spanning 1986 to 2014. To fill gap from previous studies, the authors utilised official exchange rate, parallel exchange rate and real effective exchange rate and found that official and parallel exchange rates impacted negatively but significantly on the manufacturing sector. On the other hand, real effective exchange rate had positive but insignificant impact on manufacturing output in Nigeria.

In other jurisdictions, a number of studies investigated the impact of exchange rate on the performance of manufacturing sector. Nucci and Pozzolo (2001) investigated the effect of exchange rate variations on investment decisions of a sample of Italian manufacturing firms. Employing the generalised method of moment (GMM) estimation technique, the authors established that the depreciation of the naira had positive impact on investment decisions of Italian companies, via the channel of price competitiveness, but a negative impact of exchange rate fluctuation on the investment decisions of the Italian manufacturing firms. The authors, however, found that the impact of exchange rate fluctuations on investment in the manufacturing sector was stronger for firms with lower degree of monopoly power, than in firms with a higher degree of monopoly power.

Harchaoui et al., (2005) evaluated the effects of exchange rate variations on investment in the manufacturing industries in Canada, by utilising industry-level data, covering 22 manufacturing firms from 1981 to 1997. This study employed two-stage least squares (2SLS), the generalised method of moment (GMM), and the ordinary least squares (OLS) estimation methods. The empirical results from the OLS showed that exchange rate had a negative but insignificant impact on manufacturing investment in Canada, during the evaluation period. Similarly, the two-stage least squares (2SLS) estimation results showed that the exchange rate exhibited a negative and insignificant impact on investment in the manufacturing industries in Canada, and outcome based on the generalised method of moment (GMM) technique revealed that exchange rate movement had a negative and insignificant relationship with investment on manufacturing industries in Canada during the study period.

Fung and Liu (2009) investigated the effect of real exchange rate variations on the performance of manufacturing firms in Taiwan, using data for the period 1992-2000.

Specifically, this study sought to examine the impact of real exchange rate on the volume of exports, domestic sales, value-added and the overall productivity of manufacturing firms in Taiwan. The study employed the ordinary least squares (OLS) regression technique and found that real depreciation of the Taiwan dollar resulted to increases in exports, domestic sales, total firm sales, value-added in production and the overall productivity of the manufacturing firms in Taiwan.

Tkalec and Vizek (2009) analysed the impact of macroeconomic policies on manufacturing production in Croatia, using quarterly data spanning 1998 to 2008. The study used multiple regressions to assess how personal consumption, investments, interest rates, the real effective exchange rate, government consumption, fiscal deficit and foreign demand affected the output of 22 manufacturing sectors. The results showed that the kuna depreciation recorded mixed outcome across industries. The depreciation of the Croatian kuna boosted output in industries characterised by low and medium technological intensity. On the other hand, the depreciation of the kuna led to the contraction of manufacturing output for industries, requiring a medium to high level of technological intensity.

Dhasmana (2013) examined the effect of real exchange rate variations on the performance of Indian manufacturing companies for the period 2000 – 2012, utilising data from financial records of 250 manufacturing companies listed on the Bombay stock exchange. The study employed the ordinary least squares (OLS) regression technique and found that the variation of exchange rate had negative but significant effect on manufacturing companies' performance, via cost and revenue channels. The results also showed that the appreciation and depreciation of the rupee had a negative but significant impact on firms' and sale growths in India. While appreciation of the rupee had a strong influence via the export channel, the depreciation of the rupee, on the other hand, had a strong influence on the manufacturing output and sales growths, via the import channel.

Lotfalipour et al., (2013) assessed the impact of exchange rate variations on investment in the manufacturing sector in Iran for the period 1995 to 2009, using a panel data collection approach. The study adopted the generalised method of moment (GMM) estimation technique and found that there was a negative but significant impact of exchange rate fluctuation on investment in the Iranian manufacturing sector. In real terms, the results showed that a 1 per cent depreciation in the Iranian rial resulted in increase in manufacturing sector investment by 0.568 per cent.

Griffin (2015) carried out investigation on the impact of exchange as one of the determinants of profitability of manufacturing firms in Columbia for the period 2000 - 2012 for a group of 4850 manufacturing firms. The estimation was done using the ordinary least squares (OLS) regression technique and the author found that real exchange rate had a negative but significant impact on profit growth of manufacturing firms in Columbia for the period under investigation. In real terms, a 1 per cent appreciation in the real rate of exchange led to an increase in external revenue growth of manufacturing firms by 0.29 per cent.

IV. Theoretical Framework and Methodology

IV.1 Theoretical Framework and Empirical Model

The theoretical review for this study is anchored on the neoclassical and the endogenous growth theories. The neoclassical growth model, which is utilised in this paper, was the Solow-Swan model of economic growth. This model was developed independently by Solow (1956) and Swan (1956). In their specification, Solow (1956) and Swan (1956) specified a linear production function that expressed output as a function of physical capital, labour input and an exogenous technology. The Solow-Swan can be expressed mathematically as follows:

$$Y_t = A_t f (K_t, L_t,) \quad (1)$$

Where:
Y_t = economy's aggregate output; K_t = the amount of physical capital; L_t = the amount of labour; A_t = the index of technological advancement or progress. The Solow-Swan neoclassical growth model upholds technological progress as the main factor, causing long-run economic growth. In this way, technological progress in the neoclassical paradigm replaces growth in capital stock in the classical growth model, as the main cause of economic growth in the economy. The level of technological advancement, according to the neoclassical theorists, is exogenously determined irrespective of other factors of production (Todaro, 2000). The neoclassical theorists also stressed that the level of capital accumulation accounts for differences in the growth of output across countries.

To capture the impact of exchange rate on the output of manufacturing sector therefore, the standard neoclassical growth model of the Solow-Swan type was augmented to capture exchange rate as one of the variables influencing manufacturing output. Specifying the original Solow-Swan growth model in its augmented form permits the introduction of extension and modification to the original growth model to bring in more variables in line with the observed empirical phenomena (Sinai & Stoke, 1972; Ndebbio, 1991). Thus, the original growth model of the Solow-Swan specification in its augmented form is augmented in a slight manner to incorporate exchange rate as one of the variables influencing the output of manufacturing sector in Nigeria.

The endogenous growth theory was developed in the early 1980s, following some criticisms leveled against the neoclassical growth theorists. The endogenous growth theorists held that the process of economic growth is generated by factors of production within the production function, rather than from outside the production function (Gokal & Hanif, 2004). In particular, endogenous growth theorists considered human capital as the main factor driving economic growth. According to Lucas (1988), the accumulation of human capital is regarded as the main factor generating economic growth. The crucial role played by human capital, in the process of economic growth, could be traced to the process of innovation and technological advancement. Thus, in the endogenous growth model, human capital enters into the production function as the main driver of economic growth; just the same, way technological advancement does in the neoclassical growth model.

The analytical formulation of the endogenous growth model is expressed as follows:

$$Y_t = AK_t^{\alpha} (U_t H_t L_t)^{1-\alpha} \quad (2)$$

Where:
Y_t = economy's aggregate output; K_t = the stock of physical capital; L_t = the quantity of labour; A = efficiency parameter; U_t = proportion of time devoted to work by an individual; and H_t = the stock of human capital existing in the economy. Since there is no diminishing return in the acquisition of skills, there is the tendency that human capital can continue to grow indefinitely, thereby generating economic growth endogenously.

Within the mainstream endogenous growth models, the impact of exchange rate on manufacturing output can be discussed. Exchange rate affects manufacturing output via three channels; namely; trade; investment and productivity. For instance, Grossman and Helpman (1991), Barro and Sala-i-Martin (1997), Baldwin et al., (2005), documented that trade openness could promote economic growth by facilitating the diffusion of innovation and knowledge, via the inflow of foreign direct investment. Thus, for greater degree of trade openness, there is need for a competitive exchange rate (Razmi, et al., 2011). The argument is that adopting trade that promotes exchange rate policy, would promote trade openness that results in faster rate of economic growth in the medium- to long-term.

To capture the effect of exchange rate and other macroeconomic variables on output, the standard neoclassical growth model in Equation (1) was augmented as follows:

$$Y_t = f(K_t, L_t, E_t, \upsilon_t) \quad (3)$$

Where: Y, K and L are as earlier defined. However, manufacturing output replaced aggregate output in (3). E is the exchange rate and υ represents other macroeconomic variables, influencing manufacturing sector performance such as deposit money banks' loans and advances to manufacturing sector, manufacturing capacity utilisation and inflation rate. The model was explicitly written as:

$$MGDP = f(KAP, LAB, EXCH, BLM, MCU, INFLA) \quad (4)$$

Expressed in econometric log linear form, Equation (4) became:

$$LMGDP = \alpha_0 + \alpha_1 LKAP + \alpha_2 LLAB + \alpha_3 LEXCH + \alpha_4 LBLM + \alpha_5 MCU + \alpha_6 INFLA + U \quad (5)$$

Where:
LMGDP = logarithm of manufacturing gross domestic product;
LKAP = logarithm of capital stock, represented by gross fixed capital formation;
LLAB = logarithm of labour force;
LEXCH = logarithm of exchange rate;
LBLM = logarithm of deposit money banks' loans and advances to manufacturing sector;
MCU = manufacturing capacity utilisation; and

INFLA = inflation rate
a_0 to a_6 were the parameters to be estimated, and U was the error term. The a priori expectation on the signs of the coefficients was stated as follows: a_0, a1, a2, a3, a4, a5>0; a_6< 0.

IV.2 Estimation Procedures

The estimation technique adopted was the auto-regressive distributed lag (ARDL) estimation approach. However, given the fact that time series variables were used for the estimation, there is need to conduct stationarity test to avoid spurious outcomes. The unit root test was conducted using the Augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests. The ADF and PP specifications were stated as follows:

$$\Delta Y_t = \delta_0 + \varphi Y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta Y_{t-i} + U_t \quad (6)$$

$$Y_t = \omega_0 + \rho Y_{t-1} + \varepsilon_t \quad (7)$$

Where:
δ_0, ω_0, φ, β_i, and ρ were the parameters to be estimated; and U_t, and ε_t were the stochastic error terms. In both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, the null hypothesis of non-stationarity was accepted if $\varphi = 0$ and $\rho = 1$, respectively, whereas the null hypothesis of non-stationarity is rejected if $\varphi < 0$ and $\rho < 1$, respectively.

Next on the estimation procedures was the determination of the existence or otherwise of the long-run relationship among the variables using the ARDL bounds testing approach, developed by Pesaran et al., (2001). Following from these authors, the unrestricted auto regressive distributed lag (ARDL) in Equation (4) was specified as follows:

$$\begin{aligned}\Delta LMGDP_t &= \alpha_0 + \alpha_1 LKAP_{t-1} + \alpha_2 LLAB_{t-1} + \alpha_3 LEXCH_{t-1} + \alpha_4 LBLM_{t-1} + \alpha_5 MCU_{t-1} \\ &+ \alpha_6 INFLA_{t-1} + \sum_{i=1}^{k} \beta_i \Delta LMGDP_{t-i} + \sum_{i=0}^{k} \phi_i \Delta LKAP_{t-i} + \sum_{i=0}^{k} \delta_i \Delta LLAB_{t-i} + \sum_{i=0}^{k} \omega_i \Delta LEXCH_{t-i} \\ &+ \sum_{i=0}^{k} \gamma_i \Delta LBLM_{t-i} + \sum_{i=0}^{k} \pi_i \Delta MCU_{t-i} + \sum_{i=0}^{k} \psi_i \Delta INFLA_{t-i} + U_t\end{aligned} \quad (8)$$

Where: U_t is the error term.

The first part of the right hand side of equation (8) with parameters a_1 to a_6 represented the long-run specification, whereas the second part with parameters β_i to ψ_i explained the short-run dynamics of the model.

The ARDL approach proceeds in two stages. The first stage involves carrying out co-integration test, using bounds testing procedure. The bounds test involves estimating equation (8) and then testing the null hypothesis (H_0) of no long-run relationship against

the alternative hypothesis (H_a) that there is a long-run relationship. That is, the study tested the hypothesis that: H_0: $a_1=a_2=a_3=a_4=a_5=a_6=0$, against the alternative hypothesis that: H_A: $a_1\neq a_2\neq a_3\neq a_4\neq a_5\neq a_6\neq 0$. To reach an acceptable conclusion, the computed bounds test based on F-statistic was compared with the critical values computed by the Pesaran et al., (2001). If the computed F-statistic value exceeds the upper bound critical value, then there is co-integration among the variables. On the other hand, if the F-statistic value is less than the lower critical values, then there is no co-integration among the variables. However, if the F-statistic value lies between the upper and lower bounds critical values, the result is rendered inconclusive.

The major advantage of the ARDL bounds testing approach is its ability to determine co-integration among variables without considering the integrating order of the series. Thus, it can be applied to series I(0), I(1) or mutually integrated. Another advantage of this method is its suitability for small sample size. The error correction model (ECM) of (4) based on the unrestricted ARDL specification was expressed as:

$$\Delta LMGDP_t = \alpha_0 + \sum_{i=1}^{k} \beta_i \Delta LMGDP_{t-i} + \sum_{i=0}^{k} \phi_i \Delta LKAP_{t-i} + \sum_{i=0}^{k} \delta_i \Delta LLAB_{t-i} + \sum_{i=0}^{k} \omega_i \Delta LEXCH_{t-i} + \sum_{i=0}^{k} \gamma_i \Delta LBLM_{t-i} + \sum_{i=0}^{k} \pi_i \Delta MCU_{t-i} + \sum_{i=0}^{k} \psi_i \Delta INFLA_{t-i} + \theta ECM_{t-1} + U_t \quad (9)$$

Θ is expected to be negative but significant and less than 1.

