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Aims and Scope
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Contents

Savings, Net Foreign Assets and Current Accounts Dynamics in Sub-Saharan Africa

Adeleke, A., W. Ohemeng and K. Ofori-Boateng

Abstract

A profile of the current account balance in sub-Sahara Africa (SSA) shows that many countries in the region have consistently experienced current account deficits, dwindling savings and diminishing net foreign assets. These macroeconomic variables convey important information to economic agents about the health of a nation. The relationships among these three important variables in terms of short-run and long-run dynamics are cloudy in the literature. Therefore, this study examined the long-run and short-run dynamics of savings, net foreign assets and current account balance in sub-Saharan Africa. Utilising panel econometric techniques with annual data from 38 countries in SSA for the period 1980 to 2013, it was found that savings and net foreign assets impact positively on the current account balance, while foreign direct investment, population growth and dependency ratio had negative impact on current account balance. These findings implied that African governments, desirous of improving their current account balance, must institute policies aimed at increasing savings and net foreign assets and properly manage foreign direct investment, as well as population growth and dependency ratio.

Keywords: Savings, Net Foreign Assets, Current Account Deficits, Panel Data Analysis, Sub-Saharan Africa

JEL Classification Numbers: E44, F43, O42

I. Introduction

A country's current account is the difference between its savings and its domestic investment. Equivalently, it is the difference between its exports of goods and services (including income receipts on assets held abroad) and its imports (Obstfeld, 2012). Strong current account surpluses may indicate heavy dependence of a country on its export revenues, resulting in a high savings rate, weak domestic demand and high net foreign asset base. Similarly, countries recording current account deficits may tend to have strong

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imports reliance, a low saving rates, weak net foreign asset base and high personal consumption rates, as a percentage of disposable income. Therefore, policy makers view the evolution of the current account balance as a key leading indicator of the health of a country's economy, with its dynamics conveying information about the actions and expectations of the domestic and foreign market participants.

Persistent current account deficits frequently signal disruptive economic trends. For instance, current account imbalances have preceded and accompanied by adverse economic and financial crises (Erauskin, 2015). Researchers and practitioners alike recognise the existence of strong correlation among financial, trade and economic crises across borders (Obstfeld, 2012). Changes in one country's current account balance can create negative spill-overs, via trade and financial channels. It has been shown within the European Union (EU) that countries with the highest current account disequilibria were the worst hit in terms of greater fall in the domestic demand and its negative spill-over during the 2007/2009 economic and financial crises (Lane, 2010).

Sub-Sahara Africa has been characterised by very large current account deficits in the past years recording the world's highest current account deficit of 5.9 per cent of the gross National Disposable income between 1975 and 1995. This trend persists even in recent times. For instance, sub-Sahara Africa recorded an average current account deficit of 1.33 per cent of GDP from the period 1980 to 2013. The average annual percentage change of the volume of imports from 1980 to 2013 was 5.17 per cent while that of exports was 3.14 per cent, clearly indicating an average of 40 per cent in excess of imports over exports. This implied consistent trade deficit, resulting in current account deficits (International Monetary Fund, World Economic Outlook Database, October 2015). These prolonged deficits in most of the countries have become unsustainable, crowding out domestic saving, and leading to economic instability (Opoku-Afari, 2005; Osakwe and Verik, 2007). Generally, a current account deficit exceeding 5 per cent of gross Domestic Product (GDP) threshold is regarded as unsustainable, and requires adjustment process of the current account (Freund, 2005). It is also quite common that government policies may lead to larger deficits and, in theory, different distortions could result in absolute current-account imbalances that are too small, rather than

too big, compared to an efficient benchmark (Obstfeld, 2012). It is well known that relatively large deficits are natural when a country begins its development process, strengthening domestic investment by importing capital (Obstfeld and Rogoff, 1995; Bussière et al., 2004; Chinn and Ito, 2007). Looking at the scale of development of countries within the sub-Saharan African, relatively large number of countries falls within the early development scale and, as such, prone to current account imbalances.

Nevertheless, when a growing number of countries run persistent current account deficits, it is crucial to understand what might have been driven these persistent deficits overtime to enable the formulation of effective policy interventions. Accordingly, these current account imbalances are a matter of concern for sub-Saharan countries, requiring an adequate policy prescription. The current study therefore sought to provide an in-depth account of the empirical linkage between savings, net foreign assets and current account balance, including a broad set of economic variables in sub-Saharan African countries.

Although sub-Sahara Africa has been facing turbulent current account dynamics in recent past, they have not been the subject of many empirical studies. The numerous empirical literature on the dynamics of current account balance as indicated above are based either on the experiences of a set of developed countries or based on large samples, consisting of a mixture of developed and developing countries, using cross section and panel data without much consideration to their time dimension. The corresponding results with this approach only provide a generalised picture for such economies. The empirical literature available also fails to ascertain the dynamics of the current account with respect to savings and net foreign assets, which are key procyclical, and countercyclical determinants of the current account balance. This paper therefore uses data from 1980 to 2013 and employs a panel data analysis to assess the dynamics of savings, net foreign assets and current account in sub-Sahara Africa to assist in policy formulation and implementation.

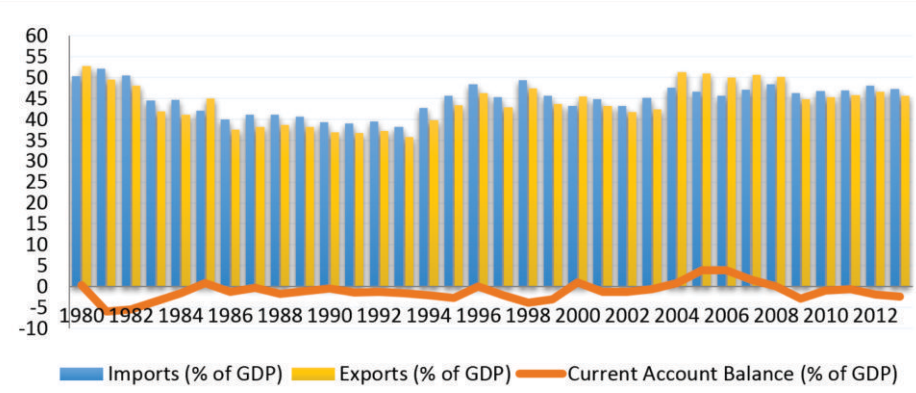
Following this introductory Section, the rest of the paper is presented in 5 sections. Section 2 discusses stylised facts on savings, net foreign assets and current account dynamics as well as trend analysis of selected

macroeconomic variables in the region. Section 3 reviews theoretical and empirical literature that focuses directly on the subject. Section 4 examines the methodology, while Section 5 presents the empirical results. Finally, Section 6 provides a conclusion and proffers policy recommendations.

II. Stylised Facts on Savings, Net Foreign Assets and Current Accounts Dynamics in the sub-Sahara Africa

Sub-Saharan Africa has exhibited very large current account deficits in the past years. Available data indicate that from 1980 to 2013, sub-Sahara Africa recorded more current account deficits than surpluses. The highest current surplus of 3.97 per cent of GDP was recorded in 2006, when exports exceeded imports by 9.52 per cent. Between 2004 and 2008, there were favourable terms of trade with commodities prices witnessing upward trends. For example, oil exporters, in the region, including Angola, Congo, Nigeria and Gabon, recorded 63.47, 84.16, 43.11 and 61.60 per cent of GDP for exports, respectively. Figure 1 explained the trends in exports, imports and current account balances as a percentage of GDP in SSA spanning from 1980 to 2013.

Figure 1: Trends in Imports, Exports and Current Account Balance in SSA from 1980-2013



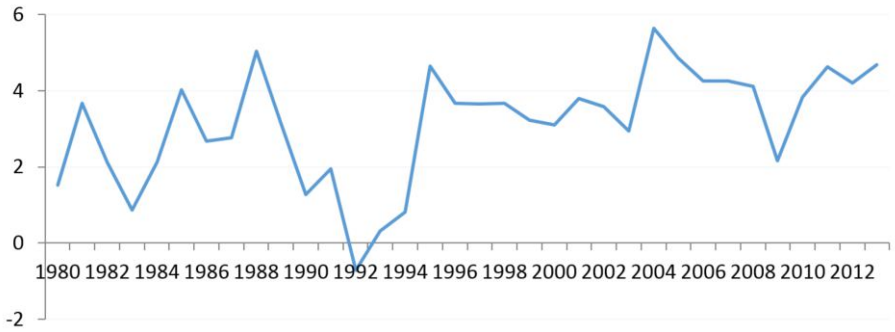
Source: World Development Indicators

Despite this impressive performance, current account deficits had dominated the period, from 2009 to 2013. As the global economy plunged into recession, crude oil prices dropped to US$41 a barrel, a more than 70 per cent decline from the peak in July, while non-energy prices, including food, had declined by

nearly 40 per cent at end-December 2008 (Global Economic Outlook, 2009). This resultant falling export demand, coupled with declining commodity prices, spread the impact of the crisis to other sub-Saharan African countries, thereby suppressing economic activity and causing fiscal and external balances to deteriorate significantly. Within this period, imports consistently exceeded exports.

Figure 2 showed the trend in annual GDP growth rate for some countries in SSA from 1980 to 2013. This region witnessed mixed and, most of the times, low annual growth during the review periods review. The annual GDP of sub-Saharan Africa grew, on the average, by 3.13 per cent from 1980 to 2013. The region recorded the highest growth of 5.64 per cent in 2004 and the lowest of negative 0.71 per cent in 1992. Drivers for the growth included: implementations of various structural reforms; solid global demand for commodities; greater flows of capital in the region; and debt relief. With the Global economic crises in 2008, however, economic growth faltered in many economies due to prolonged crisis in the world economy that caused the contraction in the global GDP first time after a long period of global stability. The GDP growth rate of the region thus reduced from an average of 4.05 per cent from 2000 - 2007 to 2.1 per cent in 2009.

Figure 2: Trends in Annual GDP Growth Rate for Countries in SSA from 1980-2013



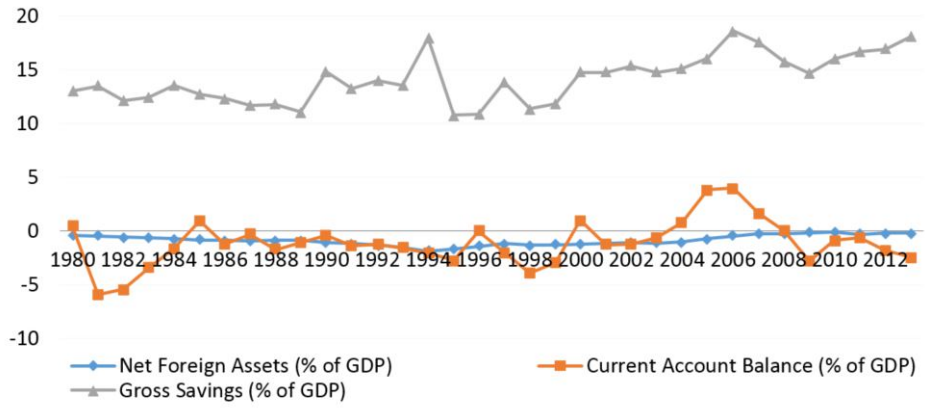
Source: World Development Indicators

Figure 3 showed the relationship between gross savings, NFA, and current account balance for the SSA from 1980 to 2013. The figure revealed weak current account positions, which consequently, resulted in weak net foreign

assets. The sub-Sahara Africa recorded negative net foreign asset positions throughout the period under review with the unprecedented least net foreign asset position of negative 1.87 per cent of GDP recorded in 1994 and the highest (negative 0.11 per cent of GDP) recorded in 2010. At the individual country levels, all countries recorded negative net foreign asset positions, with the exception of Algeria, Angola, Equatorial Guinea, Eritrea, Namibia, Nigeria, Rwanda and Swaziland, which recorded positive net foreign asset positions for some years in the period under review. All countries recorded negative Net Foreign Asset between 1980 and 2011 with the exception of Swaziland that recorded a positive average net foreign asset of 12.89 percent of GDP.

Gross domestic savings was, however, in a sinusoidal trend with the highest savings of 18.60 per cent of GDP recorded in 2006. In that same year, the highest current account surplus of 3.97 percent of GDP was also recorded, indicating the fact that higher saving will result in a high current account surplus. The lowest gross savings of 10.76 per cent of GDP and lowest net foreign asset of negative 186.86 per cent of GDP were recorded in 1994.

Figure 3: Trends in Gross Savings, Net Foreign Assets and Current Account Balance for Countries in SSA from 1980-2013



Source: World Development Indicators

III. Literature Review

III.1 Theoretical Literature Review

A variety of theoretical models have been used to explain the determinants of the current account balance, with each model indicating varying economic

policy implications. The traditional analysis of the current account imbalances, and their adjustment was based on two approaches. These approaches (i.e. the elasticity and absorption), which are theoretically consistent, can be derived from each other in the framework of the national income and product accounts.

The elasticity approach, pioneered by Marshall (1923) and Lerner (1944), is concerned with the condition under which exchange rate changes can compensate for price distortions in international trade. It is based on the analysis of price elasticity of demand for imports and exports, with respect to changes in exchange rate. It makes it easy, therefore, to predict the partial-equilibrium impact of expected changes in the terms of trade and relative income growth on the trade deficit. Determinants of international expenditure levels and incomes are held constant while static price elasticities of demand and supply determine the net international flow of capital. The main weakness of this approach is that it is a partial equilibrium analysis that looks at the traded goods market and ignores the interaction of other markets in an economy (Alexander, 1959).

The absorption approach views the current account as the difference between income and absorption, or equivalently, the difference between savings and investment. It states that if an economy spends more than it produces (absorption exceeds income), it must import from other countries for its excess consumption and spending and such an economy thus runs a current account deficit. Conversely, if this economy spends less than it produces (income exceeds absorption), it runs a current account surplus. This approach provides a more-inclusive and less-misleading context to analyse and forecast the current account than the elasticity approach by making it easier to incorporate determinants of financial account transactions into modelling the current account balance. Several critics have, however pointed out various defects in this approach. They argued that, analytically, it appeared to be superior to the elasticity approach, but deficient in computing marginal propensities to consume, save and invest. More importantly, the approach is weak in that it relies too much on policies designed to influence domestic absorption and does not take into consideration the effects of devaluation on the absorption of other countries. This approach also fails as a corrective measure of balance of payment deficit under a fixed exchange rate system

and places more emphasis on the level of domestic consumption than on relative prices. It is argued that a mere reduction in the level of domestic consumption for reducing absorption does not mean that resources released will be redirected towards improving the balance of payment deficit.

Another approach to current account analysis is the inter-temporal approach, which extends the absorption approach by recognising that private saving, investment decisions, and sometimes government decisions, are as a result of forward-looking expectations of future productivity growth, government spending demands and real interest rate, among several others. Obstfeld and Rogoff (1995, 1996) developed the inter-temporal approach to the current account and predicted four main inter-temporal perspectives. They indicated that a temporary rise of output above its permanent level would contribute to higher current account surpluses, due to consumption smoothing. Secondly, productivity growth and higher output growth rates would weaken the current account, since people borrow today against higher future income. Thirdly, increased investment needs would induce foreign borrowing and higher current account deficits, since representative agents would seek to cushion its consumption impact. Finally, government budget deficits, including lower taxes today and higher taxes in the future would have no impact on the current account, since representative agents smoothen their consumption over time. As a result, they would increase their savings whenever the public sector borrows against future tax income (Obstfeld and Rogoff 1995, 1996).

Inter-temporal models of the current account suggest that temporary income shocks are fully reflected in a country's net foreign asset position; hence agents invest abroad any savings generated by a positive income shocks. The model treats the current account as an outcome of consumption and investment decisions made over a long-term horizon under forward-looking expectations, and predicts that the current account will absorb any temporary shocks to the net national cash flow. It, thus, allows domestic agents to smoothen their consumption over time, with an assumption of free capital movements. Limitations of the inter-temporal approach, however, include the fact that, although it is theoretically rigorous, the model exhibits a poor empirical fit. Secondly, with its focus on the long-run, the models have limited applicability for assessing current account sustainability over the short to medium-term. Bergin and Sheffrin (2000) opined that, to explain the current account

behaviour of small economies, it may be important not only to consider shocks to domestic output but also shocks, arising in the world in general. They indicated that these external shocks would generally affect the small economy through movements in the interest and exchange rates. Bergin and Sheffrin (2000), therefore, developed and constructed a model that incorporated precisely a moving interest rate and the real exchange rate. The idea was that an anticipated rise in the relative price of internationally-traded goods can raise the cost of borrowing from the rest of the world when interest is paid in units of these goods. As a result, changes in the real exchange rate could induce substitution in consumption and thus produce inter-temporal effects on a country's current account, similar to those of changes in the interest rate.

There is another view of the inter-temporal approach to analyse the dynamics of current accounts with the occurrence of transitory income shocks. The new rule states that the current account response is equal to the savings generated by a transitory income shock multiplied by the country's net foreign assets. In reference to a small open economy, it implies that the slope of the coefficient of regression of the current account balance on savings multiplied by the ratio of the net foreign assets position to domestic wealth should be equal to unity. This happens when risk associated with investment is high, compared with the effect of diminishing returns of capital (Kraay and Ventura, 2000). Favourable income shocks, therefore, lead to current account surpluses in creditor countries. compared with current account deficits in debtor countries. Some studies have, however, doubted the validity of the new rule to analyse the behaviour of current accounts. For example, Tille and Van Wincoop (2010) asserted that the new rule would not hold in a two-country dynamic general equilibrium, since it did not distinguish between gross and net foreign assets positions and, as such, only holds in a one-way capital flow. Other critics argued that the empirical evidence by Kraay and Ventura (2000), in favour of the new rule, had nothing to do with the new rule (Guo and Jin, 2009). Erauskin (2015), on the other hand, revealed that the two main critiques of the new rule were flawed, stressing that the new rule was adapted to distinguish between gross and net foreign asset positions. The new rule would apply when the growth rates in the domestic and foreign economies were equal or when foreign holdings of domestic capital were negligible. It is seen that neither the traditional rule nor the new rule can explain completely the dynamics of

current account, independently. Therefore the size of the net foreign asset position, either as a share of domestic wealth or as a share of GDP, has been introduced as a key variable to reconcile both rules.

III.2 Review of Empirical Literature

Earlier studies on the current accounts dynamics focused on developed economies, rather than developing economies. Current account behaviour in sub-Saharan African in influenced by diverse factors, while most of the empirical studies carried out have been largely country-specific, using different estimation approaches and giving different findings. This section attempts to survey the empirical literature from both the developed and developing countries.

Some studies that focused on short-term current account variations were based on the assumption that current account served as a buffer against temporary shocks to income, to smoothen consumption and to maximise welfare. Studies in this direction, which were conducted by Ghosh and Ostry (1995) and Kraay and Ventura (2000), revealed that, for a sample of industrial countries, country-specific shocks, rather than global shocks were important for current account fluctuations and also that the degree of persistence of a productivity shock affects significantly the response of current account.

Debelle and Faruqee (1996) explained the short-run dynamics and long-term variations of the current account, specifying cross-section and panel data models. Their results indicated that relative income, government debt and demographic factors played significant roles in the long-term variation of the current account in the cross section, whereas fiscal surpluses, terms of trade and capital controls did not. They also estimated partial-adjustment and error-correction models, using panel data, which also revealed that fiscal policy had both short-run and long-run effects on the current account using the time series data; whereas real exchange rate, business cycle and the terms of trade had short-run effects on the current account.

Chinn and Prasad (2003) investigated the medium-term determinants of current accounts, by adopting a structural approach that highlighted the roles of the fundamental macroeconomic determinants of saving and investment.

They employed an annual data for 18 industrial and 71 developing countries for the period 1971 to 1995. Cross-section and panel regression techniques were used to examine the properties of current account variations over time and across countries. Their findings indicated that current account balances were positively correlated with government budget balances and initial stocks of net foreign assets. They also found that measures of financial deepening were positively correlated with current account balances, while indicators of openness to international trade were negatively correlated with current account balances, among developing countries.

Calderon et al., (2002) extended the work of Debelle and Faruqee (1996) by applying more advanced econometric techniques to control for joint endogeneity and distinguished between within-economy and cross-economy effects. They used a panel data of 44 developing countries for the period 1966-1995 to examine the empirical links between current account deficits and a broad set of macro-economic variables. Adopted a reduced-form approach, they found out that current account deficits in developing countries were persistent moderately. Additionally, they revealed that higher domestic output growth, increase in the terms of trade and the real exchange rate appreciation intensified the current account deficit. Conversely, increases in the public and private savings, higher growth rates in industrial countries and higher international interest rates had favourable impacts on the current account balance.

Bussière et al., (2004) examined the excessive deficits of the current account in the most of new member states of the European Union. Based on panel data estimations, deficits in these countries were determined mainly by the relative income per capita and high capital investments. The differences of incomes between new and old member states was really shrinking, while the effect of budget deficits was quite small, since they were mainly financed by private savings. Based on the work of Chinn and Prasad (2003), Gruber and Kamin (2007) used a panel data of 61 countries over the period 1982-2003 to assess the explanations for the global pattern of current account imbalances that had emerged in recent years, particularly in the U.S. Their findings showed that the Asian surpluses could be explained by a model that incorporated the impact of financial crises on current accounts. However, their model failed to explain the large U.S. current account deficit, even when the model was augmented by measures of institutional quality.

