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Empirical Estimation of Optimal International Reserves for Nigeria: The Sudden Stop Model

Sanni, G. K., Olusegun T. S. and Sani Z.*

Abstract

The study examined the issue of optimum external reserves for Nigeria during 2010 – 2014, using Jeanne and Ranciere (2006) and Goncalves (2007) sudden stop model approach. The study showed that resident foreign currency deposit accounted for over 90 per cent of the total foreign currency deposit, while non-resident foreign currency deposit accounted for the remaining. The result of the model suggested that external reserves were adequate in 2010 but beyond that period, it was far below optimal level. On average, the optimum external reserves were around 15.7 per cent of GDP in the past four years, translating to US\$54.52 billion.

Keywords: Optimum Reserves, Sudden Stop, Capital Flow, Foreign Currency Deposits

JEL Classification Numbers: F31 and F320

I. Introduction

Globally, central banks aim at holding optimum level of external reserves because of its implications for capital flows, trade and exchange rate stability. Optimum reserves is the level of reserves that ensure stability in domestic currency in the event of global economic shocks, which could be financial crises, terms of trade shock and sudden capital flow reversal. Optimal reserves vary from country to country, depending on the structure, stage of economic development as well as the level of economic and financial integrations of such economies. Thus, countries whose economies are externally-driven and well-integrated into the global economy would need to build more reserves to be able to absorb shocks than a closed economy. Based on the foregoing, an optimal level of reserves can be described as a form of insurance against external shocks emanating from natural disaster, terms of trade shocks and sudden stop in capital flow (Barnichon, 2009).

Optimum reserve is important to central banks because it creates buffer stock against crisis and serves as early warning signal to central banks to mitigate future crisis, amongst others. When a country's level of reserves is above the optimum level, the costs to the domestic economy are huge. The country is denied resources that could have been used to step up more productive investments and also, the monetary authority is saddled with the cost of managing it. However, when external reserve is below the optimum level, the

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economy becomes more vulnerable to sudden external shocks. This development could encourage speculative attack on the domestic currency, hamper trade flows, trigger capital reversal, and erode confidence in the domestic economy, which may eventually lead to currency crisis, exchange rate instability, and increased capital flight. In order to avert these costs, most central banks strive to keep optimum level of external reserves. In addition, the resilience of the economies with huge foreign exchange reserves during the global financial crisis has further strengthened the necessity for central banks to keep and ensure optimal reserves against the event of sudden shocks (Calvo et al., 2012).

An examination of the global reserves accumulation over the past decade revealed that some central banks in emerging and developing countries hold large external reserves far above what could be considered optimum¹. For example, in 2013, China, Japan, Brazil, Algeria, and Libya held external reserves of US\$3.88 trillion, US\$1.27 trillion, US\$358.82 billion, US\$201.44 billion and US\$119.71 billion, respectively. One reason for large reserves accumulation is insurance against sudden crisis². Also, the shift in the direction of capital flows from developed economies to emerging and developing markets in the last two decades contributed to huge external reserves accumulation. For example, capital flows to emerging markets in 2013 was US\$1.24 trillion and projected to be US\$1.16 trillion in 2014³. Also, sub-Saharan Africa have been one of the recipients of global capital movements, due to sustained robust growth and improved macroeconomic environment with portfolio investment accounting for the highest share of aggregate foreign capital inflow. In Nigeria for instance, portfolio investment inflow accounted for 38.1 and 70.7 per cent, in 2010 and 2012, respectively.

Portfolio investments are temporary in nature and highly volatile, for development. Therefore, the surge in portfolio investment in the past two years and dwindling trend in foreign exchange receipts from oil export have necessitated concern for the determination of optimal level of reserves in order to keep the Nigerian economy on sustainable path of growth. Previous studies on Nigeria such as Oputa (1997), Nda (2006), Abeng (2007), Onwioduokit (2008) Migap (2010) and Igue and Ogunleye (2012) did not focus on the optimal level of reserves. For instance, Oputa and Ogunleye (2010) estimated reserves

¹ Jeanne and Ranciere (2006); Goncalves (2007); Drummaon and Dhasmana (2008); Rodriguez and Funk (2012)

² Countries hold large external reserves for different reasons, including prevention of output reduction, export-led growth strategy, limitation of the behaviour of other economies, amongst others.

³ Source: IIF, IMF, National Sources.

adequacy for Nigeria but failed to establish optimal reserves threshold during the study period. This study therefore sets to fill this gap.

Nonetheless, sudden stop framework was adopted by Jeanne and Ranciere (2006) for emerging markets and established an average Reserve/GDP ratio of 10 per cent for the sample countries. The objective of this study, therefore, is to estimate optimum external reserves for Nigeria using sudden stop framework. Following this introduction is Section 2, which presents the empirical framework and review of relevant literature, Section 3 presents the synopsis and implications of capital flow for external reserves in Nigeria. Section 4 focuses on the methodology and presentation of results, while Section 5 concludes the paper.

II. Theoretical and Empirical Literature Review

II.1 Theoretical Literature Review

The framework of sudden stop was originally provided by Jeanne and Ranciere (2006) and later extended by Goncalves (2007) to accommodate economy with some degree of dollarisation. The framework is built on the assumptions of small open economy that traded one good consumed locally and abroad. The economy is also made up of two sectors, namely, private sector and the government, and that the economy is susceptible to sudden stop i.e. loss of access to external credit.

The literature contains various perspectives to the determination of optimum reserves (Jeanne and Ranciere, 2006) and Goncalves, 2007) model. We employ Jeanne and Ranciere (2006) sudden stop model to derive optimal level of foreign reserves for Nigeria.

Reserves accumulation is undertaken to allow government to smoothen consumption when it is faced with financial crises. The sudden stop framework shows the link between domestic absorption, output and reserves in sudden stop scenarios. Domestic absorption could be defined as follows:

$$ASP = Y_{gdp} - TAB \quad (1)$$

Where ASP represents domestic absorption, Y_{gdp} is output, while TAB stands for trade balance.

From the balance of payments identity, TAB can be expressed as follows:

$$TAB = -FNA - NFI - \Delta RES \quad (2)$$

Where FNA stands for financial account, NFI is the net income and transfers from abroad, while ΔRES is the change in foreign reserves. A negative

$\Delta RES < 0$ implies accumulation, while a positive ΔRES ($\Delta RES > 0$) implies depletion of central bank reserves. Substituting equation (2) into equation (1), the domestic absorption ASP becomes:

$$ASP = Y_{gdp} + FNA + NFI + \Delta RES \quad (3)$$

The effect of capital reversal or sudden stop on domestic absorption is shown in equation (3). Reduction in FNA or financial account, which could be due to capital reversal, reduces domestic absorptive capacity. Reduction in domestic absorption in turn could further trigger panic withdrawal of foreign currency deposits from the banking system by residents and non-residents. This development could lead to liquidity shortage and this in turn could incapacitate the banks' ability to lend to the real sector, which may eventually result in loss of output. However, the effects on domestic absorption could be mitigated through effective use of foreign reserves by the central bank. For example, if FNA falls in equation (3), the effect on ASP could be neutralised by adjusting reserves. This can be achieved if central banks use their reserves to settle foreign currency credit lines that are not rolled over. If unfavourable, this poses significant risks.

II.2 Theoretical Underpinning

In anticipation of risk of sudden stop of capital inflow or capital reversal, the country keeps stock of foreign exchange reserves to mitigate the effects on the domestic economy. In the event of sudden stop, the extended work of Goncalves (2007) showed that larger portion of foreign currency deposits are withdrawn from the banking sector, short-term foreign currency debts are not rolled over, output falls and the real exchange rate depreciates. Following this framework, the private sector of the economy, which represents the consumers would face the following budget constraint (Jeanne and Ranciere, 2006):

$$C_t = Yd_t + \alpha_t [L_t - (1 + r_L)L_{t-1} + P_t - (1 + r)P_{t-1} + Tg_t] \quad (4)$$

Where C_t represents domestic consumption, Yd_t stands for domestic output, α_t is the real exchange rate, L_t is the banks' short-term dollar lending to private sector, P_t represents private sector's short-term external debt and Tg_t is government transfer. The constants r_L and r stand for interest rates. The model also assumes that r is risk free whereby consumers do not default on the short-term external debt obligations. However, the banks are subject to other set of budget constraint as specified in Equation (5):

$$L_t - (1+r_L)L_{t-1} + RL_t - (1+r)RL_{t-1} = D_t - (1+r_D)D_{t-1} \quad (5)$$

Where RL_t represents banks' dollar deposits invested in risk free short-term foreign assets at r interest rate. It is a measure of banks' self-insurance against crises. The r_D is the interest rate that banks pay on dollar deposits D_t , the dollar deposit D_t is interpreted to measure precaution against sudden withdrawal of foreign currency deposits. The model further assumes that some portion of short-term foreign currency deposits are constant such that $RL_t = qD_t$, $0 < q < 1$ and that $r_D = r$. Therefore, the equation 5 becomes:

$$L_t - (1+r_L)L_{t-1} = (1-q)[D_t - (1+r)]D_{t-1} \quad (6)$$

Substituting equation (6) into (4), we derived aggregate private sector consumption that includes banking and non-financial private sectors, such that equation (4) becomes:

$$C_t = Yd_t + \alpha_t \{ (1-q)[D_t - (1+r_L)D_t] + P_t - (1+r)P_{t-1} + Tg_t \} \quad (7)$$

In order to derive the second component of consumption for the economy, i.e. government consumption, Jeanne and Ranciere (2006) framework assume that issuance of long-term security by the government is constant at price P and produces a unit of good every period until the sudden stop occurs, but seized to yield any income during sudden stop (Goncalves, 2007). Furthermore, the framework use the present discounted value of the expected future returns to derive the price of security before the sudden stop such that:

$$P = \frac{1}{1+r+\eta} [1 + (1-\kappa)P]$$

Where κ represents probability of sudden stop occurrence, η stands for the term premium and r is the short-term interest rate on short-term external debt. Solving for P , we have:

$$P = \frac{1}{r+\eta+\kappa}$$

To determine the number of security required to finance stock of external reserves R_t , number of long-term securities N_t issued by government is multiplied by P . That is:

$$R_t = PN_t$$

The framework also situates a condition where government issues short-term foreign debt Gd_t and the interest payment r on this debt is risk-free, which implies no default in payment. Then, budget constraint before the sudden stop becomes:

$$P(N_t - N_{t-1}) - N_{t-1} + Gd_t - (1+r)Gd_{t-1} = Tg_t + R_t - (1+r)R_{t-1} \quad (8)$$

Substituting N_t , N_{t-1} and P in to equation (*), government transfer to the private sector before the sudden stop is derived as follows:

$$Tg_t^{before} = Gd_t - (1+r)Gd_{t-1} - (\eta + \kappa)R_{t-1} \quad (9)$$

The expression above indicates that before sudden stop, government transfers Tg_t is an increasing function of short-term external public debt Gd_t i.e. issuance of debt can increase government transfers. However, issuance of short-term external public debt comes at a cost of holding reserves and default risk premium. The situation defers from the scenario presented in equation (9) during sudden stop, because both public and private sectors would no longer be able to issue short-term external debt. To smoothen consumption during sudden stop, government therefore would need to transfer its external reserves to consumers. However, government must still maintain the component of equation (9) $(\eta + \kappa)R_{t-1}$ which is the payment on its long-run security (Jeanne and Ranciere, 2006). In view of this, government transfer during sudden stop becomes:

$$Tg_t^{during} = -(1+r)Gd_{t-1} - (1-\eta + \kappa)R_{t-1} \quad (10)$$

During sudden stop, balance of payments crisis unfolds, leading to loss of significant proportion of output γ , a proportion of dollar deposits is withdrawn from the bank θ , and the real exchange rate, ΔRER depreciates. With these assumptions and with cognisance of scenarios in equations (9) and (10), domestic consumption before and during crisis, therefore, becomes:

$$C_t^{before} = Yd_t^{before} + (1-q)D_t^{before} + P_t^{before}T + Gd_t^{before} - (1-r)\left[(1-q)D_{t-1}^{before} + P_{t-1}^{before} + Gd_{t-1}^{before}\right] - (\eta + \kappa)R_{t-1} \quad (11)$$

$$C_t^{during} = (1-\gamma)Yd_t^{before} + (1+\Delta RER)\left\{(1-\theta)D_{t-1}^{before} - (1+r)\left[(1-q)D_{t-1}^{before} + P_{t-1}^{before} + Gd_{t-1}^{before}\right] + (1-\eta - \kappa)R_{t-1}\right\} \quad (12)$$

To determine optimum reserves, government chooses reserves that maximise consumers' welfare function, given that reserves at period t only matter for consumption at period $t+1$. Therefore, government chooses reserves that take cognisance of the probability of sudden stop, and consumers' welfare before and during crisis, such that:

$$\max (1 - \kappa).u(C_{t+1}^{before}) + \kappa.u(C_{t+1}^{during}) \quad (13)$$

The first order condition of equation (13) becomes:

$$\kappa.(1 - \eta - \kappa).(1 + \Delta RER).u'(C_{t+1}^{during}) = (1 - \kappa).(\eta + \kappa).u'(C_{t+1}^{before}) \quad (14)$$

Equation (14) shows the optimum state that equate the probability of a sudden stop multiplied by utility of reserves during sudden stop with the probability of no sudden stop multiplied by the marginal cost of holding reserves (Goncalves, 2007). Manipulating equation (14), marginal rate of substitution p_t that shows the ratio between consumption during the sudden-stop and consumption in the non-sudden-stop period is generated, such that:

$$p_t = \frac{u'(C_t^{during})}{u'(C_t^{before})} \quad (15)$$

At the optimum state, the ratio of the price of a sudden stop dollar and the price of a non-sudden stop dollar p , a proxy for liquidity premium induced by sudden stop equals marginal rate of substitution p_t i.e.

$$p_t = p = \frac{(1 - \kappa)(\eta + \kappa)}{\kappa(1 - \eta - \kappa)(1 + \Delta RER)} \quad (16)$$

Also, λ_t represent the sum of total deposit withdrawal to output λ_d , private short-term foreign currency debt λ_p to output, and public short-term foreign currency debt λ_g to output. This can be expressed thus:

$$\lambda_t = \frac{i^{before}}{Yd_t} \quad (17)$$

Where i^{before} is a set of total deposit withdrawal, private short-term foreign currency and public short-term foreign currency debt.

Substituting Equation (16) and (17) in the first order condition in Equation (14), Goncalves, (2007) derived ρ thus:

$$\rho = \lambda + \gamma + \frac{(1-\gamma)p^{\frac{1}{\sigma}}\Delta RER}{1 + \left[p^{\frac{1}{\sigma}}(1 + \Delta RER) - 1 \right] (1 - \kappa - \eta)} \quad (18)$$

$$- \frac{p^{\frac{1}{\sigma}}(1 + \Delta RER) - 1}{1 + \left[p^{\frac{1}{\sigma}}(1 + \Delta RER) - 1 \right] (1 - \kappa - \eta)} \left\{ 1 - \frac{r-g}{1+g} \left[\lambda + (1-\theta)\lambda_d \right] - (\kappa + \eta)(\lambda + \gamma) \right\}$$

It can be summarised that the optimum reserves R_t before the sudden stop is a constant proportion of output such that:

$$R_t = \rho Y d_{t+1}^{before} \quad (19)$$

The study, therefore, leverages on equation (18) as expressed in Jeanne and Ranciere (2006) to derive optimum reserves for Nigeria. The Nigerian economy satisfies the assumptions for using the Sudden Stop framework, which include small open economy that trade largely on one product; existence of two sectors (private and public sectors); and the economy is susceptible to shocks due to its reliance on one single product, whose both price and quantity are exogenously determined.

II.3 Review of Empirical Literature

Empirical studies showed that countries have diverse motives of holding external reserves (Nda 2006; Gosh et al., 2012; Benigno and Fornaro 2012). Generally, central banks hold external reserves for transactionary purpose; precaution against external shocks in the event of disruptions in the country's balance of payments; and safety in order to ensure that the economy remain financially solid at all times. Most recently, there has been an increase in the volume of literature on precautionary motive of holding external reserves, especially after the 2008/2009 global financial crisis. The crisis highlighted new sources of vulnerabilities, which underscored the importance of building external reserves in developing and emerging economies to prevent and mitigate sudden economic and financial shocks. There are different approaches, which have been adopted to estimate optimum reserves for an economy including the balance of payments, the Greenspan-Guidotti and other approaches.

II.3.1 Balance of Payments (BOP) Approach

Literature on external reserves adequacy during the 1960's mainly focused on the current account, because disruptions in the BOP came mainly from trade

flows. The most prominent measure of external reserves adequacy during that period was the ratio of external reserves to a country's import of goods and services. The measure focused mainly on current account and applied to countries with huge current account transactions and limited access/exposures to capital markets. Shocks, therefore, arise from the current account and external reserves serve as a buffer to these shocks. The approach simply measures the number of months of current import commitments a country's external reserves could cover if all other inflows cease. The IMF traditional rule of thumb is that adequate external reserves should cover three to four months of imports. It is expressed as stock of external reserves to import of goods and services (IMF, 2011).

The case for reserves to import ratio originated from Triffin (1947) who argued that the level of external reserves should be expected to grow with trade in a linear form and advocated the use of reserves/imports ratio to measure reserves adequacy. A study by the International Monetary Fund (1953) discovered that foreign trade was the largest item on the balance of payments of most countries and should, therefore, be considered in measuring external reserve adequacy. This was evidenced in the analysis of data, which showed that countries generally had external reserves/import ratio that ranged between 30 to 50 per cent. This formed the basis for the minimum of three months of import cover, which has been considered as the internationally acceptable benchmark.

II.3.2 Greenspan-Guidotti Approach

Following the Southeast Asian crisis in the 1990s, the focus on the effect of balance of payments crisis on the current account shifted to the capital and financial account. This development led to the emergence of new reserve adequacy measures, prominent among which are the "Greenspan-Guidotti" rule of 100 per cent cover of short-term debt. This measure compares the level of reserves to short-term external debt to show a country's capability of repaying its short-term debt. According to the "Greenspan-Guidotti" rule, a country's external reserves should be sufficient to cover all short-term external loan obligations without depending on external sources of funding (IMF, 2011).

II.3.3 Other Approaches

Another traditional measure of reserve adequacy is the ratio of external reserves to broad money (M_2) as highlighted in the works of Kaminsky (1999) and De Beaufort Wijnholds and Kapteyn (2001). This measure is expected to capture potential capital flight by residents and used as a precautionary indicator of financial crisis. An adequate reserve is expected to be equal to, at most, 20.0 per cent of M_2 for countries with fixed or managed exchange rate regime and 10.0 per cent for countries operating a flexible exchange rate regime.

Heller (1966) pioneered the use of international reserves demand model to measure optimal external reserves. He measured the cost-benefit of holding external reserves in terms of rational optimising decision that involves equating marginal utility of holding reserves to its marginal cost. He concluded that external reserves were held as a buffer stock to smoothen unexpected and temporary imbalances in international payments.

Frenkel and Jovanovic (1981) developed a stochastic model for determining optimal stock of external reserves based on the principles of inventory management. They estimated reserves demand elasticities with respect to macro-economic adjustment and opportunity cost for twenty-two developed countries, using time series data from 1971 to 1975. Their estimation results were consistent with their theoretical predictions. Ben-Bassat and Gottlieb (1992) noted that a drain of reserves could lead to default on external debt with subsequent output losses. Thus, it is the cost of default that must be incorporated in the trade-off against the opportunity cost of holding reserves.

Flood and Marion (2002), using the buffer stock model, noted that the model worked perfectly well in the floating exchange rate regime as it did in the era of fixed exchange rate. The IMF (2003) study on the emerging economies in Asia, used a standard buffer stock model and concluded that the rapid accumulation of reserves in emerging markets between 1997 and 2001 was broadly in line with the fundamentals of the model but the surge in reserves in 2002 and 2003 was above the level predicted by the model. The surge in reserves was driven, majorly by increases in current account and to a lesser extent by capital flows.

With the growing prominence of capital flows after the Asian crisis and the possibility of sudden stops of such flows, other studies attempted to estimate optimal reserve levels for emerging market economies. Garcia and Soto (2004) compute optimal external reserves for some East Asian economies and Chile and observed that the level of reserves were consistent with optimal self-insurance policy based on the assumption that monetary authorities accumulate reserves in order to reduce the probability of sudden stop. Aizenman and Lee (2005) examined empirically the importance of both precautionary and mercantilist motives in the accumulation of external reserves by developing countries using data from 1980 to 2000. They found the results to be consistent with the precautionary motive. Their findings also revealed that a more liberal capital account increased external reserves, because it provided opportunity for freer global capital movement. The paper noted that obtaining an optimal level of external reserves would require a more detailed model and infor-

mation, such as information on the probability and output costs of shocks, as well as the opportunity cost of holding external reserves.

Caballero and Panageas (2005) developed and estimated a quantifiable model of sudden stops to study the practical mechanisms likely to insure emerging markets against sudden stops. They argued that the addition of richer hedging instruments in central banks portfolios was likely to improve the efficiency of the mechanisms against sudden stops. Also, the authors emphasised the need for emerging market economies to increase the share of their contingent reserves. Jeanne and Rancière (2006) estimated optimal level of external reserves for 34 middle-income countries during 1975-2003, using an insurance model against sudden stops in capital flows. The model incorporated external reserves as a stabiliser of domestic consumption. They observed that the accumulation of external reserves in some Asian countries was far above what should be kept for self-defense against sudden capital flow reversal.

Gonçalves (2007) estimated the optimal international reserves by extending the work of Jeanne and Rancière (2006) to include the prudential perspective of the possibility of large foreign currency withdrawals in the period of crisis. The result was calibrated for Uruguay; a country with a highly dollarised financial sector. The results suggested that Uruguay's external reserves were close to their optimal levels and that further accumulation would be desirable.

Drummond and Dhasmana (2008) estimated optimal level of external reserves for 44 sub-Saharan African countries, using the two-good model of self-insurance against terms of trade and aid shocks with data from 1980 to 2007. The study indicated that optimal level of reserves depended on the size of the shocks, probabilities, and output cost associated with these shocks. The optimal reserve was, therefore, the one that maximised the consumption-smoothing benefits of holding reserves, while considering the related cost.