Where: ECM = the error correction factor and U_t = the error term.

IV.4 Structural Break Point Test

The Chow break point test was conducted to test for the existence of structural break attributed to a change in policy or sudden shocks to the economy. The test is often utilised to determine whether or not the explanatory variables have different effect on different subgroups of the population. The Chow test is utilised to determine whether a single regression is more efficient than two separate regressions. If there is no structural break, a single equation model can be expressed as:

$$Y_t = \delta_0 + \delta_1 X_t + U_t \quad (10)$$

In the presence of a structural break, two separate regression models can be expressed follows:

$$Y_t = a_0 + a_1 X_t + U_{1t}$$
$$Y_t = \beta_0 + \beta_1 X_t + U_{2t} \quad (11)$$

In Equation (11), the first model was applied before the breakpoint, and the second model was used after the structural break. Thus, if the parameters in the first and second models in Equation (11) are equal, that is, if $a_0 = \beta_0$, and $a_1 = \beta_1$, then the two models are expressed as a single regression in Equation (10). The Chow test employed F-statistic in its

analysis. If the computed F-statistic is greater than the critical value, then the null hypothesis is rejected with the conclusion that there is structural break and vice versa. Thus, we tested for the presence of structural breaks by examining the effect of exchange rate on manufacturing sector performance before and after the liberalisation of exchange rate in Nigeria using this technique.

IV.4 Data Sources

The study employed annual time series data spanning 1970-2016. Data on manufacturing output, capital stock, exchange rate, deposit money banks' loans and advances to manufacturing, and average manufacturing capacity utilisation were obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin (2011 & 2016). Data on inflation rate were obtained from the Central Bank of Nigeria (CBN) Annual Reports and Statement of Accounts (various years), while data on labour force were obtained from the World Bank Development Indicators Datasheet (various years).

V. Analysis of Results

V.1 Descriptive Statistics

Table 1 presented the descriptive statistics on the selected macroeconomic variables, captured in this study. Examination of skewness showed that distribution for manufacturing output, capital stock, exchange rate, deposit money banks' loans and advances to manufacturing sector, manufacturing capacity utilisation and inflation rate were positively skewed, whereas distribution for labour force was negatively skewed. Analysis of kurtosis showed that distribution for manufacturing output, capital stock, deposit money banks' loans and advances to manufacturing sector, and inflation rate were leptokurtic, whereas those for labour force, exchange rate, and manufacturing capacity utilisation were platykurtic.

Table 1: Descriptive statistics

	MGDP	KAP	LAB	EXCH	BLM	MCU	INFLA
Mean	967976.80	849164.80	31140660.00	58.82	706074.90	53.23	18.90
Median	38987.14	96915.51	31886387.00	21.89	23110.60	54.80	12.70
Maximum	8973773.00	4274226.00	57352456.00	253.49	8266101.00	78.70	72.81
Minimum	378.40	100.40	1353000.00	0.55	6.30	29.29	3.20
Std. Dev.	2455977.00	1366676.00	16519359.00	70.75	1801240.00	15.02	16.54
Skewness	2.65	1.46	-0.37	0.82	3.29	0.14	1.71
Kurtosis	8.33	3.50	2.14	2.38	12.85	1.82	4.96
Jarque-Bera	110.81	17.14	2.51	6.00	274.82	2.85	30.31
Probability	0.00	0.00	0.28	0.05	0.00	0.24	0.00
Sum	45494907.00	39910746.00	1.46E+09	2764.35	33185518.00	2501.76	888.25
Sum Sq. Dev.	2.77E+14	8.59E+13	1.26E+16	230243.20	1.49E+14	10377.93	12587.67
Observations	47	47	47	47	47	47	47

Source: Author's computation

V.2 Unit Root Tests

The results of the unit root test, using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) methodologies, were reported in Table 2 and Table 3. As indicated in the Tables, the outcome of both tests showed that labour and inflation rate were stationary at level. Whereas the remaining variables were not stationary at levels, but were stationary after first difference. This made it impossible to reject the null hypothesis of no unit root in the series. There was a unit root problem and hence the need to carry out the co-integration test to ascertain the existence or otherwise of long-run relationship among the variables. But given that the variables were integrated of I(0) and I(1) suggested that the conventional co-integration test based on the Johansen multivariate approach was not appropriate. Thus, the need for bounds testing approach. The results of the bounds test were analysed in the sub-section 5.

Table 2: Augmented Dickey-Fuller (ADF) test

Variable	ADF statistics				Remarks
	Level	5 per cent Critical Value	1st Difference	5 per cent Critical Value	
LMGDP	0.05	-2.93	-6.75	-2.93	I(1)
LKAP	-2.15	-2.93	-7.83	-2.93	I(1)
LLAB	-4.61	-2.93	-	-	I(0)
LEXCH	-0.15	-2.93	-5.42	-2.93	I(1)
LBLM	-0.73	-2.93	-10.32	-2.93	I(1)
MCU	-1.90	-2.93	-3.79	-2.93	I(1)
INFLA	-3.56	-2.93	-	-	I(0)

Source: Author's computation

Table 3: Phillips-Perron (PP) test

Variable	PP statistics				Remarks
	Level	5 per cent Critical Value	1st Difference	5 per cent Critical Value	
LMGDP	0.25	-2.93	-6.83	-2.93	I(1)
LKAP	-2.30	-2.93	-7.82	-2.93	I(1)
LLAB	-10.17	-2.93	-	-	I(0)
LEXCH	-0.26	-2.93	-5.41	-2.93	I(1)
LBLM	-0.25	-2.93	-20.35	-2.93	I(1)
MCU	-1.50	-2.93	-3.81	-2.93	I(1)
INFLA	-3.46	-2.93	-	-	I(0)

Source: Author's computation

V.3 Co-integration Test

The co-integration test based on the ARDL bounds testing approach is reported in Table 4. From the table, the computed F-statistic of 7.72 was greater than the upper bound critical values of 4.43, 3.61, and 3.23 at 1, 5 and 10 per cent levels of significance, respectively. Given that the computed F-statistic value had exceeded upper bound critical values at

the 1 per cent, 5 per cent and 10 per cent levels of significance, showed that there is existence of long-run relationship among the variables.

Table 4: ARDL Bounds test

Test Statistic	Value	k
F-statistic	7.72	6
Critical value bounds:		
Level of significance	I(0) Bound	I(1) Bound
10 per cent	2.12	3.23
5 per cent	2.45	3.61
1 per cent	3.15	4.43

Source: Author's computation

V.4 ARDL Long-run Estimation

The result of the ARDL long-run estimation was presented in the lower segment of Table 5. The result as depicted in the table showed that one period lag of manufacturing output had a significant positive impact on manufacturing output in Nigeria in the long-run. In real terms, a 1 per cent increase in the previous period manufacturing output would result to an increase in the manufacturing output in the long-run by approximately 1.18 per cent. Exchange rate had a positive but insignificant effect on manufacturing output in the long-run. This means that a depreciation of the naira by 1 per cent would lead to a rise in manufacturing output by approximately 0.18 per cent in the long-run. Other results showed deposit money banks' loans and advances to manufacturing sector, average manufacturing capacity utilisation, capital stock and labour force exhibited positive effect on manufacturing output in the long-run.

In real terms, a 1 per cent increase in deposit money banks' loans and advances to manufacturing sector, average manufacturing capacity utilisation, capital stock and labour force resulted in an increase in manufacturing output by 1.53, 0.05, 0.41 and 0.46 per cent, respectively. However, inflation rate exhibited a negative but significant impact on manufacturing output in the long-run; implying that a 1 per cent increase in inflation rate raised the manufacturing output by 0.06 per cent.

V.5 ARDL Short-run Estimates

The result of the ARDL short-run estimatation was presented in the upper segment of the Table 5. As shown in the table, previous one period of manufacturing output exerted positive impact on the output of manufacturing sector in the current period.

This indicated that a 1 per cent increase in previous one period of manufacturing output resulted in an increase in manufacturing output in the current period by 0.43 per cent. Exchange rate had positive and significant impact on manufacturing output in Nigeria. This implied that a depreciation of the naira made exports cheaper, resulting in an increase in manufacturing production. In real terms, a depreciation of the naira in the current period, lag one, two and three periods by 1 per cent raised manufacturing output by 0.22, 0.60, 0.66 and 0.58 per cent, respectively.

Table 5: ARDL Long-run and Short-run Estimates

Dependent Variable: D(LMGDP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LMGDP(-1))	0.430767	0.260167	1.655735	0.126000
D(LKAP)	1.073092	0.251659	4.264066	0.001300
D(LKAP(-1))	-0.463452	0.177389	-2.612632	0.024100
D(LKAP(-2))	-0.472849	0.199439	-2.370888	0.037100
D(LLAB)	1.670575	0.728000	2.294746	0.042400
D(LLAB(-1))	1.124773	0.559839	2.009101	0.069700
D(LEXCH(-1))	0.601513	0.259071	2.321803	0.040400
D(LEXCH(-2))	0.655768	0.277266	2.365124	0.037500
D(LEXCH(-3))	0.576222	0.250676	2.298672	0.042100
D(LBLM)	1.206808	0.459655	2.625464	0.023600
D(LBLM(-1))	-1.001235	0.262311	-3.816979	0.002900
D(LBLM(-2))	-1.019056	0.240662	-4.234396	0.001400
D(LBLM(-3))	-0.855694	0.186193	-4.595747	0.000800
D(INFLA(-1))	-0.041324	0.009364	-4.413028	0.001000
D(INFLA(-2))	-0.031012	0.007101	-4.367110	0.001100
D(INFLA(-3))	-0.012349	0.004517	-2.734067	0.019400
C	5.846994	5.572199	1.049315	0.316500
LKAP(-1)	0.414952	0.279431	1.484988	0.165600
LLAB(-1)	0.464207	0.324431	1.430832	0.180300
LEXCH(-1)	0.177272	0.187662	0.944634	0.365100
MCU(-1)	0.047154	0.019355	2.436294	0.033000
LBLM(-1)	1.534252	0.411256	3.730651	0.003300
INFLA(-1)	-0.062061	0.014853	-4.178389	0.001500
LMGDP(-1)	1.177163	0.281957	4.174966	0.001500
R-squared	0.877458	Adjusted R-squared		0.532113
F-statistic	2.540814	Durbin-Watson stat		2.750437
Prob(F-statistic)	0.051684			

Source: Author's computation

Capital stock and labour input exerted positive impact on manufacturing output. Thus, 1 per cent increases in capital stock and labour input in the current period, lags one, two and three periods increased manufacturing output by 1.07, 1.67, 1.12, 0.47, and 0.49 per cent, respectively. Similarly, average manufacturing capacity utilisation had positive effect on manufacturing output. In real terms, a 1 per cent increase in average manufacturing capacity utilisation in lag one and lag two periods raised manufacturing output by 0.01 per cent, respectively. Furthermore, deposit money banks' loans and advances to manufacturing sector exerted positive and significant impact on manufacturing output in Nigeria. In real terms, a 1 per cent increase in deposit money banks' loans and advances to manufacturing sector raised manufacturing output by 1.20 per cent. Lastly, inflation rate exerted a negative but significant impact on manufacturing output, implying that a 1 per cent rise in inflation rate in lags one, two, and three periods reduced manufacturing output by approximately 0.04, 0.03 and 0.01 per cent, respectively.

V.6 ARDL Error Correction Estimates

The result of the ARDL error correction estimation was presented in Table 6. An examination of the result showed that the coefficient of the error correction variable was negative but significant and less than unity. The coefficient was 0.436, indicating that about 44 per cent of the disequilibrium in the period was corrected in the current year. This represented a slow speed of adjustment from the disequilibrium in the short-run to equilibrium in the long-run. The high adjust R-squared of 0.72 showed that approximately 72 per cent of the total variation in the dependent variable was accounted for by the independent variables. Thus, the estimated model had a high explanatory power. The F-statistic of 4.34 with its low probability value of 0.01 showed that the entire model is statistically significant at the 5 per cent level of significance. With the Durbin-Watson statistic of 2.47, there is no problem of autocorrelation in the model, indicating that the model was well behaved.

Analysis of short-run coefficients showed that up to two periods lag of manufacturing output had positive impact on manufacturing output in the current period in Nigeria. These results were consistent with expectation, indicating in real terms that 1 per cent increases in one and two periods lag of manufacturing output resulted in an increase in manufacturing output in the current period by 0.17 per cent, and 0.51 per cent, respectively. Two periods lag of manufacturing output was statistically significant in influencing manufacturing output at the conventional 1, 5 and 10 per cent levels of significance.

Exchange rate in the current period, one period lag, had a positive and significant impact on manufacturing output in Nigeria. This means that 1 per cent depreciation in the exchange rate in the previous year raised manufacturing output significantly by 0.42 per cent.