In developing and emerging market economies, Chinn and Ito (2007, 2008) examined the upsurge from current account deficit to surplus in Asian countries since 1997 by using a framework of the work by Chinn and Prasad (2003). They found that the standard determinants, such as demographics and income variables, used in the work of Chinn and Prasad (2003) alone could not explain this upsurge. Hence, they augmented the Chinn and Prasad (2003) specification with indicators of financial development and legal environment that were likely to affect saving and investment behaviour and economic growth. On the contrary, their study revealed that it was the lack of investment opportunities rather than excess saving that helped in explaining current account improvement in the Asian countries over the last decade. Aristovnik (2007) employed a dynamic panel-regression technique to characterise the properties of current account variations across selected Middle East and North African countries for the period 1971 to 2005. The results indicated that higher domestic and foreign investment, government expenditure and foreign interest rates had a negative effect on the current account balance. Medina, Pratt and Thomas (2010) studied the determinants of current account balance for developing countries, and found that the fiscal balance affected the current account significantly, and also that an increase of net foreign assets improved the current account balance.

In the West Africa sub-region, Oshota and Badejo (2015) investigated the determinants of current account balance within the panel auto regressive distributive lag in West African countries, by applying the methodology of Pooled Mean Group and Dynamic Fixed Effect estimation. Gross domestic product per capita, domestic investment, financial deepening and dependency ratios, in the pooled mean group model, were found to affect current account balance, positively, while real effective exchange rate was found to have a negative but statistically significant long-term effect. The result of the dynamic fixed effect model suggested that an increase in gross domestic product per capita and financial deepening would raise current account balance in the long-run. In the short-run, domestic investment exerted a positive impact on current account balance in the two models, while an increase in real effective exchange rate had a significant but negative impact on current account balance. They indicated that the presence of a long-run relationship between the current account balance and its determinants supported effectiveness of targeting one of the variables in influencing the long run behaviour of other variables by policy makers.

IV. Methodology

IV.1 Model Specification

An attempt was made to explain the interactions among savings, net foreign assets and current account balance dynamics in sub-Sahara African countries by modifying the model estimated by Erauskin (2015) and Gnimassoun (2015). It covered a sample of 38 SSA countries[1] (see Appendix 1A) for the period 1980 –2013. Sources of each variable and their definition were detailed in Appendix 1B. Thus, the equation to be estimated in this study is as:

$$CAB_{it} = \alpha_i + \beta_1 SAV_{it} + \beta_2 NFA_{it} + \beta_3 REER_{it} + \beta_4 GDPGR_{it} + \beta_5 POPGR_{it} + \beta_6 CPI_{it} + \beta_7 FDI_{it} + \beta_8 OPEN_{it} + \beta_9 INTEXD_{it} + \beta_{10} RIR_{it} + \beta_{11} DEPR_{it} + \varepsilon_{it} \quad (1)$$

Where:

α_i	=	Country specific fixed effects, which is assumed to be time invariant
β_i	=	the coefficients of each variable to be estimated
CAB_{it}	=	Current account to GDP ratio for country *i* in the year *t*
SAV_{it}	=	Saving to GDP ratio for country *i* in the year *t*
NFA_{it}	=	Net foreign assets to GDP ratio for country *i* in the year *t*
$REER_{it}$	=	Real effective exchange rate for country *i* in the year *t*
$GDPGR_{it}$	=	GDP growth rate for country *i* in the year *t*
$POPGR_{it}$	=	Population growth rate for country *i* in the year *t*
CPI_{it}	=	Consumer price index for country *i* in the year *t*
FDI_{it}	=	Foreign direct investment to GDP ratio for country *i* in the year *t*
$OPEN_{it}$	=	Openness index[2] for country *i* in the year *t*
$INTEXD_{it}$	=	Log of interest payment on external debt for country *i* in the year *t*
RIR_{it}	=	Real interest rate for country *i* in the year *t*
$DEPR_{it}$	=	Dependency Ratio for country *i* in the year *t*
ε_{it}	=	classical disturbance error component

In terms of apriori expectations, SAV and NFA are expected to be positively related to current account balance (CAB). As expansion in savings tends to have the positive effect on the current account to the extent that private savings complements public savings in improving current account balance. On the NFA, a positive sign is assumed, as improvement in the NFA position has the tendency to improve net foreign income flows, which expands the current account. On the other hand, GDPGR, POPGR, REER, FDI, INTEXD, RIR and DEPR

[1] *These countries are selected based on availability of data*

[2] *Openness is measured as the addition of imports and exports of goods and services as a percentage of GDP*

are expected to be negatively-related. These assumptions are premised on the reasoning that if households expect increase in their income, due to economic growth or increasing dependency ratio, they are likely to increase present consumption, thereby reducing savings and current account. Additionally, huge FDI may reduce precautionary savings by households, as well as create the Dutch disease syndrome; thus reducing the current account deficit, although this outcome depends on the level of governance in the country (Adeleke, 2014; Gnimassoun, 2015).

The OPEN and CPI can take diverse signs, depending on the nature of the economies. This is because the higher the degree of openness of an economy the more vulnerable it is to external shocks, although this depends on the ability of the economy to diversify its trade. On the influence of CPI on current account, the impact is not clear from the literature, as investors require some level of inflation to invest; likewise, higher inflation tends to reduce real income and discourage savings, thereby reducing current account balance. In sum, the influence of these macroeconomic variables on the current account is largely an empirical question.

IV.2 Estimation Procedure

The study utilised panel econometrics technique by modifying the work of Erauskin (2015). This methodology was based on the notion that the individual country relationships would have the same parameters; sometimes known as the pooling assumption. This static panel method of fixed effects and random effects were formulated to assist in achieving the objective of the study, as against the traditional pooled OLS regression. The Hausman test was utilised to make choice between the two competing models (fixed and random effects). Hausman (1978) test is based on the idea that under the hypothesis of no correlation, both Ordinary Least Squares (OLS) and Generalised Least Squares (GLS) are consistent, but OLS is inefficient; while under the alternative, OLS is consistent but GLS is not. The appropriate choice between the fixed effects and the random effects is premised on whether the regressors are correlated with the individual (unobserved in most cases) effect or not. The advantage of the use of the fixed effects estimator is that it is consistent even when the estimators are correlated with the individual effect.

V. Estimation Results and Discussions

This Section presents the results of the models estimated to understand the interrelationship among savings, net foreign assets and current account balance dynamics in SSA. The summary statistics were presented in Table 1. It was observed that the mean value of the REER was the highest at 382.11, followed by the mean values of CPI, INTEXD, RIR and SAV, which were 52.70, 16.57 15.89 and 14.28 per cent, respectively. The mean values of NFA and CAB were, however, negatives at 62.57 and 5.45 per cent, respectively.

Table 1: Summary Statistics of the Variables

	CAB	SAV	NFA	CPI	GDPGR	POPGR	REER	FDI	OPEN	INTEXD	RIR	DEPR
Mean	-5.4549	14.2758	-62.5658	52.7041	3.7753	2.6146	382.1112	2.6442	0.1441	16.5671	15.8862	6.1862
Median	-5.1200	13.3100	-59.1000	50.2600	4.0100	2.7100	208.3000	1.2200	0.1200	17.0100	8.6600	5.7700
Maximum	49.9800	77.3400	1720.7000	237.4200	35.2200	7.9900	785.7800	54.0600	0.9600	22.3200	145.4100	12.6800
Minimum	-84.1100	-36.6600	-541.0000	-52.6000	-50.2500	-6.3400	0.0000	-28.6200	0.0100	0.0000	-94.7500	3.8200
Obs	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325	1325

Source: Authors Estimation Results

Table 2 showed the correlation matrix. It was observed that SAV, NFA, GDPGR and INTEXD were positively-correlated, with current account, while CPI, POPGR, REER, FDI, OPEN, RIR and DEPR indicated a negative correlation. The signs in the correlation matrix were largely in line with the apriori expectations. It must also be noted that all the variables were not largely correlated with the dependent variable, indicating the presence of multi-collinearity among the variables.

Table 2: Correlation Matrix

	CAB	SAV	NFA	CPI	GDPGR	POPGR	REER	FDI	OPEN	INTEXD	RIR	DEPR
CAB	1.0000											
SAV	0.2377	1.0000										
NFA	0.1184	0.1528	1.0000									
CPI	-0.0233	0.1695	0.1375	1.0000								
GDPGR	0.0198	0.1583	0.0764	0.1203	1.0000							
POPGR	-0.0365	-0.0803	-0.1657	-0.0984	0.1730	1.0000						
REER	-0.1812	-0.1232	-0.0482	0.3525	0.0520	0.1060	1.0000					
FDI	-0.3712	0.0121	-0.0560	0.2387	0.1202	-0.0398	0.0960	1.0000				
OPEN	-0.2492	-0.0862	-0.2241	-0.2409	-0.0911	0.0948	0.0192	0.0426	1.0000			
INTEXD	0.1718	0.2312	0.0930	0.0614	0.0766	0.2233	0.0239	-0.1949	-0.0167	1.0000		
RIR	-0.1448	0.2905	-0.0233	0.1625	0.0537	-0.0437	-0.0090	-0.0233	-0.0234	0.0285	1.0000	
DEPR	-0.0005	0.0848	0.1528	0.0586	-0.0715	-0.3607	-0.1122	0.1047	-0.1590	-0.4285	-0.0354	1.0000

Source: Authors Estimation Results

Table 3 summarised the estimated results obtained from the panel regressions estimated under three different assumptions.

Table 3: Estimated Results from Panel Data Analysis

Dependent Variable: CAB

Variable	Model 1 (Pooled Regression)	Model 2 (Fixed Effects)	Model 3 (Random Effects)
Constant	-3.123	8.3097**	4.5736
SAV	0.1823***	0.1444***	0.1550***
NFA	-0.0008	0.0004	0.0001
CPI	0.0127**	0.0139**	0.0133**
GDPGR	0.0268	0.0423	0.0352
POPGR	-0.2498	-0.7889***	-0.7245**
REER	-0.0017***	-0.0018***	-0.0018***
FDI	-0.6465***	-0.6469***	-0.6487***
OPEN	-0.1654***	-0.1111***	-0.1234***
INTEXD	0.0885	-0.2900**	-0.1457
RIR	-0.0265***	-0.0230***	-0.0235***
DEPR	-0.2251	-0.8804**	-0.6805**
R-squared	0.3141	0.4463	0.2539
Adjusted R-squared	0.3083	0.4255	0.2476
p-value	0.0000	0.0000	0.0000
Obs	1325	1325	1325

Notes: ***, ** and * denote 1%, 5% and 10% level of significant respectively.
Source: Authors estimation results

The results of the pooled regression (Model 1) showed that many of the variables included were significant at conventional levels of significance. 1 per cent increase in the savings level led to about 0.18 percentage increase in the level of current account balance (CAB) in SSA. Similarly, 1 per cent increase in inflation led to about 0.03 percentage increases in the level of current account. These findings were in line with a priori expectation and corroborated the work of Chinn and Prasad (2003), among others. However, the relationship between the current account and net foreign assets was found to be negative and insignificant at all levels. It is also instructive to note that the size of the economy, measured by GDP, appeared not significant in all the models. This buttressed the fact that size of an economy may not really influence the current account balance in the region. The co-efficient of determination (R2) showed that about 31 per cent of the variations in current account balance were explained by the independent variables in the pooled panel regression.

This clearly point to the limitations of the pooled panel regression results, where individual country's peculiarities were not taken care of in the estimation process.

Although, the nature of the relationship among each of the independent and the dependent variables appears largely similar across the three models estimated, they however, made different assumptions. We, therefore, subjected the models to the Hausman test to compare the fixed and random effects estimates of the coefficients. The Hausman test, as reported in Table 4, showed an insignificant probability value hence the null hypothesis of the fixed effects estimates being better than the random effects estimates could not be rejected. This implied that fitting a random effects model to the data would amount to misspecification and could generate bias and inconsistent estimates. Hence, the appropriate model for the data was a fixed effects model (Model 2). Besides the Hausman test, a comparison of the R-squared coefficients in Table 3 showed preference for the fixed effects model. Therefore, Model 2 was selected as the preferred model.

Table 4: Correlated Random Effects - Hausman Test

Test Summary	**Chi-Sq. Statistic**	**Chi-Sq. d.f.**	**Prob.**
Cross-section random	**13.8616**	**11**	**0.2407**

Source: Authors Estimation Results

Based on the Hausman test, which preferred the fixed effect model to random effect, all other explanatory variables with the exception of net foreign assets and size of the economy (GDPGR) were found to be significant in determining current account balance in sub-Sahara Africa. In terms of co-efficient of determination (R2), the effect model showed that about 43 per cent of the variations in current account balance are accounted for by the explanatory variables. This indicated the improvement of the fixed effect results over both the pooled and random effect models.

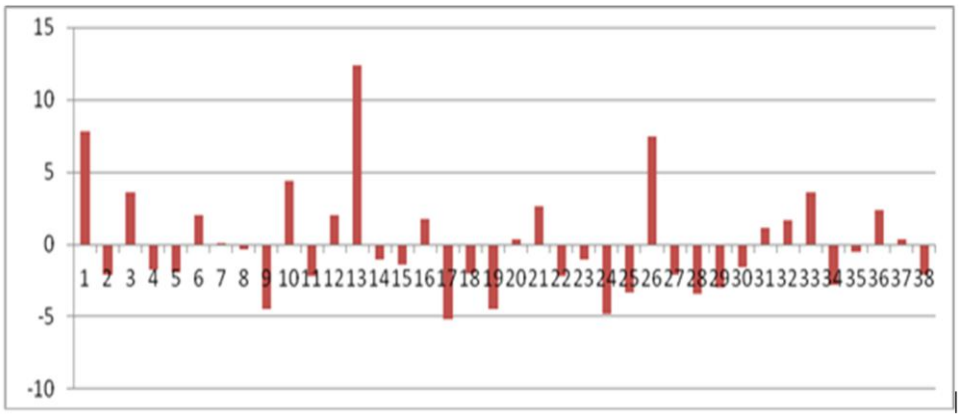
The result showed that 1 per cent increase in levels of savings would lead to about 0.14 per cent increase in the level of current account. This is in conformity with the apriori expectations where growth in the level of savings is expected to have positive impact on the current account balance. Also, 1 per cent increase in the net foreign assets of these countries would lead to positive but insignificant effect on the level of current account. When proxied, consumer

price index as a measure of inflation, it was clear that 1 per cent increase in CPI would increase current account balance by 0.01 per cent in SSA. This result indicated that some level of inflation might be required for investors in SSA to invest in exportable goods and services that would improve the level of current account balance. As in the results of the pooled panel estimate, the size of each country appeared to be insignificant in the models.

In the same vein, 1 per cent decrease in levels of population growth (POPGR), real effective exchange rate (REER), foreign direct investment (FDI), openness (OPEN), Interest payment on external debt (INTEXD), real interest rate (RIR) and dependency ratio (DEPR) generated about 0.79, 0.002, 0.65, 0.11, 0.29, 0.02 and 0.88 per cent increase, respectively, in the level of current account balance in SSA. This implied that all these variables impacted negatively on the current account balance in SSA and were in line with the apriori expectations. This outcome depicted the reality in SSA countries, where expectation of higher income, because of increased FDI, may encourage both households and governments to raise current consumption, hence, reducing savings and the current account balance. More importantly, the coefficient of POPGR and DEPR were negative and significant, as expected apriori, implying increase in population and dependency ratio would increase households and national spending, thereby reducing average national income, savings, and the current account balance.

The results of the cross section fixed effects obtained to understand peculiarities of the countries under study were presented in Figure 4. The outcome revealed that only 15 out of the 38 countries, including Angola, Botswana, Cameroon, Central Africa Republic, DR Congo, Cote D'Ivoire, Gabon, Guinea, Malawi, Nigeria, South Africa, Swaziland, Sudan, Uganda and Zambia, were above the regional average, in terms of the level of current account balance, during the period under consideration. This buttressed the fact that larger SSA countries had their current account balance in the negative region; and thus, required urgent individual country attention, as well as collaborative regional organisational support.

Figure 4: Cross Section Fixed Effects



Source: Authors estimation Results

VI. Conclusions and Policy Implications

This study examined the interactions between savings, net foreign assets and current account balance in sub-Saharan Africa from 1980 to 2013. The effects of intervening variables, such as, real effective exchange rate, size of the economy (proxy by GDP), and real interest rate, among others, were considered in estimating the interrelationship. This study was motivated by the fact that most studies carried out on this issue were either country-specific or largely focused more on developed countries and other regions of the world. It then utilised panel regression technique in establishing the statistical relationship among the variables. Based on the Hausman test, the fixed effect model was preferred to the random effect model. The results from the study showed that savings and net foreign assets impacted positively on the current account balance, while foreign direct investment, population growth and dependency ratio had negative influence. This implies that African governments, desirous of improving their current account balance must institute policies aimed at increasing savings and net foreign assets. Also, they must properly managing foreign direct investment, as well as population growth and dependency ratio.

Therefore, policies that are aimed at improving current account balance should be harnessed, by advancing intiatives that would encourage exports, particularly non-resource-based exports, which in turn may increase the net foreign asset base. Also, there should be continuous encouragement of

intiatives aimed at increasing both public and private domestic savings, while discouraging high population growth and dependency ratio. This should be complemented by institutionalising strategies to better manage resources, particularly those relating to foreign direct investment.

References

Adeleke, A.I. (2014). Foreign Direct Investment and Economic Growth Nexus in Africa: Does Governance Matter? *Journal of Economic Development*, Vol. 39, No. 1, pp. 111-135.

Alexander, S. (1959). Effects of a Devaluation: A Simplified Synthesis of Elasticities and Absorption Approaches. *American Economic Review* (49): 22-42.

Aristovnik, A. (2007). Short and Medium Term Determinants of Current Account Balances in Middle East and North Africa Countries. *William Davidson Institute working Paper* No. 862.

Baltagi, H., Kao, C. & Liu, L. (2007). Asymptotic Properties of Estimators for the Linear Panel Regression Model with Individual Effects and Serially Correlated Errors: The Case of Stationary and Non-Stationary Regressors and Residuals. *Center for Policy Research Working Papers* 93, Centre for Policy Research, Maxwell School, Syracuse University.

Bergin, P. R. and Sheffrin, S. M. (2000). Interest Rates, Exchange Rates and Present Value Models of the Current Account. *Economic Journal*, Vol. 110, Issue 463, pp. 535-558.

Bussière, M., Fratzscher, M., & Müller G. J. (2004). Current Account Dynamics in OECD and EU Acceding Countries – An Inter-Temporal Approach. *EIB, Luxembourg, EIB Working Paper Series.* No. 311.

Calderon, C., Chong A. & Loayza, N. (2002). Determinants of Current Account Deficits in Developing Countries, *Contributions to Macroeconomics* Vol. 2(1): 1021–1021, Berkeley Electronic Press Calderon.

Cédric T. and Wincoop V. (2010). International Capital Flows. *Journal of International Economics,* Elsevier, Vol. 80(2), Pages 157-175.

Chinn, M., D. and E. S. Prasad (2003). Medium-Term Determinants of Current Accounts in Industrial and Developing Countries: An Empirical Exploration. *Journal of International Economics*, Vol. 59(1), pages 47-76.

Chinn, M.D. and Ito, H. (2007). Current Account Balances, Financial Development and Institutions: Assaying the World Saving Glut. *Journal of International Money and Finance*, 26(4), pp. 546–569

Chinn, M. D. and Ito, H. (2008). Global Current Account Imbalances: American Fiscal Policy Versus East Asian Savings. *Review of International Economics*, 16(3), pp. 479–498.

Debelle, Guy and Hamid Faruqee (1996). What Determines the Current Account? A Cross-Sectional and Panel Approach. *IMF Working Paper* WP/96/58.

Erauskin, I. (2015). The Net Foreign Asset Position and Government Size. *International Review of Economics & Finance*, Elsevier, vol. 35(C), pages 130-148.

Feldstein, Martin and Horioka (1980). Domestic Saving and International Capital Flows. *The Economic Journal*, Vol. 90, pp. 314-329.

Hausman, J. A. (1978). Specification Tests in Econometrics. *Econometrica* 46(6), 1251-1271.

Ghosh and Atish (1995). International Capital Mobility Amongst the Major Industrialised Countries: Too Little or Too Much? The *Economic Journal*, 105: 107-128.

Ghosh, A. R. Atish and Jonathan O. (1995). The Current Account in Developing Countries: A Perspective from the Consumption-Smoothing Approach. *The World Bank Economic Review*, 9: 305-343.

Gnimassoun, B. (2015). The Importance of the Exchange Rate Regime in Limiting Current Account Imbalances in Sub-Saharan African Countries. *Journal of International Money and Finance*, 53, pp. 36-74.

Gruber, J. W. and Kamin, S.B. (2007). Explaining the Global Pattern of Current Account Imbalances. *Journal of International Money and Finance*, 26(4), pp. 500-522.

Guo, K. and Jin, K. (2009). Composition and Growth Effects of the Current Account: A Synthesised Portfolio View. *Journal of International Economics*, 79, pp. 31-41.

Henry, C. and Longmore, R. (2003). Current Account and the Real Exchange Rate Dynamics. The Jamaican Experience, *Bank of Jamaica Working Papers.*

International Monetary Fund (2010). Global Economic Outlook Online, Washington, D. C.

International Monetary Fund (2016). World Economic Outlook Database, October.

Kraay, A. & Ventura, J. (2000). Current Accounts in Debtor and Creditor Countries. *Quarterly Journal of Economics* 115, 1137–1166.

Lane, P. R. (2010). External Imbalances and Fiscal Policy, Institute for *International Integration Studies*, Trinity College Dublin and CEPR, IIIS Discussion Paper No 314.

Marshall, A. (1923). Credit and Commerce, (London, Macmillan) in Pilbeam, K. (1992), (London, Macmillan).

Medina, L., Prat J. and Thomas A. (2010). Current Account Balance Estimates for Emerging Market Economies. *IMF Working Paper* WP/10/43.

Obstfeld, M. (2012). Does the Current Account Still Matter? *American Economic Review*, 102(3), 1-23.

Obstfeld, M. & Rogoff, K. (1995). The Inter-Temporal Approach to the Current Account. In G.M. Grossman & K. Rogoff (Eds.), *Handbook of International Economics*, Vol III, Elsevier.