Barnichon (2009) developed an analytical framework for the quantification of optimal level of reserves for a small open economy with limited access to global finance and subject to sudden economic shocks. The study revealed that optimal level of reserves was sensitive to the parameter calibration, which implied that the use of three months import criterion for reserves adequacy might be inappropriate because of changing global conditions; such as degree of risk aversion, size and persistence of shocks, which had implications for setting optimal reserves level.

Hur and Kondo (2011) posited that reserves accumulation in emerging economies was a response to the increase in foreign debt rollover risk. The paper

argued that increase in debt rollover risk in emerging economies in the 1990s was responsible for the sudden stop in international capital flows.

Calvo et al., (2012) estimated optimal external reserves for 110 developed and developing countries, using the self-insurance model against sudden stops. The model incorporated the balance sheet effect of large foreign currency liability. The results indicated that the average observed external reserves were close to the optimal reserves and that the choice of optimal external reserves levels by individual countries was driven by country specific factors.

There are other studies that attempted to estimate external reserves adequacy for Nigeria. For example, Oputa and Ogunleye (2010) estimated optimum level of reserves for Nigeria during the period 1992-2009, using the Shcherbakov (2002) model. The result revealed that before 2006, the actual levels of external reserves were below the estimated adequate levels by an average of US\$19.56 billion. However, from 2006 to 2009, the actual stock of external reserves exceeded the optimum levels by US\$9.1 billion, US\$15.4 billion, US\$2.6 billion and US\$0.7 billion in 2006, 2007, 2008, and 2009, respectively. The study concluded that the reserves accumulation during the period was in line with global trend, especially in emerging economies but could not be adjudged to be sufficient.

Moreover, Abiola and Adebayo (2013) examined the reserves adequacy in Nigeria using the traditional approaches of external reserves adequacy. They concluded that Nigeria's foreign reserve was adequate, based on international benchmarks of import cover and debt based measures. Udo and Antai (2014) examined the opportunity cost of Nigeria's external reserves using OLS. The study found that the accumulation of external reserves impacted negatively on investment and economic productivity in Nigeria. The paper recommended de-accumulation of external reserve with a view to channeling additional foreign exchange into productive investment. Tule et al., (2015) examined the optimal level of international reserves for Nigeria. The study found the external reserves to be optimal between 2008Q1 and 2010Q4. They, however, noted that the average core reserve available to the economy was insufficient to absorb the adverse economic impact of financial crises, if they occur in future. Irefin and Yaaba (2012) estimated the determinants of foreign exchange reserves in Nigeria, using an Autoregressive Distributed Lag (ARDL) approach to modify the Frenkel and Jovanovic (1981) 'Buffer Stock Model'. The study found strong evidence in support of income as a major determinant of external reserves management in Nigeria.

These studies on Nigeria, however, did not consider optimal reserves level under a sudden stop scenario. The study intends to fill this gap through the application of sudden stop framework by Jeanne and Rancière (2006) and Gonçalves (2007) to Nigeria specific conditions.

III. Synopsis of Foreign Capital Inflow and External Reserves in Nigeria

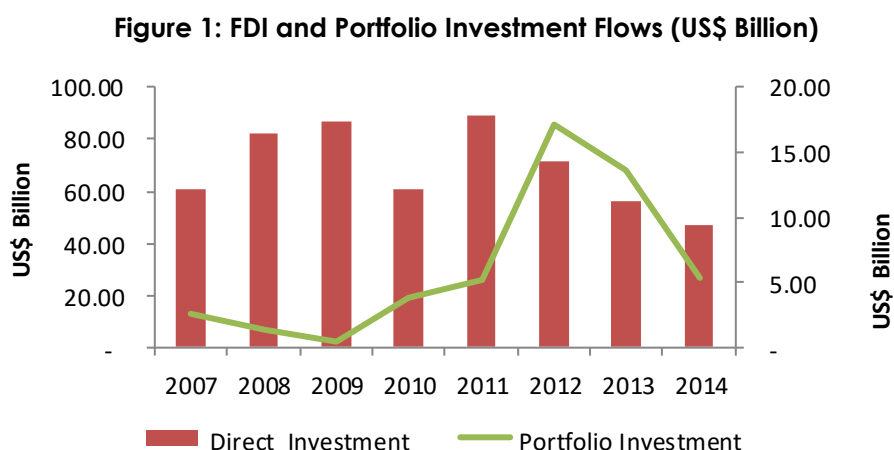
The stylised facts on foreign capital inflows and external reserves in Nigeria are presented, thus:

III.1 Capital Inflow

Foreign capital inflow to Nigeria is composed of foreign direct investment (FDI), portfolio investment (PI) and other investment liabilities, which comprised of foreign currency deposits and trade credits, among others. Aggregate foreign capital inflow to Nigeria, which averaged US\$10.07 billion between 2007 and 2010 increased to an average of US\$19.98 billion during 2011 to 2014. The improved inflow of foreign capital to the country was attributed to policy consistency, occasioned by coherence between the fiscal and monetary policies, macroeconomic stability and attractive rate of return on domestic financial assets.

Out of the total capital inflow, FDI averaged US\$7.27 billion and accounted for 72.2 per cent of total flows, while portfolio investment averaged US\$2.06 billion and accounted for 20.5 per cent of total flow between 2007 and 2010. Other investment inflow in form of loans accounted for the balance. The average share of portfolio investment inflow into domestic equity and debt markets increased significantly to US\$10.33 billion between 2011 and 2014, accounting for 51.7 of total, while FDI inflow at US\$6.59 billion accounted for 33.0 per cent of total. The dominance of portfolio inflow, sometimes regarded as 'hot money', has created fear of capital reversal and exchange rate volatility, given the experiences of Asian countries in the 1990's and most industrialised nations during the global financial crisis of 2008-2009. For example, the global economic crisis of 2009 triggered large capital outflow from Nigeria, which was reflected in the draw down on external reserves of about US\$12.00 billion. Thus, the reserves fell from US\$62.08 billion in September, 2008 to US\$50.04 billion in 2009.

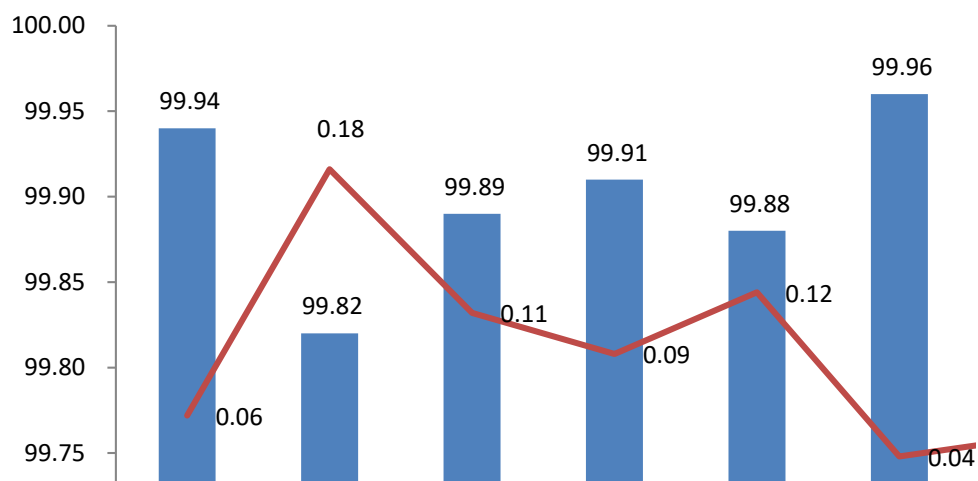
Analysis of other investment inflows, particularly foreign currency deposits, revealed that resident foreign currency deposit as a percentage of total foreign currency deposit remained over 99 per cent throughout the period while that of non-resident foreign currency deposit was less than 1 per cent during the same period as indicated in Figure 2.



Source: CBN

Nigeria experienced sudden stop in capital inflow between 2008 and 2009. This was traced to a number of factors, which included the adverse impact of global financial crisis on developed economies that hindered access to international capital market; the collapse of the oil market, which affected investment in the Nigerian oil sector; and the lack of coherent and clear policy direction, which discouraged the growth of both domestic and foreign investment. Consequently, foreign reserves went down by 20.0 per cent to US\$42.38 billion in 2009. The declining trend persisted till end-December, 2014 at US\$34.24 billion. This development led to the continual depreciation of the average nominal exchange rate from N118.53/US\$1.00 in 2008 to N148.90/US\$1.00 in 2009 and further to N169.68 /US\$1 in 2014.

Figure 2: Resident and Non-Resident Foreign Currency Deposit (Share of Total Foreign Currency Deposits)



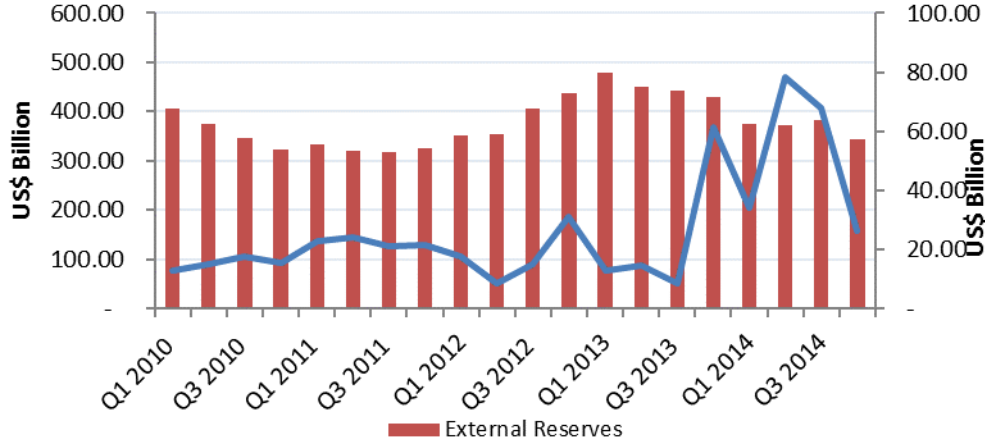
Source: Authors' computation

III.2 External Reserves

Nigeria increased its external reserves from US\$9.39 billion in 2000 to US\$16.96 billion, US\$28.28 billion and US\$42.30 billion in 2004, 2005 and 2006, respectively, and peaked at US\$53.00 in 2008. The accumulation was driven majorly by receipts from oil exports, occasioned by increase in the oil prices at international oil market. At the inception of global economic crisis in 2009, the external reserves stood at US\$42.38 billion, but dropped to US\$32.33 billion in 2010. However, in 2012, the reserves further increased to US\$43.83 billion but declined by 21.9 per cent to US\$34.24 billion at end-December, 2014. The decline in external reserves was attributed to global dynamics, which led to crash in oil prices and sharp drop in foreign exchange inflow.

III.3 Relationship between External Reserves and Capital Flow in Nigeria

External reserves have been identified as one of the pull factors for attracting capital flow to an economy. Choi et. al., (2007) examined the interaction between capital flows and international reserves holdings in the context of financial integration. The authors noted that capital flow was sensitive to international reserve holdings. Alberola et. al., (2014) described external reserves as stabiliser of international capital flows, in particular during period of global financial stress. These views are applicable to Nigeria. There is no gainsaying in the fact that capital flow has influenced the growth pattern of Nigeria's external reserves over the past five years. This is because capital flow surges tend to stem foreign exchange demand pressure which culminates in growing external reserves. Also, in recent times, short-term capital flow reversal has contributed to declining external reserves in Nigeria.

Figure 3: External Reserves and Capital Inflow (US\$ Billion)

Source: CBN

IV. Data, Methodology and Results

IV.1 Data and Data Source

The data used for this study were generated from two sources, namely, CBN database and some calibrated variables from past studies. The CBN data is from 2010 to 2014 because the rebased GDP only exists for these periods.

IV.2 Model Specification

We applied the formula for optimum reserves specified in Equation (18) of Section 2, using the variables in Table 1 and calibrated parameters in Table 2.

$$\rho = \lambda + \gamma + \frac{(1-\gamma)p^{\frac{1}{\sigma}}\Delta RER}{1 + \left[p^{\frac{1}{\sigma}}(1 + \Delta RER) - 1 \right] (1 - \kappa - \eta)}$$

$$- \frac{p^{\frac{1}{\sigma}}(1 + \Delta RER) - 1}{1 + \left[p^{\frac{1}{\sigma}}(1 + \Delta RER) - 1 \right] (1 - \kappa - \eta)} \left\{ 1 - \frac{r-g}{1+g} [\lambda + (1-\theta)\lambda_d] - (\kappa + \eta)(\lambda + \gamma) \right\}$$

IV.3 Estimation Procedures

The estimation of optimum reserves for Nigeria was leveraged on Jeanne and Ranciere (2006) model, which held the following assumptions during sudden stop: that banking system would lose larger fraction of foreign currency deposits, short-term foreign currency debt was not rolled over; real exchange rate depreciates and output falls.

Table 1: Variable Parameters

Variable Parameters (%)	2010	2011	2012	2013	2014
Residents' Foreign Currency Deposits/Total foreign currency deposits (RD)	99.91	99.88	99.96	99.95	99.79
Non-Residents' Foreign Currency Deposits/Total foreign currency deposits (NRD)	0.09	0.12	0.04	0.05	0.21
Banks' liquid Foreign assets/Foreign Currency Deposits	196.19	164.87	87.63	86.06	86.62
Private sector short-term foreign currency debt/GDP λ_p	0.001	0.003	0.008	0.008	0.012
Total Foreign Currency deposit/GDP λ_d	0.007	0.008	0.024	0.017	0.025
Public sector short-term foreign currency debt/GDP λ_g	0.006	0.005	0.016	0.009	0.013

Source: Authors' Computation

In calibrating the parameters, we adopted standard assumptions used in most studies, such as Jeanne and Ranciere (2006) and Goncalves (2007), for developing countries. We set risk aversion parameter σ at 2, number mostly adopted in business cycle literature. The risk free rate of 5 per cent was adopted, which was derived from average of US 3-month Treasury bill rates, mostly adopted on studies for developing countries. We assumed 6 per cent growth potential for Nigeria, using average of real growth for the past five years. Based on the recent experience in Nigeria during global financial crisis where real exchange rate depreciated by around 20.0 per cent, we assumed the same level of depreciation in the future occurrence of sudden stop. For the term premium, 1.5 per cent was assumed as in other studies for developing countries (Jeanne and Ranciere, 2006; Goncalves, 2007). The term premium is usually derived from differences between averaged yields on 10 year US Treasury bond and the federal fund rate in the last 20 years as in most studies for developing countries.

Table 2: Fixed Parameters

Fixed Parameters	In Per cent
Coverage of non-residents' deposits (NRD)	1.00
Coverage of Residents' deposits (RD)	0.70
Accumulated output loss (γ)	0.10
Probability of sudden stop (κ)	0.08
Term premium (η)	0.02
Risk-free rate (r)	0.05
Risk aversion (σ)	2
Real exchange rate depreciation(ΔRER)	0.20
Long-run GDP growth rate(g)	0.06

Source: Authors' Computation

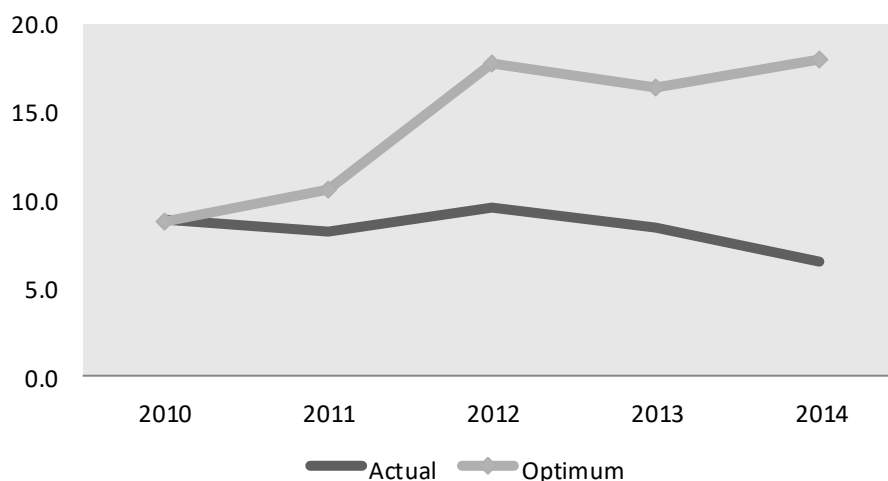
We further assumed that 100.0 per cent of non-residents' currency deposits by official reserves and banks' liquid foreign assets would be covered in the occurrence of sudden stop to insulate the domestic economy from the sudden withdrawals by non-residents. However, we also assume that residents would withdraw about 70.0 per cent of their foreign currency deposits during sudden stop. In terms of output loss during crisis, we assume that only 10.0 per cent of output would be lost.

IV.4 Model Results

The result of the calibrated model for Nigeria was reported in Table 3 and Figure 4. The results showed that the optimum reserve in 2010 was 8.4 per cent of GDP almost at the same level with 8.9 per cent for the actual level of reserves. However, the actual reserves fell slightly below the optimum reserves by 2.4 percentage point in 2011. The result further suggested that from 2012, the actual reserves were far below optimal levels. On average, the optimum reserve was around 15.7 per cent of GDP in the past four years, translating to optimum reserves of US\$54.52 billion. However, the actual level of reserves was US\$28.56 billion as at end-May, 2015, indicating that the actual level of reserves was far below the trigger or optimum level in Nigeria.

Table 3: External Reserves (% of GDP)

	Actual Reserves	Optimum Reserves
2010	8.9	8.4
2011	8.2	10.6
2012	9.6	17.7
2013	8.4	16.4
2014	6.5	18.0

Figure 4: External Reserves as a Percentage of GDP

IV.5 Discussion of Results/ Policy Implication

These findings have some policy implications for Nigeria. Given the current level of exports in Nigeria, with an average official foreign exchange inflow of US\$3.88 billion per month in 2014, there is the need to review foreign exchange policies and further eliminate some non-essential import items from interbank funding. Also, the CBN should reduce the frequency of its interventions at the interbank. These policies would generate net official inflow of about US\$1.2 billion every month and would bridge the gap between current actual and optimum external reserves in Nigeria within one year, ten months. Therefore, CBN should intervene occasionally in the interbank market and the foreign exchange supply base enhanced through addressing the challenges to economic and export competitiveness.

V. Conclusion

The study has estimated optimum external reserves for Nigeria during 2010 – 2014, using Jeanne and Ranciere (2006) model of sudden stop, which was later modified by Goncalves (2007). The study showed that resident foreign currency deposit accounted for over 90 per cent of the total foreign currency deposit, while non-resident foreign currency deposit accounted for the balance. The study also showed that non-resident foreign currency deposits, which is the most vulnerable during sudden stop era, is small in Nigeria. However, there has been an increased private sector participation in short-term foreign currency debt. The result from the estimated model suggested that external reserve was adequate in 2010 but beyond that period, it was far below optimal levels. On average, the optimum reserve was around 15.7 per cent of GDP for the past four years, translating to optimum reserves of US\$54.52 billion.

These findings have some policy implications for Nigeria. Given the current level of exports in Nigeria, which has generated average official foreign exchange inflow of US\$3.88 billion per month in 2014 despite falling oil prices, there is the need to review foreign exchange policies to further eliminate some non-essential import items from interbank funding. These policies could generate net official inflow of about US\$1.2 billion every month, which is barely sufficient to bridge the gap between actual and optimum external reserves. This would help to ensure exchange rate stability and increase confidence against sudden stop.

The estimated optimal reserves of US\$54.52 billion implies that the government has to be fiscally prudent to keep the economy afloat and immune from global economic shock, largely manifested in capital flow reversal from developing countries such as Nigeria. Also, at this level of reserves, foreign investors would be willing to invest in Nigeria, since the country has enough buffer to withstand sudden repatriation of capital.

In conclusion, to ensure sustainable optimal level of reserves, monetary authority should revisit its foreign exchange management policies by intervening occasionally in the foreign exchange market in order to grow the reserves over and above the optimal level. In addition, the supply base could be enhanced by focusing on growing the non-oil sector and tackling the challenges to export competitiveness by drastically reducing high cost of doing business in Nigeria. By so doing, the Nigerian economy will be less vulnerable to external shocks.

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Economic Growth, Poverty and Income Inequality Matrix in Nigeria: A Further Investigation

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Abstract

This paper examined the existing relationship among economic growth, poverty and income inequality in Nigeria. Using the Vector Auto-regressive (VAR) model and the Engle-Granger technique to test for the causality existing among the variables, the results revealed that economic growth had no impact on poverty reduction and income distribution in Nigeria due its non-inclusive nature. There was, however, evidence of a unidirectional causality, running from income inequality to increased poverty. This implied that inequality would lead to increase in poverty in Nigeria. Therefore, the paper recommended that government should develop stronger economic institutions that are capable of reorganising the productive base and reward system in the economy so as to promote and guarantee economic efficiency, equity and macroeconomic stability and inclusive growth.

Keywords: Variance Decomposition, Impulse Response Function, Equity, Macroeconomic stability

JEL Classification: C51, D63, I32, O43

I. Introduction

Economic growth and development are among the main macroeconomic objectives pursued by most developed and developing nations of the world. The debate about whether growth precedes development or development leads to growth appears to have been settled around the priorities and stages of development of nations, while the distributional effects of both remained largely unsettled in the literature. For a developing country like Nigeria, achieving sustainable growth that promotes employment and poverty reduction is a justifiable purpose given the increasing incidence of poverty in the midst of natural resource endowment of the country. Consequently, the Government over the years initiated series of reform programmes aimed at promoting job and wealth creation with the ultimate objectives of boosting economic growth, reducing poverty and narrowing income inequality in the system.