Manufacturing capacity utilisation has positive influence on manufacturing output in Nigeria. A 1 per cent increase in lag one and lag three of capacity utilisation increased manufacturing output significantly by 0.07 and 0.003 per cent, respectively. One period lag of manufacturing capacity utilisation was significant in influencing manufacturing output at 1, 5 and 10 per cent levels of significance.

Also, deposit money banks' loans and advances to manufacturing sector in the current period, lags 1, 3 and 4 had positive and significant impact on manufacturing output in Nigeria. This is consistent with a priori expectation, indicating that a 1 per cent increase in the current period, one period lag, three periods lag, and four periods lag of deposit money banks' loans and advances to manufacturing sector, raised manufacturing output significantly by 1.60, 0.71, 0.19 and 1.05 per cent, respectively.

Labour force exhibited a positive impact on manufacturing output in Nigeria. This result was consistent with theoretical expectation, indicating, in real terms, that a 1 per cent increase in labour force in the current period increased manufacturing output significantly by 2.06 per cent. Similarly, capital stock had a positive and significant effect on manufacturing output indicating that a 1 per cent increase in the current, three periods

lag and four periods lag increased manufacturing output by 1.2, 0.43 and 0.24 per cent, respectively.

Lastly, inflation rate in the lags 1 and 3 had negative influence on manufacturing output in line with a priori expectation. In real terms, a 1 per cent increase in the inflation in these periods decreased manufacturing output significantly by 0.02 and 0.01 per cent, respectively.

Table 6: ARDL Short-run Estimates

Dependent Variable: DLMGDP				
Method: ARDL				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
DLMGDP(-1)	0.170406	0.104522	1.630337	0.137500
DLMGDP(-2)	0.511815	0.144174	3.549993	0.006200
DLKAP	1.208256	0.170790	7.074499	0.000100
DLKAP(-1)	0.096175	0.105121	0.914893	0.384100
DLKAP(-2)	-0.223052	0.135559	-1.645418	0.134300
DLKAP(-3)	0.431109	0.132408	3.255902	0.009900
DLKAP(-4)	0.241248	0.131395	1.836054	0.099500
DLLAB	2.056793	0.562464	3.656753	0.005300
DLLAB(-1)	-0.387622	0.499366	-0.776229	0.457500
DLLAB(-2)	-1.259977	0.407577	-3.091383	0.012900
DLLAB(-3)	-0.014554	0.246891	-0.058950	0.954300
DLLAB(-4)	-0.925478	0.353136	-2.620739	0.027800
DLEXCH	0.085084	0.145005	0.586766	0.571800
DLEXCH(-1)	0.422988	0.133423	3.170280	0.011400
DLEXCH(-2)	-0.211372	0.141356	-1.495313	0.169000
DLEXCH(-3)	0.080090	0.155220	0.515978	0.618300
DLEXCH(-4)	-0.161134	0.167598	-0.961432	0.361500
DMCU	-0.022828	0.013298	-1.716654	0.120200
DMCU(-1)	0.067010	0.014325	4.677917	0.001200
DMCU(-2)	0.003048	0.014296	0.213225	0.835900
DMCU(-3)	-0.027008	0.011725	-2.303501	0.046700
DLBLM	1.603533	0.301119	5.325248	0.000500
DLBLM(-1)	0.709653	0.132004	5.376008	0.000400
DLBLM(-2)	-0.198300	0.109229	-1.815449	0.102800
DLBLM(-3)	0.189919	0.102209	1.858143	0.096100
DLBLM(-4)	1.049036	0.139082	7.542567	0.000000
DINFLA	0.009926	0.003727	2.663481	0.025900
DINFLA(-1)	-0.017166	0.003286	-5.224205	0.000500
DINFLA(-2)	0.007868	0.003282	2.397505	0.040100
DINFLA(-3)	-0.015040	0.003170	-4.744182	0.001100
DINFLA(-4)	0.008654	0.002820	3.068948	0.013400
ECM(-1)	-0.436490	0.085751	-5.090176	0.000700
C	-0.020413	0.126190	-0.161761	0.875100
R-squared	0.939170	Adjusted R-squared		0.722886
F-statistic	4.342300	Durbin-Watson stat		2.471967
Prob(F-statistic)	0.012531			

Source: Author's computation

V.7 Test for Structural Break

The result of the Chow breakpoint test was presented in the Table 7. From the Table, the F-statistic of 1.28 is less than the critical F-statistic of 3.15 at the 5 per cent level of significance. Based on this result, the null hypothesis could not be rejected, which implied that there was no break at the specified breakpoint. Hence, it could be concluded that exchange rate had significant effect on manufacturing output, both in the fixed exchange rate and flexible exchange rate regimes in Nigeria.

Table 7: Structural breakpoint test

Chow Breakpoint Test: 1985
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1970 2016

F-statistic	1.282725	Prob. F(2,43)	0.2877
Log likelihood ratio	2.723633	Prob. Chi-Square(2)	0.2562
Wald Statistic	2.565450	Prob. Chi-Square(2)	0.2773

Source: Authors' computation

V.8 Diagnostic Tests

Several diagnostic tests were conducted to ascertain the adequacy of the estimated model. The Ramsey RESET test was utilised to check for the function specification of the estimated model. The Jarque-Bera statistic, the Breusch-Godfrey serial LM test and the Breusch-Pagan-Godfrey Heteroscedasticity test were performed to examine the normality condition of the estimated model. The results of the tests were presented in Table 8. These tests showed that estimated equation had passed all the diagnostic checks. Using the Ramsey RESET test, showed the stability of the estimated model.

The low Jarque-Bera statistic value of 0.838382, with associated high probability of 0.657579, showed that the estimated model was normal. The Breusch-Godfrey serial LM test statistic of 0.884500, with its high probability value of 0.657579, revealed that there was no problem of autocorrelation in the model. This implied that the error terms were not dependent and hence there was no autocorrelation. Lastly, the Breusch-Pagan-Godfrey Heteroscedasticity test value of 0.601411, with its high probability of 0.8604, indicated showed that there was no problem of heteroscedasticity, and hence the disturbance terms were distributed normally.

Table 8: Diagnostic Tests

Test statistic	Value(prob.)
Ramsey RESET Test	0.275804 (0.6059)
Jarque-Bera	0.838382(0.657579)
Breusch-Godfrey Serial Correlation LM Test	0.884500 (0.4545)
Breusch-Pagan-Godfrey Heteroscedasticity Test	0.601411 (0.8604)

Source: Author's computation

VI. Conclusion and Policy Recommendations

The impact of exchange rate on the real sector in general, and manufacturing sector in particular, has remained contestable. This is because variation in exchange rate could either inhibit or enhance the performance of the manufacturing sector. On the empirical perspective, there has been lack of consensus as to whether or not exchange rate behaviour has enhanced or inhibited manufacturing sector performance in Nigeria. The non-consensus in empirical studies concerning the impact of exchange rate on manufacturing has motivated the conduct of this study. This study, therefore investigated the impact of exchange rate on manufacturing sector performance in Nigeria, by employing the auto-regressive distributed lag (ARDL) modeling and bounds testing approach.

The result of the ARDL long-run estimation showed that exchange rate had a positive and significant effect on manufacturing output in the long-run in Nigeria. This implied that a depreciation of the naira would lead to an increase in manufacturing output in the long-run. Similarly, the result of the ARDL short-run dynamics indicated that exchange rate had a positive and significant impact on manufacturing output, which is consistent with a priori expectation. Furthermore, the result of the ARDL error correction estimation revealed that exchange rate exerted positive and significant influence on manufacturing output in Nigeria.

Based on these results, the authors recommended the need to implement and manage a robust exchange rate policy regime that would promote manufacturing sector performance in Nigeria. To achieve this, exchange rate should be stabilised to facilitate manufacturing sector performance in Nigeria. The current market-determined exchange rate policy, occasioned by intervention by the Bank should be sustained.

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Bonds vs. Equity: An Evaluation of the Monetary Policy Implication on Relative Cost of Capital of Quoted Firms in Nigeria

***Nnanna, J. U., F. K. Ohuche and J. G. Omayuku* ***

Abstract

The paper analysed the relative impact of the cost of debt and equity on firms' performance in Nigeria. Following the work of Asteriou and Kavetsos (2003), the study adopted the panel least squares dummy variable model (LSDV) on data spanning 2010 to 2015. The findings showed that: earnings per share remained the most appropriate measure of firm performance in Nigeria, as it captured the dynamics of capital cost structure; Nigerian firms with the relatively high cost of debt were more sensitive to inflation and interest rates, than firms with high cost of equity; firms that sourced their capital off-shore were less-sensitive to monetary policy decision than firms that sourced their capital domestically. The paper, therefore, recommended that: monetary policy decisions should be more sensitive to developments in the manufacturing and services sub-sectors more than banking and oil and gas; and intervention schemes of the Central Bank of Nigeria should be targeted at sectors that were sensitive to monetary policy, particularly those that relied on the domestic debt markets for raising funds.

Keywords: Cost of Equity, Cost of Debt/bonds, Monetary Policy
JEL Classification: G1, G2, M14

I. Introduction

The overarching objective of monetary policy in Nigeria is to ensure price stability and non-inflationary growth (CBN Act, 2007). This core objective is achieved largely by constantly striving to maintain equilibrium liquidity conditions in the economy using effective instruments of liquidity management. Liquidity control measures ensure availability or otherwise of loanable funds at market-determined interest rates crucial for successful implementation of monetary policy. The basic policy instrument for liquidity management is monetary policy rates (MPR). This benchmark policy rate routinely sets the upper or lower thresholds of an anticipated overnight call rates through which all other interest rates are determined. Consequently, firms or investors who desire to source credit for their operations closely watch these rates and, therefore, pay attention to the central bank's monetary policy stance in determining their short, medium and long-term financing decisions.

Typically, while high interest rates constrain access to loanable funds, which restrain excess money supply, low interest rates, act in the opposite direction to; ensure liquidity availability to induce investment and growth expansion. However, the response of monetary policy in the context of liquidity control becomes challenging when there is liquidity crunch in the economy. In such circumstances, firms and governments compete for available financial resources in financial markets with the tendency to push up interest rates beyond equilibrium levels.

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Therefore, determining firms' response to anticipated monetary policy actions, in such a scenario will, apriori, have implications for firms' preference for sourcing investible funds either from the debt or equity markets, on one hand, or from domestic or foreign credit markets, on the other hand.

Two main reasons motivate the choice of empirical investigation of firm's capital structure, in the context of macroeconomic and monetary policy developments in Nigeria: first, the increasing competition between government and firms for scarce capital, due to liquidity crunch, occasioned by the aftermath of the Global Financial Crisis (GFC). Second, the consequent near collapse of bonds and equity markets globally, impacted firms' access to credit; thus, undermining growth in Nigeria.

The implication of the foregoing, on the effectiveness of monetary policy suggests that there is need to investigate the relationships between these variables, especially in emerging and frontier markets, including Nigeria with fledgling credit markets prone to domestic and external shocks that often threaten their solvency and financial stability. Therefore, monetary policy must take into account firm's capital structure decisions to ensure that policy stance does not impact negatively on the solvency and liquidity of firms.

This study determined empirically the capital structure preferences (debt or equity) of some quoted firms in Nigeria and evaluated to what the extent such choices were influenced by monetary policy and macroeconomic variables. The results provided a policy feedback mechanism on how to use effectively information on firms' capital structure to manage liquidity conditions in the economy.

The rest of the paper was structured as follows. Section 2 presented literature review, while Section 3 highlighted some stylised facts about the relationship between capital markets and performance of quoted firms in Nigeria. Section 4 focused on the research design, empirical methodology and data analysis. Section 5 discussed empirical findings, while Section 6 concluded with findings, policy implications and recommendations.

II. Literature Review

II.1 Theoretical Literature

The role of capital in the successful implementation of firm's strategic objective cannot be overemphasised in any market economy. As one of the major factors of production, it determines the extent to which firms can expand their operations to increase output, upgrade technology, improve human capital and grow market share through innovation and profitability (Wendel, 2015). Broadly speaking, two sources of capital, namely; debt (bonds and short-term loans) and equities are available for firms to access.

While debt markets respond to inflation, demand for equities is driven by the desire for long-term funding and the need to circumvent high interest rates associated with tight monetary conditions that impact domestic debt market rates. Luengnaruemitchai and Ong (2005) argued that financial vulnerability that lead to crises could be mitigated through efficient firm

capital structuring underpinned by a well-diversified financial system with balanced distribution of bank lending and corporate bonds options for firms to access. Sensarma and Bhattacharyya (2016) also argued that corporate bond market offers effective competition to the banking sector credit market, thereby strengthening financial stability.

However, sourcing capital in their appropriate mix by firms is not straightforward given that it is often contextualised within constrained optimal conditions driven mainly by availability and cost. While availability is determined by liquidity conditions in the banking system, cost is driven by intermediation dynamics, which reflect interest rate movements. Nevertheless, as a rule, most firms aim to have an optimal capital structure that could guarantee value maximisation and cost minimisation that will positively impact their bottom lines in the medium to long-term (Akhbar and Bhutto, 2004).