Obstfeld, M. and Rogoff, K. (1996). *Foundations of International* Macroeconomics. Vol. 30, MIT Press, Cambridge, MA.

Opoku-Afari, M. (2005). Capital Flows and Current Account Sustainability. Research paper at *www. Nottingham.ac.uk/ economics/credit.*

Osakwe, P and S. Verik (2007). Current Account Deficit in Sub-Saharan Africa, Do they Matter? United Nations Commission for Africa, 201-220. Downloaded from /antiopa/Economica/002461G/ Conference_2007_anglais/10-part II-3.

Oshota, S. O. and Badejo, A. A. (2015). What Drives Current Account Balance in West Africa States: Evidence from Panel ARDL. *Journal of International and Global Economics Studies* 8(2), 91-105.

Saqib, G, X. Hui, F. and Wang Y. (2007). The Current Account Balance of Pakistan, a Co-integration Analysis. *Information Technology Journal* 6(5).

Tille, C. and Van Wincoop, E. (2010). A New Perspective on "The New Rule" of the Current Account. *Journal of International Economics,* Vol. 80(1), pp. 89-99.

World Bank (2015), World Development Indicators (WDI) *Online Database*, World Bank, Washington, D.C.

APPENDICES

Appendix 1A: List of Countries

CROSSID	Country	CROSSID	Country	CROSSID	Country	CROSSID	Country
1	ANGOLA	11	CONGO	21	MALAWI	31	SOUTH AFRICA
2	BENIN	12	COTE D'IVOIRE	22	MALI	32	SWAZILAND
3	BOTSWANA	13	GABON	23	MAURITIUS	33	SUDAN
4	BURKINA FASO	14	THE GAMBIA	24	MOZAMBIQUE	34	TANZANIA
5	BURUNDI	15	GHANA	25	NIGER	35	TOGO
6	CAMEROON	16	GUINEA	26	NIGERIA	36	UGANDA
7	CENTRAL AFRICA REPUBLIC	17	GUINEA BISSAU	27	RWANDA	37	ZAMBIA
8	CHAD	18	KENYA	28	SENEGAL	38	ZIMBABWE
9	COMOROS	19	LESOTHO	29	SYCHELLES		
10	DR CONGO	20	MADAGASCAR	30	SIERRA LEONE		

Source: Authors' Compilation

Appendix 1B: Data sources and Definition of the variables

	Data sources and Definition of the variables			
S/N	**Variable Name**	**Sources**	**Notation**	**Comments**
1	Gross savings	World Development Indicators	SAV	(% of GDP)
2	Current Account Balance	IMF World Economic Outlook	CAB	(% of GDP)
3	GDP Growth Rate	World Development Indicators	GDPGR	GDP (annual %)
4	GDP per Capita	World Development Indicators	GDPPC	(current US$)
5	Gross Domestic Product	World Development Indicators	GDP	(Current USD)
6	Imports of Goods and Services (% of GDP)	World Development Indicators	IMPT	% of GDP
7	Exports of Goods and Services (% of GDP)	World Development Indicators	EXPT	% of GDP
8	External Debt	World Development Indicators	EXTDEB	(Current USD)
9	Interest Payment On External Debt	World Development Indicators	INTEXD	(Current USD)

10	Real Effective Exchange Rate	IMF World Economic Outlook	REER	Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs.
11	Population, Total	IMF World Economic Outlook	POP	Millions
12	Population Growth Rate	World Development Indicators	POPGR	Annual population growth rate
13	Age Dependency Ratio	World Development Indicators	DEPR	Age dependency ratio, old (% of working-age population)
14	Net Foreign Assets	External Wealth of Nations Database	NFA	% of GDP
25	Foreign Direct Investment	World Development Indicators	FDI	net inflows (% of GDP)
16	Real Interest Rate	World Development Indicators	RIR	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.
17	Consumer Price Index	World Development Indicators	CPI	Consumer price index reflects changes in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly.

Source: Authors' Compilation

Determination of Optimal Foreign Exchange Reserves for Nigeria

Tule M.,E. Egbuna, S. Abdusalam and A. Oduyemi

Abstract

The study examined the optimal level of international reserves for Nigeria that is capable of absorbing a shock similar to that experienced during the 2007/2009 Global economic crisis. Using, generalised autoregressive conditional heteroscedasticity (GARCH), vector autoregressive (VAR) estimation techniques and normalised Johansen co-integrated equation, and setting the maximum and minimum output losses for the entire period, the study found a positive relationship between the odds of default on sovereign debt and fiscal deficit to GDP ratio, short-term debt to reserves ratio and volatility in portfolio investments. In minimising the Bank's cost of holding reserves, the study found that the Nigerian economy required the minimum "core" foreign reserves level of US$32 billion to absorb adequately similar external shocks to the economy. The study found that while actual reserves had been above the optimal reserves level between 2008Q1 – 2014Q1, the average "core" reserves available to the economy was however, insufficient to absorb the adverse economic impact of financial crises, if they occur in the future. The study, therefore, recommended, amongst others, the need to block leakages to foreign reserves, facilitate fiscal consolidation and export diversification and improve the macroeconomic fundamentals of the Nigerian economy.

Keywords: International Reserves, Sovereign Risk, Optimisation, GARCH, Co-integration
JEL Classification: E58 F31 F34

I. Introduction

Every nation maintains foreign reserves for different reasons, including, amongst others, efficient management of foreign exchange rate volatility and adjustment of costs, associated with variations in international payments (Elhiraika & Léonce, 2007). There has been a growing trend in reserves accumulation amongst developing countries. The International Monetary Fund (IMF) estimated that the global external reserves holding increased from US$1.57 trillion in 1996 to US$11.69 trillion in 2013, with the share of developing and emerging economies increasing from US$0.55 trillion to US$7.87 trillion. The phenomenal rise in external reserves holding, across

* *The authors are staff of the Monetary Policy Department, Central Bank of Nigeria. The usual disclaimer applies.*
[1] *See CBN, 2015, pp. 245-266, 271-276 & 291-298, which covers the CBN's MPC Communiqué 59 – 62, 64 & 67.*

many emerging markets and oil exporting countries in recent years, has been motivated, largely by the drive for self-insurance against adverse external shocks (Elhiraika & Léonce, 2007).

Nigeria has witnessed significant rise in external reserves from US$3.40 billion in 1996 to US$28.28 billion in December 2005, peaking at an all-time high of US$62.08 billion in September 2008 before declining to US$ 39.07 billion at end-July 2014. The huge accretion to external reserves between 2000 and 2008, reflected favourable developments in the oil market, including high prices, strong demand and improved domestic production. However, the significant drop in reserves between 2008 and 2010 was attributed to the effect of the 2008/09 Global Financial Crisis (GFC), significant production declines, due to insecurity in the oil producing region and high import bills. In addition, the effect of the unwinding of quantitative easing measures in the US coupled with dwindling fiscal buffers, accentuated the threat of depletion of the country's external reserves[2].

The depletion in foreign reserves, witnessed in Nigeria in recent times, could elevate risk concerns among foreign investors. This could have serious implications for risk premium, portfolio flows, short-term external debt position, balance of payments position and economic growth. Also, dwindling fiscal buffers tend to increase the country's reliance on foreign portfolio flows, which are known to be volatile and characterised by sudden stop, constitute a major risk to exchange rate stability, especially with uncertainties around capital flows and oil price. This suggests that a country's ability to manage its short-term obligations to the outside world, maintain a disciplined fiscal regime and attract long-term capital is crucial in the determination of its risk premium (Ozyildirim & Yaman, 2005).

The debate on what constitutes an optimum reserve holding remains unsettled in the literature. While some countries have remained aggressive in the accumulation of external reserves, others strive to maintain adequate reserves, based on certain international standards. Practical experience suggests, at least, three month import cover[3] "rule of thumb" in determining the optimal level of reserves (Mendoza, 2004) . Import-based reserves adequacy criteria

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[2] *See CBN, 2015, pp. 841-920 & 979-1048, which covers the CBN's MPC Communiqué 93 – 95 & 98 – 99.*

[3] *Import cover in the literature is defined as the ratio of average monthly import to the average stock of foreign reserves. The inverse of which is the reserves to imports ratio.*

suggest that 30 per cent of broad money or 4 months of import covering reserves can be considered as a minimum benchmark for reserve adequacy. Similarly, Wijnholds & Kapteyn (2001) proposed that countries on managed float or on fixed exchange rate regime could maintain reserves to cover around 10 and 20 per cent of broad money, while the IMF posits 3 months of import cover. The role of reserves in macroeconomic management remains debatable, as both low and high reserves portfolios have their peculiar cost implications. The conventional external reserves adequacy ratios may not represent optimality in external reserves holdings. Therefore, it is important to estimate the optimal external reserve holding[4], while taking cognisance of adverse external shocks, cost profile of reserve maintenance and sensitivity of international capital to macroeconomic fundamentals. This would facilitate the comparison of the optimal trend with the conventional benchmarks, and help determine if actual reserves are beyond or below the optimal levels, in which case, the country could be incurring some costs or benefits.

The knowledge of how a country's sovereign risk may be impacted by key external and fiscal variables such as portfolio flows, fiscal deficit and short-term external debt in relation to the external reserves level and output is critical for the attainment and sustenance of macroeconomic stability. More importantly, identifying the external reserves level, which is deemed optimal to enable the country adequately absorb the effect of a severe adverse shock is key to effective macroeconomic management. The primary objective of the study is to establish an optimum external reserve level that would provide adequate buffers for the Nigerian economy to absorb adverse external or internal economic shocks, and gradually return the economy back to its growth trajectory. The value addition of the paper on existing literature on reserves adequacy in Nigeria is that it adopts an optimisation approach in establishing an optimum reserves in the face of economic shocks. Following this introduction, Section 2 presents some stylised facts; while Section 3 examines related literature, including theoretical framework. Section 4 discusses data and methodology. Section 5 interprets the empirical results; while Section 6 concludes with policy recommendations.

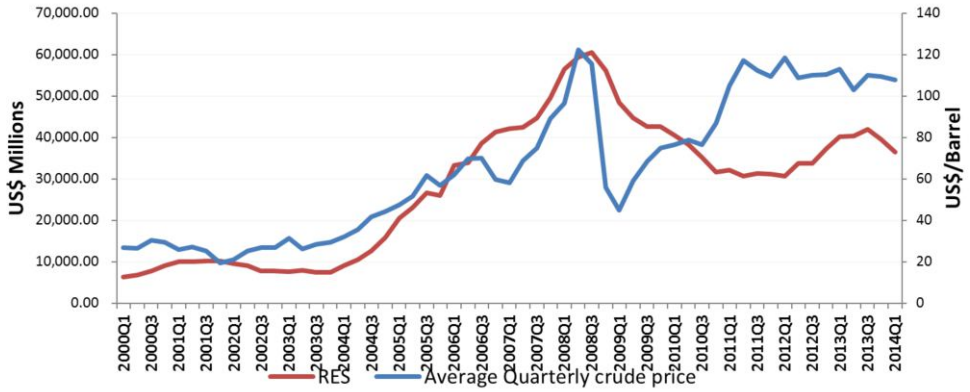
II. Stylised Facts

Nigeria's external reserves derive mainly from the proceeds of crude oil production and sales. The main sources of rising external reserves in Nigeria

[4] *See Bird & Rajan (2003) and IMF (2011).*

include: inflow of oil revenues, complemented by diaspora remittances; growing foreign direct investment (FDI) and foreign portfolio investments (FPI); and other capital inflow. Nigeria's external reserves rose phenomenally from 2005 and maintained the upward trend until the wake of the global financial crisis when it nose-dived from its peak in 2008. From an average position of $US6.32 billion from 1990Q1 and 2004Q4, the external reserves peaked at $US62.08 billion in 2008Q3. It, however, declined to $US38.33 billion in 2014Q1 (Figure 1).

Figure 1: Oil Price and Nigeria's Foreign Reserves (2000Q1 - 2014Q1)



Source: Statistics Database, CBN (2014)

Table 1: Average periodic Trend in Interest Rate Spread, FPI, and Foreign Reserves (2000Q1 – 2013Q3)

	2000q1 - 2006q1	2006q2 - 2007q4	2008q1 - 2010q4	2011q1 - 2014q1
Average Interest Rate Spread	3.05%	1.54%	3.96%	8.96%
Average FPI	135.03	694.69	457.93	3,098.37
Average External Reserves	12,635.54	42,493.63	46,843.65	38,176.10

Source: CBN & Authors' Calculations

Table 1 indicates that between 2000Q1 and 2006Q1, external reserves, FPI and interest rate spread, averaged US$12.64 billion, US$135.03 million and 3.05 per cent, respectively, per quarter. This period was characterised by high levels of short-term debt to reserves ratio, which adversely impacted the inflow of FPI. Between 2006Q2 and 2007Q4, external reserves, FPI and interest rate spread averaged US$42.93 billion, US$694.69 million and 1.54 per cent, respectively, per quarter. The increase in FPI, despite the lower spread could be explained

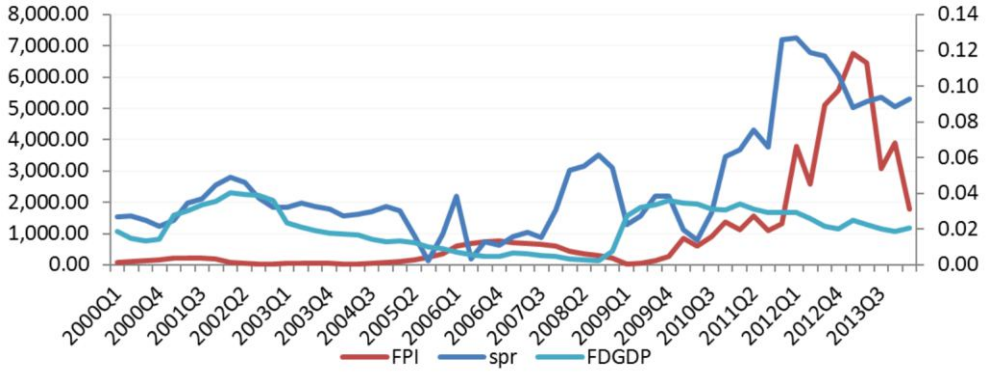
by the significant decline in the ratio of short-term debt to reserves during the period. Furthermore, it coincided with a period when the economy exited the Paris and London club debt obligations. The significant increase in the stock of external reserves was primarily as a result of the steady increase in crude oil prices, during the period.

The period 2008Q1 and 2010Q4 saw a decline in the average FPI to US$457.93 million, despite having an average interest rate spread of 3.96 per cent. This was due primarily to the onset of the global economic crisis, which also impacted on the Nigerian economy, triggering the Nigerian Banking crisis. Furthermore, the crises triggered the withdrawal of credit lines and capital flow reductions, as foreign investors repatriated funds back to their home countries to shore up their balance sheets. Surprisingly, despite the reduction in FPI, external reserves averaged US$46.84 billion during the period. The period also witnessed a significant drop in reserves from its peak of US$62.08 billion in 2008Q3 to US$33.00 billion in 2010Q4. Between 2011Q1 and 2014Q1, average FPI and interest rate spread increased to US$3.10 billion and 8.96 per cent, respectively, while average foreign reserves declined to US$38.18 billion. The increase in FPI was triggered by the significant increase in average interest rate spread[5] and improved fundamentals of the Nigerian economy, occasioned by steady GDP growth and stable prices. Furthermore, though average external reserves were lower than that of the period 2008Q1 to 2010Q4, the average for the period was higher than the low point of US$33 billion in 2010Q4.

Figures 2, 3, 4 and 5 suggest that between 2000Q1 and 2005Q3, FPI was primarily influenced primarily by the uncertainty about capacity to service the short-term sovereign debt, which was signaled by the high short-term external debt to foreign reserves ratio. Furthermore, between 2010Q3 and 2014Q1, FPI was influenced strongly by the interest rate spread and good macroeconomic fundamentals, which was manifested by strong GDP growth and stable prices. Significantly though, the major driver of foreign reserves remained the international price of crude oil.

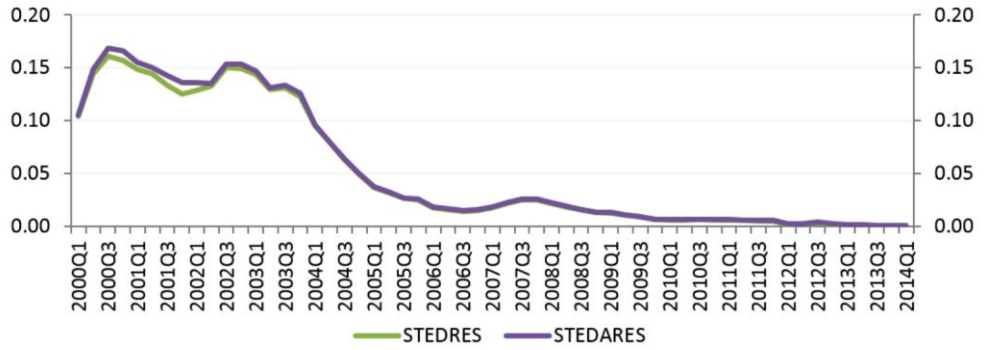
5. The spread is the difference between weighted return on Nigerian sovereign debt instruments and 90-day FED TB rate

Figure 2: Interest Rate Spread (SPR), Fiscal Deficit to GDP Ratio (FDGDP) and Foreign Portfolio Investment (FPI) (2000Q1 - 2014Q1)



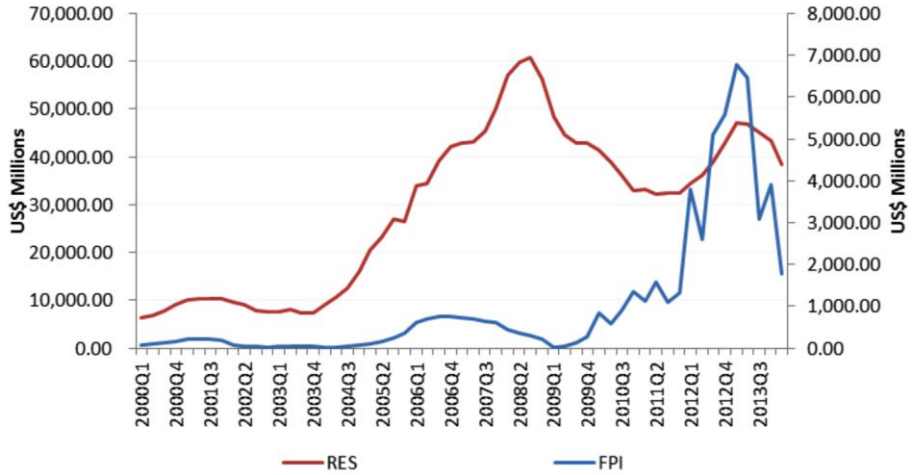
Source: CBN and Authors' Calculations

Figure 3: Short-Term Debt to Actual Reserves (STEDRES) and Short-Term Debt Adjusted Reserves (STEDARES) (2000Q1 - 2014Q1)



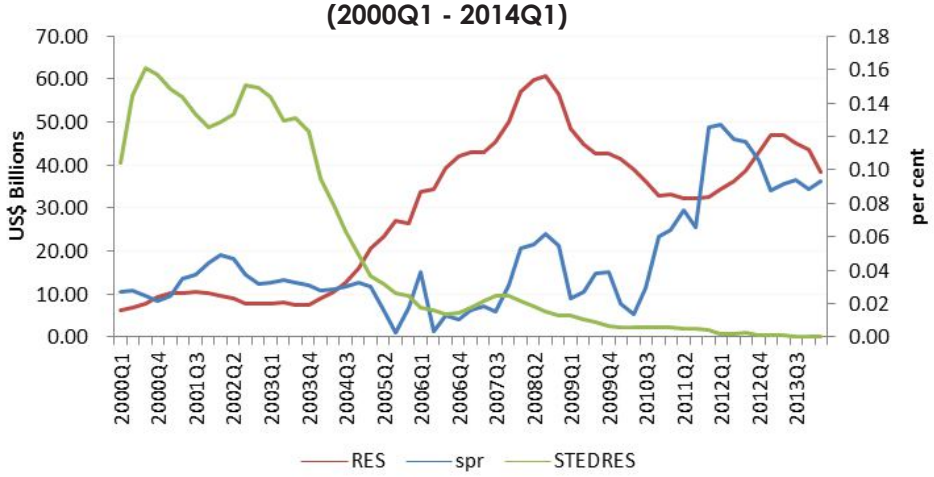
Source: CBN and Authors' Calculations

Figure 4: Nigerian Foreign Reserves (RES) and FPI (2000Q1 - 2014Q1)



Source: Central Bank of Nigeria

Figure 5: Spread (SPR), Reserves (RES) and Short-Term External Debt (STEDRES) (2000Q1 - 2014Q1)



Source: CBN and Authors' Calculations

Figure 6 showed that prior to the onset of the global economic crisis, the interest rate spread was below the weighted average rate, but it had subsequently mirrored the weighted interest rate on Nigerian sovereign debt instruments, with the collapse of the external cost of funds to near zero per cent.

Figure 6: Weighted Rates and Interest Rate Spread (SPR) (2000Q1 - 2014Q1)

Source: CBN and Authors' Computations

III. Literature Review

The literature on the determinants of optimal level of reserves revolves around three central areas of consensus. In the first cluster of literature, Heller (1966), Frenkel & Jovanovic (1981) viewed foreign reserves accumulation as a process

of satisfying the obligation of external payments and suggested a framework of ratio of reserves to imports. This establishes whether a country has the minimum capability to support its external obligations or not. Triffin (1961) suggested import-based reserves adequacy of 30.0 per cent of broad money (M2) or 4 months of import covering reserves. Similarly, Wijnholds and Kapteyn (2001) proposed that countries could maintain reserves to cover around 10.0 and 20.0 per cent of broad money, if operating a managed float or fixed exchange rate regime.