The overriding philosophy is that increased output is expected to reduce poverty and narrow the gap between the rich and the poor. The channel runs through increased output and income to the redistributive impacts of eco-

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conomic expansion by way of economic rent to the agents of production. In the literature, however, several schools of thought have emerged within different ideological perspectives on the nature of relationship existing among economic growth, poverty and income inequality. Some argued that economic expansion leads to increase income, which ultimately reduces poverty and inequality (Aghion, Carol and Garcia-Penalosa, 1999). On the other hand, Ravallion (2001) suggested that economic growth could even result in higher income disparity and increased poverty. Nonetheless, there is also another view in the literature, which argued that high income inequality leads to economic growth (Galor and Zeira, 1993; Persson and Tabellini, 1994; and Alesina and Rodrik, 1994). In contemporary economics literature, however, there appears to be a consensus that inclusive growth propels higher income, which could narrow the gap between the rich and the poor, as well as reduce poverty.

The 2014 National Bureau of Statistics report indicated that Nigeria's GDP grew at an annual average of 5.6 per cent between 2006 and 2013¹. Interestingly, that steady growth could not create wealth and jobs to improve the overall standard of living, narrow poverty levels and reduce income inequality. In contrast, poverty level rose from 53.3 per cent in 2003 to 61.2 per cent in 2010, while income inequality widened from 40.0 per cent in 2004 to 42.95 per cent in 2010. Unemployment rate also increased from 18.0 per cent in 2006 to 27.1 per cent in 2014, while per capita GDP narrowed from US\$3,200 in 2007 to US\$2,970 in 2014.

Consequently, more than 70 million Nigerians, representing about 45.0 per cent of the entire labour force, were either unemployed or underemployed. Over 73.0 per cent of this population is between the productive ages of 18 and 45 years. More so, industrial and infrastructural developments have also been relatively weak with manufacturing capacity utilisation slowing from 58.0 per cent in 2007 to 49.2 per cent in 2014. The consequences of these macroeconomic challenges are the fast creeping wave of crime, economic depression, weak infrastructural base, poverty and insecurity.

Against this background, this study examined the link between economic growth, poverty and income inequality matrix in Nigeria. Several studies on the subject matter in Nigeria had relied largely on non-parametric analysis of the issues. The method adopted in this study is different from previous studies for two folds. First, the paper tried to provide insight on the behavioural pat-

¹ CBN Statistical Bulletin, 2014.

tern of growth, poverty profile and income distribution in Nigeria. Second, a reduced form VAR models and the Engle and Granger causality techniques were applied to analyse the relationship existing among growth, poverty and income inequality in Nigeria.

Understanding the nature of causality and the response of each variable on the changes in the other variables could help provide greater insight on how to advance sound policy prescription. In other words, it could help in making growth more inclusive and distribution more effective and efficient for overall societal wellbeing. Following this introduction, Section 2 deals with a survey of related literature, Section 3 provides some stylised facts about growth, poverty and inequality in Nigeria while Section 4 anchors the methodology of the analysis. The empirical results and discussion of findings are contained in Section 5, and Section 6 concludes the study with some policy implications.

II. Literature Review

The relationship between economic growth, poverty and income inequality has received the attention of economist and policy makers in the literature within the last five decades. The original debate on this relationship was heralded by the pioneering work of Kuznets (1955). According to the popular Kuznets hypothesis, an inverted-U relationship existed between income and inequality. This implied that the degree of inequality would increase first and then decrease with level of income or economic growth. Nonetheless, the seeming economic expansion witnessed by most emerging and developing countries, alongside with growing inequality and high profile poverty incidence, has put the Kuznets hypothesis into contention.

Since, the pioneering work of Kuznets, several schools of thought have emerged within different ideological perspectives on the nature of relationship between economic growth, poverty and income inequality. Some studies such as Galor and Zeira (1993), Persson and Tabellini (1994) and Alesina and Rodrik (1994) argued that income inequality created economic growth, while others argued that economic expansion would lead to increased income, which ultimately would reduce poverty and income inequality (Aghion, Carol and Garcia-Penalosa, 1999). On the other hand, Ravallion (2001) suggested that economic growth could even result in higher income disparity and increase poverty profile. In general, this showed that the channels and determinants of these variables still vary in the literature.

According to Bourguignon (2003), there is yet no consensus throughout the economics profession on the relationship between income inequality and growth. Early thinking on the effects of inequality on growth suggested that greater inequality might be good for growth, for example by redistributing in-

come to the rich, who save, from the poor, who do not. This view implied a trade-off where more growth could be bought for the price of more inequality, with ambiguous effects on poor people. Bourguignon (2004) presented three different approaches through which income inequality affected growth: The classical approach (see, Kaldor, 1957 and Bourguignon, 2002), suggested that the marginal propensity to save of the rich was higher than that of the poor, implying that a higher degree of initial inequality would yield higher aggregate savings, capital accumulation, and ultimately increased economic growth.

In contrast, the modern approaches emphasised the main four channels through which income inequality lowers growth namely: inequality encourages rent seeking activities that reduce the security of property rights as evident in most African democratic systems, particularly in the MENA region (Ncube, Anyanwu and Hausken, 2013); unequal societies are more prone to difficulties in collective action—possibly reflected in political instability, a propensity for populist redistributive policies, or greater volatility in policies—all of which lower growth; the median voter in a more unequal society is relatively poorer and favours a higher (and thus, more inefficient) tax burden; and to the extent that inequality in income or assets coexists with imperfect credit markets, poorer people may be unable to invest in their human and physical capital, with adverse consequences for long-run growth.

Galor (2000), however, popularised a “unified model” which provided an inter-temporal reconciliation for the above two conflicting approaches. The author argued that the classical approach holds at low income levels, but not at later stages of development. In the early stage of development, inequality would promote growth because physical capital is scarce at this stage and its accumulation requires savings. Inequality in income would then result in higher savings and rapid growth. In later stages of economic development, however, as the return to human capital increases, owing to capital-skill complementarity, human capital becomes the main engine of growth. As argued by Bourguignon (2004), credit constraints, however, become less-binding as wages increase, and the adverse effect of income inequality on human capital accumulation subsides, and thus, the effect of inequality on the growth process becomes insignificant.

Nonetheless, the propensity of growth to reduce poverty and income inequality is predicated on a case where inclusive growth would produce some kind of redistributive mechanism or in-kind-transfer. As argued earlier, the possibility

of this condition would depend on income disparity in the society and the nature of policy interventions. If for instance, such policy interventions focus more on the pro-poor sectors of the economy, the poverty reducing coefficients may be high. In the case of Nigeria, income inequality is high and policy intervention programmes, such as the Subsidy Reinvestment and Empowerment Programme (SURE-P), Youths Empowerment Scheme (YES), and the Youth Enterprise with Innovation in Nigeria (You-win), among others, seem inadequate for proper and effective redistribution of wealth. This is because they do not target strong job creating activities such as agriculture, manufacturing and industry that could lead to inclusive growth.

Although the relationship between economic growth and poverty reduction is assumed to be clear in the literature, there are significant differences across countries and over time, how much poverty reduction occurs at a given rate of economic growth and vice versa. The extent of poverty reduction depends on how the distribution of income changes with growth and on initial inequalities in income and the sources or quality of growth. In theory at least, if income inequality increases, it is possible for a country to enjoy positive economic growth without significant benefit to its poorest segment of population—the rich get richer, while the incomes of the poor stagnate. Therefore, establishing the relationship between economic growth and income distribution is critical for poverty reduction.

Thus, there has been a substantial interest in the literature to empirically determine the nature of the relationship between growth, poverty and inequality (Aigbokhan, 2000, 2008; Datt and Ravallion, 1992; Ogunmike, 1995; Okojie, Anyanwu, Ogunmike and Alayande 2000; Adams, 2004; and Kakwani, 1993). Most studies employed simple correlation analysis, Gini coefficient approach and computable general equilibrium methods to test for relationship between and among these variables. More so, these studies utilised different variables to measure and estimate these models.

For instance, Aigbokhan (2000, 2008) and Kakwani (1993) had separately developed methodologies that measure the impact of changes in average income and income inequality on poverty, by deriving analytical formulae for that purpose. Both approaches used in obtaining poverty elasticity of growth, holding inequality constant, have two disadvantages: it gives only the point elasticity by use of single survey; and it requires knowledge of the probability density of income at the poverty threshold, which is not always available. Kakwani (1993) was able to derive this density only for a special parametric form of the Lorenz curve by utilising its second derivative under particular assumptions. This method may be fraught with some difficulties as the assumptions may be peculiar to the environment.

Datt and Ravallion (1992) provided another much simpler method to decompose change in poverty into growth and inequality components. Their method had the advantage that it did not require any assumptions about the functional form of the Lorenz curve or the probability distribution. Moreover, it was applicable even to discrete changes in poverty between two surveys. But again it provided a measure of short-run relation and did not possibly capture the long-run effects. Moreover, in the Kakwani (1993) formulation, the short-run effect of growth on poverty was calculated in such a way that possible interaction of growth on inequality could subsequently influence poverty in the form of elasticity was ignored. Nigeria Institute of Social and Economic Research (NISER, 2003) also attempted to show the differences between absolute poverty and relative poverty. The study indicated that the various government intervention programmes had led to substantial poverty reduction in Nigeria. A possible way to overcome all these shortcomings is to apply regression methods or other empirical techniques.

Aigbokhan (2008) found poverty elasticity of growth to be high in Nigeria. The author argued that economic growth in Nigeria propelled poverty, probably due to its non-inclusive nature. The empirical links between the variables were, however, not clearly specified in his models. Fosu (2008) showed that poverty reduction in sub-Saharan Africa had been less-efficient, due to the poor distributional mechanisms of income in the region. Furthermore, a study by Ncube, Anyanwu and Hausken (2013) also found that income inequality reduced economic growth and increased poverty in the Middle East and North African (MENA) region. From the divergences of methods applied in the literature and the results found, it was clear that a wide gap existed in the subject matter, particularly in Nigeria. Therefore, establishing both the theoretical and empirical relationship among economic growth, income distribution and poverty are necessary and critical for economic policy making, particularly as it relates to the challenges put forth by the 2015 Global Development Agenda in Nigeria.

III. Stylised Facts about Growth, Poverty and Income Inequality

Nigeria, like many other developing countries, has implemented series of policy development programmes to improve economic growth and development. The introduction of the Structural Adjustment Programme (SAP) in 1986 was designed to entrench a market-driven economy that could spur growth in the productive sectors. The SAP resulted in an impressive average growth of about 5.56 per cent from 1986 and 1990, as against the negative average growth rate of 6.45 per cent from 1980 to 1985. Between 1990 and 1995, growth, however, fell to an annual average of 2.76 per cent and declined

further to 1.92 per cent between 1995 and 2000. This was due largely to global recession during the period. Since the re-emergence of democratic government in 1999, GDP had grown at an average of 3.92 per cent and 6.56 per cent during the period 2000-2004 and 2005-2011, respectively. Growth buoyed to over 5.5 per cent during 2012-2014. A major factor responsible for the modest improvement was the commitment to structural economic reform programmes of the Government.

Government also introduced several policy programmes such as the Nigeria Economic Empowerment and Development Strategy² (NEEDS) in 2003 to reduce poverty and income inequality. Since the implementation of NEEDS and other structural adjustment policies and reforms, the country's economic growth has significantly improved. Thus, government further initiated key policy framework to permeate the distributional impact of growth in the economy. For instance, the introduction of the Poverty Alleviation Programme (PAP) which metamorphosed into the National Poverty Eradication Programme (NAPEP) in 2001, Youth Empowerment Scheme (YES), Rural Infrastructure Development Scheme (RIDS), and Social Welfare Services Scheme (SOWES). These policy initiatives were targeted mostly at the poor, youths and women in the society with the primary aim of creating jobs and wealth.

Table 1: Relative Poverty Headcount (1980-2013)

Year	Poverty Incidence (%)	Population (Million)	Population in poverty (Million)
1980	27.2	65	17.1
1985	46.3	75	34.7
1992	42.7	91.5	39.2
1996	65.6	102.3	67.1
2004	54.4	126.3	68.7
2010	69.0	163	112.47
2013	33.1	172	115.06

Source: National Bureau of Statistics HNLSS 2010 and World Bank 2013.

Despite the improvement in economic growth performance and the anti-poverty initiatives, poverty and inequality have been on the increase in Nigeria, especially since the initiation of recent economic reforms. Available data from the NBS indicated that the incidence of poverty doubled between 1980 and 2004, and had been more in the rural areas of the country. The NBS standard of living survey indicated that the population was 91.5 million in 1992, while it grew to 102.3 million in 1996 and reached 126.3, 163 and 167 million in 2004, 2010, and 2012, respectively. Similarly, the data showed that the population in poverty as 17.1, 39.2, 67.1, 112.47 and 112.52 million in 1980, 1992, 2004,

² The objective of the programme was to build and consolidate solid institutions and infrastructure that could promote private sector-led growth.

2010 and 2012, respectively. Thus, these figures indicated that the incidence of poverty increased from 27.2 per cent in 1980 to 65.6 per cent in 1996. Table 1 showed that poverty incidence declined to 54.4 per cent in 2004, before rising significantly to 69.0 per cent in 2010, and thereafter, declined markedly to 33.1 per cent in 2013. More so, the relative headcount of spatial poverty in Nigeria revealed that poverty was more in the rural areas than the urban areas (see Table 2). This suggested that poverty in Nigeria was growing in tandem with the growth in the GDP and population in Nigeria.

Table 2: Spatial Incidence of Poverty in Nigeria 1980 – 2013

Year	Urban	Rural
1980	17.2	28.3
1985	37.8	51.4
1992	37.5	46.0
1996	58.2	69.8
2004	43.2	63.3
2010	-	43.3
2013	12	65.3

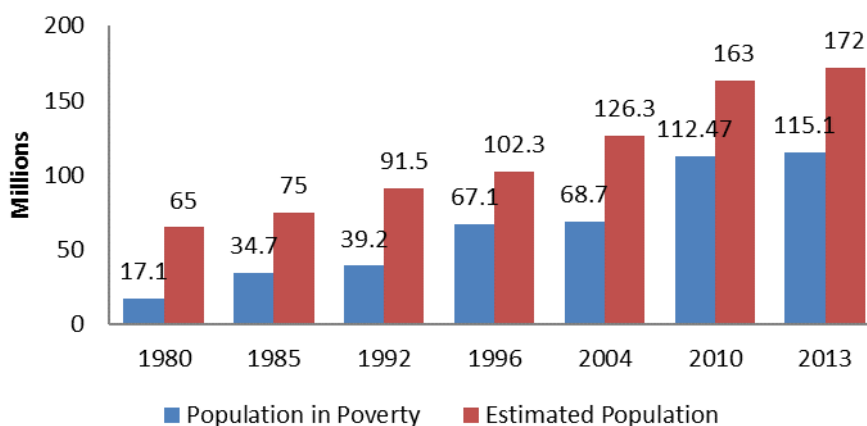
Source: NBS on Nigeria Poverty Profile 2010 Report

Table 3: Income Inequality for 1999 to 2014

Year	Income Inequality				% change
	1999	2004	2010	2014	2004 to 2010
National Gini	0.416	0.430	0.447	0.430	4.1

Source: NBS 2010 and WDI, 2015

Similarly, income inequality has also increased from 38.0 per cent in 1995 to 43.0 per cent and 45.0 per cent in 2002 and 2005, respectively. Specifically, income inequality worsened in Nigeria since the return to democratic governance. There are two dimensions to this. First, only a handful of Nigerians are meaningfully engaged in productive activities, which has led to the erosion of the middle class. Second, government reform programmes have more of short-run effects on the poor. Therefore, there is need to restructure the economy to address some of these issues. These should include special and targeted intervention programmes for the poor and development of the high job creating sectors.

Figure 2: Population and Population in Poverty

IV. Methodology

This study utilised parametric method to examine the relationship among economic growth, poverty and income inequality in Nigeria. There are three main routes of this relationship: the relationship between economic growth and poverty, the relationship between economic growth and income inequality, and the link between poverty and income inequality.

IV. 1 Model and Estimation Technique

Given that the theoretical links between and among these variables are not very clear in the literature, we rely on the VAR-based Engle Granger Causality technique and variance impulse response mechanism to determine the nature of causality and the response of each variable to the dynamics of other variables. The method assumed that the information relevant to the prediction of the respective variables (X and Y) is contained solely in the series.

We start with a typical reduced-form VAR as proposed by Sims (1980, pp. 15) in a system of equations written in the form:

$$Y_t = A(L)Y_{t-1} + \varepsilon_t \quad (1)$$

Where Y_t is the column vector of observations at time (t) on all variables and is known as the vector of endogenous variables. $A(L)$ is the matrix of coefficients to be estimated and the symbol ε_t represents the column vector of random disturbances values called innovations that may be contemporaneously correlated with each other and assumed to be non-autocorrelated over time.

Equation (1) can be expressed further as:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + A_3 Y_{t-3} + \dots + A_k Y_{t-p} + \varepsilon_t \quad (2)$$

Further from the reduced-form-VAR equation, it is possible to estimate the parameters in the structural form equation in many ways. Sims (1995) showed that Equation (2) can be estimated in a pair of regressions and it is specified as:

$$Y_t = \sum_{i=1}^n \alpha_i X_{t-1} + \sum_{j=1}^n \beta_j Y_{t-j} + u_{1t} \quad (3)$$

$$X_t = \sum_{i=1}^n \lambda_i Y_{t-1} + \sum_{j=1}^n \delta_j X_{t-j} + u_{2t} \quad (4)$$

$$u_{1t} \neq u_{2t} = 0$$

Where, X and Y are endogenous variables of interest (GDP, poverty and income inequality), and U_i's are assumed to be uncorrelated. Equations (3) and (4) help to account for the impact of the lags of the dependent variables and the lags of the exogenous variable(s) on the dependent variables. The equations help to determine whether there is causal relationship between and among the variables.

Prior to the estimation of this relationship, however, the stochastic properties were tested, using Augmented Dickey Fuller Test and the Johansen Multivariate Procedure for the co-integration test.

IV.2 Data

Data for the study were the growth rate of gross domestic product (GDP), incidence of poverty employed as a measure of poverty and Nigeria's Gini coefficient used to measure income inequality. The incidence of poverty is based on the World Bank standard, defined as poverty gap to the ratio of US\$1.25, while the Gini is defined as the deviation from the Lorenz curve. The data spanned 1980-2014 and were obtained from the World Bank development Indicator (WDI, 2014), various issues of the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS) Statistical Bulletins. Given the challenges of data quality in Nigeria, however, the missing figures were filled using extrapolation method. To ensure that results obtained from the data were meaningful and verifiable in a systematic manner, a trend approach was adopted to reflect developments within the periods for the missing data. Again, diagnostic tests were carried out to check for the behaviour of the da-

ta. Furthermore, descriptive statistics of the selected variables were examined to describe the pattern and general trend in the variables and understand the rationale for their inclusion in the equation.

V. Empirical Analysis

The descriptive statistics of the selected variables are presented in the appendix. However, the correlation matrix result is presented in Table 4 below. The result showed a positive correlation between gini coefficient and poverty as well as a low negative correlation between gini and output growth. Nevertheless, there is evidence of a positive correlation between output growth and poverty rate in Nigeria.

Table 4: Correlation Matrix Result

	Gini	Poverty	Output growth
Gini	1.000000	0.268213	-0.011248
Poverty	0.268213	1.000000	0.336559
Output growth	-0.011248	0.336559	1.000000

Source: Author's computation

Table 4 revealed that economic growth, measured by the growth rate of gross domestic product, was stationary at level, while poverty and income inequality were stationary at first difference within five per cent level of significance. This implied that the stochastic properties of the variables were integrated of order zero, $I(0)$ and one, $I(1)$.

Given the challenges in obtaining institutional and demographic data in Nigeria, we examined the stochastic properties of the data. Thus, the Augmented Dickey-Fuller (ADF) test of unit root was conducted to determine whether or not the series were integrated of order (d), where d represents the number of times the variable is differenced. The results of the ADF tests were presented in Table 5.

Table 5: Result of the Unit Root Tests

Variable	Test Statistic (5%)	Critical Value	Order of Integration
GDP	-2.9604	-4.0746	$I(0)$
POV	-2.9677	-6.2501	$I(1)$
INE	-2.9639	-4.5112	$I(1)$

Source: Author's computation

Consequently, we proceeded to investigate whether the combination of the variables was integrated or rather they possess a long-run relationship. The Johansen procedure for multivariate co-integration test was applied to determine the long-run relationship among the variables. The result in Table 6, indicated that there was at least one co-integrating equation, suggesting the existence of a long-run relationship among the variables.

Table 6: Johansen Co-integration Test Result

H0	Eigenvalue	Trace Statistic	5 Per cent Critical	Hypothesis No. of CE(s)
r=0	0.4781	18.86	21.13	None*
r=1	0.2692	9.097	14.26	At most 1
r=2	0.1479	4.644	3.841	At most 2

Source: Author's computation

As an important principle in econometrics, existence of a long-run relationship is one criterion necessary to carry out a causality test. Therefore, the study moved further to determine the causal relationship among/between the variables.

The Engle Granger Causality tests showed that the sets of GDP and poverty coefficients were not statistically significant in either of the regressions. Thus, there was no feedback mechanism between economic growth and poverty reduction in Nigeria. Table 7 also indicated that there was no causal relationship between economic growth and inequality in Nigeria, as the result suggested statistically insignificant relationship between the variables. In other words, the result showed that there was independence or no causal relationship between economic growth and poverty, and inequality and economic growth in Nigeria. This implied that there could be growth and poverty as well as growth and income inequality simultaneously in Nigeria. The intuition here is that growth is not inclusive, hence the distributional impact is weak.

Furthermore, the Granger results indicated that there was no causality running from poverty to income inequality rather the result suggested that there was unidirectional causality running from income inequality to poverty in Nigeria. This implied that income inequality Granger causes poverty in Nigeria. Intuitively, high income inequality exacerbated poverty. This could be the reason why there is no linkage between economic growth and poverty reduction in Nigeria. This result corroborated the finding of Ncube, Anyanwu and Hausken (2014) and the argument of Ravallion (2001) that high inequality was capable of engendering high poverty. As argued earlier, only a few quintile of the society were benefiting from the growth of the economy, while larger segments of the population were still deprived of the economic benefit.