Theoretically, the determinants of capital structure in firms have remained a controversial issue in the literature for over half a century. Generally, two extreme schools of thought shape the debate about the role of capital structure in the overall growth and sustainability of the firm. The first school of thought argued led by Modiglianni and Miller (1963) that firms optimal mixture of debt and equities in their portfolio have the potential to minimise the weighted average cost of capital (WACC), which can maximise the value of the firm in return. The other school of thought argued that decisions on the source and combination of capital do not enhance the value of the firm and therefore irrelevant to firm market value (Modigliani and Miller, 1958).

However, over the years there have been empirical works such as Scott (1977), Altman (1984), Chakraborty (2010) to test these two extreme theoretical propositions in both advanced, emerging and frontier economies. Hinged on the critical proposition that firms do not pay taxes, or incur any costs associated with contract defaults (cost of financial distress) or agency costs (costs of procuring and managing loans), the theory argues that investors value the firm's cash flow as the same, irrespective of how the firm is financed. To that end, firms will be indifferent to the source of capital, equity or debt. Thus, the consideration for the use of financial leverage to enhance their performance remains largely irrelevant and optional since no incentives of interest deductibility in a firm's choice of capital funding was anticipated.

Modigliani and Miller (1963) revised their earlier theoretical position as they were found to be unrealistic given the disparity in the capital structure around the world. Specifically, implementation of corporate income tax policies to enhance government fiscal positions had become a regular fiscal policy option in many jurisdictions. On the other hand, given that interest of investors are often protected in preference claims to income and assets over equities, the cost of debt was more likely to be less than the cost of equity with obvious implications for firm capital structure choices.

Therefore, as firms prefer the use of more debt in their weighted average cost of capital model because of its relative cheapness, equity options become less attractive as rising equity prices could impact firms bottom line. More importantly, when tax deductibility was introduced into the Modigliani Miller model, it became obvious that the value of the firm was enhanced by tax protection, which lowers the cost of debt, and increases the value of the firm as tax deductibility

of interest increases. Therefore, the realistic position was for firms to put all cards on the table when considering which capital structure to adopt in their financing choices.

The need to consider the pros and cons of each capital choices gave rise to Trade-*off Theory* (otherwise known as Tax-based Theory). The theory popularised by researchers, such as Scott (1977), Altman (1984) and Chakraborty (2010), argued that the Irrelevant Theory of Modigliani and Miller (1958) ignored the possibility of firm bankruptcy due to financial distress and imminent default which has the potential to make debt (bonds) a heavy burden on firms if financial crises eroded firms financial buffers. Therefore, the theory posits that in choosing debt over equity, firms' factor-in the opportunity cost of making sub-optimal decisions, inability to negotiate long-term supply contracts or loss of customers, all of which could put the firm in a precarious debt condition and possible overhang. Consequently, debt default risk could trigger bankruptcy, as the expected cost of financial distress increases relative to the increase in the use of debt, and impairs the value of the firm. The implication is that firms optimal debt ratio is one in which the advantage of borrowing is equal to the expected cost of bankruptcy which could constitute a real and present danger to firms survival (Akhbar and Bhutto, 2004).

To others, firm bankruptcies do not occur in a vacuum or in isolation of the general macroeconomic conditions in a given jurisdiction. Therefore, there is need to factor the macroeconomic stability conditions when firms consider which financing option or combinations to commit. The *Perking Order Theory,* led by Myers and Majluf (1984) and Myers (1984), provided the most appropriate framework for considering the impact of external macroeconomic conditions on the choice of optimal capital structure. The theory argued that given the high bankruptcy risk associated with debt financing, most firms willing to fund new investments, ordered their choice of capital in a particular preference; first, most profitable firms prefer to generate financing through retained earnings, given that it comes without cost and also has the tendency to maximise the value of existing shareholders. Second, in the absence of sufficient profit that will enhance retained earnings, such firms go for external debt financing through the issuance of new foreign debts, which may involve high relative costs, before considering equity, which has a flexible dividend payout but remains uncertain and largely driven by stock price dynamics.

The critical factor in the theory was the existence of information asymmetry between firm managers and outsiders, which invariably led managers to adopt their own financing strategies to minimise costs that could erode shareholder value. The most important implication of the theory was that firms preferred internal to external sources of capital for funding their new investments. Therefore, the preference for external funding exposes the firms to the vagaries of macroeconomic conditions one of which was monetary policy decisions.

II.2 Monetary Policy and Firms Capital Structure Choices: An Overview

Modelling the impact of monetary policy announcements on financial asset prices starts with establishing a consistent theoretical link between expectations formation in asset markets and the achievement of price stability function of the central bank. Three theoretical models of expectations formation furnish this link. First, the rational Expectations Hypothesis (REH,

henceforth) conceptualised market efficiency as a by-product of effective information management that shapes expectations formation in asset markets. Second, the Pure Expectations Hypothesis (PEH) established linkage between short-term interest rates and longer ones through expectations about inflation and output developments and lastly, Liquidity Preference Theory (LPT), which was an improvement on the Pure Hypothesis.

In the context of the foregoing, monetary authorities are adjudged to have better information about the trajectory of macroeconomic indicators, which inform their decisions as communicated through monetary policy pronouncements. Firms, in considering their choices of capital from stock markets keenly watch monetary policy inclinations to help them make adjustments in their financing options based on their assessment of investment sentiments motivated by Central Bank monetary policy guidance and pronouncements. According to Corrado and Jordan (2002), the main sources of information on the stock market are the performance of company profits, political and economic risk factors, general economic performance, inflationary trends, interest rate dynamics, GDP numbers and shareholder taxes.

The relationship between stock prices and monetary policy works through Market Efficiency Theory. Fama (1998) argues that Efficient Market Hypothesis (henceforth EMH) remains the workhorse for modelling equity market behavior sustainably. The theoretical imperative of EMH in determining the relationship between stock prices and monetary policy is that monetary policy information or stance determines choices between stock market and money market instruments through the impact of the latter on the cost of funds. Therefore, any threat to market efficiency through information asymmetry, undermines optimal choice of investment and erode investors' confidence.

Makhova and Zinecker (2014) noted that the relationship between monetary policy decisions and firms capital structure choices work through the impact of changing monetary policy stance on demand for money, which may induce changes in channels of firm financing and their capacity for intermediation in the economy. Therefore, while expansionary policy stance increases money supply through lower interest rates, its implication for firm financing must be contextualised within an inflationary regime, a cardinal concern for monetary policy in many jurisdictions. In other words, inflation expectations affect credit conditions and reinvestment risks. Rising inflation negatively impacts both debt and equity markets differently for two reasons: First, for firms that target equity funding, higher inflation induces the quest for higher returns which has implication for increasing equity prices and increasing their cost of financing. Consequently, high capital costs impact the profitability of firms thereby impacting investments and growth. On the other hand, under conditions of high equity prices, the debt market becomes a preferred option given that relative lower interest rates would induce lower capital costs and increase the profitability of firms.

Therefore, changes in monetary policy stance have the potential to alter firm's decisions about their source of capital. Contractionary policy stance has the potential to tighten credit conditions in the money market and engender high interest rates. Therefore, the options for capital choices in tight monetary policy regimes would be to resort to debt instruments (Bonds) with fixed and lower interest rates over longer-term periods rather than equity with uncertain settlement conditions on returns on investments to shareholders. Indeed, an understanding of

the impact of monetary policy on firms' capital structure choices can provide information on how monetary policy instruments can be better deployed to enhance firms' investment choices on a sustainable basis.

II.3 Empirical Literature

II.3.1 Monetary Policy and Corporate Firm Behavior

Bernanke and Blinder, (1992) adopted a microeconomic approach to analyse the impact of financial innovations on firm performance within a vector autoregressive (VAR) framework. Their empirical investigation, which was supported by Prasad and Gosh (2005), revealed that banks actively reshuffle their asset portfolio following a change in the monetary policy stance.

Kashyap et al., (1993) empirically examined the relationship and in some cases the existence of a loan supply (or a bank lending) channel of monetary policy transmission for the U.S. economy for the period 1974-98. Their findings suggested that tighter monetary policy tends to induce firms to rely more on financing through issuance of commercial paper and less on bank loans. The net effect was an overall decline in loan supply.

Prasad and Gosh (2005) utilised firm-level data on firms in India to examine the financing behaviour of manufacturing firms in response to contractionary monetary policy. The authors analysed the differences in the use of bank debt in response to a monetary policy tightening for "public" versus "private" firms and "listed" versus "unlisted" firms, after controlling for different industry groups and time periods". The findings revealed that a contractionary monetary policy position reduces overall debt, and listed firms ultimately increase their short-term bank borrowings, after monetary tightening. Furthermore, for private firms, the response to monetary policy tightening was weaker than that of their public sector counterparts. Third, the overall debt of listed firms tended to increase in response to a monetary tightening, driven by an increase in their short-term bank borrowings.

In Nigeria, Barine (2012) empirically investigated the capital structure determinants of quoted firms in Nigeria, using ANOVA and its implications on the choice of either debt or equity financing options. The study revealed that capital structure choices have implications for firms' profits. The study recommended that firms should reduce debt in their capital structure when there was the likelihood of financial distress while increasing debt component in their portfolios when the cost of equity, profitability and benefits from tax shield is high. However, the study did not address the impact of changes in monetary policy stance on the recommended choices which is the gap this particular study intends to fill.

Hanousek and Shamshur (2011) and Keshtkar (2012) appraised the factors that affected corporate efficiency in Europe. The aforementioned studies revealed that the capital structure of firms remained mostly unchanged during the firms' lifespan. As a result, the stability of leverage ratios is mainly generated by an unobserved firm specific effect that is liable for the majority of the variation in the capital structure. Further studies conducted on emerging economies in Europe revealed that growth variables had a weak, non-significant relationship with corporate capital structure, while the reverse was the case in the advanced economies. In

other words, the relationship amongst the variables remained strong and significant depending on the structure of the debt.

Riaz et al., (2014) used an economic factors model to check the effect of macroeconomic variables on firms' capital structure in the case of Pakistani firms. The results revealed that GDP growth had a significant negative impact on debt ratio, which implied that Pakistani firms preferred debt when GDP growth increases. In a related study, Pindado et al., (2014) examined the impact of monetary policy on corporate debt decisions using a panel of 16,743 listed companies covering 33 countries during the period 2004-2011. Their empirical analysis revealed that monetary policy facilitated firm's access to debt regardless of their specific financial constraints and borrowers' information. Moreover, the study revealed constrained firms were highly sensitive.

Kontonikas et al., (2016) investigated the effect of monetary policy stance on corporate bond returns in the U.S., using a VAR model. The results of the study revealed that higher expected bond returns in the U.S. responded to monetary policy tightening due to the higher bond risk premium, while the opposite effect occurs during periods of monetary policy easing. More specifically, the study concluded that the transmission effect of monetary policy on corporate bond returns was through future expectations on inflation development and real interest rate changes.

Mahmud et al., (2009) in their study utilised a panel approach to examine the factors that influence a firm's capital structure on the Asian continent. Japan, representing the advanced economy, while, Malaysia and Pakistan represented the emerging economies. The results revealed that higher economic growth encouraged the utilisation of long-term debt. In the final analysis, the impact of capital structure choices on firm performance in the context of macroeconomic and monetary policy stance revealed that firms cost of debt to cost of equity ratio were largely sensitive to macroeconomic and monetary policy decisions.

III. Overview of Capital Markets Development and Quoted Firms in Nigeria

Capital market facilitates economic growth by providing medium and long-term capital crucial for firms' investment and growth. Aside from providing avenue for financial intermediation, it diversifies business ownership that play important roles in income distribution, through dividend payouts to investors. In addition to the objectives of risk diversification, which act to mitigate the impact of risk concentration in firms, especially during economic downturns, capital market promotes competition for assets and debts that enhance price discovery and improve firms' bottom lines through loss minimisation and profit maximisation.

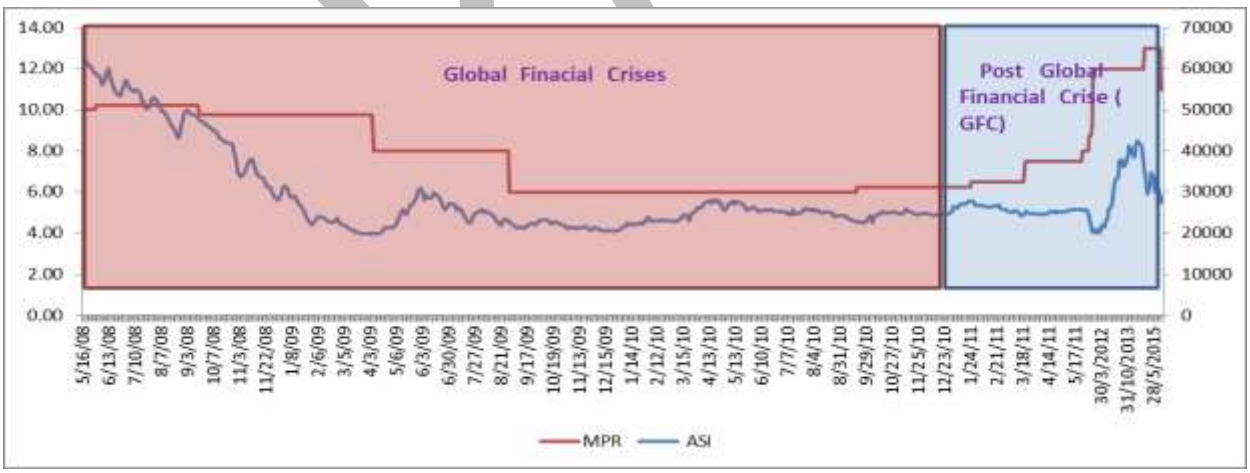
The Nigerian equity market has been shaped by three major episodes of domestic and external developments in over the years; first, the incorporation of Lagos Stock Exchange (LSE) on September 15, 1960, which opened for business with 19 listed securities made up of 3 equities, 6 Federal government bonds and 10 Industrial loans. It formally launched the equity markets in the Nigerian economy with the sole purpose of providing long-term financing both for corporate and government (Osaze, 2007). Second, the Indigenisation Decree of 1977 sought to increase

domestic ownership of hitherto foreign controlled firms and the need to provide opportunities through which Nigerians could fund their stakes in such acquisitions sustainably. The Indigenisation Decree, apart from creating opportunities for domestic ownership of stakes in the firms also expanded the Lagos Stock exchange with six more trading floors, namely; Kaduna (1978); Port Harcourt (1980); Kano (1989); Onitsha (1990) and Yola (2002).