The second consensus consisted of contributions from authors, like: Calvo (2002); Rodrik and Velasco (1999); Bird and Rajan (2003); García and Soto (2004); Jeanne and Rancière (2006); Jeanne and Rancière (2011); and ECB (2006). They argued that the maintenance of reserves at levels other than the optimal level could trigger a macroeconomic disequilibrium. Calvo (2002) noted that the accumulation of foreign exchange reserves, leads to monetary expansion and, hence, inflation. This is, however, in contrast to the submission of Polterovich and Popov (2010), who argued that reserves were accumulated through maintenance of government budget surplus, which averts inflationary pressure. They discovered that there was no link between the accumulation of foreign reserves and inflation. Others, like Jeanne and Rancière (2011) suggested that reserves were deployed to fill balance of payments gap associated with GDP losses, arising from external shocks and sudden restrictions[6] in accessing international capital. Bird and Rajan (2003) acknowledged that the desire to maintain reserves at adequate levels helped ensure that interest rates are kept at competitive levels to discourage capital outflow. Dooley et al (2004) posited that reserves were accumulated to facilitate the actualisation of the macroeconomic agenda of government, such as export oriented growth and job creation.

The third is the optimising reserves approach argument. Ben-Bassat and Gottlieb (1992) posited that reserves were held at levels that equated the added benefits and costs of keeping reserves are equated. They argued that reserves accumulation had the benefit of signaling a low default risk on sovereign debt, which translated into improved sovereign risk rating and lower interest premium to compensate international investors. Furthermore, they

6. *Similarly, Ben-Bassat and Gottlieb (1992), Aizenman and Lee (2007) and Espinoza (2014) argument on optimal reserves suggested that reserves accumulation could be viewed as self-insurance to mitigate and prevent an undesired output drop or the crisis caused by sudden stops.*

opined that an associated opportunity cost of keeping reserves, which includes the income forgone for not investing the reserves in higher interest income-earning instruments, output losses and interest expense from the finance of expenditure through taxes and debt rather than depletion of the reserves. Intrinsically, the approach estimates the central bank's optimal reserves level by solving its optimisation problem either by minimising its cost of holding reserves or maximising the benefits of holding reserves. Heller (1966) posits that optimal reserves holding is achieved when the marginal cost and benefits of holding reserves are equated. The approach derived an expression for optimal reserves as a function of observables (such as the level of imports and external debt) and a few unknown quantities, namely: the opportunity cost of holding reserves; the output cost of default; the probability of default; and the effect of higher reserves on this probability. The outcomes of the literature differ across countries.

Prabheesh (2013) empirically determined the optimal level of international reserves for India by explicitly incorporating the country's sovereign risk associated with default of external debt due to financial crisis. The empirical results showed that the volatility of foreign institutional investment, short-term debt to reserves and the fiscal deficit to GDP significantly explained the variations in risk premium. The author concluded that international reserves in India were higher than the estimated optimum level of reserves. Ozyildirim and Yaman (2005) conducted research on optimal reserves adequacy in Turkey for the period 1998 and 2002. The empirical findings indicated that actual reserves were below the optimal and adequate levels, when a cumulative GDP loss in excess of 5.0 per cent during a financial crisis was imposed on the entire sample period. Jeanne and Rancière (2006) argued that reserves allowed a country to smoothen domestic absorption in response to sudden stop, but yielded a lower return than the interest rate on the country's long-term debt.

A significant amount of research has been undertaken on foreign reserves adequacy and optimal reserves in Nigeria. However, none of the research attempted to solve the central bank's optimisation problem. Furthermore, existing literature does not estimate optimal reserves necessary for the economy to withstand a severe economic crisis. Abiola and Adebayo (2013) studied the demand for reserves in Nigeria and concluded that Nigeria's foreign reserves were adequate, based on international benchmarks. Irefin

and Yaaba (2012) used an autoregressive distributed lag (ARDL) to estimate the determinants of foreign reserves in Nigeria and found strong evidence in support of income as a major determinant of reserves management in Nigeria. Oputa and Ogunleye (2010) indicated that while Nigeria's reserves were adequate based on international standards, actual reserves were on the average below their estimated adequate reserves. They concluded that the economy needed to sustain reserves accumulation to enable it adequately absorb the adverse impact of external shocks. Udo and Antai (2014) suggested that reserves accumulation in Nigeria had an adverse impact on investment, economic growth and productivity, and recommended a cut-back in reserves accumulation to finance domestic investment.

The central message of the different approaches and studies is that the motives for keeping reserves determine the key variables, which influence actual reserves levels. However, there is an optimal level of reserves that engenders macroeconomic stability even in the presence of a financial crisis. The study is built on Ben-Bassat and Gottilieb (1992) framework and Prabheesh (2013), given the simplicity in estimating optimal reserves and the peculiarities of the Nigerian economy.

IV. Theoretical Framework and Methodology

IV.1 Theoretical Framework

The study adopted the framework developed by Ben-Bassat and Gottilieb (1992), which was employed by Prabheesh (2013) to determine optimal international reserves in India for the period 1994 to 2008. The model is based on the cost-benefit approach in determining optimal reserves. Theoretically, optimality is achieved by equating the marginal cost of holding reserves to the marginal benefits of doing so. The cost of holding reserves is identified as the potential income forgone for holding foreign exchange in reserves rather than utilising it for other purposes, while the benefit is the avoidance of output, losses associated with balance of payments (BOP) and exchange rate fluctuations. Economies, by virtue of international trade and finance, are susceptible to global economic shocks. Thus, every economy has a probability (π) that such shocks will result in reserves depletion. Alternatively, (π) is the probability that the economy may default of its debt obligations faced with adverse financial and economic shocks.

$$\pi = f(R, Z) \quad (1)$$

$$\frac{\partial \pi}{\partial R} = \pi_R < 0^{7} \text{ (I.e. convex)} \quad (1.1)$$

Where:
R is stock of reserves holdings and Z is a collection of economic variables, which influence the ability of the economy to meet her debt obligations as and when due (i.e. default risk).

Based on the above discussions, the expected total cost to the economy for holding reserves is:

$$E(TC) = \pi_{|r,z} C_o + (1 - \pi_{|r,z}) C_1 \quad (2)$$

Where:
E is the expectation operator;
TC is the total cost of reserves holding to the economy;
C0 is the cost of holding low reserves (i.e. potential output loss)[8];

C_1 is the total opportunity cost for holding reserves; and
$\pi_{|r,z}$ is the probability of default.

$$C_1 = rR \quad (2.1)$$

r is the interest forgone for holding reserves (i.e. interest rate that would have been earned, if the reserves were converted into domestic currency and invested in Treasury Bills) and R is stock of reserve holdings.
Substituting (2.1) into (2) we get equation (2.2)

$$E(TC) = \pi_{r,z} C_o + (1 - \pi_{r,z}) \mathrm{rR} \quad (2.2)$$

Optimality requires the minimisation of the expected total cost of reserves to the economy (i.e. optimality in reserves accumulation is obtained when the cost of reserves accumulation is at its minimum level).

Taking the first order derivative of equation 2.2 with respect to R and equating it to zero, gives:

$$\frac{\partial E(TC)}{\partial R} = (C_o \frac{\partial \pi}{\partial R} - \frac{rR \partial \pi}{\partial R}) + (1 - \pi_{|r,z}) \mathrm{r} = 0 \quad (3)$$

---

7 $\frac{\partial \pi}{\partial R} = \pi_R < 0$ because an increase in reserves improves the ability of the economy to repay its debt obligations, absorb adverse economic shocks, and moderate volatility in BOPs and foreign exchange rate.

8 This is the difference between potential GDP and actual GDP

Substituting (1.1) into (3) we get equation (3.1)

$$\frac{\partial E(TC)}{\partial R} = \pi_R(C_o - rR) + (1 - \pi_{|r,z})\,\mathrm{r} = 0 \qquad (3.1)$$

Solving for optimal reserves holding R*, we get equation (4)

$$R^* = \frac{(1-\pi_{r,z})}{\pi_R} + \frac{C_o}{r} \qquad (4)$$

Once the first order condition is established, the individual parameters are estimated. For example, the output gap (*Co*) is estimated using Hodrick-Prescott (1980) filter method.

IV.1.1 Cost of Default

In line with the methodology adopted by Ozyildirim and Yaman (2005), Prabheesh (2013), estimated the adjustment cost as the potential output loss, due to the prospect of insolvency and financial crisis. It takes into cognisance the fact that low reserves may threaten the ability of an economy to meet its debt obligations in a period of crisis. The country's credit rating is likely to drop and may be unable to secure credit and credit lines to meet up its commercial and financial obligations. Consequently, the economy would be operating below its pre-crisis capacity and, thus, be on a lower growth trajectory during the crisis and immediate post-crisis periods. In view of this, the cost of default on external debt or cost of insolvency is a good proxy for the cost of reserves depletion in developing economies, which are characterised by borrowing with sustained BOP disequilibrium[9].

IV.1.2 Opportunity Cost (C1)

This refers to the income forgone for holding reserves and is computed as the product of domestic returns on 91-day Treasury bill and total reserves.

IV.1.3 Probability of Default (Πr,z)

Prabheesh (2013) estimated the probability of default function as:

$$\Pi_{r,z} = \frac{e^f}{1+e^f} \qquad (5)$$

[9]. *Prabheesh (2013) imposed an output loss of 4.8 and 7.5 per cent of GDP on the model for the sample period (1995 – 2009), based on the potential output loss to the Indian economy between 1991 and 1994, resulting from the economic crisis of 1991 – 1994.*

Where:

f is a function of economic variables that determines the likelihood that an economy will default on its sovereign debt obligations. Hence f is defined as the odds of default

$\left(\frac{\Pi_{r,z}}{1-\Pi_{r,z}}\right)$, which under a perfect capital market is equivalent to the discounted risk premium (i.e. $\left(\frac{i-i^*}{1+i}\right)$),

Where:

i = rate of return on a risky financial assets (e.g. borrowing rate)

i* = rate of return on risk-free assets (e.g. sovereign bonds)

Equation (5) is derived, based on the preceding discussions

$$\left(\frac{\Pi_{rz}}{1-\Pi_{rz}}\right)=\left(\frac{i-i^*}{1+i}\right) \qquad (6)$$

The discounted risk premium $\left(\frac{i-i^*}{1+i}\right)$ in a perfect international capital market can be interpreted as the spread between returns on investment in domestic financial instruments and returns on safe (risk free) international financial instruments (e.g. LIBOR, T-Bills). This, in effect, measures/proxies the sovereign risk of a nation. A high positive spread is indicative of high risk premium, attributable to the poor sovereign rating of the economy. International investors are thus likely to demand a higher spread to encourage them to invest in domestic financial instruments.

Substituting (5) into (6) and taking logs of the left and right hand sides we have:

$$f = \log\left(\frac{\Pi_{rz}}{1-\Pi_{rz}}\right) = \log\left(\frac{(i-i^*)}{(1+i)}\right) = \log(e^f) \qquad (7)$$

Based on previous discussions, f is equal to the log of discounted risk premium or spread and is function of the economic variables collectively captured by Z.

$$f = f(\mathrm{Z}) \qquad (8)$$

Thus, f can be estimated by regressing it with macroeconomic fundamentals. Following Edwards (1983), Nogue´s and Grandes (2001), Ferrucci (2003), Ozyildirim and Yaman (2005) and Prabheesh (2013), the risk premium equation can be specified as follows:

$$\log\left(\frac{i-i^*}{1+i}\right) = a_0 + a_1 \log(sii) + a_2 \log\left(\frac{sted}{rr}\right) + a_3 \log\left(\frac{fd}{gdp}\right) + \varepsilon_t \qquad (8.1)$$

The economic variables contained in the set Z, which explained the variations in the spread are as follows: #

1. Volatility of Foreign Institutional Investment – This captures the impact of the volatility of foreign international investment on risk premium. It takes cognisance of the characteristically mobile nature of international capital and the relationship between macroeconomic risks and the interest premium on international borrowings. Consequently, it is expected that a positive relationship exists between foreign institutional investment and the spread, because investors must be paid a high premium to compensate them for investing in debt instruments in a risky macroeconomic environment.

2. Short-Term External Debt to Reserves – This helps explain how the ability of the government to service short-term debt obligations through reserves depletion impacts on risk premium. The capacity to meet immediate debt obligations is influenced by existing stock of actual and core[10] foreign reserves at the disposal of the government. The larger the stock of reserves, the greater the ability to meet short-term obligations and, thus, the lower the risk of default. This translates into low default risk and low compensatory risk premium to international investors for absorbing the risks associated with investing in short-term debt instruments issued by the government. This portends an expected positive relationship between the ratio and the spread.

3. Fiscal Deficit to GDP – This essentially captures the inefficiency of government in managing its operations, economically and efficiently. Persistently, high fiscal deficit/GDP ratio, puts into doubt the ability of the government to raise sufficient funds to meet its debt obligations as and when due. Consequently, investors in sovereign debt instruments issued by the government would require a high premium to compensate for absorbing a high risk of possible default on debt obligations by the issuing government. A high ratio signals national incapacity to service debt obligations as they mature and translates to lower credit-worthiness; thus, requiring high

[10] *The core reserve can be defined as total reserves less the quarterly adjusted cumulative foreign portfolio investment. This gives an indication of the unencumbered reserves available to the authority to defend the currency in the event of capital flight.*

compensatory premiums for investors willing to absorb such risks. Thus, it is expected that a positive relationship exists between the interest rate premium and the ratio of short-term debt to external reserves.

IV.1.4 Volatility of Portfolio Investment

Prabheesh (2013) established the volatility of portfolio investment with an Autoregressive Conditional Heteroscedasticity (ARCH) model, to justify its inclusion as a variable in the determinant of the discounted risk premium.

The Arch (p) model utilised is represented by equation (9):

$$\text{Sii} = \mu + \varepsilon_t \tag{9}$$

Where **Sii** is sentiment of international investors

$$\frac{\varepsilon_t}{\Omega_{t-1}} = N(0, h_t) \tag{10}$$

Where μ is the mean of sii, the error term is conditional upon the set of information Ω, that existed in the immediate past period t-1. The error term εt is normally distributed and has a mean and variance of zero and constant variance (h), respectively. Equation (10) is the conditional mean equation for sii.

$$h_t = \omega + \sum_{t=1}^{p} \alpha_t \varepsilon^2_{t-i} \tag{11}$$

$\omega > 0; a1 \ldots ap \geq 0$

Equation (11) indicates that the variance h_t is conditional on the mean ω and available set of information on the variance of past periods ε^2_{t-i}.

IV.2 Data

The study utilises quarterly data covering the period 2000Q1 – 2014Q1. Data for key economic variables of interest were sourced from the following:

- CBN's Statistical Database, Statistical Bulletin and internally generated data from relevant departments of the CBN. The variables were 90-day T-Bill rates, stock of foreign exchange reserves, foreign portfolio investment, nominal import, naira-US$ exchange rate, nominal GDP;

- The World Bank database – the datum obtained from the source was the US 90-day Treasury bill rates; and
- Bloomberg terminal – 90-day LIBOR rate was obtained from this source.

The variables GDP, FPI and fiscal deficit were converted to United States of American dollars (US$) using the average prevailing official exchange rates for the quarter. In so doing, it internalised the fluctuations in foreign exchange rate into the variables and by reasoning, internalised the impact of foreign exchange movements and its impact on reserves within the model.

IV.3 Methodology

In order to obtain the optimal reserves ®*) the cost of default (C_0), was calculated by employing the H-P filter method, while the ARCH model was used to derive the volatility series of foreign institutional investment (fii). The multivariate co-integration procedure was employed for the estimation of the spread.

IV.3.1 HP Filter Method for the Estimation of the Cost of Default

The methodology assumes that the GDP series can be decomposed into trend (gdp_t^T), cyclical (c_t) and random ε_t components, represented by:

$$gdp_t = gdp_t^T + c_t + \varepsilon_t \tag{17}$$

This estimates a smoothened GDP series (i.e. GDP^T) that minimises its variance around gdp_t, while subjecting the second derivative of gdp_t^T to a penalty constraint. Thus, given an appropriate smoothening parameter (λ), there exist an optimal trend components gdp_t^T, that solves Equation (17.1)

$$\min_{gdp_t^T}\left(\sum_{i=1}^{n}\left(gdp_t - gdp_t^T\right)+\lambda\sum_{t=2}^{n-1}\left(\Delta gdp_{t+1} - \Delta gdp_t^T\right)^2\right) \tag{17.1}$$

Where n is the sample size and λ is the smoothening parameter. The cost of default or output gap is the difference between the computed smoothened gdp_t^T series and actual gdp_t series.

Following Prabheesh (2013), the author adopted the H-P filter method to estimate potential output loss, associated with the 2008 global economic crisis. The cost of default is the estimated output gap (i.e. percentage of output forgone) associated with the BOPs crisis of 2008 – 2010, which was imposed throughout the sample period as the cost of reserves. The opportunity cost of holding reserves was estimated as the product of domestic returns on the Nigerian 91 days T-Bill and total reserves.

IV.3.2 ARCH/GARCH Model for the Estimation of Volatility of Portfolio Investment

A generalised ARCH (GARCH) (P, Q) model was used to estimate the volatility of investor sentiments in Nigeria, using weekly data on portfolio investment in bonds and equities, which were obtained from weekly reports on foreign capital inflows by investment type. The GARCH model had the same mean equation and distribution as Equation (10), while, the conditional variance is of the GARCH type and is specified as follows:

$$h_t = \omega + \sum_{i=1}^{p} \alpha_i \varepsilon^2_{t-i} + \sum_{i=1}^{q} \gamma_i h_{t-i} \qquad (18)$$

The variance equation (18) indicates that the variance ht is conditional on the mean ω, available set of information on the variance of past periods, ε^2 t-i, and the values of the past variance. The condition that ω > 0; a1... ap ≥ 0 is maintained. The confirmation of the volatility of Sii (FPI), informed its inclusion in multivariate co-integration equation in the estimation of the discounted spread equation.

IV.3.3 Multivariate Co-integration Estimation of the Discounted Risk Premium

Using the Johansen co-integration approach, the author estimated the risk premium equation, in a matrix form as follows[11]:

$$\Delta Y_t = \sum_{1=1}^{k-1} \Gamma \Delta Y_{t-1} + \Pi Y_{t-1} + \lambda D + \varepsilon_t \qquad (19)$$

Where:

Y is vector of dependent variables (i.e. $\left(\frac{i_w - i^*}{i + i_w} \right)$)

[11] *Upon the establishment of the volatility of Indian foreign portfolio investment, Prabheesh (2013) estimated the discounted risk premium using the ARDL technique*

Γ, Π, and λ are matrix of parameters to be estimated. The long-run relationship is determined by the rank of matrix Π, which is a product of α and β' (i.e. the adjustment and co-integrating vectors).

D represents the vector of independent variables, which the dependent variable is regressed against. This includes a0 (constant term), sii (sensitivity of international investors), stedres (i.e. short-term debt to reserves ratio), stedares (i.e. short-term debt to residual reserves ratio) and fdgdp (i.e. fiscal deficit to gdp ratio). Δ is the change operator, while εt is the error term. The establishment of the existence of co-integrating vectors, using the maximum eigen value and trace test statistics, would facilitate the test of the hypothesis of short-run to long-run adjustment and the co-integrating vectors.

Thus, the functional form of multivariate co-integration is specified as follows

$$\left(\frac{i-i^*}{1+i}\right) = f(\text{sii}, \frac{\text{sted}}{rr}, \frac{\text{fd}}{gdp}) \quad (20)$$

Transforming Equation 20 into logarithm, we obtained:

$$\log\left(\frac{i-i^*}{1+i}\right) = a_0 + a_1 \log(\text{sii}) + a_2 \log(\frac{\text{sted}}{rr}) + a_3 \log(\frac{\text{fd}}{gdp}) + \varepsilon_t \quad (21)$$

$$\log\left(\frac{i-i^*}{1+i}\right) = a_0 + a_1 \log(\text{sii}) + a_2 \log(\frac{\text{sted}}{arr}) + a_3 \log(\frac{\text{fd}}{gdp}) + \varepsilon_t \quad (21.1)$$

The estimated reduced form discounted spread equations were:

$$\log \text{spr} = a_0 + a_1 \log(\text{fpi}) + a_2 \log(\text{stedres}) + a_3 \log(\text{fdgdp}) + \varepsilon_t \quad (22)$$

$$\log \text{spr} = a_0 + a_1 \log(\text{fpi}) + a_2 \log(\text{stedares}) + a_3 \log(\text{fdgdp}) + \varepsilon_t \quad (22.1)$$

Where:

- spr is the spread $\left(\frac{i-i^*}{1+i}\right)$
- Sii = fpi captures sentiments of international investors (i.e. volatility of portfolio investment);
- sted/rr is the ratio of short-term sovereign debt obligations to reserves;
- sted/arr is the ratio of short-term sovereign debt obligations to adjusted reserves; where adjusted reserves is actual reserves less FPI;

- fd/gdp is fiscal deficit to GDP ratio; and
- εt is the error term.

The authors analysed the stock of core reserves (i.e. actual reserves less adjusted quarterly portfolio investment) in addition to a separate analysis, based on actual reserves, using Nigerian data.

V. Empirical Results

This segment presented the descriptive statistics, as well as the results of the empirical findings, based on the estimation of the equations (22) and (22.1)

V.1 Descriptive Statistics and Unit Root Test

V.1.1 Descriptive Statistics

Summary statistics of the variables considered for risk premium equation, using the actual reserves were shown in Table 5.2, while the summary statistics of variables for risk premium equation, using the actual reserves, were reported in Table 5.1a. The Jarque-Bera statistics indicated that the null hypothesis of normality was rejected for the logarithm values of discounted interest rate spread/premium (LDSPR) and fiscal deficit as a ratio of GDP (LFDGDP); while the null hypothesis of normality could not be rejected for foreign portfolio investment (LFPI) and ratio of short-term debt to external reserves, as well as ratio of short-term debt to residual external reserves.