Table 7: Causality between GDP, Income Inequality and Poverty

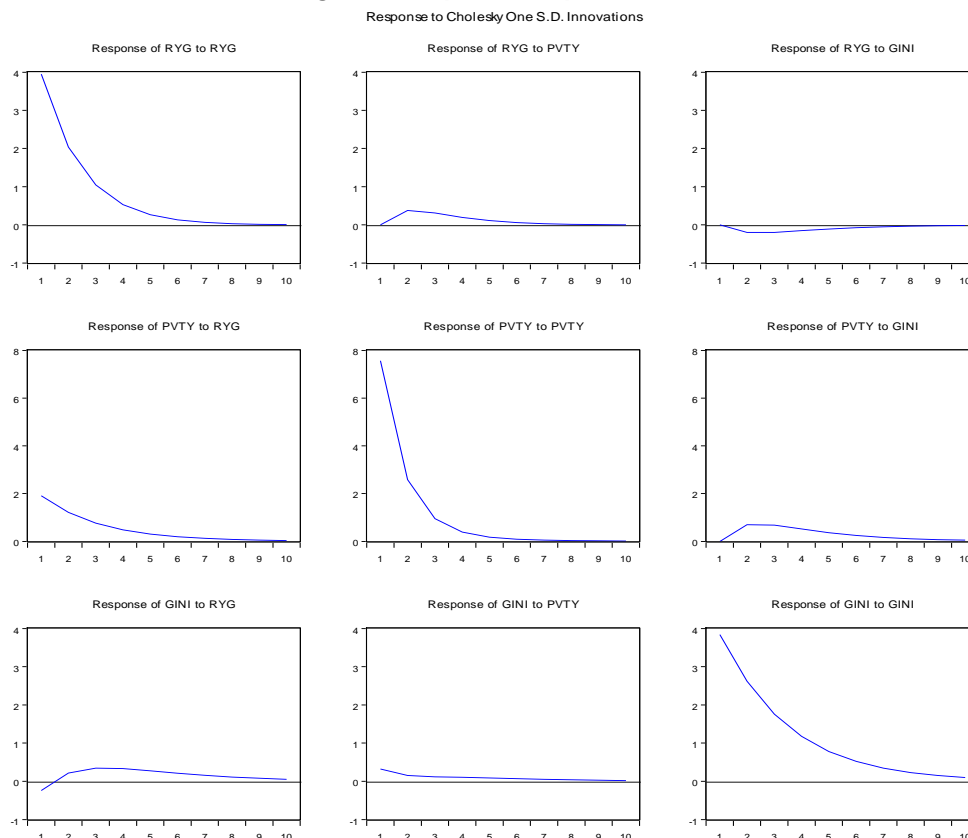
Null Hypothesis:	Obs	F-Statistic	Prob.
INE does not Granger Cause GDP	30	0.41482	0.6649
GDP does not Granger Cause INE		1.65895	0.2106
POV does not Granger Cause GDP	30	0.50199	0.6113
GDP does not Granger Cause POV		0.34519	0.7114
POV does not Granger Cause INE	30	1.09829	0.3490
INE does not Granger Cause POV**		4.24203	0.0259

Source: Author's computation

In an attempt to provide greater insight to the link between and among the variables, the analysis was extended to determine the impulse response of the variables on the changes of the residuals known as the Cholesky deviation.

Figure 4 indicated that growth did not impact on poverty reduction in Nigeria. This reinforced the fact that the fundamental institutions needed to redistribute growth fallouts were weak. The main factors that may be responsible for this kind of relationship can be grouped into 3: economic structure, weak industrial base, and inequality. First, the nation's economic structure is skewed toward total dependence on oil and tradeables. This makes growth to be non-inclusive in production and distribution (Djemoah, 2012 and Umo, 2012). Second, weak and poor industrial base and third, growing income inequality in the system are the main culprits. Given the imperatives of the 2015 post-Global Development Agenda, there is the need to reverse the trend. Policy measures required to address these imbalances must recognise these constraints and develop strong economic reorganisation of the economic structure supported by high industrial base and large reliance on domestic made goods.

Figure 4: Impulse Response Results



VI. Conclusion and Policy Recommendations

Nigeria has witnessed significant growth alongside widening income inequality and wide spread poverty particularly, among the rural populace within the last three decades. Huge oil resources and human capital required for growth and development, however, abound in Nigeria. In the same vein, government has initiated series of policy programmes to promote growth and enhance robust equitable distribution of the national income. This study carried out an empirical analysis of the relationship among economic growth, poverty and inequality in Nigeria. Consequently, the results indicated that economic growth has no significant impact on poverty reduction and income inequality in Nigeria. There was evidence that poverty was, however, largely promoted by income inequality in Nigeria. In other words, the paper established that non-inclusive growth and high income inequality were the main reasons for the poor distributional impact of growth on poverty reduction in Nigeria. The paper concluded that policy measures required to address these imbal-

ances should recognise these and develop strong strategies to reorganise the economic structure. This should be supported by high expansion in industrial base and manufacturing capacity of the economy. The nation needs to reorganise the productive system to promote industrialisation through significant investment in job and growth enhancing sectors of the economy as well as intensify the provision of basic infrastructure to create jobs and income. Meanwhile, the current redistributive programmes, such as SURE-P and you-win, should be expanded in terms of the quality and volume of funds to reduce poverty of jobs rather than poverty of consumption through the development of quality database to improve distribution and guarantee efficiency. Furthermore, sound institutions that would promote the rule of law and serious war against institutional corruption public would also promote economic efficiency. This could guarantee equitable distribution of national resources and national stability as well as put the nation on the path way to achieving the 2015 Global Development Agenda in the long-run.

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Appendix 1: Descriptive Statistics Result

	GINI	Poverty	Output
Mean	45.72743	48.17029	4.532286
Median	45.40000	48.90000	5.310000
Maximum	56.00000	69.00000	14.60000
Minimum	35.60000	27.50000	-7.580000
Std. Dev.	5.138224	8.829960	4.375557
Skewness	0.100610	-0.208051	-0.212526
Kurtosis	2.251687	3.436189	3.445704
Jarque-Bera	0.875673	0.529962	0.553178
Probability	0.645431	0.767221	0.758366
Sum	1600.460	1685.960	158.6300
Sum Sq. Dev.	897.6459	2650.919	650.9470
Observations	35	35	35

The Impact of Lending Rate on the Manufacturing Sector in Nigeria

Akpan, D. B., Yilkudi, D. J. and Opiah, D. C.*

Abstract

The study investigates the impact of lending rate on output of the manufacturing sub-sector using the Vector Error Correction Model (VECM) and annual data from 1981-2014. The empirical results indicated that high lending rate had negative impact on manufacturing output in the long-run. This suggests that increase in lending rate undermines manufacturing output, thus retarding growth in the real sector. Specifically, the estimates revealed that a 1.0 per cent increase in lending rate reduces manufacturing output by 0.03 per cent. The study, therefore, recommends the implementation of investment friendly policies that narrows the lending rate by the deposit money banks (DMBs) in order to stimulate output growth in the manufacturing sub-sector and allow global competitiveness of products. Similarly, development finance institutions should be encouraged to lend at concessionary rates to the manufacturing sector.

Keywords: Deposit Money Banks, lending rate, Intermediation, Manufacturing capacity utilisation, Vector Error Correction Model (VECM), Co-integration

JEL Classification Numbers: E2, E5

I. Introduction

The manufacturing industry remains a key driver of economic growth. Its performance is driven largely by monetary policy action, especially benchmark interest rate. Precisely, an appropriate interest rate remains crucial for achieving improved productivity and promoting economic growth and development. High interest rate increases cost of borrowing, retards domestic investment, diminish aggregate demand, increase unemployment and contract economic growth. It poses serious concerns for policymakers about economic growth; investment and financing options. On the other hand, lower interest rate stimulates aggregate demand, output, investment, employment, business confidence and export competitiveness.

The benchmark policy rate set by the monetary authority directly affects interest rates that banks and other financial institutions charge. These charges by banks for on-lending to economic agents are, however, determined by both explicit and implicit costs. The explicit costs are the costs of obtaining

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deposits, while the implicit cost is the opportunity cost associated with firms' use of its own resources.

In Nigeria, there is growing disaffection among investors and entrepreneurs on the current high cost of production, which has constrained their efforts at creating wealth and reducing unemployment in the country. Globally, Nigeria ranks 52nd and 170th on both the ease of getting credit and doing business, respectively, out of 189 economies examined by the World Bank in its *Ease of Doing Business* publication (2015). For instance, the maximum lending rate increased from 24.6 per cent in 2012 to 24.9 per cent in 2013 and further rose to 25.7 per cent in 2014. The contribution of the manufacturing sector to GDP which was merely 8.0 per cent in 2012, increased marginally to 9.2 per cent in 2013 and further to 10.0 per cent in 2014.

The poor performance of the manufacturing sector has been attributed to high bank lending interest rates, among other factors (Adebiyi and Babatope-Obasa 2004; Obamuyi *et al.*, 2012; and Gideon *et. al.*, 2015). The high rates charged by banks are influenced by increased overhead costs, contributions by deposit money banks (DMBs) to the Banking Sector Sinking Fund, payment of the Nigerian Deposit Insurance Corporation's (NDIC) premium, as well as the cash reserve ratio (CRR) and the liquidity ratio, placed additional pressure on banks' earnings and the cost of funds. These additional costs may partly be transmitted to high lending rates which have remained double digit over the years (Jibrin *et. al.*, 2015).

To promote its developmental functions and ensure that credit gets to the real sector at single digit rates, the CBN has continued to support and encourage specialised institutions such as the Bank of Industry (BOI), the Bank of Agriculture (BOA), the Nigeria Export Import Bank (NEXIM) and the Urban Development Bank through funding, technical assistance, regulation and supervision. The CBN has also assisted through the provision of specialised credit schemes at concessionary interest rates, particularly in the areas of agricultural finance, export promotion and small and medium scale enterprises.

Despite these interventions, interest rates charged by banks have remained high making credit expensive for the private sector, particularly those engaged in capital-intensive production processes. This has led to the folding up of manufacturing firms contributing to job losses and declining output. The challenge, therefore, has been the determination of the extent to which the cost of borrowing as reflected in the prevailing lending rates charged by banks impacts the performance of the manufacturing sector in Nigeria and

the role of other intervening variables in reinforcing this impact. Past studies on this relationship in Nigeria have produced mixed evidence raising questions about the overall stability of selected models. Enebong (2003) had argued that the Nigerian manufacturing sector is exposed to stiff competition in the international market for raw materials; yet none of the identified studies captures this effect. This paper, therefore, deviates from existing studies by introducing 'Trade Openness' to account for this 'competitive effect' which is arguably an intervening variable in explaining the relationship between lending rate and performance of the Nigerian manufacturing sector. To this end, it has as its main objective, the determination of the impact of lending rate on manufacturing sector performance in Nigeria employing the Co-integration technique and the Vector Error Correction Model (VECM).

The paper is structured into five sections. Following the introduction, Section two reviews the theoretical and empirical literature. Section three provides stylised facts on interest rates and manufacturing output in Nigeria, while Section four presents the methodology of the study. The presentation and discussion of empirical findings are undertaken in Section four, while the summary, recommendations and conclusions are presented in Section five.

II. Literature Review

II.1 Theoretical Review

II.1.1 Theories of Interest Rate

The major theories of interest rate are the Classical, Neoclassical (Loanable Funds), Keynesian and Taylor rule models. Each of these theories is discussed in this sub-section.

The Classical Theory of Interest Rate

The rate of interest played a critical role in the Classicalist analysis of the relationships between financial flows and real flows. Their perspective reflects the traditional conceptualisation of interest rate and its determination in economics. The Classicalists conceived the interest rate as the factor that equates the demand for investment and individuals' willingness to save and thus, described interest rate as the price of investible resources. Walras (1874) for instance considers the interest rate as the variable that brings the sum that individuals are willing to save and invest in new capital assets, to equality.

In this regard, interest rate is determined in the capital market where demand for investment, on one hand, is equated to the supply of investment, which is dependent on individuals' marginal propensity to save, on the other. The demand and supply for investment identity is stated as:

$$I = f(r): \frac{\Delta I}{\Delta r} < 0 \quad (1)$$

$$S = f(r): \frac{\Delta S}{\Delta r} > 0 \quad (2)$$

Where I is investment demand, S is the volume of savings, while r is the interest rate, and f connotes a functional relationship. The interest rate thus, plays an important role in determining both the quantum of investment that would be demanded and the level of savings. The equilibrium interest rate is eventually determined at the point investment demand equals the supply of savings ($S = I$).

Neo-Classical (Loanable Funds) Theory of Interest Rate

The neo-classical or loanable funds theory was built on the classical approach. The theory states that interest rate is the price paid for loanable funds demanded by economic agents: government, firms and households, while the supply of loanable funds comes from their savings. The supply of funds available for lending (credit) is influenced by the incentives to save and the money supply through credit creation by banks. Thus, savings comprise the supply of loanable funds (S), and new money supply resulting from credit creation by commercial banks (M). The total supply of loanable funds is equal to $S + M$, while the demand side of the loanable funds is determined by the demand for investment expenditure (I) and the demand for hoarding money (H). Thus, $I + H$ are the total demand for loanable funds. If the hoarded money increases, there would be a reduction in the supply of funds, and vice versa.

According to the loanable funds theory, equilibrium interest rate is determined at the point where the demand for loanable funds ($I + H$) and the supply of loanable funds ($S + M$) intersect (Hansen, 1951).

This assertion can be expressed as;

$$r \rightarrow (S + M) = (I + H)$$

Where;

r = equilibrium rate of interest

I = Investment expenditure

S = Savings

M = Credit creation by commercial banks

H = Demand for hoarded money

More loanable funds are available at higher interest rates, and vice versa. Overall, the demand for loanable funds is inversely related to the interest rate, while the supply of loanable funds is positively related to the interest rate.

Keynesian Theory of Interest rate

This is otherwise known as the liquidity preference theory and is predicated on the ground that interest rate is determined based on the interaction of supply of money and the desire to hold money. By this assumption, the quantity of money and prices are non-proportional and absolutely indirect, through the rate of interest. In other words, the stock of money is determined by the ability of the monetary authority to manage the monetary base, while the demand for money is influenced by the desire of economic agents to hold money.

The Keynesian theory of interest rate considered interest to be the reward for parting with liquidity for a specified period, rather than saving as argued by the classical economists. Individuals have the choice of what to consume which is dependent on the propensity to consume and what to save from their income which will either be held as cash or non-interest-paying bank deposits. How much an individual will part with or lend depends on what the Keynesian theory termed 'liquidity preference' (Keynes, 1936).

According to the Keynesians, the demand for liquidity is determined by three motives; transactionary - desire to hold cash for day-to-day transactions; precautionary - desire to hold cash for unforeseen contingencies; and speculative - desire to hold resources in liquid form in anticipation of future changes in interest rates and bond prices. The demand for money (specifically, the liquidity preference for the speculative motive) and supply of money determine the rate of interest. The rate of interest is determined by the reward for keeping money in bonds or other assets rather than keeping it in cash. The rate of interest is thus, determined by the interaction between investments and savings on the assumption that the relationship between changes in the quantity of money and prices is non-proportional and is absolutely indirect, through the rate of interest.

The hallmark of the Keynesian theory lies in its integration of monetary theory and value theory, on the one hand, and the theory of output and employment through the rate of interest, on the other. Thus, when the quantity of money increase, the rate of interest falls, leading to an increase in aggregate investment and demand, thereby raising output and employment. The theory observed a link between the real and monetary sectors of the economy – an economic phenomenon that describes equilibrium in the goods and money market (IS-LM). The theory also considers the relationship between the quantity of money and prices under situations of unemployment and full employ-

ment. Accordingly, so long as there is unemployment, output and employment will change in the same proportion as the quantity of money, but there will be no change in prices. At full employment, however, changes in the quantity of money will induce a proportional change in price (Keynes, 1936).

Taylor Rule

The Taylor Rule is a monetary policy rule used to establish interest rate as a monetary policy instrument. Thus, it postulated how central banks determine interest rate in the economy based on the rational expectation theory. It explains how central banks adjust interest rate policy instruments in response to macroeconomic developments. It provides a useful framework for the analysis of historical policies and economic evaluation of specific economic strategies that the central bank can use as the basis for its interest rate decisions. In principle, when economic growth unexpectedly weakens below its potential, accommodative monetary policy can stimulate aggregate demand and restore full employment. Likewise, when inflationary pressures develop, monetary restrictions can restore the central bank's price stability objective (Durlauf and Blume, 2010).

As it relates to the nominal interest rate, the Taylor rule prescribes that for a one per cent increase in inflation, the central bank should raise the nominal interest rate by more than one percentage point. This implies that the nominal interest rate should be set to equate the inflation rate plus an equilibrium real central bank rate that is consistent with full employment in the long-run and a weighted average of inflation gap (current inflation rate minus a target inflation rate) and output gap (percentage deviation of real GDP from an estimate of its potential or natural rate output growth).

The movement in interest rate by central banks according to the Taylor rule could be written as:

$$i = r^* + \pi + 0.5 (\pi - \pi^*) + 0.5 (y - y^*)$$

Where:

i = the target short-term interest rate

r^* = real monetary policy rate

π = rate of inflation

π^* = target inflation rate

Y = logarithm of real output

y^* = logarithm of potential output

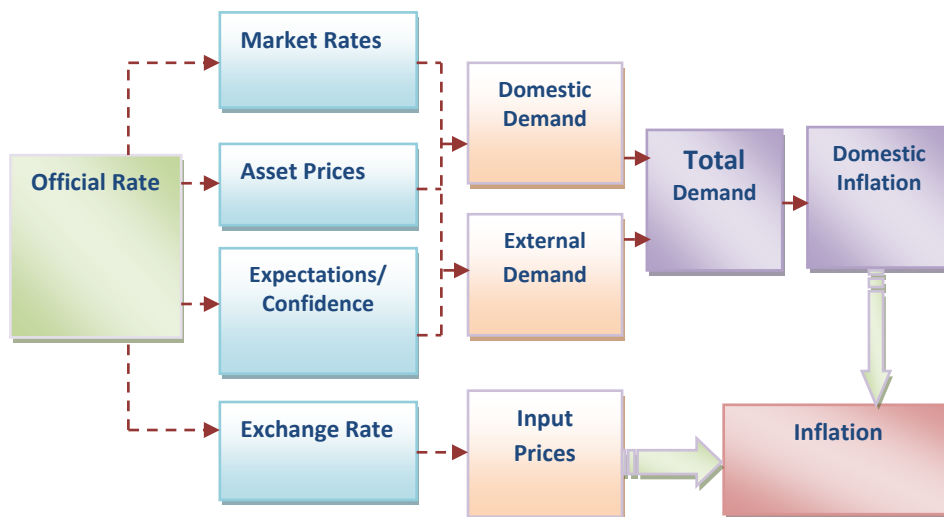
The coefficient (0.5 or 5 per cent) is a specific weight suggested by Taylor (1993) as a 'rule of the thumb'. The weight ensures that inflation remains low and output remains high.

Under the assumption of the model, central banks determine the future interest rate in the economy based on the rational expectation theory. The model presupposes that the difference between nominal and real interest rate is inflation. Overall, the Taylor Rule requires that central banks should raise interest rates when inflation is above planned target or when GDP growth is too high and above potential. The model aims at stabilizing the economy in the short-term and inflation over the long-term. In addition, it systematically linked monetary policy formation to current economic conditions in a manner that, on average, yields favourable results.

II.1.2 Interest Rate Transmission Mechanism

The interest rate channel is often referred to as the 'traditional' channel of monetary policy transmission mechanism and forms the framework for this study. It is the main channel of monetary policy transmission and was first popularised by the Keynesian view of how monetary policy effects are transmitted to the real economy through the interest rate.

Figure 6: Monetary Policy Transmission Mechanism



Source: Adapted from the Bank of England (Undated)

According to the traditional Keynesian interest rate channel, a policy-induced increase in the short-term nominal interest rate leads first to an increase in long-term nominal interest rates. Thus, adjustments in short-term rates are transmitted to the medium and long-term interest rates. Investors will act to arbitrage away differences in risk adjusted expected returns on debt instruments of various maturities. When nominal prices are slow to adjust, movements in nominal interest rates translate into movements in real interest rates. Firms, observing that their real cost of borrowing has increased, reduce their investment expenditures. Similarly, households facing higher real borrowing costs, reduce consumption, thus, aggregate demand, output and employment decline.

Mishkin (1995) observed that the traditional Keynesian view of how monetary tightening is transmitted to the real economy can be characterised schematically as follows;

$$M \downarrow \rightarrow i \uparrow \rightarrow I \downarrow \rightarrow Y \downarrow \quad \text{Where;}$$

M= Money supply

i = real interest rate

I = Investment Spending

Y = Output

A contractionary monetary policy leads to an increase in real interest rate, which in turn raises the cost of capital, causing a decline in investment spending which then reduces aggregate demand and output (Mishkin, 1995).

II.2 Empirical Literature

Studies on the purported link between interest rate and manufacturing output have generally been consistent, reverberating the theoretical expectation of a negative relationship between interest rate and manufacturing output through the credit channel. LeBrasseur-Serwin and Chowdhury (1994) examined the impact of floating rate loans and interest rate on the aggregate cash flow for 14 manufacturing industries in the United States. The study employed a non-linear regression model to estimate quarterly time series data covering 1974 to 1990. Their findings revealed that changes in the short-term interest rate have negative effect on the cash flow of eleven (11) of the fourteen (14) sampled manufacturing industries. The study indicated some levels of heterogeneity in the effect and noted that the magnitude of decline in industries' cash flow tended to vary between industries. For instance, while a rise in the short-term interest rate impacted positively on the cash flows of the petroleum

and the primary metals industries, the effect was negative for the cash flow in the textile mills products and the transportation equipment industries.

Although the negative impact of interest rate on the cash flows of selected industries was the highlight of LeBrasseur-Serwin and Chowdhury (1994), the heterogeneity of the impact exposed new grounds in the literature. One explanation for the observed heterogeneity basks on the differing characteristics of firms, especially in relation to their sizes (Kumar and Francisco, 2005).