Third, the banking system consolidation in Nigeria in 2005 merged 89 existing banks with very fragile capital bases into 25 banks. The consequent increase in capital base of consolidated banks liquidity and motivated the creation of "margin loans", which investors latched on to play in the Nigerian equity markets. Consequently, the sudden increase in private sector credit created a "credit bubble" that would burst in the wake of the global financial crisis between 2008 to 2010 (Eboh and Ogbu, 2010). This credit burst induced severe liquidity constraints in both the banking system and the economy, which prompted the Central Bank of Nigeria to provide "bail-out funds" to halt the imminent collapse of the banking system. Each of the foregoing episodes had implication for firms' ability to raise both short and long-term capital, as well as their profitability and sustainability.

Figure 1 indicated that during the GFC, monetary policy easing (2008-2010) aimed at reflating the economy was not effective in lifting the Nigerian equity market as All Share Index declined sporadically between 2008 and 2009, and remained low through 2010, when the impact of GFC started waning. From 2011 to 2015, Monetary Policy stance entered a "tightening cycle" which tended to correlate with rising All Share Index, as most firms resorted to equity financing given high interest rates in debt markets because of the prolonged period of liquidity crunch.

Figure 1: Monetary Policy Rate (MPR) and All Share Index (ASI) 2008-2015

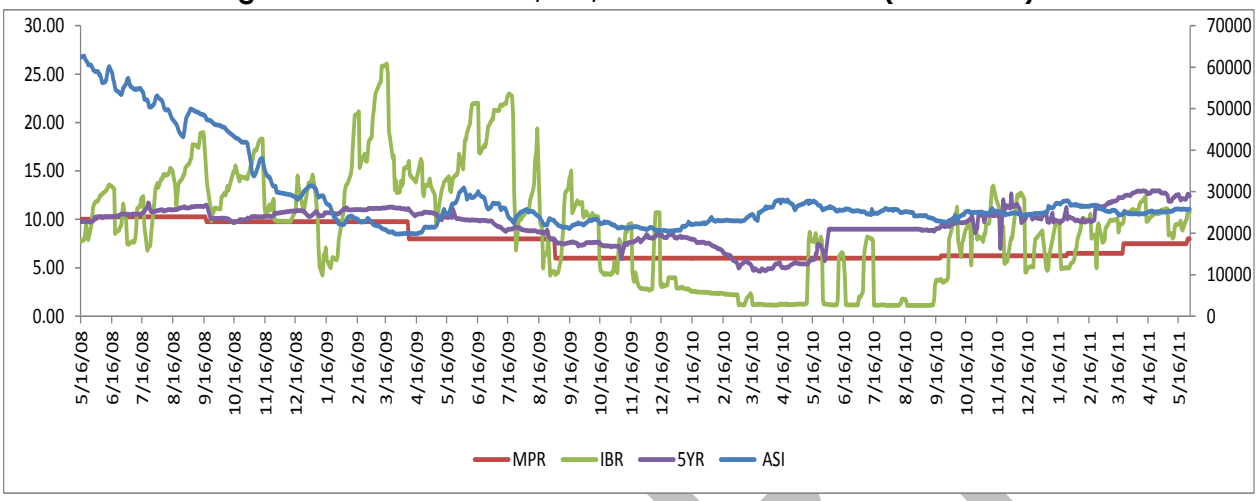


Source: Central Bank of Nigeria data base and Statistical Bulletin (several issues)

Figure 2 presents the behavior of market interest rates and bond yields during and immediately after the Global Financial Crises of 2008-2010. It was envisaged that high equity market performance would connote that interbank rates remained flat given the inverse relationship between asset prices and interest rates. However, at best, interbank rates were very volatile and bond yields, as represented by 5-yr Bonds yields, remained flat during the period. This suggests that the impact of monetary policy on the behavior of firms in both the equity and

bond markets were not consistent during and immediately after the Global Financial Crises. This situation further buttressed GFC's disruptive role in firm funding and macroeconomic stability during the period under review.

Figure 2: Interbank Rates, ASI, Bond Yields and MPR (2008-2011)

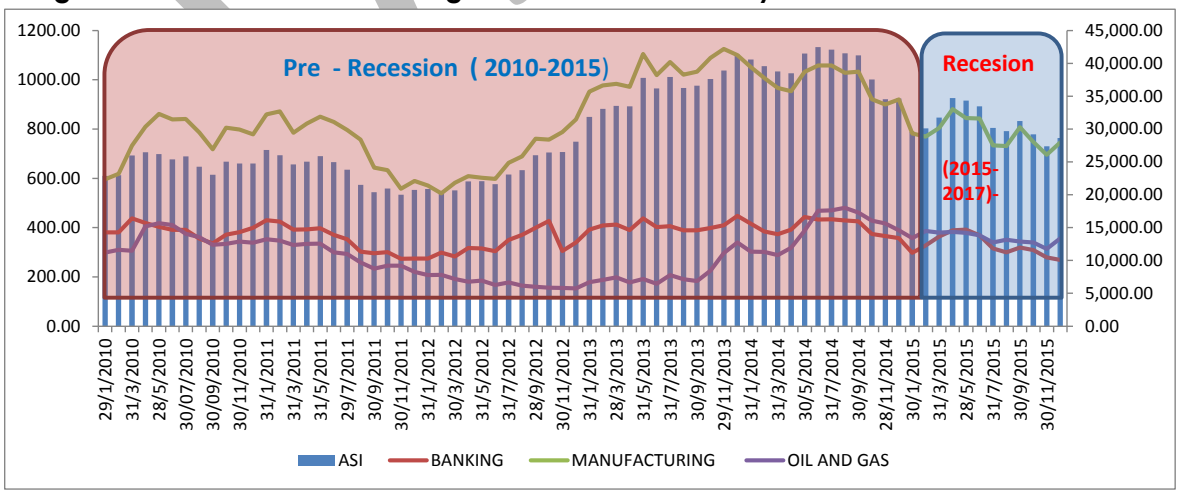


Source: Central Bank Statistical Bulletin and Nigerian Stock Market Data Base

III.2 Disaggregated Sectoral Performance in Equity Markets 2015-2017

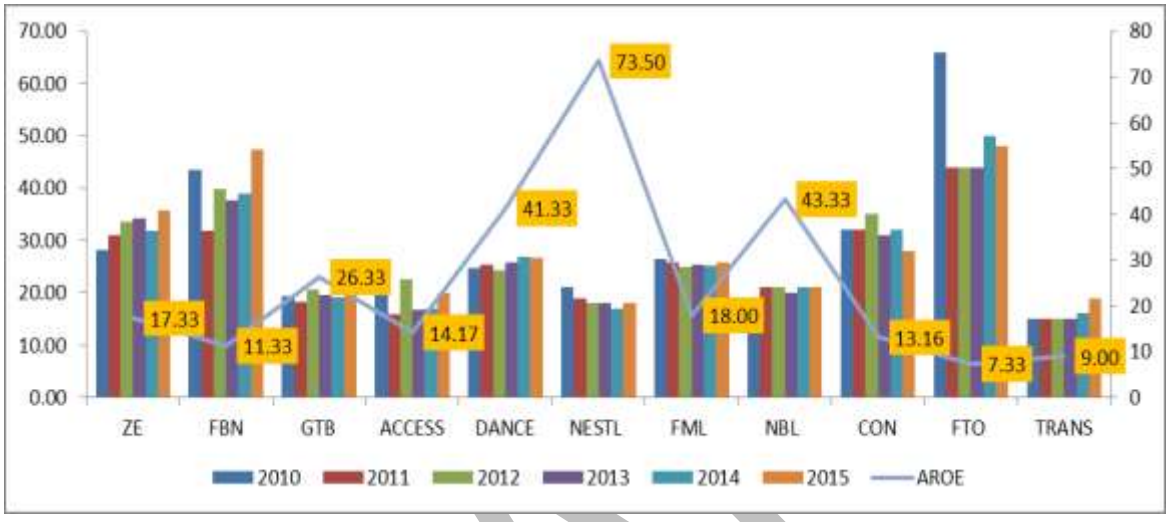
Figure 3 illustrates the contribution of the banking, manufacturing, oil and gas sub-sectors to all share index (ASI) of the Nigerian equity market. The manufacturing sector effectively tracked ASI before and after the economic recession, which commenced in the third quarter of 2015 and ended in the Q2 of 2017. Notably, the banking and the oil and gas sub-sectors were predictably impacted by the recession given their downward spiral during the recession period as indicated in the period under review. The implication was that firms were constrained in seeking both debt funding and equity funding during the recession period and the effort to use monetary policy to address the challenge was, at best, muted according to available data.

Figure 3: Contributions of Leading Sectors of the Economy to All Share Index 2010-2015



Firms preference for the use of either equities or debt or a weighted combination of both depends on a number of factors, including cost, prevailing macroeconomic conditions especially interest rates, inflation, corporate tax rates, returns on equity and prospects for growth of the economy and by extension firm growth (Efobi and Uremadu, 2012). Therefore, it is possible that the impact of the aforementioned factors have implications for firm performance in the short to long-term.

Figure 4: Average Cost and corresponding Returns on Equities of Firms in Nigeria 2010-2015



Source: Annual Reports and Statement of Accounts 2010-2015 of Zenith Bank (ZE); First Bank (FBN); GTB; Access bank (Access;, Dangote Cement, Nestle Plc (NESTL); Flour Mills Plc (FML); Nigerian Breweries Plc (NBL); Conoil Plc (CON); Forte Oil Plc (FTO); Transnational Corporation (TRANS)

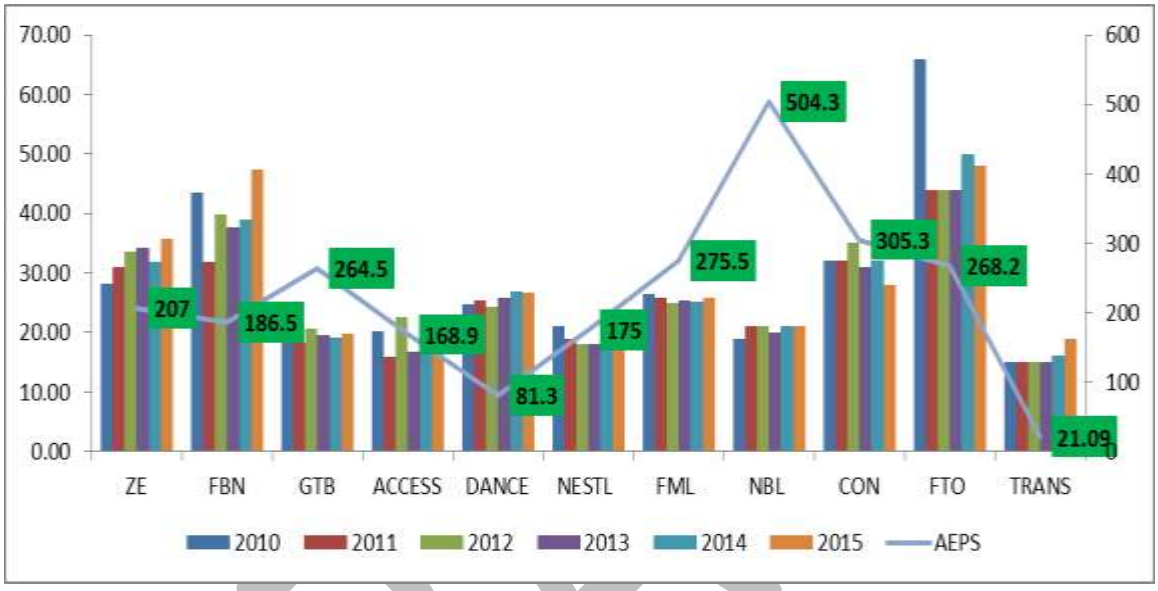
Figure 4 presents the relationship between cost of equity and return on equity (2010-2015) of some quoted corporates in Nigeria's Stock Exchange (NSE). The cost of equity represents the return on investment that shareholders expect to earn from their equity holdings in the firms. For instance, Zenith Bank had a stable level of cost of equity between 2010 and 2015 with average return on equity (ROE) of about 17.33 per cent. This contrasts with First Bank (FBN), Forte Oil (FTO), CON Oil (CON) which recorded high average cost of maintaining their equities principally due to high dividend payouts to the shareholders with average Return on Equity of 11.33 per cent, 13.16 per cent and 7.33 per cent, respectively. The relatively higher equity return by Zenith Bank (17.33) may be explained by high revenue reserves which were capitalised and further reduced reliance on debt and equity capital during the period.