Table 5.1: Descriptive Statistics (Actual Reserves)

	LSPR	LFDGDP	LFPI	LSTED_RE
Mean	-3.345900	-4.092614	5.787736	-3.984917
Median	-3.413131	-3.902545	5.680465	-3.998183
Maximum	-2.063523	-3.213540	8.819940	-1.826385
Minimum	-5.960179	-5.990789	2.833255	-7.834013
Std. Dev.	0.789206	0.750698	1.606783	1.723679
Skewness	-0.856780	-0.909260	0.108875	-0.459206
Kurtosis	4.812752	2.784798	2.095646	2.317417
Jarque-Bera	14.77809	7.964148	2.055021	3.109828
Probability	0.000618	0.018647	0.357897	0.211208
Sum	-190.7163	-233.2790	329.9009	-227.1402

Table 5.1a: Descriptive Statistics (Residual Reserves)

	LSPR	LFDGDP	LFPI	LSTED_AR
Mean	-3.345900	-4.092614	5.787736	-3.891352
Median	-3.413131	-3.902545	5.680465	-3.984603
Maximum	-2.063523	-3.213540	8.819940	-1.783103
Minimum	-5.960179	-5.990789	2.833255	-7.461958
Std. Dev.	0.789206	0.750698	1.606783	1.621511
Skewness	-0.856780	-0.909260	0.108875	-0.321037
Kurtosis	4.812752	2.784798	2.095646	2.135916
Jarque-Bera	14.77809	7.964148	2.055021	2.752389
Probability	0.000618	0.018647	0.357897	0.252538
Sum	-190.7163	-233.2790	329.9009	-221.8071

V.1.2 Unit Root Test

As a starting point, the time series properties of the data were evaluated by adopting the Augmented Dickey Fuller (ADF) and the Phillips-Perron (PP) procedures for unit root test. The results, as reported in Table 2, showed that all the variables were stationary at first difference.

Table 2: Unit Root Test Results (Actual Reserves)

	T-Statistics			
Variable	**ADF (0)**	**ADF(1)**	**PP (0)**	**PP (1)**
LSPR	-1.292161	-8.959460*	-2.858988	-11.02280*
LFDGDP	-2.367539	-4.776235*	-1.787240	-4.349323*
LFPI	-1.172305	-6.334739*	-1.404593	-6.360871*
LSTED_RE	1.757566	-6.778355*	1.870506	-6.771807*
LSTED_AR	1.447163	-6.567720*	1.367062	-6.567720*

*Denotes rejection of H0 at 1% significance level

Tables 3 and 3a indicated that the spread equation variables were weakly-correlated with each other (except for foreign portfolio investment and ratio of short-term debt to reserves [-0.84] and ratio of short-term debt to residual reserves [-0.82]).

Table 3: Correlation Matrix (Actual Reserves)

	LSPR	LFDGDP	LFPI	LSTED_RE
LSPR	1.000000	0.340962	0.392743	-0.452459
LFDGDP	0.340962	1.000000	-0.077007	-0.043190
LFPI	0.392743	-0.077007	1.000000	-0.834449
LSTED_RE	-0.452459	-0.043190	-0.834449	1.000000

Table 3a: Correlation Matrix (Residual Reserves)

	LSPR	LFDGDP	LFPI	LSTED_AR3
LSPR	1.000000	0.340962	0.392743	-0.431671
LFDGDP	0.340962	1.000000	-0.077007	-0.031076
LFPI	0.392743	-0.077007	1.000000	-0.824234
LSTED_AR3	-0.431671	-0.031076	-0.824234	1.000000

V.3 Estimation of Cost of Default (C0)

Using the HP filter method, the authors were able to generate the series on potential quarterly nominal GDP and the output gap for the study period. Given that the Nigerian banking crisis occurred immediately after the 2008/2009 Global economic crisis, the cumulative crisis period was 2008 – 2010. Consequently, the author imposed the cumulative quarterly output loss for the period 2008Q1 and 2009Q4 (i.e. 52.80 per cent) and 2009Q1 – 2010Q4 (i.e. 32.22 per cent) as the maximum and minimum output losses for the entire study period. Table 4 illustrated the quarterly output losses, due to the financial crisis between 2008Q1 and 2010Q4. The cumulative output loss between 2008Q1 and 2009Q4 (the height of the crisis) was 52.80 per cent, while the cumulative output loss between 2009Q1 and 2010Q4, when the crisis was abating was 32.40 per cent. Therefore, the optimal reserve was calculated by considering the two ranges of output contraction i.e. 52.8 per cent and 32.40 per cent.

Figure 5.1: Cost of Default (2000Q1 - 2014Q1)

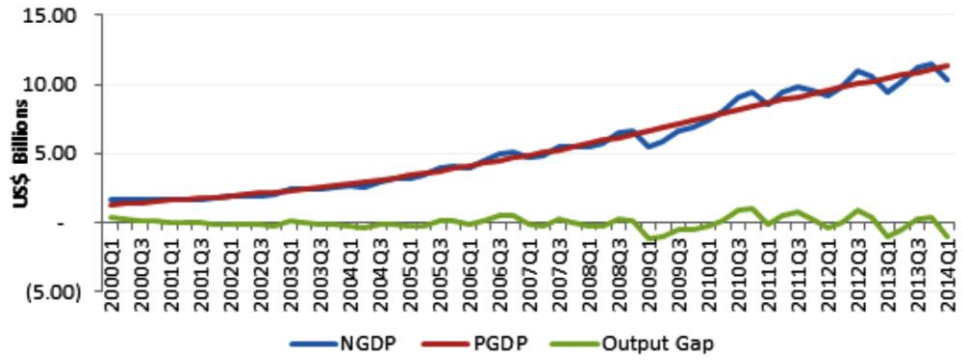


Table 4: Actual and Potential Output

Year/ Quarter	Actual Output	Potential Output	% Deviation
2008Q1	5,535,963.74	5,712,738.63	-3.19%
2008Q2	5,720,249.45	5,933,482.27	-3.73%
2008Q3	6,461,894.67	6,159,267.09	4.68%
2008Q4	6,578,221.42	6,390,089.96	2.86%
2009Q1	5,460,764.42	6,626,136.90	-21.34%
2009Q2	5,872,694.58	6,867,711.54	-16.94%
2009Q3	6,608,436.40	7,114,389.10	-7.66%
2009Q4	6,852,343.26	7,365,122.97	-7.48%
2010Q1	7,426,523.85	7,618,550.27	-2.59%
2010Q2	8,043,198.10	7,872,987.67	2.12%
2010Q3	9,055,632.86	8,126,631.79	10.26%
2010Q4	9,459,399.32	8,377,785.67	11.43%

V.4 Volatility of Foreign Portfolio Investment (FPI)

Unlike the approach of Prabheesh (2013), the authors estimated the volatility of foreign portfolio investment, using weekly FPI (WFPI) data and a Generalised Autoregressive Conditional Heteroschedastic (GARCH) (1, 2) model. Figure 7, showed the weekly trend in FPI from January 21, 2013 to August 29, 2014. Table 5, which was the result of the GARCH (1, 2) model, indicated that the conditional variance had a significant GARCH effect. The diagnostic tests on the model confirmed the absence of serial correlation in the standardised squared residuals, as well as the absence of GARCH effect on the residuals.

Figure 7: Trend in Foreign Portfolio Investment Returns

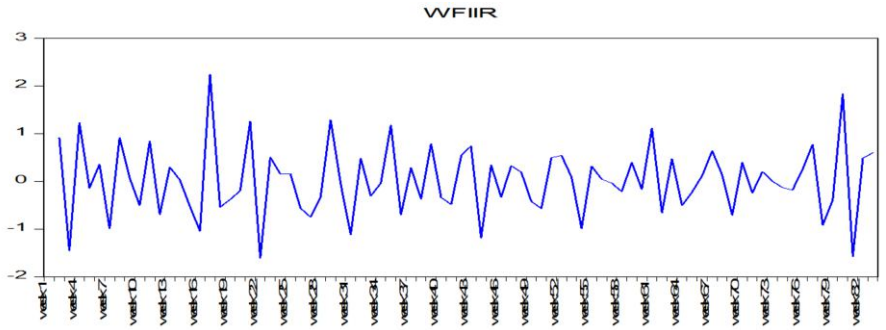


Table 5: GARCH (1, 2) Results of Foreign Institutional Investment

$fii_t = 153.820 + 21 \quad fii_{t-1}$ $(6.98)^*(2.64)^*$ $h_t = 10998.05 - 0.03\varepsilon_{t-1}^2 + 1.21h_{t-1} - 1.05h_{t-2}$ $(4.41)^*(2.80)^*(28.26)^*(31.47)^* \quad -$
Log likelihood = -203.15, LM_ARCH = 0.01 [0.96] $x^2 = 0.00[0.96]$

Note: * denotes significance at 1 per cent critical levels; Figures in parenthesis represent t-statistic, while those in square brackets represent level of significance.

V.5 Johansen Co-integration

Given that all variables were integrated of order (1), the multivariate co-integration technique of Johansen and Juselius (1992) was used to derive the equation for the risk premium, used to measure the probability of default. The authors adopted an optimal lag length of 5, at which point the residuals of the VAR were found to be uncorrelated and homoscedastic (i.e. constant variance).

V.5.1 Analysis Based on Actual Reserves

The trace and maximum eigen test statistics in Table 6, 6.1 and 6.2 provided evidence that the null hypothesis of no co-integration and at most one co-integration could be rejected at the 5 per cent critical value for the model, using actual reserves. This implied that there exists a set of co-integrating relationship among the four variables in the system.

Table 6: Johansen Co-integration Test based on Actual Reserves Johansen Critical Values

Hypothesised No of CV(s)	Trace Statistic	5% C.V	Max-Eigen Statistic	1% C.V
None	71.26861	54.07904*	30.65420	28.58808**
At most 1	40.61441	35.19275*	22.82410	22.29962**
At most 2	17.79031	20.26184	13.40790	15.89210
At most 3	4.382411	9.164546	4.382411	9.164546

Table 6.1: Johansen Co-integration Test based on Actual Reserves Using the Osterwald-Lenum Critical Values

Hypothesised No of CV(s)	Trace Statistic	5% C.V	1% C.V
None	71.26861	53.12*	60.16**
At most 1	40.61441	34.91*	41.07
At most 2	17.79031	19.96	24.60
At most 3	4.382411	9.24	12.97

Table 6.2: Johansen Co-integration Test Based on Actual Reserves Using the Osterwald-Lenum Critical Values

Hypothesised No of CV(s)	Max-Eigen Statistic	5% C.V	1% C.V
None	30.65420	28.14*	33.24
At most 1	22.82410	22.00*	26.81
At most 2	13.40790	15.67	20.20
At most 3	4.382411	9.24	12.97

Note:* denotes statistical significance at 5%, **denotes statistical significance at1%

The normalised co-integrating coefficients with respect to LDSPR were given in Table 7.

Table 7: Long Run Coefficients of the Co-integrating Vectors – Actual Reserves

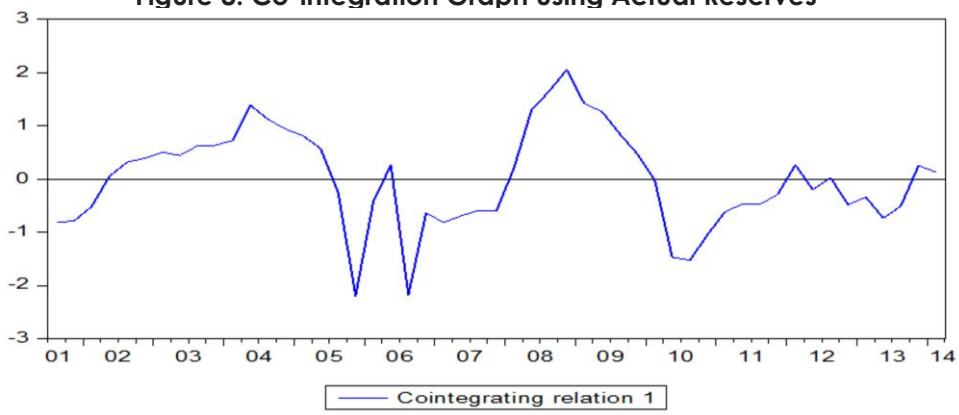
LDSPR	LFPI	LFDGDP	LSTED_RE	CONSTANT
1	-7.256688*	-2.901351	-3.560122	11.18279
	(2.25957)	(1.77248)	(2.21977)	(9.33945)

Note: Figures in parenthesis indicate standard error, *denotes 5 % significance level

The coefficients of the long-run co-integrating equation had the expected a priori signs, but the result suggested that only one regressor (FPI) was statistically significant at 5 per cent. The relationship between volatility of foreign portfolio investment (FPI) and spread was positive and highly significant. This suggested that short-term capital flows reflected the risks inherent in the Nigerian

economy. The co-integrating graph in Figure 8 showed that the relationship among the variables was fairly stable across the sample range.

Figure 8: Co-integration Graph using Actual Reserves



From the estimated spread equation the probability of default ***p*** is derived by estimating*ldspr*, given as log $\frac{(i-i^*)}{(1+i)}$ which is then plugged in the equation (22) and represented by (23):

$$\pi = e^f / (1+e^f)$$
$$f = \log(i - i^*/1+i)$$
$$\mathrm{l}(\frac{\pi}{1-\pi})_t = 11.18 + 7.26lfpi_t + 2.90lfdgdp_t + 3.56lstedres_t \quad (23)$$
$$\frac{\pi}{(1-\pi)} = \frac{i-i^*}{(1+i)}$$

The estimated average probability of default ***p***is 5.63 per cent; with the maximum and minimum default probability values being 99.9 and 0.00 per cent, respectively. The time varying probability of default captured the sovereign risk of a country better than the traditional approach, which assumed a default probability value of 50.00 per cent.

Considering the spread equation (6), π_R can be derived by differentiating it with respect to (res).

$$\frac{\partial^2 \pi}{\partial res} = \pi_R = -\pi(1-\pi)\frac{3.56}{res} < 0 \quad (24)$$

It showed that the change in probability of default, due to a small accretion to external reserves was negative. In other words, the probability of default diminished as a country accumulated more external reserves.

V.5.1.1 Probability of Default (π) – Actual Reserves

Figure 9, plotted the estimated probability of default, based on Equation (22). The estimated average probability of default was found to be 0.06 with maximum and minimum values of 99.9 and 0.00 per cent, respectively.

Figure 9: Probability of Default Based on Actual Reserves (2000Q1 - 2014Q1)

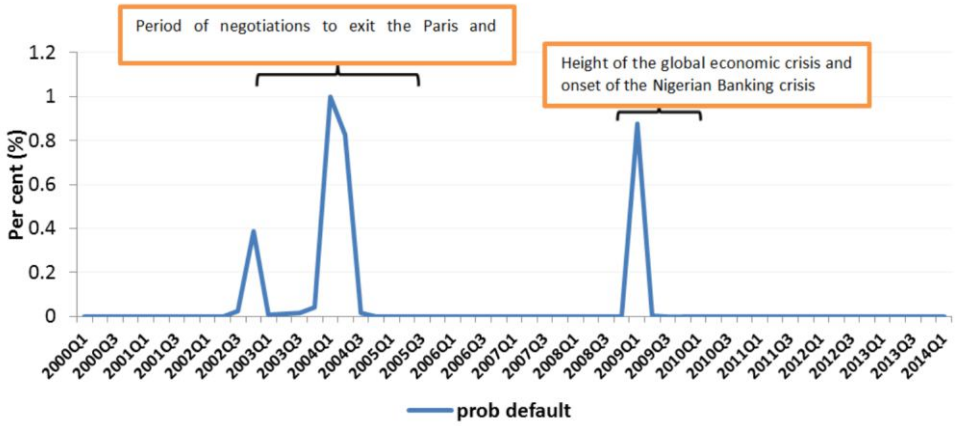


Figure 9a: Probability of Default, Foreign Portfolio Investment and Short-term Debt to Reserves Ratio (2000Q1 - 2014Q1)

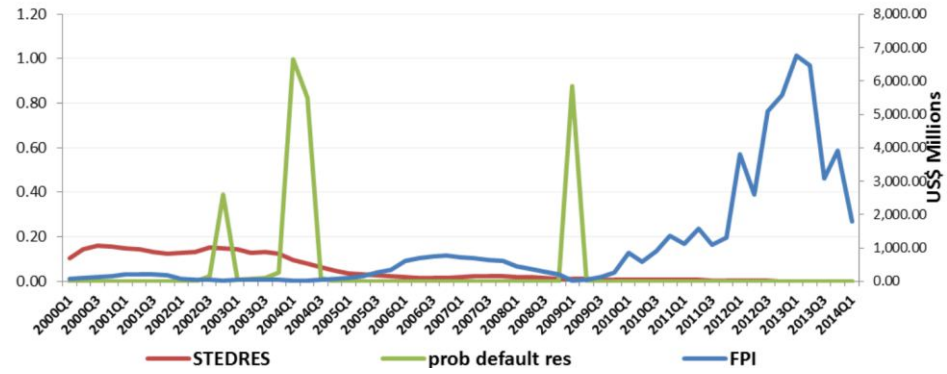


Figure 9a provided an explanation for the probability of default series observed in Figure 9 Between 2000Q1 and 2002Q2, probability of default was close to

zero. Within that period, FPI averaged US$145.81 million per quarter. Negotiations on the exit from the Paris and London club debt commenced in 2002 and lasted till 2004. This invariably increased concerns about possibility of default and loss of investments on the part of international investors, which invariably manifested in a decline in FPI and increase in the probability of default. Within the period 2002Q3 to 2004Q4, the average quarterly FPI dropped to US$42.23 million, while the average probability of default increased to 23.25 per cent, reaching a peak of 99.9 per cent in 2004Q1.

Between 2005Q1 and 2008Q3, the average quarterly probability of default was close to zero on the back of sound economic fundamentals. This helped stimulate an increase in FPI within the period to a quarterly average of US$497.13 million. The contagion effect of the global economic crisis, which commenced in 2008Q3, hit the Nigerian economy between 2008Q4 and 2009Q1, and precipitated significant drop in the market capitalisation of the Nigerian Stock Exchange (NSE), as well as the Nigerian banking sector crisis. Between 2008Q4 and 2009Q4, the joint crises prompted a decline in average quarterly FPI to US$136.98 million and an increase in average probability of default to 17.62 per cent. Within the period, quarterly FPI reached a minimum value of US$23.64 million, while probability of default reached a maximum value of 87.9 per cent in 2009Q4.

Policy actions by the monetary and fiscal authorities in the face of the crises, coupled with good economic fundamentals, helped restore investor confidence in the economy. The devaluation of the naira, via the adjustment of the exchange rate midpoint, helped moderate reserves depletion, while a wide interest rate spread helped attract FPI into the economy. As a result, between 2010Q1 and 2014Q1, the FPI and probability of default averaged US$2.82 billion and 0.00 per cent, respectively.

V.5.2 Analysis of Residual/Adjusted Reserves

The Trace statistics from Table 8 and 8.1 indicated that there were two co-integrated equations amongst the variables at the 5 per cent critical level. However, Maximum Eigen statistics, in Table 8.2, indicated there was one co-integrated equation amongst the variables. Given the superiority of the

Osterwald-lenum test statistic over that of the Johansen test statistic[12] and the superiority of the rank test over the trace test[13], the results strongly suggested the existence of one co-integrated equation amongst the variables in the system at the 5 per cent critical level.

Table 8: Johansen Co-integration Test Based on Adjusted Reserves

Hypothesised No of CV(s)	Trace Statistic	P-value	Max-Eigen Statistic	P-value
None	68.97403	54.07904*	28.41955	28.58808
At most 1	40.55448	35.19275*	21.93722	22.29962
At most 2	18.61727	20.26184	14.15008	15.89210
At most 3	4.467188	9.164546	4.467188	9.164546

The normalised co-integrating coefficients with respect to LDSPR are given in Table 8a.

Table 8.1: Johansen Co-integration Test Based on Actual Reserves Using the Osterwald-Lenum Critical Values

Hypothesised No of CV(s)	Trace Statistic	5% C.V	1% C.V
None	68.97403	53.12*	60.16**
At most 1	40.55448	34.91*	41.07
At most 2	18.61727	19.96	24.60
At most 3	4.467188	9.24	12.97

Table 8.2: Johansen Co-integration Test Based on Actual Reserves Using the Osterwald-Lenum Critical Values

Hypothesised No of CV(s)	Max-Eigen Statistic	5% C.V	1% C.V
None	28.41955	28.14*	33.24
At most 1	21.93722	22.00	26.81
At most 2	14.15008	15.67	20.20
At most 3	4.467188	9.24	12.97

Note:* denoted statistical significance at 5%, **denoted statistical significance at1%

[12] *See Osterwald-Lenum (1992)*

[13] *See Johansen (1991)*

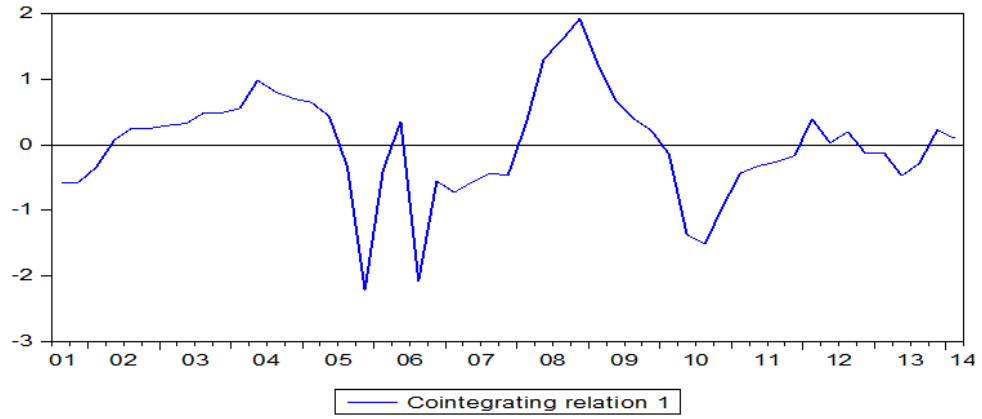
Table 9: Lon-Run Coefficient of the Co-integrating Vector – Adjusted Reserves

LDSPR	LFPI	LFDGDP	LSTED_AR	CONSTANT
1	-2.000296	-1.007854	-1.107000	4.773614
	(0.58048)*	(0.47750)*	(0.59659)**	(2.51673)**

Note: Figures in parenthesis indicated standard error, *denoted 5 per cent significance level and ** denotes 10 per cent significance level.