Gertler and Gilchrist (1994) analysed the differential responses of small versus large manufacturing firms to monetary policy in the United States. The authors estimated bivariate and multivariate systems VAR equations using many firm-level quarterly panel data from 1958 to 1994. The Federal Funds Rate was used as the proxy for monetary policy. The study attributed the differential response of firms to their sizes noting how this feature determines their access to the capital market (credit) and consequently their susceptibility to business cycles. The results showed that small firms contracted substantially and accounted for a significantly disproportionate share of the manufacturing decline relative to large firms after a monetary policy tightening.

Sanchez (2002) investigated the behaviour of investment by Mexican manufacturing firms covering the period 1994-1999. He utilised annual panel data and estimated standard investment equations focusing on the relevance of a difference between the costs of internal funds and external funds to the firm. His major findings were that internal funds in the form of cash flow played a relevant role in explaining investment expenditures by firms. Specifically, he separated firms more likely to be financially constrained from those not likely to be financially constrained and found the former to be more sensitive to changes in internal funds. Furthermore, investment expenditures were also found to respond to changes in real interest rates when a measure of the foreign interest rate was used as a proxy for the cost of capital.

Zulfiqar and Din (2015) investigated the effects of some macroeconomic variables on the performance of Pakistan's textile industry. Using a panel of 50 textiles firms for the period 2006 to 2011, they found that interest rate had a positive impact on return on equity.

In Nigeria, empirical studies on the impact of interest rate on manufacturing output are quite novel. Some of the earliest studies on the subject dated back to the last decade. For instance, Adebisi and Babatope-Obasa (2004) employed the co-integration and Error Correction Model (ECM) techniques within the Ordinary Least-Square (OLS) framework to estimate the impact of interest rate on the financing of the manufacturing industry in Nigeria in the SAP and pre-SAP interest rate regimes, using annual time series data ranging between

1970 and 2002. Assuming a bivariate relationship among the variables, the authors established the existence of a long-run relationship between interest rate and the Nigerian manufacturing index. They found that interest rate spread had a negative, but significant effect on the growth of the manufacturing sector. A 1.0 per cent rise in the interest rate was noted to induce a 3.0 per cent decrease in manufacturing output. The study also concluded that the liberalisation of interest rates in Nigeria left a positive trail on the growth of the Nigerian manufacturing industry. It, however, failed to establish any significant relationship between bank credit and growth in the manufacturing sector.

Gideon *et. al.*, (2015) replicated the work of Adebisi and Babatope-Obasa (2004) adopting similar estimation techniques – co-integration and ECM in investigating the effect of banking sector reforms on manufacturing output in Nigeria. They, however, introduced additional explanatory variables and extended the study period using annual time series data between 1970 and 2011. Their findings revealed that banks' lending rate, exchange rate and the real rate of interest exerted positive and significant impact on the growth of the manufacturing sector; and that financial deepening and interest rate spread have significant and negative effect on manufacturing output in Nigeria. A 1.0 per cent decrease in the real interest rate and the lending rate would result in a decrease in manufacturing output by 0.2 and 8.0 per cent, respectively. On the other hand, a one percent decrease in interest rate spread leads to an increase of 0.7 per cent in manufacturing output. Thus, the authors' findings contradict the results in Adebisi and Babatope-Obasa (2004) and Obamuyi *et al.*, (2012) with respect to the impact of interest rate on manufacturing output.

Obamuyi *et al.*, (2012) projected the empirical inquisition by extending the study period in Adebisi and Babatope-Obasa (2004) and adopting a system equation approach. They investigated the effect of bank lending on the growth of the Nigerian manufacturing sector using annual time series data covering 1973 to 2009. The authors tested for co-integration and employed the Vector-Error-Correction Model (VECM) technique to ascertain the short-run dynamics. Their results indicated a unique long-run relationship between manufacturing output, lending rate and capacity utilisation of the manufacturing sector. They also found that both the bank lending rate and capacity utilisation in the manufacturing sector impact significantly on the manufacturing sector with a priori signs.

Udoh and Ogbuagu (2012) investigated the relationship between financial sector development and growth of industrial production in Nigeria over the period 1970 to 2009 employing the ARDL bounds testing co-integration approach. The long-run estimation based on the ARDL approach, indicated that the interest rate has a positive and significant effect on industrial production. In the short-run, however, the effect was found to be negative.

Ogunleye and Saliu (2013) studied the effect of financial institutional reforms on the manufacturing performance in Nigeria. They employed co-integration and ECM techniques on annual time series data covering the period 1970 to 2005. The broad finding was that financial institutions reforms had no significant impact on manufacturing sector performance in Nigeria. Specifically, the lending rate, a proxy of the interest rate, had no significant impact on the performance of the manufacturing sector.

Ogar et al., (2014) examined the impact of commercial bank loans and the interest rate on manufacturing output in Nigeria. The study employed time series data over the period 1999 to 2011 using the OLS regression. The authors found no evidence of the impact of bank credit and interest rate on output in the manufacturing sector. At the 5.0 per cent significance level, neither of the regressors was significant in explaining output growth in Nigeria. These findings deviate from earlier studies with regards to the interest rate manufacturing output relationship. It, however, reinforced the result of Adebisi and Babatope-Obaso (2004) on the impact of bank credit on manufacturing output. Udoh and Ogbuagu (2012) explained this mismatch between bank credit and the manufacturing output to the low support the industrial sector receives from the private sector, compared with the dominant public sector.

Olayemi and Michael (2016) investigated the impact of financial reforms in Nigeria and industrial productivity growth. A VAR analysis was used along-side the impulse-response and variance decomposition analyses to isolate the effects of financial services reform variables on industrial productivity, using time series data between the period 1986 and 2013. Although the VAR estimation revealed that lending rate explained 48.4 per cent of variation in industrial output, the F-Statistics was insignificant at the 5.0 per cent significance level. Their findings on the low level impact of lending rate on industrial growth echo that of Ogar et. al.,(2014).

All the studies reviewed confirmed the *a priori* expectation on an inverse relationship between interest rate and manufacturing output. However, evidence on the role of interest rate in manufacturing sector performance Nigeria appeared to be mixed.

This study, therefore, intends to enrich the literature by firstly extending the coverage of the estimation period to accommodate current economic data, and secondly, by introducing an additional variable (trade openness) to the set of determinants of manufacturing performance in Nigeria, given the glut of empirical evidences on the impact of trade openness on real output in Nigeria.

III. Stylised Facts on Interest Rate and Manufacturing Output in Nigeria

III.1 Trends in Interest Rate in Nigeria

Interest rate is a major monetary policy instrument in Nigeria owing to its role in the mobilisation of financial resources in supporting growth and development. Over the years, Nigeria has adopted different interest rate policy regimes targeted at inflation, savings, investment, employment and growth. Broadly, these policies can be examined within two policy regimes – the pre and structural reforms periods (pre-SAP and Reform eras). In the pre-SAP era, interest rates were largely fixed and administratively determined, while in the Reform era, they were deregulated and market-based.

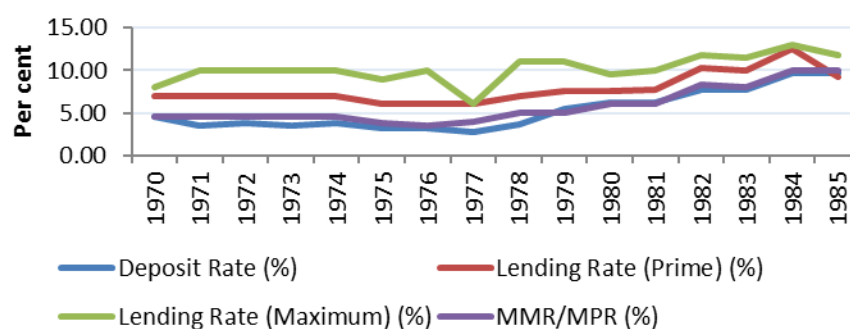
III.1.1 Pre-SAP Era (1970 – 1986)

Prior to the deregulation era and the introduction of the Structural Adjustment Programme (SAP), issues in interest rate in Nigeria were institutionally and administratively determined by the CBN, in line with the Federal Government annual macro-economic objectives of price stability and economic growth. The pre-SAP period witnessed selected interest rates for preferred sectors of the economy. The preferential interest rates were based on the assumption that the market rate, if universally applied, would exclude some of the priority sectors. Interest rates were, therefore, adjusted periodically to promote increase in the level of investment in different sectors of the economy. For example the agriculture and manufacturing sectors were accorded priority, and commercial banks were directed by the CBN to charge preferential interest rates that varied from year to year on loans and advances to these sectors (Figure 1).

The pre-SAP period was considered as a period of financial repression and was characterised by a highly regulated monetary policy environment in which policies of direct credits, interest rate ceiling and restrictive monetary expansion were the rule rather than exception (Soyibo and Olayiwola, 2000). During the regulated era, the monetary authority relied on the exclusive use of direct control mechanism to fix interest rates and other banking charges. The major reasons for the administrative interest rates were the desire to obtain optimum resource allocation, promote orderly growth of the financial market

and combat inflation. Consequently, interest rates during the period were largely irresponsive to bank cost of funds because the CBN fixed the rates in line with the desired macroeconomic objectives and a maximum limit was stipulated. Thus, resource allocation was based on the classification of preferred and less-preferred sectors. The preferred sectors, which included agriculture, mining and manufacturing, had concessionary interest rates, while the less-preferred sectors, which included imports and commerce, had higher rates (CBN Briefs, 2004 - 2005).

Figure 1: Selected Rates (1970-1985)

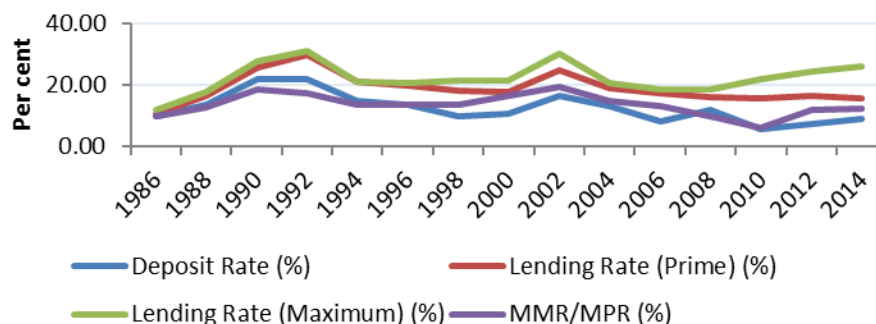


Source: Central Bank of Nigeria

The practice of direct controls promoted stability of interest rates in the banking sector because the rates were seldomly changed by the CBN. It, however, led to the inefficient use of capital which resulted in inappropriate pricing of credits and deposits. The prevailing rates were unable to keep pace with inflation, resulting in negative real interest rates. Thus, the problem of inefficient pricing and resource allocation, lack of competition and under-development of the financial markets, were among the factors that necessitated the deregulation of interest rates in the late 1980s.

III.1.2 Reform Period 1986 – 2014

The advent of the SAP in 1986 resulted in radical departure from the regime of administrative interest rate to a broad based market-determined interest rate system. By 1990, the deposit and maximum lending rates had risen to 22.1 and 27.7 per cent, respectively. In line with the SAP expectation, interest rate during the reform period continued to vary leading to maximum lending rates dropping to 20.8 per cent in 1991 and falling further to 19.5, 18.7, and 18.4 per cent in 2005, 2006 and 2007, respectively.

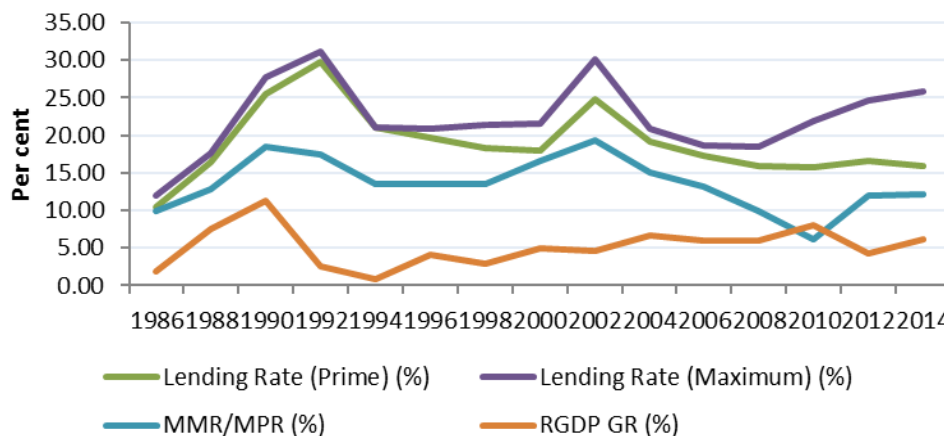
Figure 2: Selected Rates (1986-2014)

Source: Central Bank of Nigeria

The reform in interest rate in 1987 impacted positively on real GDP growth rate which rose from 7.6 per cent in 1988 to 11.4 per cent in 1990. For most of the reform period, the real GDP growth was positive. The CBN indirectly influenced the level and direction of change in interest rate using the Minimum Rediscount Rate (MRR) as well as the stop rate of weekly tender for treasury bills (CBN, 2006).

In furtherance of the liberalisation reforms, the cap on interest rate was lifted in 1992 but was re-imposed in 1994. The re-introduction was primarily due to a number of factors, including; the financing of huge fiscal deficits of the Federal Government by the banking sector resulting in the "crowding-out" of private sector investment; high rate of domestic inflation; technical insolvency and pervasive defaults in the money market; and speculative attacks on the foreign exchange.

With effect from October 1996, the earlier restriction on interest rates were removed, and the determination of interest rates became market-driven. The monetary authority set the rules of engagement and banks were allowed to participate according to the dictates of the market. The CBN, however, retained its discretionary power to intervene in the money market to ensure orderly developments in interest rates. The MRR was replaced with the Monetary Policy Rate (MPR) in 2006, aimed at ensuring stability in short-term interest rates. The purpose was to ensure liquidity management and enhance the development of inter-bank trading. Thus, the MPR was fixed at 10.0 per cent from 14.0 per cent.

Figure 3: Lending Rates, MPR and GDP (1986-2014)

Source: Central Bank of Nigeria

III.2 Interest Rates and Manufacturing Sector Performance 1970 - 2014

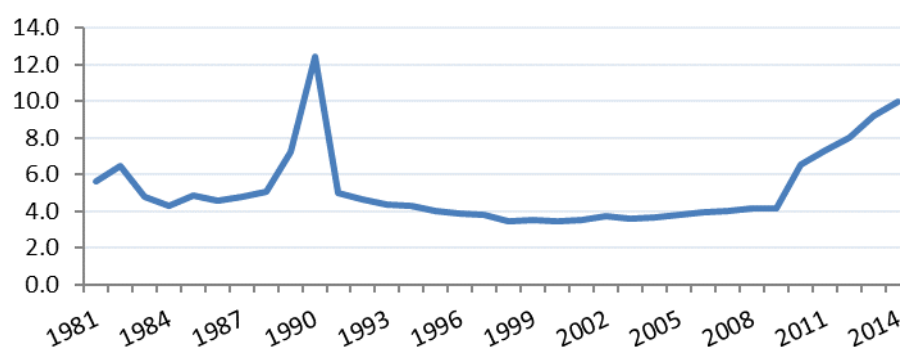
The manufacturing sector in Nigeria has suffered neglect since the discovery of crude oil in the early 1970s. Prior to the oil boom, manufacturing contributed over 10.0 per cent to the country's total output. The increased revenue from oil, however, led to the persistent decline in the sector's relative share in GDP. Consequently, the sector has not been able to attract the necessary investment to boost economic growth. The manufacturing sector's share of GDP has remained low (less than 7.0 per cent) over the past decades. Also, its contributions to foreign exchange earnings, as well as revenue and employment generation have been minimal. In 1982, manufacturing output contributed only 6.4 per cent to total output, and fluctuated between 4.3 per cent and 4.8 per cent between 1983 and 1987.

The recession triggered by the oil glut of the 1980s, however, brought about structural reforms in the economy. Consequently, the World Bank's SAP was initiated in 1986. The major policies of SAP included: trade liberalisation, deregulation of interest rates, public sector reforms, privatisation and commercialisation. During the reform period, deposit and lending rates were allowed to be determined by market forces and the interest rate actually increased as envisaged. For instance, the average deposit and maximum lending rates which were 9.7 and 10.5 per cent in 1986 rose to 15.1 and 19.2 per cent, respectively, in 1987 because of several deregulations. As a result, the share of manufacturing to GDP began to witness slight increase recording 5.1 per cent and 7.2 per cent in 1988 and 1989, respectively.

The contribution of manufacturing output to GDP peaked at 12.4 per cent in 1990. The deposit and maximum lending rates rose to 22.1 and 27.7 per cent, respectively. Throughout the 1990s and 2000's, however, Nigeria's over de-

pendence on crude oil exports continued to soar, while the manufacturing sector remain ignored with persistently low performance (Figure 4).

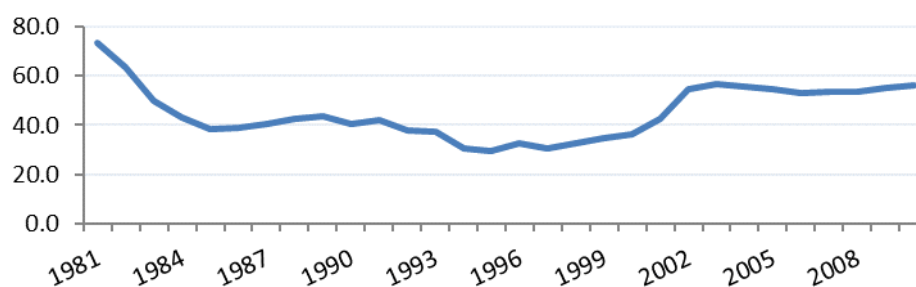
Figure 4: Manufacturing Sector Contribution to Real GDP (%) (1980 - 2014)



Source: Central Bank of Nigeria

Also, the policies of import licensing and interest and exchange rates controls led to shortages of industrial input with adverse effects on capacity utilisation and manufacturing output. The average capacity utilisation declined steadily from 73.3 per cent in 1980 to 36.1 per cent in 2000, averaging 53.6 per cent from the period 2001 to 2010 (Figure 5).

Figure 5: Average Capacity Utilisation (%) (1980 - 2010)



Source: Central Bank of Nigeria

The inadequacy of infrastructure, mostly power and transport, led to escalating costs and non-competitive operations further contributed to the decline in manufacturing output. Following the rebasing of the GDP in 2010, however, the contribution of manufacturing output to GDP started rising and maintaining an upward trend. In 2010, the manufacturing sector represented 6.6 per cent of GDP. It grew steadily from 7.3 per cent in 2011 to 10.0 per cent in 2014 (Figure 4). The increase in the contribution of the manufacturing sector to GDP

was not unrelated to the expansion of the scope of manufacturing activities. Prior to the rebasing in 2010, the manufacturing sector comprised only 3 sub-sectors - oil refining, cement and other manufacturing.

With the rebasing, however, the manufacturing sector currently comprises 13 sub-sectors, namely: oil refinery; cement; food, beverages and tobacco; textiles, apparel and footwear; wood and wood products; pulp, paper and paper products; chemical and pharmaceutical products; non-metallic products; plastic and rubber products; electrical and electronics; basic metals; iron and steel; motor vehicles and assembly; and other manufacturing. The dominant manufacturing activities are the food, beverages and tobacco sub-sectors contributing the largest output within the sector (46.4 %), followed by textiles apparel and footwear (21.5 %) in 2014.

III.3 Interest Rates and Deposit Money Banks (DMBs)' Cost of Fund

Banks obtain funds from both short and long-term sources. The costs incurred by banks in the process of sourcing funds could be direct and/or indirect, and constitute major elements in determining banks' lending rates. Direct costs are mostly interest expenses, while indirect costs comprise administrative costs incurred in the intermediation process. The cost of funds is calculated as the total interest expense annualised, divided by average interest bearing deposits and other interest bearing borrowings, plus average non-interest bearing checking deposits. It is the interest rate paid by financial institutions for the funds deployed in their businesses and constitutes one of the most important input costs for a financial institution (Jibrin, et. al., 2015). The spread between the cost of funds and the interest rate charged on loans to borrowers is one of the major sources of profit for most banks.

In Nigeria, over the years, lending rates have remained persistently high and have continued to raise concerns among policy makers, investors and other economic agents. The high lending rates have been attributed largely to the high cost of raising funds by DMBs. In a bid to influence the availability and cost of credit in the economy, the CBN stipulated the composition of cost of funds for commercial banks to include the following; i) interest expense; ii) insurance Premium; iii) cash and clearing; iv) cost of liquidity; v) overheads recovery rate; vi) cost of risk; and vii) minimum profit margin. The cost of funds includes cost items (i) to (iv), while the remaining are termed other costs (Jibrin, et. al., 2015).

Interest expense was identified as a direct cost, while the indirect cost of funds includes overhead (salaries, other costs), statutory cost such as NDIC premium and Cash Reserve Ratio (CRR), opportunity cost of holding liquid assets in excess of the minimum requirement, cost of holding non-earning assets and target return on equity. Overhead costs previously included were advertising

costs, data processing services, software development costs, parts of legal fees, networking information technology and auditing, among others. But the CBN observed that such costs appear to be wrongly articulated and tended to impact negatively on the prime lending rates. Consequently, the CBN excluded overhead costs from subsequent modifications to the frameworks for computing the bank's cost of funds (Jibrin, et. al., 2015).

The 2014/2015 CBN Monetary, Credit, Foreign Trade and Exchange Policy Guidelines excluded overhead costs from the framework in determining banks' cost of funds and computed the cost of funds by employing the weighted average cost of funds computation framework. According to the guidelines, banks should include banks' interest cost on the different types of deposit liabilities, borrowings from the inter-bank funds market, payments in respect of deposit insurance premium and costs due to reserve requirements.