Crucially, the spike in Forte Oil equity cost in 2010 may have been due to corporate merger and increased use of equity capital in its operations needed to sustain the growth of the company after its acquisition of African Petroleum Plc. Other firms, such as GTB, Access Bank (Access), Dangote Cement (Dance), NBL and TransCorp (Trans), recorded moderate cost of equity maintenance for various reasons. For instance, while Transcorp did not pay out dividends for several years due to corporate restructuring, GTB maintained moderate dividend payouts as reflected in their earnings per share (EPS) during the period.

III.3 Profitability Analysis and Average Cost of Equity of Some Quoted Firms 2010-15

Earnings per share measures the profitability of the firm in a given accounting year. While the banking sector generally recorded lower Cost of Equity funds, their EPS were relatively lower as exemplified by Zenith Bank, First Bank, Guaranty Trust Bank and Access Bank. Specifically, GTB with average EPS at N2.65k was more profitable compared with First Bank, N1.86k and Access, N1.69k during the review period. (See figure 5 below).

Figure 5: Cost of Equity and Earnings per Share of Some Quoted Firms (2010-2015)



Source: Annual Reports and Statement of Accounts 2010-2015 of Zenith Bank (ZE); First Bank (FBN); GTB; Access bank (Access;, Dangote Cement, Nestle Plc (NESTL); Flour Mills Plc (FML); Nigerian Breweries Plc (NBL); Conoil Plc (CON); Forte Oil Plc (FTO); Transnational Corporation (TRANS)

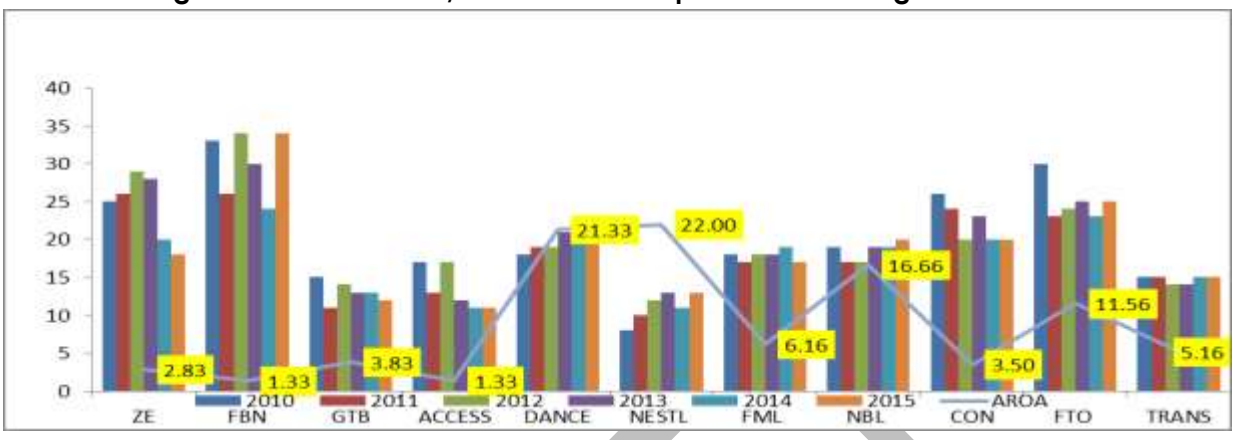
On the other hand, oil and gas sub-sector recorded relatively higher average cost of equity, but higher EPS compared with the Banking Sector. The manufacturing sub-sector performed worse than oil and gas with the exception of Nigerian Breweries Plc, which recorded a whopping average EPS of N5.04 during the period. The Hospitality industry, represented by Transcorp Hilton had the lowest EPS at N0.21k and lowest cost of equity. This was due to non-payment of dividends and its corporate restructuring exercise during the review period.

III.4 Cost of Debt Capital and Performance of Quoted firms Performance 2010-2015

The cost of debt of firms can be analysed either by yield-to-maturity approach or by Debt Rating Approach. Using the yield-to-maturity approach on their short to long-term debts, in the banking sector, Zenith Bank and First Bank recorded higher cost of debt than GTB and Access bank. This may be due to the Euro Bonds issued by Zenith Bank, which increased their debt servicing cost during the period under review. First Bank also syndicated some foreign and domestic loans, which grew their loan portfolio during the same period. The returns on assets (ROA) of the two banks during the period under review were 2.83 and 1.33 per cent, respectively. The cost of debt in GTB and Access Bank were relatively lower with comparably higher Return on Assets of 3.83

and 1.33 per cent, respectively. This suggests that their capacity to off-set the incurred debts were relatively higher, on the average, than Zenith and First Bank on average.

Figure 6: Cost of Debts/ bonds of some quoted Firms in Nigeria 2010-2015



Source: Annual Reports and Statement of Accounts 2010-2015 of Zenith Bank (ZE); First Bank (FBN); GTB; Access bank (Access;, Dangote Cement, Nestle Plc (NESTL); Flour Mills Plc (FML); Nigerian Breweries Plc (NBL); Conoil Plc (CON); Forte Oil Plc (FTO); Transnational Corporation (TRANS).

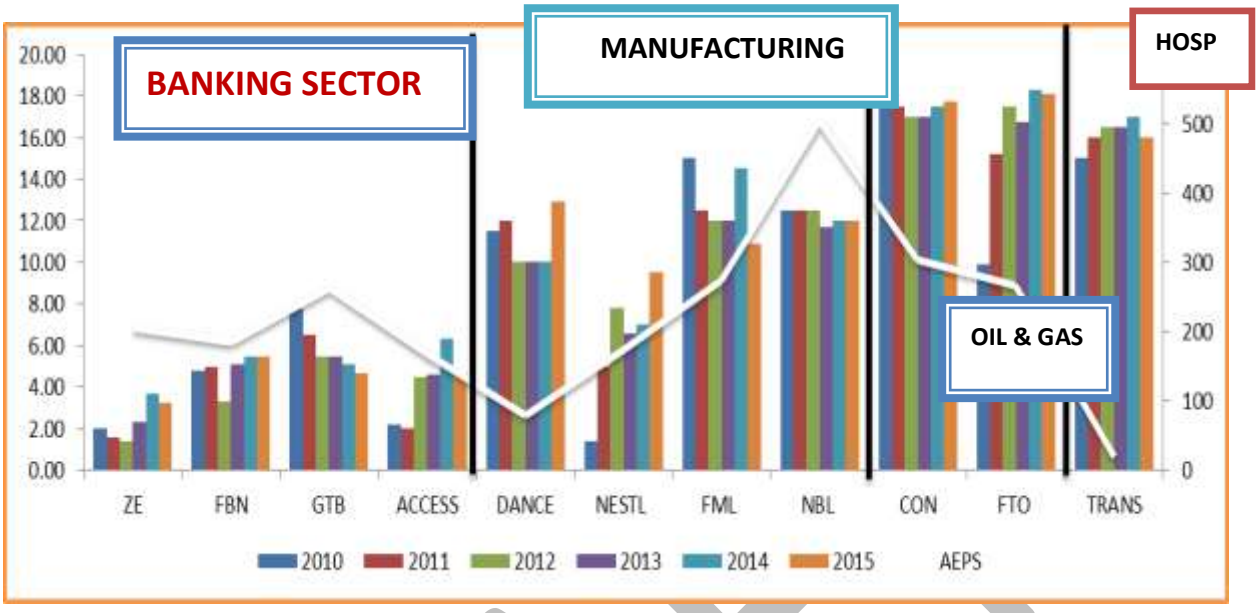
The Manufacturing sector, represented by Dangote Cement (DANCE), Flour Mills Nigeria PLC (FML), Nigeria Breweries Plc (NBL), and Nestle Nig. Plc, recorded higher cost of debt, with returns on assets of 21.33, 22.0, 6.16 and 16.66 per cent, respectively. Most of the debts were either syndicated loans from a consortium of banks, or through direct issuance of corporate bonds. The high return on assets indicated that the manufacturing sector stands a better chance to service their debts when compared with oil and gas sector, with Con oil and Forte Oil recording high Cost of debt profiles and return on assets of 3.50 and 11.56 per cent, respectively. However, the services sector, as represented by Transcorp Hilton, had moderate cost of debt exposure with equally moderate Return on Assets of 5.16 per cent during the period under review.

III.6 Weighted Average Cost of Capital (WACC) and Quoted Firms Performance 2010-2015

The weighted average cost of capital (WACC) is the combined rate at which a company repays borrowed capital either from the equity or debt markets (bonds). The WACC ratio is calculated by adding the average cost of debt to the average cost of equity. More importantly, WACC measures the stretch of the spread that lies between it and the return on investment. Analysing the Weighted Average cost of Capital of some quoted firms in Nigeria presents some interesting findings across sectors

Figure 7 presents the relationship between WACC and firms' performance between 2010 and 2015. The WACC varied among the sectors during the review period; however, a trend emerged that firms with lower WACC performed better than those with higher WACC, as reflected in their average EPS. For instance, the banking sector recorded the least WACC trends as exemplified by Zenith Bank (ZE), First Bank (FBN), Guarantee Trust Bank (GTB) and Access Bank (ACCESS) and their average earnings per share were higher than their WACC.

Figure 7: Weighted Average Cost of Capital (WACC) and Earnings per Share of Some Quoted Firms in Nigeria 2010-2015



Source: Annual Reports and Statement of Accounts 2010-2015 of Zenith Bank (ZE); First Bank (FBN); GTB; Access bank (Access;, Dangote Cement, Nestle Plc (NESTL); Flour Mills Plc (FML); Nigerian Breweries Plc (NBL); Con Oil Plc (CON); Forte Oil Plc (FTO); Transnational Corporation of Nigeria (TRANS)

The low WACC in the banking sector may have been influenced by relatively low rate (cost) of borrowing in the Standing Lending Facility (SLF) window of the Central Bank of Nigeria, often at 200 basis points above the MPR between 10 and 12 per cent during the reveiw period, as against interbank rates of over 16 per cent. In addition, most banks sourced their capital offshore, from Euro bonds or other offshore credit lines that come with Libor Rates, which is often comparably, lower than domestic lending rates and ranged between 2 to 5 per cent during the period under review. The interbank rates were also volatile, ranging between 4 to 14 per cent between 2010 and 2015.

The manufacturing sector had a relatively higher average weighted cost of funds, with mixed average earnings per share, when compared with that of the banking system. The relatively higher WACC was attributed to the high cost of funds as reflected in the prime lending rates (PLR) or Maximum lending Rates (MLR). Curiously, the highest cost of debt was recorded in oil and gas sub-sector. However, the sector recorded the lowest average earnings per share for reasons attributed to the mixed fortunes in international prices of oil in the period under review. The reasons for their high WACC ratios may not be different from the high cost of credit and the uncertainty in the oil and gas sector during the review period. Transcorp Hilton witnessed high cost on WACC given the capital restructuring they embarked upon during the period under review and the consequent collapse of the equity markets that heavily impacted their equities during and after the GFC in 2008.

IV. Research Design, Methodology and Data Analysis

IV.1 Research Design

This study was based on 11 companies drawn from 4 major leading sectors of the Nigerian economy, namely; banking; manufacturing; Oil and Gas and Hospitality. The firms were Zenith Bank, First Bank, Guaranty Trust Bank, Access bank (Banking sector), Dangote Cement, Nestle Nigeria Plc, Flour Mills Nigeria plc and Nigeria Breweries Limited (Manufacturing), Con Oil and Forte Oil (Oil and Gas) and Transcorp Hilton (Hospitality).

The data were collated from the annual reports and statement of accounts of each of the firms. Secondary data were constructed to derive the average cost of equity and debt of each of the firms, and determine the weighted average cost of capital (WACC) for the period 2010- 2015. The constructed cost of equity, cost of debt (bonds) and weighted average cost of capital were examined with firm performance measures, macroeconomic variables and near-term monetary policy stance, to determine the extent of variations in policy stance influence on firms' choice of capital structure and its impact on firm performance within a panel least squares dummy variable (LSDV) model.

IV.1.1 Technical Estimation of Cost of Equity (COE) using CAPM Model

Cost of equity was conceptualised as the return on investment that shareholders expected to earn from the stakes in the firm (or the opportunity cost). To determine the average cost of equity, the authors relied on the capital asset pricing model (CAPM), which is based on the theory that the expected return on equity is the sum of the risk-free rate of interest and a premium for bearing market risk. Equation 1 was specified thus:

$$E(R_i) = R_F + \beta_i[E(R_M) - R_F] \quad (1)$$

and $$\beta = \frac{\text{Cov (Ri, Rm)}}{\text{Var (Rm)}} \quad (2)$$

Where E(Ri) was the estimated return sensitivity of stock of the firms to changes in the future market return, R_F, plus E(RM), which was the expected return on the market; E(Rm) – R_F was the expected market risk premium or equity risk premium (ERP). Stated simply, the cost of equity is the expected return that must be equal to risk free return +/ - risk premium.