The coefficients of long-run co-integrating equation had the expected a priori signs and the "t" statistic indicated two statistically significant regressors at the 5.00 per cent (i.e. fpi and fdgdp) and 10 per cent (i.e. sted_ar and constant) critical levels, respectively. In essence, we could conclude that the explanatory variables significantly explained the risk perception of foreign investors in the Nigerian economy. Again, the relationship between volatility of FPI and spread was positive and highly significant, which further confirmed that short-term capital flows reflected the risks inherent in the economy. The co-integrating graph, in Figure 10, showed that the relationship among the variables was fairly stable, across the sample range.

Figure 10: Co-integration Graph Using Adjusted Reserves



From the estimated spread equation (17a), we derived the probability of default (π) by estimating *ldspr*, given as log $(i - i^*/1+i)$, which is then plugged in equation (22.1) which is represented by (25):

$$\pi = e^{f} / (1+e^{f})$$
$$f = \log(i - i^{*}/1+i)$$
$$\mathrm{l}(\frac{\pi}{1-\pi})_{t} = 4.77 + 2.00 lfpi_{t} + 1.01 fdgdp_{t} + 1.11 lstedares_{t} \quad (25)$$
$$\frac{\pi}{(1-\pi)} = \frac{i - i^{*}}{(1+i)}$$

The estimated average probability of default π is 32.37 per cent; with the maximum and minimum default probability values being 99.81 and 0.00 per cent, respectively. In line with Prabheesh (2013), the time varying probability of default captured the sovereign risk of a country better than the traditional approach, which assumed a default probability value of 50.00 per cent. Considering the spread equation (17a), π_{R} can be derived by differentiating it with respect to res.

$$\frac{\partial^{2}\pi}{\partial res} = \pi_{R} = -\pi(1-\pi)\frac{1.11}{res} < 0 \quad (26)$$

It showed that the change in probability of default due to a small accretion to external reserves was negative. In other words, the probability of default diminished as a country accumulated more external reserves.

V.5.2.1 Estimation of Probability of Default (π)

Figure 11, plotted the estimated probability of default based on equation 22.1. As earlier discussed, this measure was germane for the study as it gave a fair perception of the ability of the economy to defend the international value of the Naira in the event of capital flight. The estimated average probability of default, π, was found to be 32.37 per cent with maximum and minimum values of 99.81 and 0.00 per cent, respectively.

Figure 11: Probability of Default Based on Adjusted Reserves (2000Q1 - 2014Q1)

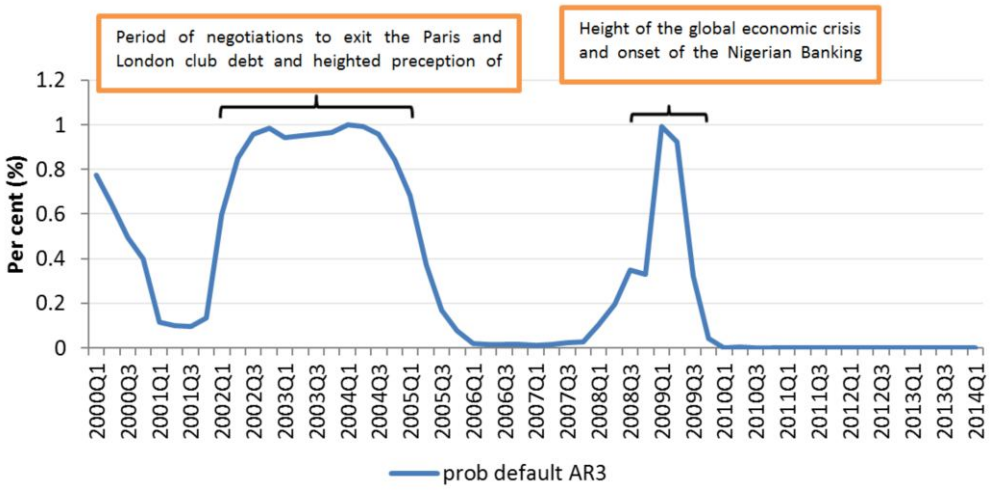


Figure 11a: Probability of Default, Foreign Portfolio Investment and Short-term Debt to Adjusted Reserves Ratio (2000Q1 - 2014Q1)

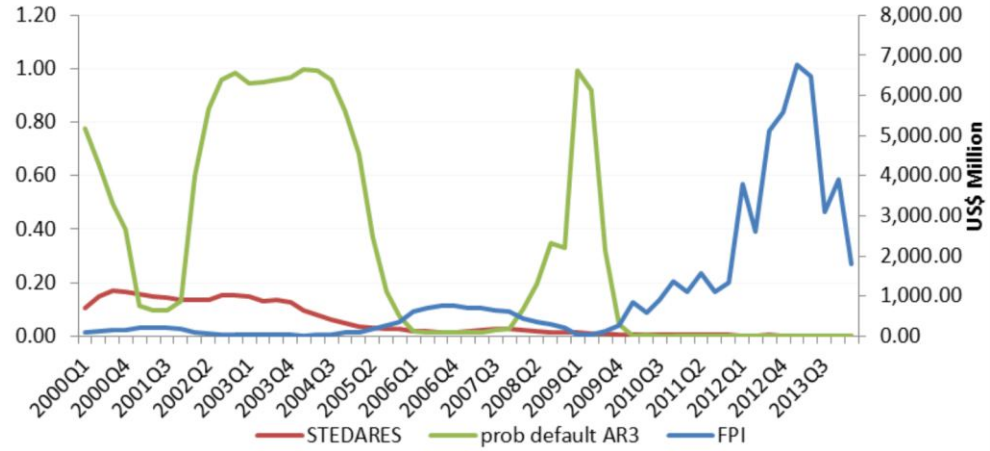


Figure 11a provided an explanation for the probability of default series observed in Figure 11. A significant observation is that while the average FPI remained the same for the periods considered, the probability of default was significantly higher based on computations, using adjusted /core reserves. The observed average probabilities were 42.01, 95.48, 13.88, 52.17[14] and 0.06 per cent, for the periods 2000Q1 – 2002Q2, 2002Q3 – 2004Q4, 2005Q1 – 2008Q3,

[14] *The maximum probability of default for the period 2008Q4 – 2009Q4, occurred at 2009Q4, reaching 99.18, while the maximum probability of default for the entire study period was attained in 2004Q1, reaching 99.81 per cent.*

2008Q4 – 2009Q4 and 2010Q1 – 2014Q1, respectively. The primary explanation for this was that computations based on adjusted reserves picked up on the impact of potential capital flight through the adjusted reserves and its interaction with short-term external debt (see Table 10).

Table 10: Periodic Probability of Default Actual and Adjusted Reserves

		Period				
		2000Q1 - 2002Q2	2003Q3 - 2004Q4	2005Q1 - 2008Q3	2008Q4 - 2009Q4	2010Q1 - 2014Q1
default	Actual Reserves	0.0%	23.25%	0.00%	17.62%	0.00%
	Adjusted Reserves	42.01%	95.48%	13.88%	52.17%	0.06%

V.6 Optimum Reserves

Following the estimation of π, π_R C_0 and r the optimum reserves for each period is computed by substituting the relevant values into the optimal reserves equation (4) $R^* = \frac{(1-\pi)}{\pi_R} + \frac{C_o}{r}$]. The resulting period specific optimal reserves (based on actual and adjusted reserves) were depicted in Figure 12 and 12a.

Figure 12 indicated that during the crisis period, the optimal core foreign exchange reserves for Nigeria were US$31.22 billion. Intuitively, the Nigerian economy needed to have a minimum stock of US$31.22 billion to be able to absorb the potential output loss and cost of holding reserves associated with the severe impact of the global economic and Nigerian banking crisis from 2008Q1 – 2010Q4. Further analysis of Figure 12, suggested that the actual stock of Nigeria's foreign reserves during and after the joint crises periods was adequate to absorb the impact of the crises. This, however, was not a true reflection of the health of external reserves for Nigeria.

In order to obtain a more complete view of the health of the national reserves, the optimal reserves based on adjusted/residual reserves was used in the analysis (as earlier discussed). The results of the computation are depicted in Figure 12a, which indicated that the optimal level of reserves, required by the

economy to adequately absorb the losses associated with the joint crises was US$31.84 billion. Significantly, an examination of the adjusted reserves vis-à-vis the optimal level suggested that with the exception of 2010Q1 & Q2, and 2013Q2, adjusted reserves had been below the optimal level required to absorb an impact of a severe crises, like that witnessed between 2008Q1 and 2010Q4.

Figure 12: Actual and Optimal Levels of Reserves in Nigeria (2000Q1 - 2014Q1)

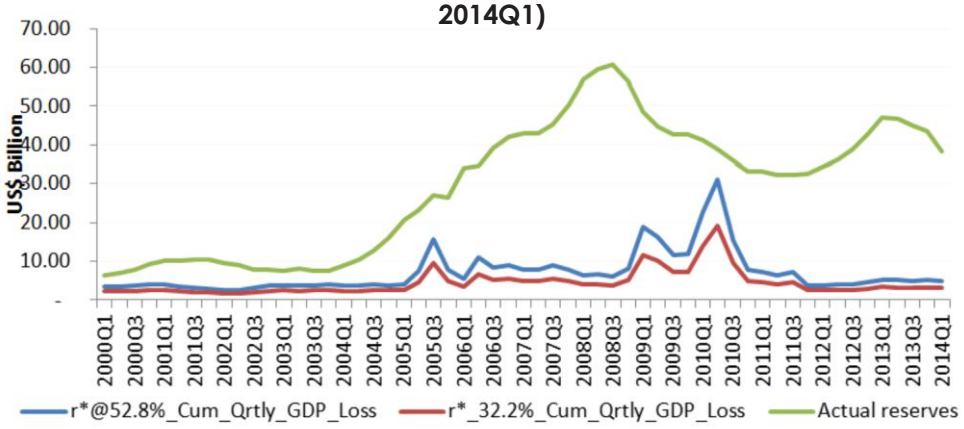


Figure 12a: Residual/Adjusted and Optimum Levels of Reserves in Nigeria (2000Q1 - 2014Q1)

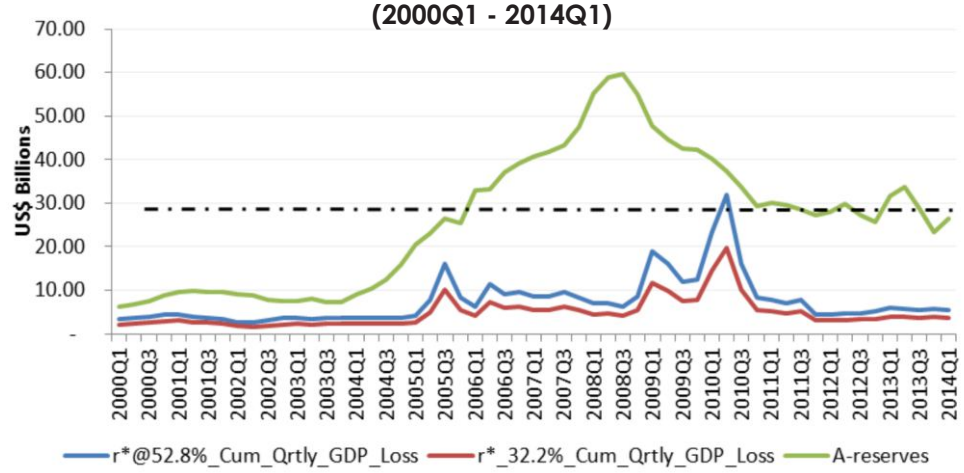
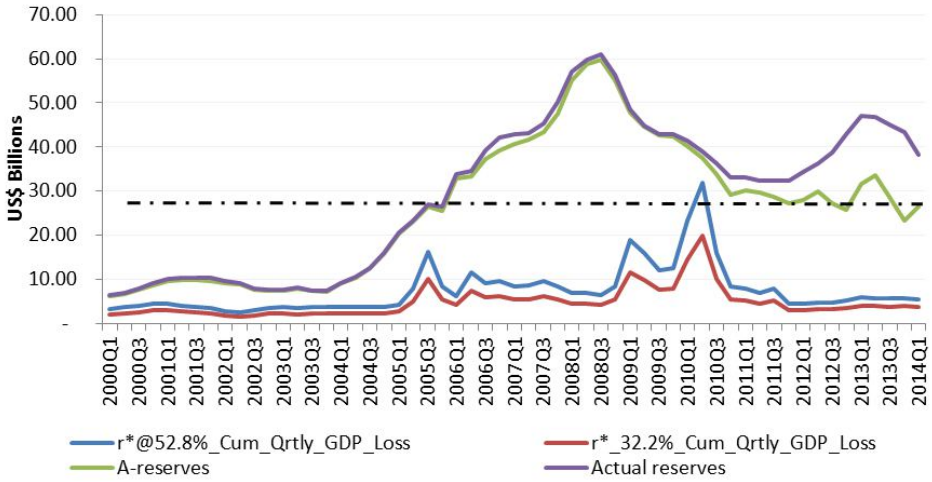


Figure 12b, further buttressed the point earlier made. It indicated that while actual reserves was above the optimal reserves level to absorb the impact of the joint crises between 2008Q1 and 2010Q4, the average core reserves

available to the economy since the crises was, however, insufficient to absorb such a crisis, if it occurs in the near future.

Figure 12b: Residual/Adjusted, Actual and Optimum Levels of Reserves in Nigeria (2000Q1 - 2014Q1)



Based on these empirical findings, it is recommended that the Nigerian economy maintains a minimum core reserves level of US$32 billion. The reserves maintenance equation is thus represented as:

(FRML) = US$32 billion + stock of FPI or HM into the economy (27)

Where:
FRML = Foreign reserves maintenance level,
FPI = Foreign portfolio investment into the Nigerian economy
HM = Hot Money invested in the Nigerian economy by foreign institutional investors.

VI. Policy Recommendations and Conclusion

The major finding was that given the severe impact of the 2008-2009 Global economic crisis and Nigerian Banking Sector crisis between 2008Q1 and 2010Q4, Nigeria required a minimum core foreign reserves level of US$32 billion to adequately absorb similar external shocks to the economy. Consequently, the foreign reserves maintenance (FRML) for the Nigerian economy was found

to be US$32 billion (being the equivalent of 7.2 months of import covers[15] at current price) plus the stock of foreign portfolio investments (FPI) currently within the economy. In view of this, the following policy recommendations are proffered.

1. Given that the current level of external reserves is about US$39 billion; out of which US$20 billion constitute foreign portfolio investments, it is imperative to build core reserves from the current level of US$19 billion to a minimum level of US$32 billion. This may be achieved by the following ways:
   a. Block all foreign reserves leakages in the economy by ensuring that foreign exchange allocation and utilisation are purely for genuine economic purposes. In doing this, the following areas are of great importance:
      (i) Speculative demand should be curbed through effective monitoring of banks and building of a robust end-user intelligence management;
      (ii) The Central Bank of Nigeria should initiate strategic engagement with the Federal Ministry of Finance (MoF) and the Nigeria Customs Service (NCS) to ensure that the seaports and borders are adequately secured against contraband and prohibited goods;
      (iii) Implement an exchange rate policy that will reduce the current high exchange rate premium, which provides arbitrage opportunities in the market; and
      (iv) Foreign payment through letters of credits is considered expensive. Alternative payment modes like bills for collection should be strongly considered.

   b. Curb excessive importation especially of goods and services that can be produced locally.
      (i) In addition to the strict enforcement of the import prohibition list by relevant agencies of government, government should identify specific import goods, which can be produced locally and provide incentives for small and medium scale enterprises to begin and/or increase the production of such goods.

15. *This is based on average quarterly imports for the past four (4) years.*

(ii) The current policy on rice importation and local production should be sustained and extended to other agricultural and agro-allied products.

c. Pursue fiscal consolidation at all levels of government.

d. Build fiscal buffers through the replenishment of the Excess Crude Account or the Sovereign Wealth Fund.

e. Measures should be taken to ensure that all exporters, especially in the oil and gas industry, repatriate proceeds within stipulated period, as provided in the guidelines.

2. Given that the interest rate spread is indicative of the sovereign risk of Nigeria, a sudden reduction in the domestic NTB rates will be adverse to FPI, as the reduced spread will not generate sufficient compensatory premium for institutional investors to keep their investment in Nigeria's sovereign debt instruments. As such, reductions to NTB rates should be gradual and reflect changing fundamentals of the Nigerian economy.

3. The over dependence on the oil and gas sector for foreign revenue generation remains a point of concern. Hence, the implementation of appropriate policies to facilitate the diversification of the Nigerian economy along areas of key comparative advantage, such as agriculture, solid mineral and small scale labour intensive manufacturing. This would help mitigate the impact of external shocks on the foreign exchange earnings capacity of the economy, and eventually help narrow the discounted risk premium as the economic fundamentals improve.

4. Foreign exchange demand to finance importation of petroleum products is a major source of reserves depletion in Nigeria. Thus, it is imperative that all the refineries should be fixed and be made to operate at their full capacity, while other private sector interest are encouraged to venture into oil refining in Nigeria. This would facilitate the eventual phasing out of importation of refined petroleum products and halt the depletion in foreign reserves associated with petroleum imports.

5. The supply side policies, aimed at removing supply bottlenecks and improving the productive capacity of the Nigerian economy should be sustained. These include interventions in the real sector including power, agriculture and small & medium scale enterprises for export promotion. Not only would such interventions help boost foreign earnings and reserves, they would further help improve the macroeconomic fundamentals of the economy and thus help facilitate a reduction in the compensatory premium, required by foreign investors for absorbing risks associated with acquiring Nigeria's sovereign debt instruments.

References

Abiola, A. G., and Adebayo, F. O. (2013). Channelling the Nigeria's Foreign Exchange Reserves into Alternative Investment Outlets: A Critical Analysis. *International Journal of Economics and Financial Issues*, 3(4), 813-826.

Aizenman, J., and Lee, J. (2007). International Reserves: Precautionary vs. Mercantilist Views, Theory, and Evidence. *Open Economies Review*, 18(2), 191-214.

Aizenman, J., and Sun, Y. (2012). The Financial Crisis and Sizable International Reserves Depletion: From 'Fear of Floating' to the 'Fear of Losing International Reserves'? *International Review of Economics & Finance*, 24, 250-269.

Aubrey , H. G. (1960). Gold and the Dollar Crisis. *Challenge,* 9(2), 40-43.

Bahmani-Oskooee, M. (1985). Demand for International Reserves: Survey of Recent Empirical Studies. *Applied Economics*, 17(2), 359-375.

Bahmani-Oskooee, M., and Brown, F. (2002). Demand for International Reserves: A Review Article. *Applied Economics*, 34(10), 1209-1226.

Baldacci, E., Clements, B., Gupta, S., and Cui, Q., (2008). Social Spending, Human Capital, and Growth in Developing Countries. *World Development*. 36 (8). 1317-1341.

Bar-Ilan, A., Marion, N. P., and Perry, D. (2007). Drift Control of International Reserves. *Journal of Economic Dynamics and Control*, 31(9), 3110-3137.

Barrientos, M., and Soria, C. (2014). *Index Mundi*. Retrieved 2014, from http://www.indexmundi.com.

Barro, R. J. (2001). Economic Growth in East Asia Before and After the Financial Crisis. *NBER Working Paper Series*, 8330, 1-42.

Ben-Bassat, A., and Gottlieb, D. (1992). Optimal International Reserves and Sovereign Risk. *Journal of International Economics*, 33(3-4), 345-362.

Bird, G., and Rajan, R. (2003). Too Much of a Good Thing? The Adequacy of International Reserves in the Aftermath of Crises. *The World Economy*, 26(6), 873-891.

Bordo, M., Eichengreen, B., Klingebi, D., & Martinez-Peria, M. S. (2001). Is the Crisis Problem Growing more Severe? *Economic Policy*, 16(32), 52–82.

Calvo, G. A. (1998). Capital Flows & Capital-Market Crisis: The Simple Economics of Sudden Stops. Journal of Applied Economics, 1(1), 35-54.

Calvo, G. A. (2002). On Dollarisation. *Economics of Transition*, 10(2), 393-403.

Calvo, G. A., and Reinhart, C. M. (2002). Fear of Floating. *The Quarterly Journal of Economics*, 117(2), 379-408.

CBN. (2015). *Compendium of Monetary Policy Communiques Numbers 1 to 104* (2001 - 2015). Abuja: Central Bank of Nigeria.

Dooley, M. P., Folkerts-Landau, D., & Garber, P. (2004). The Revived Bretton Woods System: The Effects of Periphery and Reserve Management on Interest Rates and Exchange Rates in Center Countries. *NBER Working Paper Series*(10332), 1-11.

ECB. (2006). The Accumulation of Foreign Reserves. *ECB Occasional Papers*, 43.

Edwards, S. (1983). The Demand for International Reserves and Exchange Rate Adjustments: The Case of LDCs, 1964-1972. *Economica*, 50(199), 269-280.

Eichengreen, B. (2007). Insurance Underwriter or Financial Development Fund: What Role for Reserve Pooling in Latin America? *Open Econ Rev* , 18(1), 27-52.