IV. Methodology and Data

This study adopted the Johansen (1991) and Johansen and Juselius (1992) methods of co-integration. The intention is to capture the impact of interest rate and the performance of the manufacturing sector in Nigeria in the long and short-run through the dynamics of the vector error correction methodology (VECM). The choice of this methodology is predicated on the fact that it is able to capture both the short and the long-term properties of the model. It also effectively captures the stability associated with the model which other methodologies are less efficient. To estimate the model, we first follow the procedure established by Sims (1980) by estimating an unrestricted vector autoregressive (VAR) process. The unrestricted VAR estimates jointly the dynamic relationships among endogenous variables with k lags and without any restriction such that;

$$X_t = \mu + A_1 X_{t-1} + \dots + A_k X_{t-k} + \varepsilon_{1t} \quad \varepsilon_{1t} \sim \text{IN}(0, \Sigma) \quad (4)$$

In equation (4) X_t is $(n \times 1)$ vector of endogenous variables while A_i is an $(n \times n)$ matrix of parameters. Also, k is the minimum lag length and ε_{1t} is a vector of white noise processes with non-diagonal covariance matrix. We, therefore, re-formulated equation (4) to derive the vector error correction model (VECM) such that:

$$\Delta X_t = \psi + \Gamma_1 \Delta X_{t-1} + \dots + \Gamma_{k-1} \Delta X_{t-k+1} + \Pi X_{t-k} + \varepsilon_{2t} \quad (5)$$

Where $\Gamma_i = -(1 - A_1 - \dots - A_i)$; $i = 1, \dots, k-1$ and $\Pi = -(1 - A_1 - \dots - A_k)$.

The parameter estimates of Γ_i and Π in equation (5) showed both the short- and long-run adjustments to changes in X_t . Also, $\Pi = \alpha\beta'$, where β is a matrix of long-run coefficients such that the term $\beta'X_{t-k}$ embedded in equation (5) represent up to $(n \times 1)$ co-integration relationships in the multivariate model, which ensures that X_t converges to their long-run steady state solutions; while α is the matrix containing error correction coefficients that measures the extent to which each variable in the system responds to deviations from the long-run equilibrium. The component part ΠX_{t-k} of equation (5) is the stationary long-run error correction relation, which must be stationary for $\varepsilon_{2t} \approx \mathbf{1}(0)$ to be white noise.

The data set for this study consists of annual time series data from 1981 to 2014. The variables employed include manufacturing capacity utilization, exchange rate, interest rate and the degree of trade openness (measured by the ratio of total trade to GDP). The choice of variables was informed by the literature, data availability, and the need to ensure a reliable degree of freedom in a typical VAR. The manufacturing capacity utilization index was the preferred measure of manufacturing. This, in our opinion, better reflects the of the sector, compared to the Purchasers Managers' Index (PMI)¹ as it captures the proportion of output that was actually realized. Also, the maximum lending rate was used to proxy the interest rate as it better reflects the cost of borrowing in the Nigerian economy. Based on economic linkages, changes in the nominal exchange rate are likely to affect the cost of intermediate inputs as well as the demand for manufactured exports, explaining the consideration of exchange rate as an intervening variable in the study. In addition, the 'Degree of Trade Openness' was included as an intervening variable given that Nigeria is a small open economy with a manufacturing sector that is import-dependent. It is derived by dividing total trade volume (exports plus imports) by nominal GDP. All data were sourced from various statistical publications of the CBN.

IV.1 Estimation Procedure

The variables were examined to ascertain their stationary properties and ensure appropriate specification of the VAR. Also, the optimal lag lengths were selected based on six (6) selection criteria to ensure a reliable degree of freedom in the VAR model, after which a stability test was conducted to determine the stability of the model. The co-integration test was undertaken to es-

¹ Only 25% of actual production constitutes the PMI. Other constituents include: New orders (30%), Supplier delivery time (15%), Employment level (10%) and Raw materials inventory (20%).

establish the long-run relationship among the variables in the model. The preliminary results on the stationarity properties of the variables informed the choice of a VECM.

IV.2 The Unit Root Tests

As indicated in Table 1, both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were applied to check the stationary properties of the data in levels and in differences. The result of the unit root test showed that all variables in the model were I(1), although, PP test suggested LCAP to be I(0). But since ADF suggested the contrary, we, therefore, assumed that the variable was I(1) stationary. The Johansen co-integration test proved that non-stationary variables could possibly move together in the long-run. Thus, the Johansen co-integration test was carried out to ascertain whether to proceed to long-run estimation.

Table 1: ADF and PP Unit Root Test Results

Variables	Levels				First Difference			
	ADF 1	PP 1	ADF 2	PP 2	ADF 1	PP 1	ADF 2	PP 2
LCAP	-0.7712	-7.0905	-2.4483	-7.6258	-3.7672	-22.2331	-3.7733	-32.7071
LEXC	-2.1249	-2.0093	-1.1091	-0.9214	-3.5420	-4.8350	-4.2931	-5.3356
LINT	-2.1688	-2.3437	-1.8833	-2.0764	-5.0090	-6.5336	-5.2785	-6.6511
LDOP	-1.2680	-1.3957	-3.2189	-3.6470	-5.4423	-6.8974	-5.3427	-6.7698

Notes: ADF 1 and PP 1 represent= Unit root tests with constant, while ADF 2 and PP 2 = Unit root tests with constant and trend. *, ** and *** indicate statistical significance at the 1%, 5% and 10% levels respectively. With constant and trend: McKinnon (1991) critical values are -4.2846(1%), -3.5629 (5%) and -3.2153 (10%).

IV.3 Optimal Lag Length Selection Test

The appropriate lag length was chosen for the VAR model based on the optimal lag length selection test. Most of the criteria used (FPE, AIC, SIC, HQ and LR) suggested the optimum lag length of one (1). Indeed, the VAR model was stable and not explosive at the lag length of one (1).

Table 2: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
1	-36.79	NA	0.000399*	3.519334	4.266639*	3.758403*
2	-24.0812	18.63959	0.000521	3.738747	5.233357	4.216885
3	-11.654	14.91262	0.000758	3.976934	6.21885	4.694142
4	17.20887	26.93869*	0.000435	3.119409*	6.10863	4.075686

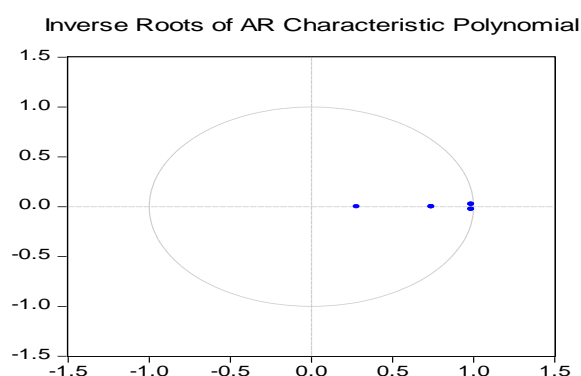
* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error; AIC: Akaike information criterion; SIC: Schwarz information criterion; and HQ: Hannan-Quinn information criterion.

IV.4 Stability Test

We also tested the reliability of the VAR model at lag length of (1). The result of the autoregressive (AR) root stability test indicated that all roots had modulus less than one and lied inside the unit circle, which is an indication of stability of the model.



IV.5 Johansen Co-integration Test

Having satisfied the stability condition of the VAR model, we proceeded to examine the existence of a long-run relationship among the variables using the Johansen co-integration test. The results of both trace and maximum eigenvalue tests statistic of the co-integration test suggested the existence of one co-integrating vector at the 5.0 per cent level of significance, providing the basis for proceeding with the estimation of the VECM.

Table 3: Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.643257	56.1432	47.85613	0.0069
At most 1	0.332806	24.19027	29.79707	0.1925
At most 2	0.251664	11.64536	15.49471	0.1748
At most 3	0.082179	2.658353	3.841466	0.103

Trace test indicates 1 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level;

**MacKinnon-Haug-Michelis (1999) p-values.

Table 4: Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.643257	31.95293	27.58434	0.0128
At most 1	0.332806	12.54492	21.13162	0.4949
At most 2	0.251664	8.987005	14.2646	0.2872
At most 3	0.082179	2.658353	3.841466	0.103

Max-eigenvalue test indicates 1 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values

V. Empirical Findings

V.1 Long-run Result

Table 5 shows the long-run co-integrating equation. Normalising this relationship, the long-run equation was derived as in equation (6).

Table 5: Co-integrating Equation

Error Correction	LCAP	INT	LDOP	LEXC
Normalized β	1	0.03	1.06	-0.54
		[1.86]	[12.46]	[10.18]

$$\text{LCAP} = -0.03\text{INT} - 1.06\text{LDOP} + 0.54\text{LEXC} \quad (6)$$

(1.86) (12.46) (10.18)

The result of the long-run model indicated that interest rate has significant impact on manufacturing output in Nigeria. A percentage increase in interest rate would reduce output of manufacturing sector by 0.03 percent. It was expected that the degree of trade openness (LDOP) would have positive effect on manufacturing output. However, it turn-out to be negative contrary to expectation. This shows the uncompetitive nature of the manufacturing output in global trade. The impact of exchange rate was positive, indicating that one percent depreciation in exchange rate improves manufacturing output by 0.54 per cent, implying that currency depreciation improves price competitiveness

V.2 Short-run Model (Vector Error Correction Model)

The result of the short-run model showed that the speed of adjustment of the ECM was negative at 0.13 and was significant with the expected positive sign. This implied that about 13.0 per cent of the deviation from equilibrium was corrected every year. The short-run result also indicated that the degree of trade openness was significant in the short-run, while other variables such as interest rate and exchange rate do not impact significantly on manufacturing capacity utilisation in the short-run.

Table 6: Short-Run Model

Error Correction:	LCAP	LCAP(-1)	INT(-1)	LDOP(-1)	LEXC(-1)
CointEq1	-0.13	0.01	-0.01	-0.11	0.05
	(-4.56]	[0.27]	[-1.41]	[-2.24]	[1.20]

Figures in parenthesis are the t-statistics of the parameters

VI. Summary of Findings, Recommendations and Conclusion

The paper empirically examined the impact of lending rate on the performance of the manufacturing sector in Nigeria, using annual data from 1981 to 2014. The Johansen and Juselius (1992) method of co-integration and vector error correction methodology (VECM) were employed to verify both the long-run and short-run relationships in the model. The result of the long-run model indicated that lending rate has negative impact on manufacturing performance in Nigeria in the long-run. While the degree of trade openness impacted negatively on manufacturing performance, contrary to expectation. The impact of exchange rate was positive as depreciation improved price competitiveness. The result of the short-run indicated that about 13.0 per cent of the deviation from equilibrium was corrected every year and that only the degree of trade openness impacted significantly on manufacturing performance, while other exogenous variables had no significant impact.

The policy implication of this finding is that high lending rate could have negative impact on the performance of the manufacturing sector in the long-run.

This corroborates the earlier findings by Obamuyi *et al.*, (2012), Udoh and Ogbuagu (2012) and Gideon *et al.*, (2015), that bank's lending rates have significant impact on manufacturing output in Nigeria. It is in view of this finding that we recommend that policy makers should pursue policies that engender the competitiveness of the manufacturing sector by narrowing the lending rate in the banking system. This may include the provision of concessionary interest rates targeted at the manufacturing sector. Also, the observed negative impact of trade openness on the manufactured sector vilifies the uncompetitive nature of the sector. In this regard, monetary policy must work towards ensuring the stability of the exchange rate given its direct implication for the cost of production, the price of manufactures and the overall competitiveness of manufactured exports.

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Non-Oil Revenue Buoyancy and Elasticity: Implications for Revenue Generation in Nigeria

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Abstract

The paper employs annual time series data on real government tax revenue components from 1981-2014 to endogenously determine the level of non-oil revenue buoyancy and elasticity and its implication for revenue generation in Nigeria. A partitioning approach to determining tax buoyancy and elasticity is employed to address these objectives. The study found that with the exception of the Company Income Tax, an inelastic tax structure exists in Nigeria for the period under review. The proxy bases had similar results in terms of their responsiveness to the tax system. There were also evidences that the discretionary measures taken during the study period were not effective as shown in the low discrepancies between the buoyancy and elasticity measures. Among others, we recommend that government should as a matter of urgency strengthen tax administration and curtail leakages associated with tax avoidance and evasion. In addition, there is need for stronger collaboration among the relevant fiscal authorities and to streamline the tax structure and rates, reduce tax waivers and bureaucratic bottlenecks in the tax administration.

Keywords: Revenue buoyancy, Revenue elasticity, Revenue generation, Revenue base

JEL Classification: E62, H68, H21, H27

I. Introduction

The rebasing exercise of Nigeria's GDP in 2010 put the size of the economy at about ₦80.0 trillion, making it the biggest economy in Africa and 26th in the world. The rebasing captured the structural changes in the economy especially in sectors such as banking, telecommunications and entertainment where Nigeria has recorded dramatic growth over the years. However, Nigeria is still dependent to a large extent on oil based revenues, accounting for 67.5 per cent of total government revenue at end-December 2014 (CBN, 2014).

The overdependence on oil and related products for revenue has exposed Nigeria to the boom-bust cycle of international oil price volatility. Consequently, Nigeria's public finance management for most of the period after the

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1970's, has been largely driven by fluctuations in the international oil market and prices. These had resulted in the co-movements of government revenue and crude oil prices. Thus, government revenue increased astronomically in periods of high oil prices and contracted sharply during periods of price slumps. The current negative oil shock, for instance, has brought about a substantial reduction in Nigeria's foreign exchange earnings and revenue. This reinforces the need for diversification of the export and revenue base by focusing on non-oil alternative sources of revenue generation and export earnings. One veritable and fairly predictable alternative source of revenue for the government is tax from non-oil sources. Taxation affords the government greater latitude for effective and efficient fiscal management with a greater amount of certainty.

Total non-oil revenue to GDP ratio declined substantially following the rebasing of the GDP in Nigeria from about 6.7 per cent in 2009 to 3.3 per cent in 2013, revealing the decline of non-tax revenue in Nigeria. Relative to other countries, including Brazil 35.3 per cent, Russia 28.7 per cent, UK 35.2 per cent, US 24.3 per cent, South Africa 25.8 per cent, Kenya 20.1 per cent, Mali 14.5 per cent, and Ghana 17.1 per cent (Heritage Foundation, 2015). This therefore, underscores the need to aggressively improve on the low collection of non-oil tax revenues in Nigeria.

Non-oil tax revenues in Nigeria are collected by all tiers of government. However, different assignments and responsibilities are constitutionally allocated to the federal, state and local government levels. These tiers of government are usually expected to enact laws and formulate policies within the provisions of the Constitution that empower them or their agents to administer taxes most efficiently. The jurisdiction of the Federal government in terms of revenue collection include; Company Income Tax (CIT), Petroleum Profit Tax (PIT), Value Added Tax (VAT), Education Tax, Capital Gains Tax on corporates and the Federal Capital (FCT) residents, stamp duties and with-holding tax on corporates, royalties, customs/excise duties as well as Personal Income Tax on personnel of the armed forces, the Police, and residents of the FCT. The constitution empowers state governments to collect varying revenue from PIT, capital gains tax and stamp duties on residents of their respective states, vehicle licenses, development levy, street name registration fees, right of occupancy fees, market fees, etc. The Local government's tax jurisdiction includes tenements and shops/kiosk rate, liquor licenses, marriage/birth/death registration; local governments' park fees, domestic animal license fees, vehicle fees, public convenience, signboards and other advertisement permit fees.

Arising from the current oil shock is the imperative for government to resort to more internal and external financing. But government is also mindful of the need to avoid huge deficits and excessive growth in public debt. This can be achieved by increasing internal tax revenues through discretionary changes in tax related revenue and improving on tax administration and collection. Such changes should ideally be reflected in a tax system which automatically yields more tax revenues. Empirical evidences (Ahmed and Muhammed, 1997, 2010; Joumard and Andre, 2008; Cotton, 2012; Belinga et al., 2014) have shown that one of the ways of certifying that revenue is responding to changes in GDP is by measuring revenue buoyancy and elasticity.

This study, seeks to evaluate the efficiency of the tax system in Nigeria by testing for revenue buoyancy and elasticity for non-oil taxes, thus, the question, "Do non-oil tax revenue rise at the same pace as increases in the GDP?" Both the traditional and partitioning approaches to estimate the tax revenue buoyancy and elasticity for the period 1981-2014, is used with annual time series data for Nigeria.

In consideration of the urgent need to raise the non-oil revenue in Nigeria, this paper will be a useful analytical tool to policy makers and academia to further explain the overall structure of the tax system and design a more efficient and effective tax administration system that will respond to changes in the tax bases. The rest of the study is structured as follows: Section 2 is the literature review which outlines the concept of revenue buoyancy and elasticity, some theoretical issues and empirical literature on the subject. Section 3 looks at the structure and trends in tax and non-tax-revenue, while Section 4 analyses the buoyancy and elasticity ratios for Nigeria's non-oil revenue sources. Section 5 provides conclusion and proffers policy recommendations.

II. Literature Review

II.1 Conceptual Clarifications

II.1.1 Revenue Buoyancy

Revenue buoyancy is defined as a measure of the total response of changes in revenue represented by the changes in total GDP or any other component of the GDP such as consumption, investment, imports and exports. It is a measure of both the soundness of the tax bases and the effectiveness of tax changes in terms of revenue collection. A buoyant tax has a tendency to yield more revenue with the growth of its base. Komolafe, Jalilian and Hiley (1999) define buoyancy of a tax as the increase in the revenue collected compared with the relative increase in the GDP (tax base). The change in revenue encompasses any effects of changes in the tax system, including discretionary changes in the tax structure.

In this study, considering that Nigeria has two components of revenue namely, oil and non-oil revenue, our focus is on the non-oil revenue buoyancy as the ratio of the rate of change in non-oil revenue due to the rate of change in their respective bases (Upender, 2008). The revenue in this case is disaggregated into tax and non-tax, while the base is the nominal GDP (Jonathan, 1998). However, the tax revenue is further disaggregated into the various components such as non-oil taxes: VAT, import duties, excise tax, and company income tax (CIT). Tax buoyancy is defined by Pike and Savage (1998) as:

$$E_{TY}^b = \frac{\Delta T^b}{\Delta Y} * \frac{Y}{T^b}$$

Where:

E_{TY}^b = Buoyancy of tax revenue to income

T^b = Total tax revenue

ΔT^b = Change in total tax revenue

Y = Income

ΔY = Change in income

II.1.2 Revenue Elasticity

Tax elasticity reflects only the responsiveness of tax revenue to a unit change in the tax base. Thus tax elasticity reflects how different taxes respond to their tax bases without considering discretionary tax policies. The tax elasticity coefficient provides a good indication of the effectiveness of tax administration in understanding the impact of growth in revenue. Thus, tax elasticity is defined as the ratio of the percentage change in tax revenue to the percentage change in income (nominal GDP) or any of the components assuming that no discretionary changes have been made to the tax rate or tax base. This differs from the concept of tax buoyancy which refers to changes in actual tax revenues due to the changes in income as well as changes in discretionary measures such as tax rates and tax bases (Timsina, 2007). When there are no changes in the discretionary measures during the period reviewed, tax buoyancy and elasticity are the same.

Tax elasticity is thus defined as:

$$E_{TY} = \frac{\% \Delta T}{\% \Delta Y}$$

Where:

E_{TY} =Elasticity of tax revenue to income or GDP

ΔT =Change in tax revenue, and

ΔY =Change in income GDP

This means that an elastic tax system is a desirable system because it provides government with a good platform for increasing revenue. However, an inelastic system is undesirable, as it calls for a lot of discretionary policies to raise adequate revenue. An elastic tax system is one in which the rate of response of revenue to the changes in the tax base or tax rate is positive or greater than one. When the changes in the tax system elicit a decrease in the revenue, then the tax is inelastic. Unity elasticity occurs when a change in the tax base or tax rate yields an equal change in the revenue.

II.1.3 Revenue Base

Revenue buoyancy and elasticity as defined earlier recognise the existence of a revenue base. The revenue base is the major source of the total revenue of a country. In terms of the public sector, the most widely recognised revenue base used in understanding the impact of growth in revenue is the Gross Domestic Product (GDP). The GDP represents the total production of the final goods and services produced in the economy. GDP is defined in terms of residency, and therefore there is no regard for the nationality of the owner of the production factors within the country. This is defined as $GDP = \text{private consumption (C) + government expenditure (G) + private investment (I) + exports (X) - imports (M)}$ (i.e. $GDP = C + G + I + X - M$)

The real GDP can be decomposed into its components which can serve as the base of the tax and non-tax revenue, for instance, VAT buoyancy and elasticity can be related to real consumption, while import duty buoyancy or elasticity can be related to changes in real imports and so on.

II.1.3.1 Types of Non-Oil Taxes and their Specific Bases

An important aspect of any tax system in relation to its productivity is the responsiveness of the tax revenue to changes in the nation's estimated gross domestic product. The starting point in situating revenue buoyancy and elasticity is on explanations of what constitutes the base (Pike and Savage, 1993). The major determinant of tax buoyancy is GDP growth rate. However, some scholars favoured the use of per capita Income as a true reflection of changes in income (Chelliah and Sheetal, 1974; Bahl, 1971 and Ansari, 1982). Others contend that some Human Development Indicators (HDI) would suffice. Not-

withstanding, this paper adopts the use of GDP which seems to be the consensus. Table 1 shows the relevant base for non-oil revenue in Nigeria.

Table 1: Revenue Sources and their Base

Revenue Source	Revenue Base	GDP Component
Non-Oil Sources		
a. Non-Tax		
i. FGN Independent Revenue	MDA's , licenses, fees	Non-Oil GDP
b. Tax		
Customs Duty	Imports	Imports
Corporate Income Tax	Profits of Companies	Private Investment/Proxy
Value Added Tax	Consumption	Consumption
Education Tax	Same as for Corporate tax	Private Investment/Proxy

Source: Author's compilation.