For the purposes of calculation, the authors used long-term government 5-year bond rates to measure risk-free rate, while historical risk premiums were used for the risk premium and Beta (β) were estimated by regressing stock returns of each of the firms against market returns. Therefore, the cost of equity became the riskless rate plus β, multiplied by the risk premium (see Table 1).

Table 1: Cost of Equity of Some Quoted Firms in Nigeria 2010-2015

Firms	2010	2011	2012	2013	2014	2015
Zenith	28.10	31.02	33.67	34.18	31.92	35.79
FBN	43.59	31.95	39.83	37.67	39.04	47.38
GTB	19.23	18.31	20.65	19.55	19.05	19.78
ACCESS	20.13	15.79	22.6	16.69	16.88	20.00
DANCE	24.82	25.31	24.39	25.88	26.93	26.69
NESTL	21.00	19.00	18.00	18.00	17.00	18.00
FML	26.36	25.81	24.94	25.37	25.12	25.77
NBL	19.00	21.00	21.00	20.00	21.00	21.00
CON	32.00	32.00	35.00	31.00	32.00	28.00
FTO	66.00	44.00	44.00	44.00	50.00	48.00
TRANS	15.00	15.00	15.00	15.00	16.00	19.00

Source: Authors Calculation based on data source and using Equation (1)

IV.1.2 Technical Estimation of the Cost of Debt (Bonds)

Cost of debt is often theorised as the return required by a business debt holder. In corporate finance literature, debt is often preferred to equity for three main reasons: first, it is often a relatively cheaper source of firm funding; second, lenders of debt (bonds) bear less risk and are directly or indirectly unaffected by adverse firm performance, unlike equity holders that are exposed to firm performance risks. Third, debts always come with tax advantages, which improve the overall bottom line of firms' profit, because interest payments are generally tax-deductible. However, increasing reliance on debt increases the probability of bankruptcy, but the net effect of debt, on the overall capital structure of firms, will determine whether firms will benefit from increasing debt or equity in its capital structure.

Two approaches can be used to estimate the cost of debt in a quoted firm. The first is yield-to-maturity approach and the second is the debt–ratio approach. In this study, the yield-to-maturity approach was employed in calculating the cost of debt of the firms.

Cost of debt was therefore, estimated by calculating the yield-to-maturity on the debt, which was derived by solving the following equation:

CMV = CP x $\frac{1}{r}-(1+r)^{-n} + faceValueofDebt = (1+r)^{n}$ (3)

Where;

CMV = Current market value; CP = Coupon payment

Coupon Rate = the stated rate on the bond/number of payments per year x face value of debt

r = Yield to maturity / number of periods of payment period per year

n = Number of coupon payments = number of periods per year x maturity in years

Cost of debt was therefore estimated as stated in Equation 6 below

$$r_d = (CPR(1-MTR) \quad (4)$$

Where;

CPR = Coupon rate of the bonds

MTR= Marginal tax rate

However, it must be noted that the cost of floating – rate debt was not considered as this was difficult to estimate, since it depended not only on current rates but also on future rates.

Table 2: Cost of Debt (Bonds) of Some Quoted Firms in Nigeria 2010-2015

Firms	2010	2011	2012	2013	2014	2015
Zenith	25	26	29	28	20	18
FBN	33	26	34	30	24	34
GTB	15	11	14	13	13	12
ACCESS	17	13	17	12	11	11
DANCE	18	19	19	21	21	22
NESTL	8	10	12	13	11	13
FML	18	17	18	18	19	17
NBL	19	17	17	19	19	20
CON	26	24	20	23	20	20
FTO	30	23	24	25	23	25
TRANS	15	15	14	14	15	15

Source: Authors Calculation based on data source using equation (2) below

IV.1. 3 Technical Estimation of Weighted Average Cost of Capital (WACC)

Weighted average of cost of capital is theorised as the cost of raising additional capital, with weights attached to the sources of capital, either debt or equity. The cost of capital reflects the opportunity cost of the suppliers of capital, i.e. what the investor would have lost or gained in alternative choice for investing their capital. Cost of capital is often considered a marginal cost of raising additional capital to support firm activities.

The Technical estimation of the capital structure choices of some quoted firms in Nigeria uses the Weighted-average cost of capital (WACC) methodology. This methodology is based on the intuition that the marginal cost of raising additional capital is affected by the costs of capital and the proportion of each source of capital.

$$WACC = r_{wacc} = \left[\frac{D}{V} r_d (1-t)\right] + \left[\frac{E}{V} r_e\right] \quad (5)$$

Where

rd = the before tax marginal cost of debt
re = the marginal cost of equity
t = the marginal tax rate
D = the market value of debt
E = the market value of Equity

V = D + E

The operational intuition behind weighted average cost of capital is that it is the combined rate at which firms repay borrowed capital, given that firms rely on either debt or equity financing to raise needed capital for its operation. This rate is often predetermined and used to forecast possible returns to investment and firm performance to warrant commitment to such borrowed

funds for operations. Two important variables are crucial when computing WACC, they are; the marginal tax rate for debt instruments and the market risk premium for equity financing. Simplifying Equation (4) for calculating WACC, we obtain the following formular:

$$WACC = (WD \times rD) + (WE \times rE) \quad (6)$$

where;

WD = Weight of debt instruments
rD = Marginal tax rate
WE = the weight of equity instruments, and
rE = the market risk premium.

Adding to the tax shield to the calculation of the debt component yields the following formular

$$WD \times rD\ (1- T) + WE \times rE \quad (7)$$

Notably, both equity and debt financing come with costs, however, if the firm uses its own funds the return is the interest you would have earned had it been employed in some other investments.

Table 3: Weighted Average Cost of Capital of some Quoted Firms in Nigeria 2010-2015

Firms	2010	2011	2012	2013	2014	2015
Zenith	2.00	1.58	1.41	2.31	3.67	3.26
FBN	4.81	4.96	3.29	5.08	5.46	5.46
GTB	7.72	6.52	5.44	5.49	5.10	4.69
ACCESS	2.21	2.03	4.49	4.60	6.32	4.64
DANCE	11.50	12.00	10.00	10.00	10.00	12.90
NESTL	1.40	5.00	7.80	6.60	7.00	9.50
FML	15.00	12.47	12.00	12.00	14.50	10.90
NBL	12.50	12.50	12.50	11.70	12.00	12.00
CON	18.00	17.50	17.00	17.00	17.50	17.75
FTO	9.87	15.18	17.50	16.75	18.26	18.12
TRANS	15.00	16.00	16.50	16.50	17.00	16.00

Source: Authors calculation based on data using Equation (7)

Therefore the overall cost of doing business depends on how that firm financing is allocated between debt and equity instruments, as well as the specific cost of each of them.

IV.2 Methodology and Data

IV.2.1 Methodology

In order to capture the specific effects of capital structure choices of the selected firms on monetary policy, we specify a fixed effect or least squares dummy variable (LSDV) panel data model of the form:

$$Y_{it} = a_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \mu_{it} \quad (8)$$

Where Y was a vector of dependent variables of firm performance measures, namely; profit after tax (PAT), earnings per share (EPS), return on equity (ROE) and return on assets (ROA) and a was the intercept; subscript i represented individual firms; while subscript t was the time period; and β was the coefficients and u was the error term. X_1 was a vector of capital structure disaggregated into cost of equity (COE), cost of debt (COD) and weighted average cost of capital (WACC), X_2 was vector of GDP and monetary policy variables of inflation and interest rates, and X3 was a vector of monetary policy stance (i.e. tight, neutral or loose) in the five year period of the study.

The choice of fixed effect or LSDV panel regression model was to capture the heterogeneity of the impact of the choice of capital structure on the individual firms and how macroeconomic variables and monetary policy stance influenced such choices or otherwise. In other words, the LSDV model captured all effects that were specific to candidate firms using dummy constants. It allowed for interpretation of the results to reflect individual firms preferred choice of capital structure options in funding their operations.

Equation 8 could also be specified in matrix algebra of the form:

$$Y = D_{\alpha} + X\beta^{i} + \mu \qquad (9)$$

Where, Y = was the dependent variable and D represented the dummy variables and X was the vector of other variables, while β was the coefficients of the variables and μ the error term, as represented in the Equation 9:

$$Y = \begin{bmatrix} Y_1 \\ Y_2 \\ Y_3 \\ Y_n \end{bmatrix}, \quad D = \begin{bmatrix} D_1 \\ D_2 \\ D_3 \\ D_N \end{bmatrix}, \quad X = \begin{bmatrix} X_{11} \\ X_{21} \\ X_{31} \\ X_{N1} \end{bmatrix}, \text{ While } \alpha = \begin{bmatrix} a_1 \\ a_2 \\ a_3 \\ a_N \end{bmatrix}, \text{ and } \quad \beta = \begin{bmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_N \end{bmatrix}$$

Where, Y represented different firm performance indicators, D is the dummy variables vector, which allowed different group-specific estimates for each of the constants for different firms in the study. To allow the subscript t to vary among firms, d a Panel Regression model was specified with differential intercept dummies of the form:

$$Y_{it} = \varphi_1 + \varphi_2 D_{2i} + \varphi_3 D_{3it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \mu_{it} \qquad (10)$$

Where D_1=0 if the observation belongs to firm one or otherwise. One dummy variable was dropped from the number of companies worked with, to avoid dummy variable trap, while the omitted dummy variable took the intercept of the dropped dummy variable as recommended in the dummy variable trap literature.

To consider the implication of monetary policy stance on the variables under consideration, time dummy variables were introduced into the standard panel VAR model in Equation (10). In that

case, capital structure choices were assumed to be influenced by variations in monetary policy stance, across time and, thus captured the panel regression model as follows:

$$Y_{it} = \varpi_1 + \varpi_2 D1 + \varpi_3 D2 + \sigma_0 + \sigma_1 DumTime + ...\sigma_n DumTime + \beta_2 X_{2i} + \beta_3 X_{3i} + \mu_{it} \quad (11)$$

Where, Y represented the dependent variable of firm performance, D1 and D2 stood for the firms, dummy time (*DumTime)* as the time variable that captured monetary policy stance, while X represented a vector of independent variables, including cost of equity, cost of debt, inflation and interest rates, while β represented the coefficients of the X variables and μ was the error term.

IV.2.2 Data

The data for firm performance indicators, such as profit after tax (PAT), earnings per share (EPS), return on equity(ROE) and return on assets (ROA) were obtained from the Annual Reports and Statement of Accounts of the various firms spanning 2010 to 2015. Data on cost of equity (COE), cost of debt/bonds (COD) and weighted average cost of capital were computed from these data. The macroeconomic variables such as inflation (INF), GDP and risk free interest rates of 180-day government debt instruments were taken from the Central Bank of Nigeria Statistical Bulletin (several years), while the monetary policy rate was obtained from monetary policy communique of Central Bank of Nigeria from 2010-2015. Some of the variables, such as firm performance measures and macroeconomic variables were averaged over five-years to control for the impact of business cycles on the results of the estimates.

IV.2. 3 Panel Unit Root Test

The Panel unit root test conveys information about the long-run relationship among the variables, especially between the dependent and independent variables in the model. In this study, the Levin and Lin (1992) test of panel unit root test was adopted, of the form:

$$\Delta Y_{i,t} = a_i + pY_{It-1} + \sum_{k=1}^{n} \phi_k \Delta Y_{i\,t-k} + \varphi_i t + \varpi_t + \mu_{it} \quad (12)$$

The strongest property of the Levin and Lin panel unit root test is that it allows for two way fixed effects identification, i. e. one coming from the individual intercept of a_1 and the other from time factor of φ_t. These specific notations boost the ability of the model to capture heterogeneity of the impact of the variables on individual firms under study.

Another important panel unit root test was the Pasaran and Shin (1997) test, which provided separate estimations for each firm (i) and allowed for different estimations of the parameter value, the residual variance and their lag lengths (Asteriou and Hall, 2007). The model took the form:

$$\Delta Y_{i,t} = a_i + p_i Y_{i,t-1} + \sum_{k=1}^{n} \phi_k \Delta Y_{i,t-k} + \varphi_i t + \mu_{it} \quad (13)$$

It is important to note that Pasaran and Shin (1997) based their model on the restrictive assumption that time constant should be the same for all panels. The most important implication of this test is that it requires an estimation of a balanced panel.

IV.2.4 The Hausman Test

The choice of whether fixed effect or random effect test is appropriate for estimating the panel model was resolved through the Hausman test approaches. Hausman (1978) developed a test, which was based on the assumption of no correlation between the variables, and, under such circumstances, concluded that ordinary least squares approach was insufficient to determine whether or not the regressors are correlated with the individual (mostly unobserved) effects. More importantly, the advantage of the use of fixed effect estimator is its relevance in the presence of correlation between the regressors and the observable individual heterogeneity. The Hausman test helps to identify which model is appropriate in the circumstance.