Elhiraika, A., and Léonce , N. (2007). Reserves Accumulation in African Countries: Sources, Motivations, and Effects. *Economics Department Working Paper Series*, 24, pp. 1-30.

Espinoza, R. (2014). A Model of External Debt and International Reserves. *Cerdi.org*, 1-29.

Feldstein, M. (1999). A Self-Help Guide for Emerging Markets. *Foreign Affairs*, 78(2), 93-109.

Ferrucci, G. (2003). Empirical Determinants of Emerging Market Economies' Sovereign Bond Spreads. *Bank of England Working Paper Series*, 205, 1-38.

Frenkel, J. A. (1980). International Reserves under Pegged Exchange Rates and Managed Float: Corrections and Extensions. *Journal of Monetary Economics*, 6(2), 295-302.

Frenkel, J. A., and Jovanovic, B. (1981). Optimal International Reserves: a Stochastic Framework. *The Economic Journal*, 91(362), 507-514.

Freund, C. (2005). Trade, Regulations and Growth. *Conference on Trade and Growth*. Research Department. Bineswaree Bolaky University of Maryland.

García, P., and Soto, C. (2004). Large Hoardings of International Reserves: Are they Worth It? 299, 1-45.

Gottlieb, D. (1987). On the Determinants of a Country's Credit-Worthiness the Case of Israel: 1971 to 1983. *IMF Working Paper Series*(87/82), 1-34.

Grandes, M., and Nogues, J. (2001). Country Risk: Economic Policy, Contagion Effect or Political Noise? *Journal of Applied Economics*, 4(1), 125-162.

Heller, H. R. (1966). Optimal International Reserves. *The Economic Journal*, 76(302), 296-311.

Heller, R. H. (1968). The Transaction Demand for International Means of Payment. *Journal of Political Economy*, 76(1), 141-145.

Heller, R. H., and Khan, M. S. (1978). The Demand for International Reserves under Fixed and Floating Exchange Rates. *IMF Staff Papers*, 25(4), 623-649.

Hodrick, R. J., and E. C. Prescott (1980). Postwar U.S. Business Cycles: An Empirical Investigation. *Discussion Paper* No. 451, Carnegie-Mellon University

Hodrick, R. J., and Prescott, E. C. (1997). Postwar U.S. Business Cycles: An Empirical Investigation. *Journal of Money, Credit and Banking,* 29(1), 1-16.

Hutchison, M. M., and Noy, I. (2005). How Bad Are Twins? Output Costs of Currency and Banking Crises. *Journal of Money, Credit and Banking*, 37(4), 725-752.

IMF. (2011), Assessing Reserve Adequacy. (R. Moghadam, J. D. Ostry, & R. Sheehy, Eds.) *IMF Policy Paper*, 1-49.

International Monetary Fund, World Economic Outlook Database, October 2015.

Irefin, D., and Yaaba, B. N. (2012). Determinants of Foreign Reserves in Nigeria: An Autoregressive Distributed Lag Approach. J*ournal of Applied Statistics*, 2(2), 63-82.

Jeanne, O. (1997), Are Currency Crises Self-fulfilling? A Test. *Journal of International Economics*, 43(3-4), 263-286.

Jeanne, O., and Rancière, R. (2006). The Optimal Level of International Reserves for Emerging Market Countries: Formulas and Applications. *IMF Working Paper*, WP/06(229), 1-35.

Jeanne, O., and Rancière, R. (2011). The Optimal Level of International Reserves for Emerging Market Countries: A New Formula and Some Applications. *The Economic Journal*, 121(555), 905-930.

Johansen, S. (1991). Estimation and Hypothesis Testing of Co-Integration Vectors in Gaussian Vector Autoregressive Models. *Econometrica*, *59*(6), 1551-1580.

Johansen, S., and Juselius, K., (1992). Testing Structural Hypotheses in a Multivariate Co-integration Analysis of the PPP and the UIP for UK. *Journal of Econometrics* 53; (1-3) pp. 211-244

Krugman, P. (1996). Are Currency Crises Self-Fulfilling? *NBER Macroeconomics Annual* 1996, 11, 345 - 407.

Lee, J. (2004). International Reserves. *IMF Research Bulletin*, 5(2), 1-6.

Lerner, A., (1944). *The Economics of Control,* New York Macmillan.

Marshall, A., (1923). *Money, Credit and Commerce*. Macmillan & Co.

Mendoza, R. (2004). International Reserve-holding in the Developing World: Self-Insurance in a Crisis-prone era. *Emerging Markets Review*, 5(1), 61-82.

Monetary and Economic Department (2005). Foreign Exchange Market Intervention in Emerging Markets: Motives, Techniques and Implications. *BIS Papers*, 24, 1-307.

Ndikumana, L. (2000). Financial Determinants of Domestic Investment in Sub-Saharan Africa: Evidence from Panel Data. *World Development*, 28(2), 381-400.

Ndikumana, L. (2005). Financial Development, Financial Structure, and Domestic Investment: International Evidence. *Journal of International Money and Finance*, 24(4), 651-673.

Obstfeld, M. (1994). The Logic of Currency Crises. *NBER Working Paper Series*(4640), 1-54.

Oputa, N. C., and Ogunleye, T. S. (2010). External Reserves Accumulation and the Estimation of the Adequacy Level for Nigeria. *CBN Economic and Financial Review*, 48(3), 1-29.

Osterwald-Lenum, M. (1992), A Note with Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics. *Oxford Bulletin of Economics and Statistics*, 54(3), 461-72.

Ozyildirim, S., and Yaman, B. (2005), Optimal Versus Adequate Level of International Reserves: Evidence for Turkey. *Applied Economics*, 37(13), 1557-1569.

Phillips, P. C., and Perron, P. (1988), Testing for a Unit Root in Time Series Regression. *Biometrika* , 75(2), 335-346.

Polterovich, V., and Popov, V. (2010), Accumulation of Foreign Exchange Reserves and Long Term Growth. *Munich Personal RePEc Archive*(20069).

Prabheesh, K. P. (2013), Optimum International Reserves and Sovereign Risk: Evidence from India. *Journal of Asian Economics*, 28, 76-86.

Rodrik, D., and Velasco, A. (1999). Short-Term Capital Flows. *NBER Working Paper*, 7364, 1-45.

Stiglitz, J. E. (2006). *Making Globalisation Work* (First ed.). New York London: W. W. Norton and Company.

Suheyla, O., and Bülent, Y. (2005). Optimal Versus Adequate Level Of International Reserves: Evidence for Turkey. *Applied Economics*, 37(13), 1557-1569 .

Triffin, R. (1961). *Gold and the Dollar Crisis; The Future of Convertibility* (Second ed.). Connecticut: New Haven Yale University Press.

Udo, A. B., and Antai, A. S. (2014). Opportunity Cost of Nigeria's External Reserves. IOSR *Journal of Economics and Finance*, 3(5), 7-16.

Wijnholds, J. O., and Kapteyn, A. (2001). Reserves Adequacy in Emerging Markets Economies. *IMF Working Paper*, WP/01(143), 1-49.

World Economic Outlook (2009). Crisis and Recovery, International Monetary Fund

Appendix

Data

The study utilises quarterly data covering the period 2000Q1 – 2014Q1. Data for key economic variables of interest were sourced from the following:

- CBN's Statistical Database, Statistical Bulletin and internally generated data from relevant departments of the CBN. The variables were 90-day T-Bill rates, stock of foreign exchange reserves, foreign portfolio investment, nominal import, naira-US$ exchange rate, nominal GDP;
- The World Bank database – the datum obtained from the source was the US 90-day Treasury bill rates; and
- Bloomberg terminal – 90-day LIBOR rate was obtained from this source.

The variables GDP, FPI and fiscal deficit were converted to United States of American dollars (US$) using the average prevailing official exchange rates for the quarter. In so doing, it internalised the fluctuations in foreign exchange rate into the variables and by reasoning, internalised the impact of foreign exchange movements and its impact on reserves within the model.
The variables of interests, rationale for their inclusion and their computations are described as follow:

I. **Spread –** The spread, which denotes risk premium, is derived by subtracting interest rates on US short-term instrument from the weighted interest rates. The computed weighted interest rate is derived from both the London Interbank Bid Offer Rate (LIBOR) and the Nigerian Treasury Bill (NTB) rates. The rationale for this is that the national debts comprise the domestic and external components. The NTB rate serves as a good proxy for the cost of the domestic component of the national debt, while LIBOR proxies the cost of external borrowing, as the bulk of commercial lines and the Eurobonds issued by the FGN and private corporations have their prices linked to the LIBOR. The rates are weighted by the ratio of domestic and external debts to total national debt. Thus, the weighted rate is derived as:

$$I_w = \alpha_{DD} NTB + \beta_{ED} LIBOR \quad (12)$$

Where:

- I_w = Weighted interest rate;
- α_{DD} = ratio of domestic national debt to total debt (domestic debt/total debt); and
- β_{ED} = ratio of external debt to total debt (external debt/total debt).

ii. **Sentiment of International Investors (Sii) (i.e. Foreign Portfolio Investment) –** International capital flows are characteristically mobile and can change abruptly the direction of flow in response to sentiments about developments in an economy. This very peculiar nature of capital flows makes it a germane variable of interest in the model. The variable is of particular interest because Nigeria is a mono-product economy, which generates about 90 per cent of foreign exchange earnings from the oil and gas sector. This is the major avenue through which reserves are built. External shocks, which trigger capital flow reversal, invariably, would exert pressure on the reserves. This is due to supply side constraints in ramping up oil production to generate sufficient foreign exchange to moderate the impact of capital reversal on the country's foreign reserves. It is, therefore, important to understand how foreign portfolio investors react to the perceived state of the economy. As previously discussed, the state of the economy can be measured as the sovereign risk of the country, which is approximated by the discounted risk premium (i.e. spread). It is expected that a high spread, indicative of high sovereign risk, would elicit volatile movement in capital, as investors would want to make quick gains and exit the economy before the situation changes. Consequently, the expectation is that a positive relationship exists between the volatility of portfolio investment and the spread (i.e. discounted risk premium).

iii. **Short-Term Debt to External Reserves –** The ability of a nation to service its immediate debt obligations can be ascertained from the quantum of reserves at its disposal. Invariably, a high level of foreign exchange reserves is an indicative of ability to meet short-term debt obligations, even in the face of severe adverse external shocks. This would translate

to a low short-term debt to reserves ratio, indicating a minimal encumbrance of reserves towards immediate obligations. Likewise, the low ratio would provide positive signals to potential investors and this is expected to improve the sovereign credit rating of the country and thus command a lower spread.

The inclusion of this variable stems from the peculiar import dependent nature of the economy. A significant part of trade transactions is carried out through trade credit lines between domestic and international financial institutions. In the event of a crisis, these credit lines are typically first hit as international financial institutions call back their facilities and, in some instances, close those lines, to improve their balance sheet positions. Importantly, though, the Nigerian debt crisis of the 1980s, that left the economy with a debt overhang of about US$38 billion in 2004[16], was due to the crystallisation of short-term debts and the inability of Nigerian merchants to meet up their debt obligations. Consequently, these were consolidated and taken over by the Nigerian government. Furthermore, domestic Deposit Money Banks (DMBs) had a torrid experience keeping trade lines open during the 2008 global economic crisis, as corresponding banks withdrew some of their credit lines. Consequently, the ratio provides an early warning signal on the state of the economy, which would invariably impact on the country's international credit rating, which in our study, is proxied by the discounted risk premium (spread).

Apart from using the actual reserves in computing the short-term debt to reserves ratio, the authors opted to deduct the quantum of portfolio inflows from the stock of reserves. This was done because the discounted ratio gives a better indication of the ability of the economy to meet short-term obligations, in view of the mobility of international capital. This is particularly important because, unlike short-term debt obligations which have contractual terms that determine their due dates, portfolio investments do not face similar constraints and can be called upon immediately, particularly in times of crisis. Thus, reducing the actual reserves by the adjusted stock of quarterly portfolio inflow

[16] *See (Barrientos & Soria, 2014) obtained from http://www.indexmundi.com/facts/nigeria/external-debt-stocks*

provides a clearer estimate of the available "core" reserves to defend the Naira in the event of a capital flow reversal.

Consequently, it is expected that a positive relationship exists between the discounted risk premium and the ratio of short-term external debt obligations to residual reserves. The short-term debt to external reserves is thus computed as:

$$\text{Stedres} = \left(\frac{pn_t}{res_t} \right) \quad (13)$$

Where:

- Stedres = short-term debt to reserves ratio;
- Pn_t = promissory notes at time t; and
- Res_t = foreign reserves at time t.

The logarithm of the computed short-term debt to external reserves ratio was used in the analysis.

vi. Short-Term Debt to Adjusted External Reserves –The short-term debt to adjusted external reserves is computed as:

$$\text{Stedares} = \left(\frac{pn_t}{(res_t - afpi_t)} \right) \quad (14)$$

Where:

- Stedares = short-term debt to adjusted reserves ratio;
- Pn_t = promissory notes at time t;
- $aFPI_t$ = adjusted foreign portfolio investment at time t ;
- Res_t = foreign reserves at time t; and
- Adjusted or core reserves = $(res_t - afpi_t)$. (15)

The logarithm of the computed short-term debt to adjusted external reserves ratio was used in the analysis.

v. Fiscal Deficit to Nominal GDP Ratio – Fiscal deficit is an indicator of the government's ability to manage its finances to deliver on its key mandate to the people. A high deficit to GDP ratio indicates that the government is unable to fund its current expenditure from its operations and, thus, may require debt to close the funding gap. If this is sustained,

it signifies heavy reliance on debt for the sustenance of governance; and signals a high probability of the future occurrence of debt overhang problems in the economy. A sustained high ratio will invariably reduce the credit-worthiness of the economy as it signals a high risk of default on debt. Significantly, the risk of default becomes even more heightened during a crisis, and a high ratio would signal the inability of the government to meet its debt obligations in the event of external shocks.

vi. This ratio, like the previous two discussed, is indicative of the health of the economy in the estimation of potential international investors. A high ratio indicates inability of government to meet debt obligations; investing in debt instruments in the economy would involve the absorption of significant risk, and would require a high compensatory premium. Consequently, it is expected that there exist a positive relationship between the discounted risk premium and the ratio of fiscal deficit to GDP. Baldacci et. al. (2008) suggested that the sovereign risk rating and thus the risk premium of emerging economies is a function of their fiscal balance. The Fiscal deficit to nominal GDP ratio was computed as:

$$FDGDP_t = \left(\frac{fd_t}{\text{ngdp}_t} \right) \quad (16)$$

Where:

- $Fdgdp_t$ = fiscal deficit to nominal GDP ratio;
- fd_t = fiscal deficit at time t; and
- $ngdp_t$ = nominal GDP at time t.

In applying the methodology in the estimation processes, the authors were able to obtain the probability of default and computed the optimal reserves during the study period. Furthermore, the authors ascertained the optimal core reserves level, which the economy must maintain, in order to adequately absorb the output loss associated with a severe external shocks.

Interest Rate Dynamics and Real Output Behaviour in Nigeria: A Simulation Analysis

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Abstract

The declining output growth observed from the second quarter of 2014, which led to calls for a more expansionary monetary policy despite rising inflationary pressure, necessitated a reassessment of the impact of interest rate on real output growth in Nigeria. Using a Bayesian Vector Autoregressive (BVAR) model and quarterly data from 2000:Q4 to 2015:Q3, the effect of monetary policy transmission (interest rate dynamics) on real output performance was estimated. Although results of the simulation analysis were somewhat mixed, those of the impulse response functions indicated that positive shocks to monetary policy rate (MPR) produced a negative and small impact on output. Specifically, reducing the MPR from 13 to 10 per cent, would lead to an increase in output growth from 2.35 per cent in 2015Q3 to 3.84 per cent in 2016Q3. However, when the MPR was raised from 13 to 14 per cent, output grew albeit at a slower rate from 2.35 to 3.16 per cent during the same period. The authors concluded that policy rate adjustment could be used as a major tool to boost output growth, especially if inflation is low and stable.

Keywords: Monetary Policy, Output, VAR, Inflation, Growth, Simulation
JEL Classification Numbers: E17, E52, E58

I. Introduction

GDP growth has been trending downward, from 6.54 to 2.84 per cent in the second quarter of 2014 and third quarter of 2015, respectively, indicating a burst in the business cycle. The declining economic growth has been occasioned by declining government fiscal revenues, following the fall in the price of crude (Nigeria's main export commodity) since mid-2014. This has resulted to declining public and private investment expenditures, thus putting output growth under severe strain. The situation has been aggravated further by the implementation of the Treasury Single

* *The authors are staff of the Research Department, Central Bank of Nigeria. The usual disclaimer applies.*

Account (TSA), leading to large liquidity withdrawals from the banking system. This action has impaired the financial intermediation role of banks, with the resultant debilitating effect on output growth, arising from decreased lending to the private sector and, subsequent, dwindling investment expenditure.

The use of monetary policy to smoothen fluctuations in business cycles has gained prominence in both developed and developing countries, including Nigeria. Short-term interest rate remains the key instrument of monetary policy to manage business cycles in order to influence the movement of macroeconomic variables, like real output, inflation and unemployment, in the desired direction. Fluctuations in business cycles, short-term interest rates and other monetary aggregates are used as operating targets.

Changes in the central bank policy rate are expected to influence money market interest rates and alter the cost of funds. Specifically, to affect bank lending and deposit rates, which are imperative in shaping the consumption and investment behaviour of economic agents, what is required is to change the policy rate, depending on the macroeconomic goal in focus. It is pertinent to note that market rates are, however, known to be sticky on account of their delayed response to changes in the policy rate; and thus, hinders the effective transmission of monetary policy impulses to the real economy (Ogundipe and Alege, 2013).

The effectiveness of the policy rate in affecting the behaviour of banks and achieving the ultimate objectives of monetary policy is determined by the speed and magnitude of the adjustments in bank lending and deposit rates. In other words, the response of real output depends on the response of banks' interest rates to monetary policy shocks. The interest rate pass-through of monetary policy changes works through the instrumentality of aggregate demand, as it affects such important variables, like consumption, investment, savings and inflation under the assumption that households do not smoothen their consumption (Ogundipe and Alege, 2013). Since real interest rates reflect the price of capital, changes in the policy rate are expected to impact on real output in Nigeria through the bank lending and interest rate channels. The response of consumption and investment behaviours to adjustments in the short-term interest rates also suggests that changes in the policy rate have implications for inflation expectations.

Given the foregoing and the established evidence that short-term interest rate could be used to influence real output behaviour, the issue of concern is whether this position holds for Nigeria, considering the need to reverse the trend of declining output and, at the same time, tame rising inflation. Various studies have been carried out the impact of a monetary policy shocks on output. While some studies (see for example, Xu and Chen, 2012; Were and Tiriongo, 2012; Robinson and Robinson, 1997) observed declining output, following interest rate hikes, others (such as Ganev et al., 2002; Aksoy and León-Ledesma, 2005; Cheng 2006) found that the impact of interest rate changes on output was quite small and, sometimes, negligible. The Nigerian studies (Ezeanyeji, 2014; Udoka and Anyingang, 2012) are few with divergent revelations. There is, therefore, the need for a reassessment, considering the changing policy environment, data and global dynamics that have serious implications for the Nigerian economy.

Consequently, the specific questions of interest are: what is the extent and direction of the impact of interest rate changes on aggregate output and employment in Nigeria? Can a change in the policy rate be used to reverse the declining trend in output growth and rising inflation, simultaneously?

The main objective of the paper, therefore, is to examine the response of real output in Nigeria to the dynamics in short-term interest rates, with a view to providing better understanding and suggesting policies to address the adverse impact of business cycle fluctuations in Nigeria. The paper is structured into six sections with the introduction provided in Section 1. Section 2 reviews the theoretical and empirical literature; while Section 3 gives the stylised facts on the interest rate policy regimes, output growth and other relevant macroeconomic variables in Nigeria. Section 4 discusses the methodology, including the estimation procedures and the specification of the model. The empirical results and policy implications are discussed in Section 5, while Section 6 provides the concluding remarks and policy recommendations.

II. Literature Review

II.1 Theoretical Framework

II.1.1 Theories of Interest rate

Bannock, et. al. (1998) defined interest rate as the price a borrower has to pay to enjoy the use of cash, which he or she does not own; and the return a lender

enjoys for deferring consumption or parting with liquidity. Interest rate has also been conceived by economists as the rate of return on capital. It can be distinguished into the natural and market rates. While the market rate of interest is the rate at which funds can be borrowed in the market, the natural rate of interest refers to the rate of return on capital investment.

The importance of interest rate centres on its equilibrating influence on supply and demand in the financial sector. Colander (2001) and Ojo (1993) confirmed this, stating that the channeling of savings into financial assets and individuals incurring financial liabilities is highly influenced by interest rate premium on those financial assets and liabilities. Furthermore, the interlocking linkage between the financial and real sectors establishes the developmental role of interest rate. It is through this linkage that the effect of interest rate on the financial sector is transmitted to the real sector. Consequently, the monetary authorities, in the pursuit of monetary policy to achieve price stability, influence the level of savings and availability of credit by adjusting the policy rate.

II.1.1.1 The Classical Theory of Interest Rate

In the classical theory, savings and investment are regarded as the only determinants of the rate of interest. The theory explains that interest rate is determined through the forces of demand and supply of funds. Thus, money lent out to investors for investment in capital goods is made available from the savings of other people out of their current incomes. By postponing consumption, they make available resources for the production of capital goods. The theory further assumes that savings are interest-elastic. Therefore, the higher the rate of interest, the more the savings people will be induced to make. That is, for people to be induced to save more, and refrain from consuming their entire income, a higher rate of interest will have to be offered.

Uchendu (1993) opines that the classical theory views interest rate as the return or yield on equity or opportunity cost of deferring current consumption. Fisher (1974) notes that time preference and marginal productivity of capital are key determinants of interest rates.