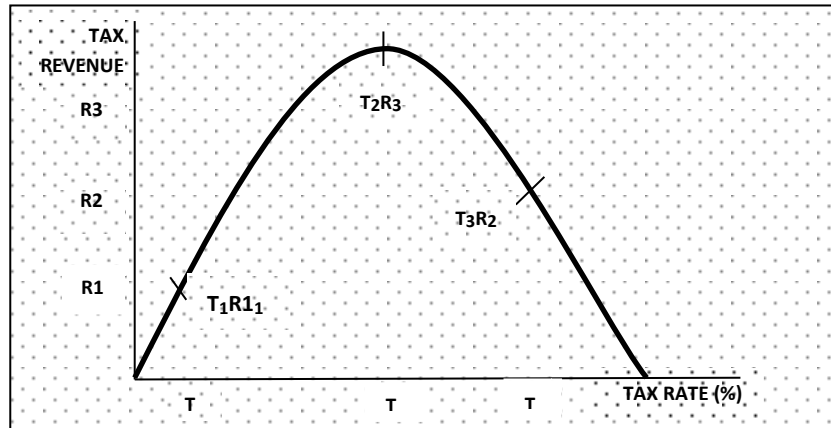
From the table, the non-oil revenue is broken down into tax and non-tax revenue. The non-tax is comprised of FGN independent revenue largely collected by ministries and agencies, operating surplus and dividends. The base of these non-tax revenue sources is the non-oil GDP. However, the focus of this study is on federally collected tax revenues which include customs duties, corporate tax; value added tax and education tax. The base of import duty is imports which is a component of GDP. The practical derivation of the tax buoyancy and elasticity for corporate tax uses the profit of companies, a component of GDP by income approach. Nonetheless, in the absence of profit component of GDP by income approach, private investment was used as a proxy. The same is true of the education tax which is a 2.0 per cent charge on companies' profits for education. The VAT is based on consumption as contained in the GDP.

II.2 Theoretical Literature

According to Arthur Laffer theory on taxation, popularly called the "Laffer Curve", government tax revenue tends to increase in tandem with the tax base when tax levy is increased. However, beyond a certain level of tax rate the optimal tax revenue begins to decline, because further increase in the tax rate brings about disincentive for more hours of work. When tax rates eventually reach 100 per cent (the far right of the curve), there is no longer incentive for a rational tax payer to earn any income, thus, the revenue raised at 100 per cent is not different from taxes raised at zero per cent. One potential result of this theory is that increasing tax rate beyond a certain point will be-

come counterproductive for raising further tax revenue because of diminishing returns (Laffer, 2004).

Figure 2: The Laffer Curve



Drawing from the Laffer curve, tax rate setting has both the arithmetic and economic effects. According to the arithmetic effect, tax revenue reduces by the same amount of the reduction in the rate once taxes are lowered and the converse happens once the tax rates are increased. From the graph above, when tax rate is increased from T_1 to T_2 , government revenue increased from R_1 to R_3 and meets at point T_2R_3 . However, a further increase in tax rate from T_2 to T_3 led to a downward movement on the curve from T_2R_3 to T_3R_2 , implying a fall in government revenue from R_3 to R_2 . It therefore appears that T_2 is the optimal tax level beyond which government fiscal policy becomes ineffective. This is because beyond that level, the intended outcome of buoyant revenue becomes depressed.

As noted by Laffer (2004), the economic effect recognises the positive impact that lower tax rate has on work, output, and employment - and thereby the tax base - by providing incentives to increase these activities, whereas raising tax rates has the opposite economic effect by penalising participation in the taxed activities. From the graph, we can deduce that the drop in revenue from R_3 to R_2 when the tax increase was due to the lack of interest to participate in tax activities or the disincentive to more work. However, prior to the optimal tax rate (T_2), government revenue increased despite rising tax. Thus, when the two effects are combined, the impact of the change in tax rate on total tax revenue becomes insignificant. This situation is defined as the concept of deadweight loss in taxation and the policy option for returning efficiency remains lowering of taxes and expanding tax base (Stiglitz, 2000).

However, tax structure is related to the stage of economic development in any country. Consequently, tax buoyancy and elasticity are affected or de-

terminated by the level of economic activity. Thus, in the early stage of economic development of a country, the tax administration and structure is characterised by low tax revenue/GDP ratio as a result of narrowness in the tax bases. Indirect taxes from foreign trade remained the veritable source of government revenue (Osemwengie and Oriakhi, 2013). As development advances and structural reforms take place, however, the tax structure changes in favour of income related taxes leading to decline in foreign trade related taxes. At this stage, the relevant taxes are personal income tax, company income tax, among others (Wilford and Wilford, 1978).

Wilford and Wilford (1978) noted that direct revenues have the inbuilt significant long-term flexibility in terms of buoyancy and elasticity which enables them to increase as income increases. On the other hand, indirect taxes become inelastic as the economy progresses because changes in the economic structure, especially with increased industrialisation, lead to a shift in import activities (Osemwengie and Oriakhi, 2013). It is therefore, expected that in terms of productivity in an economy, more revenue is expected to be derived from direct taxes such as Personal Income Tax (PIT) and Company Income Tax (CIT).

II.3 Empirical Literature

Numerous studies have been conducted by scholars on the issue of revenue buoyancy and elasticities, though, with different outcomes and conclusions. Ahmed (1994) studied the determinants of tax buoyancy in 34 developing countries in a comparative analysis of the fiscal efforts of the selected countries. First, the tax buoyancy for each country was estimated using the ratio of the change in total revenue to income. Adopting the linear Ordinary Least Squares (OLS) estimation method, the study regressed the output of the buoyancy for each country on specific categories of tax. The results were two fold – direct and indirect taxes. Direct taxes were responsive to growth in the industrial sector, monetisation (proxied by money supply), imports and growth in GDP. The outcomes of the result on indirect taxes were similar. Indirect taxes similarly responded to growth in the industrial sector, monetisation, imports, and growth in fiscal deficit.

Ahmed and Muhammed (1997) found that import tax alongside sales taxes were very buoyant at least for the economy of Pakistan. The study covered a period of 18 years from 1973-1990 and was focused on tax elasticity and buoyancy as well as their relationship to expenditure. A log-log linear model (double log model) was formulated relating tax collection to Gross Domestic Product (GDP) to aid the estimation of buoyancy coefficient parameters,

while the Prest formula was used in estimating elasticity co-efficients. The study found that on aggregate, tax buoyancy and elasticity were low. However, on a disaggregated level, import duty and sales taxes were found to be buoyant and on the expenditure side, recurrent component was found to be buoyant, while the development component was not.

Mishra (2005) investigated elasticity and buoyancy of sales tax in Jharkhand, a state in India for the period 1995 to 2004. The double log regression model was specified and estimated to determine the buoyancy parameter, while changes in the parameter estimates of the sales tax were then determined using the dummy variable technique. The findings showed that tax buoyancy was greater than unity on the average, implying that sales tax revenue in Jharkhand grew faster than the growth in GDP.

Upender (2008) adopted the linear OLS method of estimation, emphasising the unit root property to validate the outcomes inherent in the study of the degree of buoyancy on the Indian economy. He found that tax buoyancy is positively significant and more than unity during the pre-tax reform period, suggesting that gross tax is moderately elastic. The reverse was the case during the post-tax reform period. In another study, Ahmed and Muhammed (2010) examined the revenue of tax buoyancy in 22 countries, including Nigeria. The study empirically declared that Nigeria's tax system is far from buoyant and was estimated at 0.39 compared to 1.23 (Kenya) and 2.37 (Ghana). They summarised the determinants of tax buoyancy to include; growth in import, growth in industrial sector's output, growth in services sector's output, growth in agricultural sector's output, growth in grant, growth in fiscal deficit and growth in money supply (narrow and broad).

Milwood (2010) investigated the elasticity and buoyancy of the Jamaican tax system using quarterly data from March 1998 to December 2010. He specified a vector error correction model (VECM), which was estimated using the OLS estimation procedure and the Divisia Index (DI) buoyancy/elasticity estimation approach. The DI method was used because of its ability to separate the effect on total revenue into discretionary measures and the built-in response of tax revenues to the growth in GDP. The method involved three steps; removal of discretionary effects using an index that isolates the automatic growth in revenue, estimation of buoyancy with a linear regression model and the adjustment of buoyancy by transforming the index into weighted average, to determine the elasticity of the tax yield. The result indicated that in the case of customs duty/foreign trade tax, discretionary tax measures led to an increase in revenues over the estimation period.

Kargbo and Egwaikhide (2012) carried out a study on tax elasticity in Sierra Leone employing a time series approach covering a period between 1977

and 2009. Lending credence to the Singer (1968) method, dummy variables were used as proxies for four major identified discretionary changes; (1) lagged GDP as proxy for administrative bottlenecks, (2) pre and post sales tax introduction, (3) reforms period and (4) impact of war. A log linear model comprising tax revenue as dependent variables and the dummies as independent variables was estimated to underscore the effectiveness and dimension of tax productivity in Sierra Leone. The results revealed that most of the taxes investigated had elasticity ratios below unity, suggesting reasons for low tax revenue in the Sierra Leonean economy. For instance, low elasticity of import duty implied that tax evasion is high among importers. In addition, the study also found that the various discretionary measures were effective in mobilising tax revenue with the exception of 'impact of war'. The shortcoming of the study however, was its inability to state the methodology for estimating the specified model.

Samuel and Isaac (2012) conducted a similar but simplified study on the Kenyan economy covering the period from 1986 – 2009. Linear models were specified to represent tax-base and base-income. The study was undertaken for the aggregate (total income) and the disaggregated (specific taxes) levels. Series used for analysis include income tax, import duties, excise duties and sales/VAT tax. The Proportional Adjustment (PA) method of eliminating discretionary effects was adopted in the study while all series were converted to real terms to eliminate inflationary tendencies. The result showed that tax buoyancy in Kenya was very low and the tax system was inelastic. Comparatively, buoyancy ratios exceeded elasticity ratios in all cases implying that discretionary policy impact was significant. Further, the largest difference was observed for excise duties, indicating that the policies were more effective on trade. Overall, Kenya's tax system is neither income elastic nor buoyant at both the aggregate and disaggregated level.

Barfu-Insaidoo and Obeng (2012) researched on the impact of import liberalisation and customs reforms on tariff yield in Ghana covering the period/ 1965-2007. Using a double log model by relating real import tariff revenue to GDP, they estimated parameters of tax buoyancy. The estimates indicated that prior to 1983, when import liberalisation policy reform was initiated, import tariff buoyancy was high and fairly elastic, compared with the pre-reform period.

Omojimate and Iboma (2012) evaluated the link between fiscal deficit and the productivity of the Nigerian tax system between 1970 and 2010. The study was carried out in a systematic manner; first, using the entire period and then introducing structural breaks to take cognisance of episodes such as the oil

boom era and the SAP era. In each case, the study specified linear models of the relationship between selected variables which include; total tax revenue, gross domestic product, non-oil gross domestic product, non-oil total revenue, custom and excise duties, petroleum profit tax, total oil revenue, company income tax and total export duties. The models were estimated using the OLS technique and found that; (1) for most of the taxes, elasticities were relatively low; (2) elasticities were unity in the oil boom era; and (3) elasticities were also unity in the SAP era. The study concluded that overall, tax productivity in Nigeria is weak.

Muibi and Simbo (2013) conducted a study on the macroeconomic determinants of tax revenue in Nigeria. The study covered the period, 1970 to 2011. An error correction model was adopted. The model established the relationship between variables considered as indicators of macroeconomic effect (GDP, inflation and exchange rate) and tax revenue in Nigeria. The paper found that a change in GDP causes tax revenue to increase. The paper, therefore, concluded that macroeconomic stability was the main driver of tax buoyancy in Nigeria.

Osemwengie and Oriakhi (2013) adopted a standard multiple regression estimation procedure in establishing the dimension of tax buoyancy and elasticity in Nigeria using the aggregate tax. Vector Error Correction Model was employed and the outcomes revealed that, tax revenue was significantly buoyant and elastic in Nigeria.

Belinga et. al., (2014) estimated short and long-run tax buoyancy in 34 OECD countries for a period of 48 years from 1965 – 2012. The study employed panel autoregressive distributed lag model because of the time lag which was later transformed into a single Error Correction Model (ECM). The results of total tax buoyancy were mixed. On an average, both the long-run and short-run total tax buoyancy exceeded 1.0, suggesting that the OECD countries have highly productive tax system and sound fiscal management. The results of both the long-run and short-run disaggregated revenue buoyancy also yielded mixed results but identified CIT as the most buoyant in both cases.

From the literatures reviewed, it becomes clear that the studies relating to the investigation of tax buoyancy for the Nigerian economy is relatively scanty. Also, some of the studies (Ahmed and Muhammed, 2010) found that the tax system in Nigeria is not buoyant, while others such as Osemwengie and Oriakhi (2013) found revenue to be significantly buoyant and elastic in Nigeria. The study, wishes to therefore, clarify this contradiction. In addition, the scope covered in these studies did not extend beyond 2011 and were mostly focused on aggregate revenue only. Thus, this study seeks to evaluate the efficiency of the tax system in Nigeria by testing for revenue buoyancy and elas-

tivity of non-oil taxes (both aggregated and disaggregated into various tax components) and extends the scope of the study to 2014.

III. **Stylised facts on Government Revenue in Nigeria**

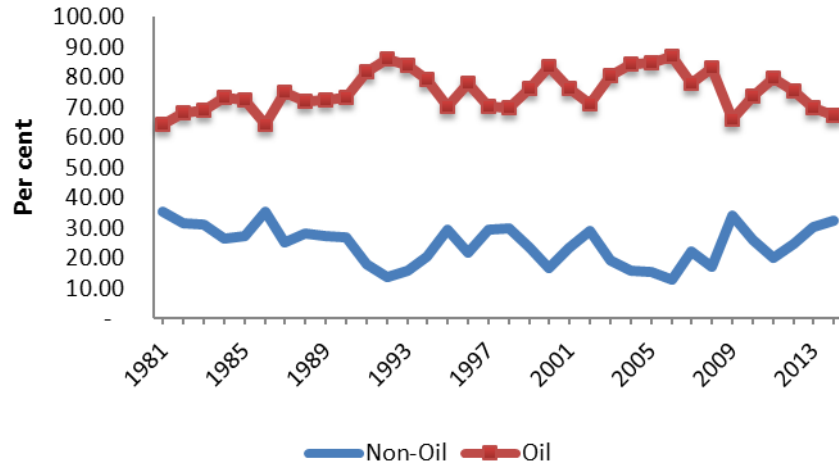
The 1950's to the early part of the 1970's saw agriculture as the main stay of economic activity in Nigeria followed by manufacturing and mining activities. The major export component of the Nigerian economy was agricultural commodities, while manufactured goods dominated her imports in international trade. Agriculture continued to play a pivotal role in the economic development of Nigeria as it contributed about 70.0 per cent of the country's GDP, employed about 70.0 per cent of the populace and accounted for about 90.0 per cent of the country's foreign exchange earnings as well as revenue by the time it attained independence in 1960. From early post-independence period up till the mid 1970's, there was rapid growth in industrial capacity and production as the contribution of manufacturing to GDP grew from 3.9 per cent to 10.0 per cent in 1981 (Adedipe, 2004).

By the late 1970's when oil became the mainstay of the Nigerian economy, the pattern of government revenue profile changed with oil sources accounting for a large chunk of government revenue, thereby becoming an oil dependent economy susceptible to oil prices vagaries. In Nigeria, revenue sources are divided into oil and non-oil. Within each category, there exists a tax and non-tax component. Oil revenue sources include receipts from crude oil export, petroleum profit tax, domestic crude oil sales, royalty, gas flare penalty, and gas sales. Federally collected non-oil revenue sources currently include broad receipts from customs/excise duties, company income tax, education tax, rents on government property, value added tax and independent revenue of the Federal Government.

Figure 1 shows that despite the fluctuations in oil revenue due to volatility in the price of oil, oil revenue has remained the major contributor to total revenue. In percentage terms, it increased from an average of 69.6 per cent in 1981-1985 to 71.4 per cent in 1986-1990. It further increased to 80.4 per cent in 1991-1995 and fell to 75.7 per cent in 1996-2000. The global financial crisis which occurred between 2008 and 2009 further affected the contribution of oil to total revenue as there was a drastic fall in international oil prices leading to a decline in oil of 77.6 per cent in 2006-2010 from 79.4 per cent in 2001-2005, while the drop in oil price in the second quarter of 2014 also led to a further drop to 73.1 per cent in 2011-2014. The non-oil sources of revenue have been less significant except for customs and excise duties, corporate tax and VAT. Given the relevance of non-oil revenue as a more predictable source of rev-

enue for planning purposes, the major concern of this study is to investigate the responses of individual tax sources to changes in the tax base.

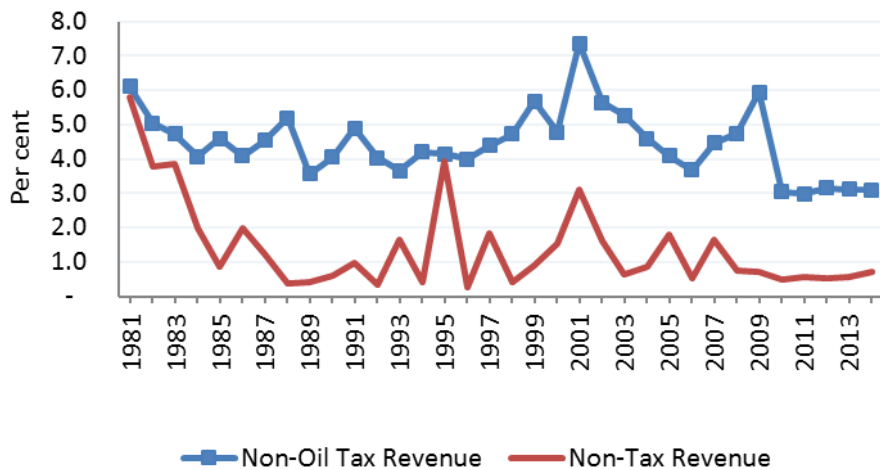
Figure 1: Oil and Non-oil Revenue as a ratio of Total Revenue



Source: Author's computation using data from the CBN Statistical Bulletin, December 2014

As a percentage of GDP, oil revenue remained the major contributor compared to the non-oil sources. Oil revenue's contribution to GDP has continued to increase but dipped in 1998 and started to rise showing the impact of oil price volatility on economic growth of Nigeria.

Figure 2: Non-Oil Tax and Non-Tax Revenue as a ratio of GDP



Source: Author's computation using data from the CBN Statistical Bulletin, December 2014

Figure 2, shows that as a ratio of GDP, non-oil tax revenue stood at 6.1 per cent while non-tax revenue was 5.8 per cent in 1981, which put both of them almost at par. They both declined in 1982 to 5.0 and 3.8 per cent respectively, and continued to decline until 1988 when non-oil tax revenue rose to 5.2 per cent from 4.5 per cent and non-tax revenue fell to 0.4 from 1.2 per cent as both began to decline from 1982 until non-oil tax revenue rose to become the major contributor to GDP.

From the foregoing, Non-oil tax revenue has remained the major contributor to GDP compared with its non-tax revenue counterpart. As a result, growth of the non-oil tax revenue base should be encouraged through the diversification of the economy in order to achieve the desired economic growth.

The Customs taxes as a ratio of import (tax base) have been fluctuating during the period under review. The outcome is reflected in the fact that increased customs taxes were not commensurate with the growth in imports, indicating the effect of poor tax administration or inefficiency in collection of import tax.

The corporate tax is assessed using private investment as a base. This is because corporate tax is derived from company profit. Consequently, investment is a major determinant of profit. Therefore, in this study we use investment as a proxy for the corporate tax base. In the same vein, volatility in the ratio for corporate tax was witnessed over the years. This could mean that the increase in corporate tax is not in line with the growth in investments. Perhaps, this may be attributed to tax evasion by a large portion of tax payers.

Table 2: Non-Oil Tax Revenue as Ratio of Tax Base

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total Revenue/GDP	38.6	32.7	27.7	32.4	19.5	13.4	17.7	14.9	12.2	12.1
Non-oil Rev/Total GDP	5.9	4.2	6.1	5.5	6.7	3.5	3.0	3.1	3.3	3.5
Customs/Import	8.3	4.4	3.8	4.5	3.8	3.1	3.2	5.1	3.5	4.4
Corporate Tax/Investment	20.2	15.8	16.9	20.3	18.6	16.4	17.9	25.3	13.2	15.4
VAT/Consumption and Inv	1.5	1.7	1.7	2.2	2.1	2.1	2.4	3.1	10.4	9.8
Education Tax/Inv	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Total GDP	14,572.2	18,564.6	20,657.3	24,296.3	24,794.2	54,612.3	62,980.4	71,713.9	80,092.6	84,097.2
Oil GDP	137.0	130.9	125.1	117.5	118.1	124.3	124.6	123.5	123.1	122.2
Non-oil GDP	14,435.2	18,433.6	20,532.2	24,178.8	24,676.1	54,487.9	62,855.8	71,590.4	79,969.5	83,975.0

Source: Author's calculations based on data from the CBN Statistical Bulletin, December 2014

Note: 2014 figures are 5% incremental figures of 2013

Due to the nature of VAT, tax evasion is difficult and as a result the administration and collection of VAT recorded significant increase during the period as shown by the ratio of VAT to its tax base, consumption. The tax ratio, has therefore, increased from 1.5 per cent of the total consumption in 2005 to 9.8 per cent in 2014.

IV. Data and Empirical Analysis

IV.1 Description and Sources of Data

The study employed annual time series data for Nigeria spanning 1981-2014 on nominal government revenue components, including; total non-oil tax revenue (NOTR), Value Added Tax (VAT), Company Income tax (CIT), Customs and Excise Duties (CED), Education Tax (EDT) and nominal Non-oil Gross Domestic Product (NOGDP) as the broad tax base. Other tax revenue bases used in the analysis include Gross Fixed Capital Formation (GFCF), Imports of Goods and Services (IGS) and Private Consumption Expenditure (PCE). All the data were sourced from various issues of the CBN Annual Report and Statements of Account, as well as the CBN Statistical Bulletin.