V. Presentation of Empirical Results

Table 4 presented the results of the panel unit root test. The Table indicated that all the variables were stationary at levels, while the results of the first difference test without time trend showed that cost of debt/bond was above 5 per cent threshold for stationarity. This confirmed existence of long-run relationship between the variables under study.

Table 4: Panel Unit Root Test Results

	Level		First Difference	
Variables	**Levin and Lin**	**Pasaran and Shin**	**Levin & Lin**	**Pasaran and Shin**
EPS	I(0)	I(0)	I(1)	I(1)
PAT	I(0)	I(0)	I(1)	I(0)
ROE	I(0)	I(0)	I(1)	I(0)
ROA	I(0)	I(0)	I(1)	I(0)
COD	I(0)	I(0)	0.0529	0.0850
COE	I(0)	I(0)	I(1)	I(0)
WACC	I(0)	I(0)	I(1)	I(0)
GDP	I(0)	I(0)	I(1)	I(1)
INF	I(0)	I(0)	I(0)	I(1)
INT	I(0)	I(0)	I(0)	I(1)

Note: EPS = Earnings per share, Pat = Profit after tax, Roe = Return on equity, Roa = Return on assets, COD= Cost of cebt (Bonds), Coe = Cost of equity, GDP= Gross Domestic Product, INF= Inflation and INT = risk free interest rate on bonds

V.2 Wald Test Results for Dummy Variables

Table 5 present Wald tests of coefficient restrictions on the variables of the model. From the results, F- statistics was 19.43, which was more than the critical F statistics of 3.84. The Null Hypothesis that the coefficients of the variables were the same was rejected and accepted the alternative hypothesis that suggested that coefficients of the variables were stochastic. The implication of the Wald test result revealed that the individual firm's coefficients reflected the

independent impact of the choice of capital structure and that of monetary policy rate on the capital structure on firm performance.

Table 5: Wald Test Results for the Dummy Variables

Test Statistics	Value	df	Probability
F-Statistics	19.43799	(10,47)	0.0000
Chi-square	194.3799	10	0.0000

Note: Null Hypothesis : C(8)= C(9) = C(10)= C(11) = C(12)= C(13) = C(14) = C(14) = C(15)= 0

V.3 Hausman Test Results

The Hausman test results in Table 6 rejected the Null hypothesis that the Random effect model was appropriate and accepted the alternative that random effect was inappropriate and, therefore, supported the fixed effect model, given that the Chi-square statistics was very significant and the probability value was far less than 5 per cent threshold.

Table 6: Hausman Test

Test Summary	Chi-Sq. Statistics	Chi-sq. d.f	Probability
	10.403	3	0.0154

Table 7 presented the results of the least squares dummy variable model on the impact of the various capital structure choices on firm performance. The results indicated that the coefficients of cost of debt, cost of equity, weighted average cost of capital (WACC) and inflation were significant and appropriately signed. Specifically, in column (1), the coefficient of cost of debt/ bonds (COD) was significant but negative at 1 per cent, while that of cost of equity was significant but negative at 5 per cent. The weighted average cost of capital (WACC) was also positive and significant at 5 per cent, while inflation was negative but significant at 1 per cent.

Table 7: Benchmark estimates with Capital Structure Options, Macroeconomic Variables and Firm Performance Measures: Whole Sample

	EPS	**PAT**	**ROE**	**ROA**
Variables	**(1)**	**(2)**	**(3)**	**(4)**
COD	-0.553*** (0.167)	-4.080 (2.133)	1.419 (1.560)	0.302 (0.560)
COE	-0.205** (0.092)	1.278 (1.223)	0.291** (0.880)	-0.427 (0.316)
WACC	0.357** (0.102)	5.534 (1.206)	1.776* (0.882)	-0.171 (0.316)
INT	-0.181 (0.094)	2.821*** (1.073)	0.737 (0.785)	0.213 (0.282)
INF	-0.656 ** (0.157)	4.942** (1.786)	2.593** (1.306)	-0.762** (0.469)
GDP	-0.232 (0.177)	-1.452 (1.870)	1.045 (1.368)	0.419 (0.492)

Note: *, **, and *** indicated significance at 10, 5 and 1 per cent respectively; standard errors are in parenthesis. The dependent variables were firm's measure of profitability.

On the other hand, in column (2), profit after tax (PAT), as a measure of firm's profitability, showed high coefficient of cost of debt/bonds (COD), cost of equity (COE) and weighted average cost of capital had high coefficients but insignificant. However, inflation was significant at 1 per cent but wrongly signed.

Column (3) with return on equity as the dependent variable, cost of debt was significant but wrongly signed, while cost of equity was positive and significant at 5 per cent. Inflation was significant at 5 per cent but wrongly signed. Column (4) with return on assets had inflation highly significant at 5 per cent but was wrongly signed. Therefore, for this study, the most appropriate measure of firm performance was the earnings per share.

Table 8 revealed the results of the baseline estimation, which adopted earnings per share (EPS) as the most appropriate measure of firm performance. It is important to note that in dummy variable models, such as LSDV, which was used in this study, negative signs were theoretically appropriate (See Asteriou and Kavetsos, 2003).

Column (1) in Table 8 indicated that cost of debt/bonds, cost of equity and weighted average cost of capital were all significant but negative at 5 per cent. In addition, the coefficients of inflation and interest rates were also significant and appropriately signed, while monetary policy rate (tight) remained significant, but not properly signed. The impact of monetary policy rate (neutral and loose) remained ambiguous, as the coefficients were high but were wrongly signed and insignificant.

In Column (2), the cost of debt/bonds in most firms in the banking sector were statistically significant but wrongly signed, indicating that the effect of debt/ bonds on the capital structure of banking sector was ambiguous. However, the cost of equity was significant and appropriately signed, which indicated that banks reliance on equity funding impacted their equity more than debt. The Weighted average cost of capital, for most firms in the banking sector are significant and properly signed indicating that the impact of cost of equity in their capital structure remained dominant. Nevertheless, the impact of interest rates, in some of the firms in the banking sector was negligible, but properly signed, while that of inflation was mixed. Monetary policy rate (tight) on capital structure of banks was not significant but properly signed, while monetary policy rate (neutral) was significant and properly signed. The effect of monetary policy rate (loose) was not significant, but properly signed in the banking sub-sector.

In Column (3), the costs of debt/bonds in three of the four firms in the manufacturing sub-sector were correctly signed, with the exception of the Dangote Cement. On the other hand, the coefficients of most of firms in the manufacturing sector had high cost equity but statistically insignificant. The overall impact of weighted average cost of capital in the manufacturing sub-sector indicated that two of the firms had their WACC significant and properly signed but the remaining two were significant but wrongly signed. However, the overall impact of macroeconomic variables in the manufacturing sector showed that interest and inflation rates were significant and properly signed in most of the sampled firms, while the overall impact of monetary policy rate (tight) was significant and properly signed. Neutral monetary policy stance is significant but not properly signed.

In Column (4), the impact of cost of debt/ bonds in the performance of oil and gas sub-sector of the economy was high but not statistically significant, while the cost of equity remained largely significant and mixed. The impact of the weighted average cost of capital on the oil and gas subsector was not straight forward, as the coefficients remained high but not statistically significant. The macroeconomic effect of inflation and interest rates were high but statistically insignificant. The effect of monetary policy rate (tight) was high but not statistically significant. However, monetary policy rate (neutral) was significant but not properly signed, while monetary policy rate (loose) was not significant but properly signed.

Column (5) presented the results of the hospitality sub-sector, which was represented by the Transcorp Hilton. The cost of debt/bonds was high and properly signed but not statistically significant, while the cost of equity was statistically significant and properly signed. Inflation and interest rates were also statistically significant and properly signed, while the monetary policy rate (tight and neutral) were statistically significant and properly singed. The impact of monetary policy rate (loose) was statistically insignificant and not properly signed.

Table 8: Baseline Estimation with Capital Structure Options, Monetary Policy Variables, Monetary Policy Rate (Tight, Neutral and Loose) and Firm Performance: Whole Sample and Sectoral Sub-Samples

	Whole Sample (1)	**Banking Sector (2)**				**Manufacturing Sector (3)**				**Oil and GAS (4)**		**Hospitality (5)**
		EPS				EPS				EPS		EPS
Variables		**ZENITH**	**FBN**	**GTB**	**ACCESS**	**DAN**	**NEST.**	**FML**	**NBL**	**CON**	**FORTE**	**TRANS**
COD	-0.121** (0.244)	-17.639 (5.914)	2.273* (2.089)	-2.256 (2.405)	-3.554 (2.393)	-0.039 (2.712)	- 10.917* (2.456)	-0.453* (3.034)	-0.661* (3.045)	2.667 (4.030)	6.868 (4.816)	-3.490 (3.994)
COE	-0.281** (0.161)	-0.621* (0.082)	5.231* (2.068)	4.231* (0.085)	4.261** (0.634)	-3.092* (1.203)	-15.023 (0.354)	-2.841 (1.012)	-0.823 1.232	-3.208* (2.731)	3.013 (0.172)	-2.312* (0.631)
WACC	0.192* (0.155)	3.071 (0.563)	3.129* (0.721)	2.891* (0.642)	2.010 (0.321)	0.921* (0.101)	3.012 (1.292)	2.563* (0.891)	0.912 (1.920)	0.421 (3.021)	0. 702 (0.317)	0.721 (0.561)
INF	-0.581** (0.244)	-0.321* (0.121)	-0.203* (0.812)	2.043 (1.091)	2.011 (2.031)	1.067* (2.060)	2.019* (1.026)	-0.621* (0.062)	0.345 (1.072)	2.015 (0.241)	0.231 (2.032)	-3.402* (1.321)
INT	0.105* (0.157)	-2.612 (0.142)	2.014 (0.321)	0.102 (2.032)	0.231 (0.381)	2.013* (4.091)	0.141* (2.013)	2.067* (2.081)	3.017 (2.042)	-1.021 (2.051)	-3.215 (0.318)	2.019* (2.064)
GDP	-0.289 (0.335)	-0.021 (2.089)	2.076 (3.212)	0.321 (0.486)	1.069 (2.307)	2.075 0.921)	-3.121 (0.921)	1.076 (0.326)	-3.232 (1.072)	2.085 (0.521)	-3.242 (2.031)	-3.211 (0.721)
MPR (TIGHT)	-1.396* (1.06)	- 0.231 (0.521)				- 3.021*** (0.212)				0.351 (3.012)		-0.920* (0.123)
MPR (NUETRAL)	3.490 (3.99)	2.073* (2.081)				2.001 (0.021)				0.023** (1.203)		1.203* (0.071)
MPR (LOOSE)	0.031 (0.623)	-0.002 0.233				0.011 (2.901)				-0.001 (2.901)		0.011 (3.013)

VI. Findings and Conclusion

In this study, we evaluated the implications of macroeconomic and monetary policy of the relative cost of debt/ bonds and cost of equity on firm performance in Nigeria, using panel least squares dummy variable methodology (LSDV). Dummy variables were used to capture the impact of monetary policy stance on the choice of capital structure by quoted firms in Nigeria. The firms were further disaggregated into sectors and evaluated the sectoral-specific impact of the cost of capital choices on firm performance, within a given macroeconomic environment and different monetary policy stance. The study found that firms cost of debt and cost of equity were sensitive largely to macroeconomic variables and monetary policy stance, during the period under review. However, firms that sourced their capital from debt market were more sensitive to macroeconomic and monetary policy action of the Central Bank of Nigeria than those that source for their capital externally. The impact of tight monetary policy stance on banking sector choice of capital structure was ambiguous.

On the other hand, the impact of the cost of capital structure choices on oil and gas sub-sector was mixed. In the manufacturing sub-sector, the cost of debt impacted firms' performance more than cost of equity. The manufacturing sub-sector cost of debt was highly sensitive to macroeconomic and monetary policy stance, indicating that their capital structure choices were more sensitive to cost of debt than that of the banking and oil and gas sub-sectors. The possible reasons for this may not be unconnected to the fact that oil and gas firms source their funds majorly from off-shore sources. The cost of debt impacted the hospitality sector more than the cost of equity, compared with other sectors in the study. From the results, the following policy implications were derived and consequent policy recommendations made.

VI.1 Policy Implications

a. Monetary policy impact on firms performance were not generic but sector-specific, reflecting their cost structure in their capital structure models;
b. Earnings per share represented a more robust measure of firm performance in the Nigerian economy than profit after tax, return on equity or return on asset;
c. Firms with high cost of debt/bonds were more responsive to macroeconomic volatility than firms with higher equity costs, in their capital structure choices;
d. Tight monetary policy regimes impacted firms that had more debts/bonds than firms that relied on equity funding for their operations;
e. Costs of debts/bonds of firms that sourced their funds off-shore were less-sensitive to monetary policy decisions, compared to firms that sourced their funds in the domestic markets.

VI.2 Recommendations

a. Information on sectoral firm performance and their capital cost structure should be reflected in the economic report for Monetary Policy Committee meetings.

b. Monetary policy decisions should be sensitive to developments in the manufacturing and hospitality/services sub-sectors than the banking and oil/gas sub-sectors, whose capital structure choices emphasise off-shore capital sources than the domestic credit market.
c. Intervention schemes should be targeted at firms that are prone to negative impact of monetary policy decisions, due to their reliance on the domestic capital market for their funding requirements.

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