IV.2 Approaches to Computation of Tax Elasticity and Tax Buoyancy

Tax elasticity is the ratio of percentage change in tax revenue to the percentage change in nominal income (GDP), without any discretionary changes in the tax rate or tax base. In calculating tax elasticity, the actual tax revenue is adjusted to remove the impact of discretionary changes in the tax system on the tax revenue. Tax buoyancy on the other hand reflects the changes in actual tax revenue as a result of the changes in both nominal income and discretionary economic measures. If a country's tax structure remains unchanged over a given period of time, her tax elasticity and the tax buoyancy will be equal over the specified period. Tax elasticity and buoyancy analyses are, therefore, imperative in understanding whether or not a country's actual tax revenue or the components thereof are capable of automatically and commensurately improving along the economy's growth path without any significant changes in the tax structure.

In the literature, two major approaches to the computation of tax elasticity and tax buoyancy are popular. One of the approaches to computing the elasticity and buoyancy is the traditional approach. However, the results of the traditional approach are now questionable because of its assumption that all tax revenues directly depend on the GDP, when some of the taxes do not bear such a direct relationship with the level of income. Import taxes, for instance do not directly depend on the level of GDP but on the volume and value of imports, which are in turn dependent on the level of income. To capture such indirect relationships requires an appropriate separation of the impacts to determine the overall elasticity and buoyancy coefficients.

The partitioning approach, thus, splits tax elasticity and tax buoyancy coefficients into two components: tax to base (which is estimated as a ratio of tax revenue to the proxy tax base), and base to income (estimated as a ratio of tax revenue to nominal GDP). The tax to base elasticity is influenced by factors like tax rates, tax holidays/exemptions and the efficiency of the tax administration upon which the fiscal authorities have a measure of control. The base to income elasticity is, however, influenced mainly by the response of the economic structure to growth. Though not always the case, the product of the tax to base and the base to income elasticity or buoyancy yields the same result as the overall elasticity or buoyancy coefficient computed using the traditional approach (Timsina, 2007).

We will, thus, compute the tax elasticity and tax buoyancy coefficients using both approaches to verify the similarities of the results and confirm whether the tax system is elastic or inelastic.

IV.3 Procedures for Tax Revenue Adjustment

The three different procedures used in the literature for the adjustment of tax revenue series include the constant rate procedure, the proportional adjustment procedure and the dummy variable procedure. The decision on which procedures to adopt is a function of the availability of data, type and frequency of tax changes. The constant rate structure procedure can only be used when the data on tax rates and tax bases are available and the revenue accruable to the two can readily be decomposed. This is not the case in many developing countries. The proportional adjustment procedure necessitates the computation of the revenue exclusively accruable from the changes in discretionary measures as follows.

$$AJ_t = \frac{AR_t - DR_t}{AR_{t-1}} [AJ_{t-1}] \quad (1)$$

Where;

AJ_t = Adjusted tax revenue in the current period

AR_t = Actual Revenue in the current period

DR_t = Proportional Revenue attributed to discretionary changes in the current period

AR_{t-1} = Actual tax revenue in the previous one period

AJ_{t-1} = Adjusted tax revenue in the previous one period

The dummy variable approach is, however, appropriate in situations where changes in tax revenue due to discretionary measures are rare. Since changes in tax rates and tax bases are not frequent in Nigeria and revenue accruable to the changes in the tax rates and tax bases cannot be easily decomposed and are not readily available, this study adopts the dummy variable approach to eliminate the impact of discretionary changes in the estimated elasticity coefficients.

IV.4 Computation of Elasticity and Buoyancy Coefficients

Tax elasticity is expressed as the ratio of proportionate change in adjusted tax revenue to the relative change in income (GDP) such that:

IV.4.1 Tax Elasticity (E_{π})

$$E_{\pi} = \frac{\Delta AJ_d / AJ_d}{\Delta TB / TB} \quad (2)$$

Where:

ΔAJ_d = Change in tax revenue adjusted for the estimated impact of discretionary changes in the tax system.

ΔTB = Change in the actual tax base.

IV.4.2 Tax Buoyancy (B_T)

$$B_T = \frac{\Delta AR / AR}{\Delta TB / TB} \quad (3)$$

Where:

ΔAR = Change in the actual tax revenue. The tax buoyancy coefficient will be greater than the tax elasticity coefficient provided the discretionary tax changes are helpful in boosting total tax revenue; otherwise the tax revenue buoyancy and the tax elasticity coefficients will be the same.

IV.5 Model Specification and Estimation Procedures

The paper follows the model of Timsina (2007) to estimate the elasticity and buoyancy of the various tax components using the OLS regression technique.

The tax buoyancy equation is specified as follows;

$$LNOTR_t = \alpha + \beta LNODGP_t + \mu_t \quad (4)$$

Where:

$NOTR_t$ = Tax revenue in the current period.

β = Elasticity coefficient of the individual tax component.

$NOGDP_t$ = Nominal Non-oil GDP at current market prices.

α = intercept;

μ_t = Stochastic error term.

L = Log operator, reflecting the double logarithmic transformation of the variables specified in (4).

The elasticity equation requires the adjustment of the buoyance equation to take care of discretionary changes in tax policies, administration etc. To achieve this, the dummy variable approach was adopted because of data limitation. The elasticity equation is specified as follows:

$$LNOTR_t = \alpha + \beta LNOGDP_t + DUM + \mu_t \quad (5)$$

Where:

$NOTR_t$ = adjusted to remove the impact of discretionary changes in the tax system.

β = Elasticity coefficient of the individual tax component.

$NOGDP_t$ = Nominal Non-oil GDP at current market prices.

DUM = captures policy and administrative changes

α = intercept;

μ_t = Stochastic error term.

L = Log operator, reflecting the double logarithmic transformation of the variables specified in (5).

In line with the partitioning approach, we further sliced equation (4) into two: tax to base and base to income buoyancy regression equations.

The double logarithmic expression of the tax to base buoyancy equation is specified thus:

$$LNOTR_t = \alpha + \beta LTB_t + \mu_t \quad (6)$$

Where:

$NOTR_t$, α , β , μ_t and L are as previously defined.

TB_t = Tax Base at time t.

The base to income buoyancy regression equation can be expressed as:

$$LTB_t = \alpha + \beta LNOGDP_t + \mu_t \quad (7)$$

Where: TB_t , $NOGDP_t$, α , β , μ_t and L are as previously defined.

The tax to base elasticity equation captures the progressiveness and administrative efficiency of the tax structure. On the other hand, the base to income elasticity captures the responsiveness of the tax base to income. Thus, the elasticity equation for partitioning approach is specified as follows

The double logarithmic expression of the tax to base elasticity equation is specified thus:

$$LNOR_t = \alpha + \beta LTB_t + DUM + \mu_t \quad (8)$$

Where:

$NOTR_t$, TB_t , α , β , DUM , μ_t and L are as previously defined.

The base to income elasticity regression equation can be expressed as:

$$LTB_t = \alpha + \beta LNOGDP_t + DUM + \mu_t \quad (9)$$

Where: TB_t , $NOGDP_t$, DUM , α , β , μ_t and L are as previously defined.

The product of the tax to base and base to income elasticity and buoyancy coefficients will be equal with the elasticity and buoyancy coefficients estimated under the traditional approach expressed in equation (4 and 5).

Equation 4 to 9 represents the general form of buoyancy and elasticity models that were adapted to estimate the coefficients of buoyancy and elasticities of each class of tax estimated; namely; the CIT, VAT, CED, EDT and NOTR.

IV.6 Time Series Properties of the Data

The Augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) test procedures were used to verify the stationarity of the data series. The results are reported in Table 3. The results indicate that with the exception of VAT, all the included variables (in their natural log) have unit roots and thus, are non-stationary at levels. However, all the non-stationary series became stationary after taking their first differences. The regressions were, thus, estimated on first difference for all the tax components except VAT which was run at level.

It is important to note that running the regression on first difference merely reflects growth and not elasticity coefficients. The variables were, therefore, transformed into their natural log before running the regressions in order to produce coefficients that can be interpreted as elasticities. The Cochrane

Orcutt Method [AR(1)] and Moving Average method [MA(1)] were used to correct the autocorrelation problem noticed in the estimated results (Timsina, 2007). Dummy variables (CITDUM and CEDDUM) were also introduced in the elasticity equations for tax components (CIT and CED) that were known to have witnessed changes in their rates and bases, albeit infrequently.

Table 3: Results of Unit Root Test

Variables	Augmented Dickey-Fuller		Order of Integration	Phillips-Perron		Order of Integration
	Test Statistic	Critical Value		Test Statistic	Critical Value	
LNOTR	-6.664	-3.654*	I (1)	-6.952	-3.654*	I (1)
LCIT	-15.805	-3.654*	I (1)	-15.805	-3.654*	I (1)
LGFCF	-4.076	-3.662*	I (1)	-3.906	-3.654**	I (1)
LVAT	-3.407	-3.021**	I (0)	-3.407	-3.021**	I (0)
LPCE	-5.102	-3.654*	I (1)	-5.073	-3.654*	I (1)
LCED	-5.440	-3.654*	I (1)	-5.437	-3.654*	I (1)
LIGS	-4.950	-3.654*	I (1)	-4.923	-3.654*	I (1)
LEDT	-4.016	-3.321**	I (1)	-6.976	-4.297*	I (1)
LGDP	-6.956	-3.654*	I (1)	-7.398	-3.654*	I (1)
LOGDP	-5.082	-3.662*	I (1)	-6.550	-3.654*	I (1)
LNOGDP	-7.451	-3.654*	I (1)	-9.088	-3.654*	I (1)

Note: *, ** and *** denote level of significance at 1%, 5% and 10%, respectively.

V. Presentation and Analysis of Empirical Results

The empirical results of the elasticity and tax buoyancy coefficients of major taxes in Nigeria using the formulated models in section IV are presented in Table 4 and 5.

Table 4: Buoyancy of Major Taxes in Nigeria (1981-2014)

Major Taxes	Equation estimated	α	β
a) CIT			
Total Buoyancy	$lcit_t$ c $lnogdp_t$ MA(1)	-4.51	1.06
Tax to Base	$lcit_t$ c $lgfcf_t$ AR(1)	-2.55	1.07
Base to Income	$lgfcf_t$ c $lnogdp_t$ AR(1)	-1.32	0.92
b) VAT			
Total Buoyancy	$lvat_t$ c $lnogdp_t$ AR(1)	-0.55	0.65
Tax to Base	$lvat_t$ c $lpce_t$ AR(1)	0.32	0.58
Base to Income	$lpce_t$ c $lnogdp_t$ AR(1)	0.04	0.99

c) CED			
Total Buoyancy	$lced_t$ c $lnogdp_t$ AR(3) MA(1)	-1.67	0.74
Tax to Base	$lced_t$ c $ligs_t$ AR(1)	-0.74	0.74
Base to Income	$ligs_t$ c $lnogdp_t$ AR(4) MA(1)	7.61	0.76
d) EDT			
Total Buoyancy	$ledt_t$ c $lnogdp_t$ AR(1)	-5.61	0.99
Tax to Base	$ledt_t$ c $lgfcf_t$ AR(1)	3.16	0.0003
Base to Income	$lgfcf_t$ c $lnogdp_t$ AR(1)	-1.32	0.92
e) NOTR			
	$lnotr_t$ c $lnogdp_t$ AR(3) MA(1)	2.77	0.10

NB:

lci_t = natural log of corporate income tax at time t;

$lnogdp_t$ = natural log of nominal non-oil GDP at time t

α = estimated intercept

β = estimated buoyancy coefficient

$lvat_t$ = natural log of value added tax at time t;

$lgfcf_t$ = natural log of gross fixed capital formation at time t

$ledt_t$ = natural log of education tax at time t;

$lpce_t$ = natural log of private consumption expenditure at time t

$lnotr_t$ = natural log of non-oil tax revenue at time t;

$ligs_t$ = natural log of imports of goods and services at time t

$lced_t$ = natural log of customs and excise duties at time t

All buoyancy coefficients are significant 1.0 per cent

V.1 Company Income Tax

The results indicate that the elasticity of company income tax is 1.03 (Table 5), suggesting that, a 10.0 per cent change in the nominal GDP will yield a more than proportionate (10.3 per cent) change in company income tax. The result is significant at 1.0 per cent level with a satisfactory adjusted-R² of 0.99. DW statistics is 2.04 reflecting the absence of auto correlation in the estimated equation. The buoyancy coefficient, on the other hand is 1.06 (Table 4). It is higher than the elasticity coefficient by 0.03 indicating that only 0.3 per cent of the changes in company income tax as a result of a 10.0 per cent change in the nominal GDP were due to discretionary measures. The above findings clearly attest to the elasticity of company income tax in Nigeria. Discretionary measures, thus, play an insignificant role in generating company income tax in Nigeria during the period under review.

Also, in the case of 'tax to base' coefficients, buoyancy at 1.07 as shown in Table 4 is higher by 0.31 over the elasticity of 0.76 as illustrated in Table 5. This implies that although a 10.0 per cent change in the total tax revenue from Companies results in 7.6 per cent change in the CIT, the 3.1 per cent of the change is from discretionary measures. Also, in this case, elasticity is more than half of the buoyancy. One interesting finding here is that Companies Income Tax is highly responsive to the changes in the tax rate in Nigeria. This conclu-

sion is confirmed by the substantial increase in tax revenue from companies between 1994 and 2014. The substantial increase in tax revenue, arising from the reduced revenue leakages from tax avoidance and evasion as the CIT reduced from 40.0 per cent to 30.0 per cent during the review period led to the moderate responsiveness of the tax revenue to the changes in CIT.

Another important finding is that both the traditional approach (tax to GDP) and the partitioning approach (tax to base and base to income) for calculating the elasticity provide very similar results. In the case of CIT, the traditional approach provides an overall buoyancy of 1.06, while the buoyancy under the partitioning approach defined by the product of the tax to base (CIT to gross fixed capital formation) and the base to income (total CIT to GDP) is 0.98. Similarly, the traditional approach provides elasticity coefficient of CIT at 1.03, while the partitioning approach, and has an elasticity coefficient of 0.74.

V.2 Customs and Excise Duties

The elasticity of Customs and Excise Duties (CED) is 0.03 (Table 5) suggesting that a 10.0 per cent change in the nominal GDP will yield a less than proportionate (0.3 per cent) change in customs and excise duty. The result is significant at 1.0 per cent level with a satisfactory adjusted-R² of 0.99. DW statistics is 1.79, reflecting the absence of auto correlation in the estimated equation. The buoyancy coefficient, on the other hand is 0.74 (Table 4) and higher than the elasticity coefficient by 0.71, indicating that 7.1 per cent of the changes in customs and excise duty due to a 10 per cent change in the nominal GDP were due to discretionary measures. The above finding is clearly suggestive that customs and excise duties are inelastic in Nigeria. However, it could be observed that discretionary measures played a significant role in generating customs revenue during the review period.

Also, in the case of the 'tax to base' coefficients, buoyancy at 0.74 (Table 4) was higher by 0.34 over the elasticity of 0.40 (Table 5). This implies that of the 7.4 per cent increase in total customs revenue, arising from the 10.0 per cent change in GDP, 3.4 per cent was from discretionary measures and the balance from change in tax rates. In this case, elasticity is more than half of the buoyancy. One interesting observation from the result is that customs revenue is highly unresponsive to the changes in tax rates in Nigeria. This conclusion is confirmed by the fact that despite impressive increase in customs revenue during the study period, there were no significant increases in tax rates. The decrease in tariff rates as a result of the Common External Tariff (CET) accord, removal of some quantities restrictions, exemptions of intermediate manufac-

turing inputs, sizable duty waivers and the ample revenue leakages arising from the inefficiency in tax administration could be attributed to the non-responsiveness of customs revenue to the changes in tax rates.

Another important finding is that both the traditional approach (tax to GDP) and the partitioning approach (tax to base and base to income) for calculating the elasticity provide close results. In the case of CED, the traditional approach provides buoyancy (CED to GDP) of 0.74. The product of the tax to base (CED to gross fixed capital formation) and the base to income (total CED to GDP) under the partitioning approach is 0.56. Similarly, the traditional approach provides elasticity coefficient of CED at 0.30, and 0.50 in the partitioning approach.

V.3 Value Added Tax/Education Tax

Elasticity coefficients were not computed for VAT and Education tax as the rates on these taxes remained the same over the period under review. However, the buoyancy coefficients of VAT and Education tax were 0.65 and 0.99, respectively, during the period under review. Though the major reason for introducing VAT in Nigeria was to broaden the tax base to increase tax revenue, the above empirical evidence suggests that VAT is inelastic. The buoyancy coefficients obtained under the partitioning approach confirmed the result of the traditional approach. The results of both the traditional and partitioning approaches also indicated that education tax in Nigeria is inelastic.

V.4 Total Non-Oil Tax Revenue

Total non-oil tax revenue, which contributes less than 20.0 per cent of the total revenue in Nigeria, was found to have an elasticity coefficient of only 0.09, which is less than the buoyancy coefficient of 0.10 by 0.01. The result suggests that the automatic growth of tax revenue in Nigeria is very low in view of the above empirical finding. The elasticity coefficient of 0.09 indicates that a 10.0 per cent change in the nominal GDP will change total non-oil tax revenue (adjusted for the estimated impact of discretionary changes in the tax system) by only 0.9 per cent. The buoyancy coefficient of the total non-oil revenue is far less than unity (0.10) with a difference of 0.01, compared with the elasticity coefficient of 0.09. This further indicates that a 10 per cent change in nominal GDP will lead to only 0.1 per cent change in total non-oil tax revenue via changes in discretionary measure. Overall, the results indicate that non-oil tax revenue in Nigeria will not automatically respond to changes in nominal GDP. The discretionary measures taken during the period to remedy the situation were also found to have insignificant impacts on non-oil tax revenue mobilisation.

Table 5: Elasticity of Major Taxes in Nigeria (1981-2014)

Major Taxes	Equation estimated	α	β	CITDUM	CEDDUM	DUM
f) CIT						
Total Elasticity	l_{cit_t} c $lnogdp_t$, CITDUM, MA(3)	-4.18	1.03	-0.46	na	na
Tax to Base	l_{cit_t} c $lgfcf_t$, CITDUM, MA(5)	-2.53	0.76	-0.49	na	na
Base to Income	$lgfcf_t$ c $lnogdp_t$, CITDUM, AR(2) MA(4)	-1.76	0.97	-0.34	na	na
g) CED						
Total Elasticity	l_{ced_t} c $lnogdp_t$, ceddum AR(1) MA(4)	3.10	0.30	na	-0.09	na
Tax to Base	l_{ced_t} c $ligs_t$, ceddum AR(8) MA(1)	-2.45	0.40	na	-0.11	na
Base to Income	$ligs_t$ c $lnogdp_t$, ceddum AR(1) MA(9)	1.46	0.65	na	0.25	na
h) NOTR						
	$lnotr_t$ c $lnogdp_t$, MA(4)	3.01	0.09	na	na	-0.83

NB: Figures in parenthesis are t-statistics

l_{cit_t} = natural log of corporate income tax at time t

α = estimated intercept

l_{vat_t} = natural log of value added tax at time t

β = estimated buoyancy coefficient

l_{edt_t} = natural log of education tax at time t

AIC = Akaike Information Criterion

$lnotr_t$ = natural log of non-oil tax revenue at time t

SIC = Schwarz Information Criterion

l_{ced_t} = natural log of customs and excise duties at time t

$ligs_t$ = natural log of imports of goods and services at time t

CITDUM = Corporate income tax dummy

$lgfcf_t$ = natural log of gross fixed capital formation at time t

CEDDUM = Customs and excise duties dummy

l_{pce_t} = natural log of private consumption expenditure at time t

DUM = policy

na = Not applicable

VI. Conclusions and Recommendations

The analysis of tax elasticity and buoyancy shows an inelastic tax structure in Nigeria for the period 1981-2014. Apart from CIT, all other taxes were not responsive to changes in income with most elasticity coefficients falling below unity. The proxy bases did not yield different results in terms of their responsiveness to tax system. According to Adhikari, (1995), a progressive tax system needs to have at least greater than unitary value of the coefficient of elasticity, while a higher degree of progressivity in the tax structure would result in an elasticity greater than 2 (Dahal, 1984). Also, there are evidences that the discretionary measures taken during the study period were not effective as

shown in the low discrepancies between the buoyancy and elasticity coefficients.

The inability of tax system to automatically respond to the changes in nominal income as well as the failure of the discretionary measures to address the challenges in the tax system during the study period could be attributed to inherent inefficiencies in the tax system occasioned by excessive tax exemptions, duty waivers, low compliance, huge corruption practices and paucity of data for assessment in order to be able to capture a sizeable number of taxable entities in the country. Thus, for the planned decentralisation of the Nigerian revenue base from oil to occur, rigorous efforts of the fiscal authorities would be needed to improve the overall tax system and the efficiency of revenue administration.

This study thus, recommends the following:

- (a) That, since non-oil tax revenue is responsive to the changes in CIT, but less responsive to discretionary policies, there is need to put measures in place to curtail leakages associated with tax avoidance and tax evasion by addressing the incidence of double taxation in Nigeria. The Federal Inland Revenue Services (FIRS) also needs to ensure that all companies currently not in their database are brought under the tax net to broaden the CIT base.
- (b) Since customs revenue is not responsive to the changes in the tax rates, there is need to enhance the efficiency of customs administration so as to control revenue leakages by improving on the Automated System for Customs' Data (ASYCUDA), minimising smuggling through enhanced customs border patrol, and reducing import duty waivers, amongst others.
- (c) The potential of VAT to contribute immensely to tax revenue is high despite the observed low buoyancy coefficient. The FIRS, therefore, needs to improve on its collection efforts through administrative efficiency. This is expected to minimise the current leakages in VAT revenue and its remittances to the government as well as make the tax deduction and VAT refund process less cumbersome. There is also the need to increase consumer awareness, increase the rate on luxurious items and broaden the VAT base by integrating the informal sector.
- (d) Overall, there is need for stronger collaboration among the relevant fiscal authorities to overhaul the Nigerian tax system towards enthroning a simple, equitable, fair and vibrant tax system that reduces the effective

tax rates while at the same time curtailing the incidence of double taxation in the country to induce voluntary tax compliance. Above all, there is need to streamline the tax structure and rates, reduce tax waivers and bureaucratic bottlenecks in the tax administration.

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