In general, the view of the classical theory is that interest rate is the price paid for saving capital, which is determined by its demand for, and supply of savings. The demand for capital comes mostly from investors who borrow for

productive activities, while the supply comes from income earners. The borrower compares the market rate of interest with the marginal productivity of capital and stops borrowing when he believes productivity is equal to the rate of interest.

II.1.1.2 The Loanable Funds (Neo-classical) Theory

The neo-classical loanable funds theory, which is an extension of the classical theory, emphasises the demand for, and supply of loanable funds in the determination of interest rate. When the supply of fund is higher than the demand, interest rates will be low and vice versa if the demand outweighs supply. Thus, the equilibrium interest rate is given at the point where both supply and demand for loanable funds are equal.

The supply of funds available for lending (credit) would be influenced by the savings of the people, as well as the additions to the money supply through credit creation by banks. Thus, savings constitutes 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. The demand side of the loanable funds would be determined by the demand for investment expenditure (I) and the demand for hoarding money (H). Thus, I + H is 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, the rate of interest is determined at the point where the demand for loanable funds (I + H) equates the supply of loanable funds (S + M). This clearly shows that the theory is an extension of the classical theory, which states that the rate of interest is a function of savings and investment.

Symbolically, the loanable funds theory can be expressed as;

$$r = f(I,S,M,H) \quad (1)$$

where;

r = the rate of interest
I = Investment expenditure
S = Savings
M = Credit creation by commercial banks
H = Demand for hoarded money

II.1.1.3 Keynes (Liquidity Preference) Theory of Interest Rate

The Keynesian theory of interest rate perceives interest to be the reward for parting with liquidity for a specified period, rather than savings. Individuals have the choice of what to consume and what to save from their income. The former depends on what the Keynesian theory calls the propensity to consume. Given this, a certain proportion will be saved, which will either be held as cash or non-interest-paying bank deposits. How much an individual will part with or lend depends upon what Keynes calls liquidity preference. According to the Keynesian theory, demand for liquidity is determined by three motives: (i) the transactionary motive, where people prefer to hold cash to assure basic and current transactions; (ii) the precautionary motive, where people prefer to hold cash in case of unexpected problems/contingencies; and (iii) the speculative motive, where people desire to hold their resources in liquid forms so as to speculate market movements, concerning 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 level of reward for keeping money in bonds or other assets rather than keeping it in cash. It is determined by the interaction between investments and savings. The Keynesians also believe that the relationship between changes in the quantity of money and prices is non-proportional and absolutely indirect, through the rate of interest.

The strength of 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 hand. 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. The theory also examined the relationship between the quantity of money and prices under situations of unemployment and full employment. 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 (CBN, 2012).

II.1.1.4 The Taylor Rule

The Taylor rule (1999) is a monetary policy rule, which prescribes how a central bank should alter nominal interest rates in a systematic manner in response to changes in inflation and output, as well as other macroeconomic activities. Specifically, it stipulates that for every one percent rise in inflation, the nominal interest rate should be raised by more than one percent.

The Taylor rule assumes the following form:

$$i_t = 2 + \pi_t + g_\pi (\pi t - \pi^{*}) + g_x x_t$$

Where;

it is the nominal policy rate,

2 is a constant term, which is the long-run or equilibrium real rate of interest,

π^* is the central bank's inflation objective,

π_t is the current period inflation rate, and

X_t is the current period output gap.

Gπ and gx are parameters to be estimated

The Taylor's rule assumes that the central bank's inflation target remains unchanged at 2.0 per cent, and over time, there is improvement in monetary policy because the central bank has responded more vigorously to deviations of inflation from the 2.0 per cent value, by increasing the magnitude of the coefficient gπ on the inflation term $(\pi t - \pi^{*})$ (Hetzel, 2000). The central bank aims at stabilising inflation around its target level, while output around its potential. Positive deviations of the two variables from their target or potential level would be associated with a tightening of monetary policy, while negative deviations would be associated with loosening of monetary policy (Hofmann and Bogdanova, 2012).

The output gap is further illustrated with the following;

$$x_t = - ?(i_t - \pi_t - r) + \upsilon_t \quad (2)$$

$$\pi_t = \pi_{t-1} + \lambda x_{t-1} + e_t \quad (3)$$

$$i_t = g_0 + g_\pi \pi_t + g_x x_t \quad (4)$$

Equation (2) is the IS function, which relates the output gap to the real rate of interest. The Phillips curve is depicted in Equation (3), and it relates inflation to the output gap. The reaction function of the central bank is captured in equation (4) and it takes the form of a Taylor rule.

Overall, the Taylor rule suggests that central banks should raise interest rates when inflation is above planned target or when GDP growth is too high and above potential. Conversely, the central banks should lower rates, when inflation is below the target level or when GDP growth is too slow and below potential.

II.1.2 Monetary Policy Transmission Mechanism

Monetary policy is a deliberate action of the monetary authorities to influence the value, quantity, cost and availability of money in an economy in order to achieve the desired macroeconomic objectives of internal and external balances (CBN, 2011a). The need to regulate money supply is premised on the fact that there should be a stable relationship between money supply and economic activity, such that if the former is not limited to what is required to support productive activities, the undesirable effects of inflation will arise.

The primary objective of monetary policy is price stability. In most economies, the central bank is usually charged with the responsibility of conducting monetary policy, and they have remained focused on achieving internal and external balances, as well as promoting non-inflationary growth in output. Thus, monetary policy measures are specifically designed to ensure stable inflation rates, stimulate growth in the productive sectors and reduce pressure on the balance of payments.

Central banks achieve the broad objectives of monetary policy through the use of certain monetary policy instruments, which could be direct or indirect. With the direct instruments, a central bank can direct commercial banks on the maximum percentage or amount of loans (credit ceilings) to different economic sectors or activities. Interest rate caps, liquid asset ratio and issue credit guarantee to preferred loans are other direct monetary policy tools to ensure that available savings is allocated and investment directed in particular directions as desired by the central bank. The indirect instrument, on the other hand, involves the use of reserve requirements, open market operations,

discount window operations, among others, by the central bank to control money supply (CBN, 2011b).

Since one of the major objectives of monetary policy is to stimulate growth in the productive sectors, it is imperative that such policies should be effectively transmitted to the real economy. There is an interlocking linkage between monetary policy and the real sector, which establishes the developmental role of interest rates. Through this linkage, the effect of monetary policy/interest rate is transmitted to the real sector. Consequently, the central banks, in their pursuit of monetary policy, try to influence the level of savings and availability of credit by influencing the policy rate.

The monetary policy process presupposes that changes in the supply of money will work through some intermediate variables through which some effects are transmitted to the ultimate objectives of monetary policy. Therefore, monetary policy is formulated with some assumptions of the path through which it would follow in order to impact on the real economy. This path is referred to as the transmission mechanism of monetary policy. It defines the various channels through which policy-induced changes in the nominal money stock or the short-term nominal interest rate affects prices and output in the economy. The transmission mechanism of monetary policy has been conceptualised in many ways. According to the European Central Bank (2015), it is the process through which monetary policy decisions affect the economy, in general, and the price level in particular. This mechanism is characterised by long, variable and uncertain time lags, which makes it difficult to predict the precise effect of monetary policy actions on the economy and price level. Similarly, CBN (2010), notes that, the transmission mechanism of monetary policy traces the relationship between changes in the supply of money and real variables, such as output, employment, and prices of goods and services.

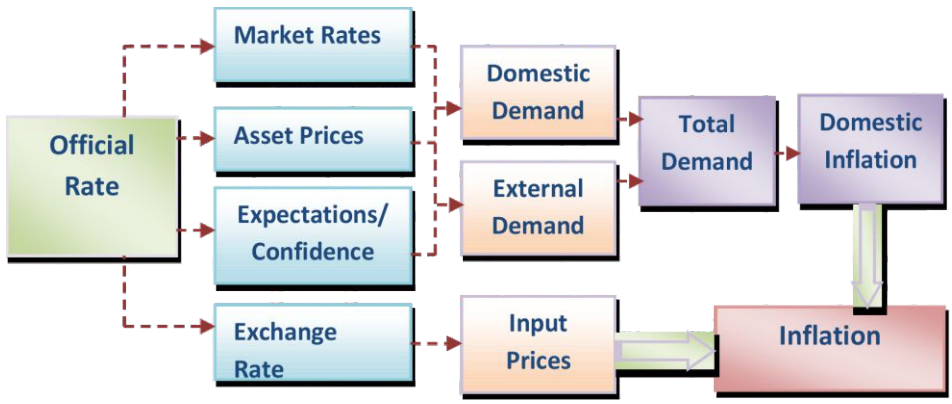
According to Ireland (2005) monetary transmission mechanism describes how policy-induced changes in the nominal money stock or the short-term nominal interest rate impact real variables, such as aggregate output and employment. Petursson (2001) describes the transmission mechanism of monetary policy as the process through which changes in the central bank policy rate are transmitted to the economy, affecting aggregate demand, inflation expectations and the rate of inflation. Similarly, Taylor (1999) simply

states that it is the process by which monetary policy decisions are transmitted in real GDP and inflation.

Andries (2012) emphasises that central banks affect developments in the real economy, by means of a transmission mechanism of monetary impulses. He believes that a better understanding of the transmission mechanisms of monetary policy would require an analysis of the factors that influence it. He opines that the transmission of monetary policy to the real sector defers from one geographical area to another and from one period to another. For example, in low income countries, the effectiveness of interest rate and credit channels are limited due to lack of proper institutional framework, reduced depth of financial markets; and high costs of funds. Similarly, the effectiveness of exchange rate channel is undermined by the frequent interventions of the central bank in the foreign exchange market.

The literature identifies five major channels of monetary policy transmission. These include: interest rate, credit, exchange rate, asset prices and expectation channels. Figure 2.1 describes how monetary policy is transmitted to the economy.

Figure 2.1: Monetary Policy Transmission Mechanism



Source: Bank of England

The Interest Rate Channel

The interest rate channel is often referred to as the 'traditional' channel of monetary policy transmission and forms the framework for this study. It is the main channel of monetary policy transmission and was first postulated by the

Keynesian view of how monetary policy effects are transmitted to the real economy through the interest rate. 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) observes that the traditional Keynesian view of transmission of monetary tightening is expressed as follows;

$$\mathbf{M}\downarrow \rightarrow \mathbf{i}\uparrow \rightarrow \mathbf{I}\downarrow \rightarrow \mathbf{Y}\downarrow$$

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).

The Credit Channel

The credit channel consists of two channels of monetary policy transmission – the bank lending and balance sheet channels. The bank lending channel operates through the supply of bank loans. Banks tend to rely on deposits as a principal source of funding for lending, while many small firms rely on bank loans as a principal source of funds for investment. A contractionary monetary policy by the central bank increases bank reserves and reduces the supply of loans for small or medium-sized bank-dependent business, which are compelled to search for new lenders and establish new credit relationships. These constraints increase their external finance premium and affect their spending decisions.

Schematically, the monetary policy effect is as follows;

$$\mathbf{M} \downarrow \rightarrow \mathbf{BD} \downarrow \rightarrow \mathbf{BL} \downarrow \rightarrow \mathbf{I} \downarrow \rightarrow \mathbf{Y} \downarrow$$

Where;

M= Money Supply
BD = Bank Deposits
BL = Bank Loans
I = Investment Spending
Y = Output

However, the central bank can regulate the availability of bank loans in two principal ways; by raising reserve requirements with the prime intention of reducing the loanable funds to borrowers; and by conducting open market sales of government securities aimed at reducing commercial banks' reserves since depositors will substitute deposits with the more attractive financial assets.

The balance-sheet channel, on the other hand, is based on the well-established fact that a borrower with a stronger financial position pays a lower external finance premium, as the present value of an investment is more sensitive to a given interest rate change, when the stream of payment is longer. Changes in policy do not affect only market interest rates but also the financial positions of borrowers. A tight monetary policy raises interest rates and weakens borrowers' balance sheets, which invariably reduces net cash flows. Rising interest rates, also, lead to decline in asset prices, which among other things, reduce the value of the borrower's collateral. There could be indirect effects of a tight monetary policy, which arise from the deterioration in consumers' expenditure. The revenue of firm's will decline, while its fixed costs do not adjust in the short run. Over time, this financing gap thus erodes the firm's net-worth and credit-worthiness (Mishkin, 1995; and Ishioro, 2013).

The Exchange Rate Channel

In open economies, such as Nigeria, the effects of monetary policy could be transmitted to output and prices through the exchange rate. According to Mishkin (1995), this channel involves interest rate effects because when domestic real interest rates rise above its foreign counterparts, it makes local currency deposits to become more attractive relative to deposits dominated

in foreign currencies. This leads to a rise in the value of domestic currency deposits, relative to other currency deposits, that is, an appreciation of the local currency. The higher value of the local currency makes domestic goods more costly than foreign goods, thus causing a decline in net exports, and hence, aggregate output.

The relationship is presented thus:

$$\mathbf{M}\downarrow \rightarrow \mathbf{i}\uparrow \rightarrow \mathbf{ER}\uparrow \rightarrow \mathbf{NX}\downarrow \rightarrow \mathbf{Y}\downarrow$$

Where;

M= Money supply
i = Interest Rates
ER = Exchange Rates
NX = Net Exports
Y = Output

The strength of the exchange rate channel, however, depends on the responsiveness of the exchange rate to monetary shocks, the degree of openness of the economy and the exchange rate arrangement of the country. Under a floating exchange rate regime, an expansionary monetary policy would depreciate domestic currencies, and increase the prices of imports. However, the managed floating regime often results to a relatively weak transmission process in affecting real output and prices.

The Asset Price Channel

The asset price channel, also known as the portfolio balance channel, comprises the equity price channel, and the housing and land price channel. Equity price channel is further sub-divided into two: the investment effect, popularly explained by the Tobin's Q theory; and the wealth effect on consumption, advanced by the Modigliani's life-cycle income hypothesis. This channel is based on the monetarists' paradigm and objects the Keynesian paradigm of analysing monetary policy effects on the economy by focusing on only one relative asset price, the interest rate. Instead, the monetarists posit that it is vital to assess how monetary policy affects the universe of relative asset prices and real wealth.

The Tobin's Q theory explains how monetary policy affects the economy through its effects on the valuation of equities. The Q is defined as the market value of firms divided by the replacement cost of capital. If Q is high, the market price of firms is high, relative to the replacement cost of capital, and new plant and equipment capital is cheap relative to the market value of business firms. Thus investment spending will rise because the firm can buy a lot of new investment goods with only a small issue of equity. However, when the Q is low, firms will not purchase new investment goods because their market value is low, relative to the cost of capital (CBN, 2010).

According to the Tobin's Q theory, an expansionary monetary policy reduces interest rates, making bonds less attractive relative to equities, thereby raising the price of equities. This leads to an increase in the market value of companies, in relation to their cost of capital. Thus, companies are encouraged to issue new shares at higher prices, and use the proceeds for the purchase of investment goods (CBN, 2010).

The transmission of monetary policy through the equity price channel is schematically shown thus;

$$\mathbf{M}\uparrow \rightarrow \mathbf{Pe}\uparrow \rightarrow \mathbf{q}\uparrow \rightarrow \mathbf{I}\uparrow \rightarrow \mathbf{Y}\uparrow$$

Where;

M= Money supply
Pe = Equity Prices
q = Ratio of market value of firms to replacement cost of capital
I = Investment
Y = Output

The other sub-channel in the assets prices channel is the wealth effect on consumption, which was modeled on the life-cycle income hypothesis, developed by Modigliani (Modigliani, 1971). Since consumption is a function of lifetime resources, a rise in stock prices, translates to higher financial wealth higher consumption of households. The monetary transmission mechanism is depicted thus:

$$\mathbf{M}\uparrow \rightarrow \mathbf{Pe}\uparrow \rightarrow \mathbf{W}\uparrow \rightarrow \mathbf{C}\uparrow \rightarrow \mathbf{Y}\uparrow$$

Where;

M= Money Supply
Pe = Equity Prices
W = Wealth
C = Consumption
Y = Output

Housing and land prices are also important channels of wealth, such that a rise in their prices, relative to replacement costs, leads to a rise in Tobin's Q for housing, which stimulates production. Also, since housing and land prices are key components of wealth, a rise in their prices will increase wealth and raise consumption. Monetary expansions, which raise housing and land prices through such mechanisms, lead to rise in aggregate demand. This makes the housing and land channels key mechanisms for the transmission of monetary policy (Mishkin, 1996).

The Expectations Channel

Monetary policy decisions also affect expectations for prices and the future performance of the economy. This is because individuals and firms determine their prices based on such expectations. Inflation expectations are transmitted to the economy when individuals bargain for higher wages and when firms adjust their prices in response to their perception of how future prices would trend. Inflation expectations affect interest rates, which in turn affects aggregate supply and demand through the other channels. However, the effects of expectations on monetary policy rest on the credibility of central bank's actions to tame future inflation expectations by pushing down current inflation. If the commitment of monetary policy to reduce inflation is credible, its effectiveness is enhanced by its potential to reshape inflation expectations.

II.2 Empirical Literature

Empirical findings on the impact of interest rate on real output behaviour differ. Robinson and Robinson (1997) using the structural vector auto-regression (SVAR) model and monthly data for the period examined the channels through which monetary policy was transmitted in Jamaica, since the liberalisation of the economy. The study found that 1 per cent shocks to repo

rate had important short-run effects on both prices and economic activity, as the inflation rate decelerated within two months by approximately 0.1 per cent per month, while real economic activity declined by approximately 2.0 per cent in four months.

Findings by Christiano et. al., (1998), using the VAR methodology and quarterly data from 1965:3-1995:2 for the US indicated that a decline in the key interest rate controlled by the Federal Reserve tended to boost output over two to three years, but the effect die-off thereafter so that the long-run effect was confined to only prices. Aron and Muellbauer (2002), applied the multi-step forecasting model to study inflation and output in South Africa using quarterly data from 1963:1 to 2001:2. The result showed an important link between interest rates and output, with low inflation rate associated with higher openness of the economy, low wholesale prices relative to consumer prices, high real exchange rate, low real mortgage payments, as well as low real interest rates, output gap and indirect tax rate.

Xu and Chen (2012) examined the effect of interest rate on aggregate demand in China using quarterly data from 1998:Q1 to 2009:Q4 and monthly data from July 2005 to February 2010. They found that a change in the policy rate, transmitted to bank lending rates, influenced aggregate domestic demand, investment, and eventually output in China. Similarly, Hafer and Kutan (2002), in a study of 20 countries, using quarterly data from 1990-1998 and applying the VAR technique, found that, although interest rates generally played an important role in explaining output, in about half of the countries, money accounted for more of the variance in real output than nominal interest rates.

Starr (2005) in studying four core Commonwealth of Independent States (CIS) countries (Russia, Ukraine, Belarus and Kazakhstan), used quarterly data for 1995:1 to 2003:4 and the VAR methodology and found little evidence of real effects of monetary policy on output in these countries, with the notable exception that interest rates had a significant impact on output in Russia. Were and Tiriongo (2012), using the simple VAR model and annual data, covering the period 2007 to 2011 for Kenya, found that, following a monetary policy shock, real GDP declined after 10 periods (months), whereas there was no significant impact on domestic price.

Ganev et. al., (2002), using the autoregressive distributed lag (ARDL) approach and monthly data from 1995-2000 from ten countries in the Central and Eastern Europe (CEE), found no evidence that changes in interest rate affected output, though there was some indication that changes in the exchange rate did.

Similarly, Aksoy and León-Ledesma (2005) tested for the long-term relationships between monetary indicators and real output, using an autoregressive specification and annual data for the United Kingdom from 1948-2001 and the United States from 1947-2001. The results showed that there was no empirical evidence to support the existence of long-term relationships between the relevant policy indicators and real output. Various tests showed that there was neither significant nor stable long-term relationship between short-term interest rates and real output in the UK and the US.

Cheng (2006) examined the impact of a monetary policy shocks on output, prices, and the nominal effective exchange rate for Kenya, using data spanning 1997–2005 and the VAR technique. His findings suggested that an exogenous increase in the short-term interest rate tended to be followed by a decline in prices and an appreciation in the nominal exchange rate, but had an insignificant impact on output.

In the case of Zambia, Odhiambo (2009) examined the dynamic impact of interest rate reforms on economic growth and its influence on financial deepening using annual time series data from 1969 to 2006. The study employed two models, including error correction model (ECM), and found that financial deepening, which resulted from interest rate liberalisation, Granger-caused economic growth.

Bayangos (2010) re-specified a dynamic, structural, economy-wide macro econometric model, using annual data for the period 1999 to 2009 in the Philippines and found that the impact of a monetary policy tightening on real output appeared to be relatively moderate and that the lags was quite long, while the impact on the price level appeared to be stronger and shorter, compared to the impact on the real output.

Using SVAR methodology with quarterly data for the period 1971-2009, Ćorić, Perović, and Šimić (2012) studied the effects of a monetary policy shock on output and prices in 48 countries. The result of the cross-country output regressions suggested that the effect of a monetary policy shock on output was, on average, smaller in countries that were more correlated with the global economy.

In Nigeria, Ezeanyeji (2014) applied the ordinary least square (OLS) technique in assessing agricultural productivity using annual data covering the period 1986 to 2010. The authors findings suggested that interest rate played a significant role in enhancing economic activities. Similarly, Udoka and Anyingang (2012), employed the ordinary' least square (OLS) methodology and annual data for Nigeria from 1970-2010, found an inverse relationship between interest rate and economic growth in Nigeria.

Ojima and Fabian (2015) used multiple regression and annual data from 1986 to 2012 to investigate the impact of interest rate on investment in Nigeria. The results revealed that high interest rate negatively affected investment. Specifically, a 1.0 per cent increase in interest rate would reduce investment by 14.0 per cent. However, Idoko and Kpeyol (2010) assessed the impact of interest rate deregulation on economic growth in Nigeria. Using an autoregressive model and data from 1970 - 2009, the result showed that deregulated interest rate had insignificant impact on economic growth.

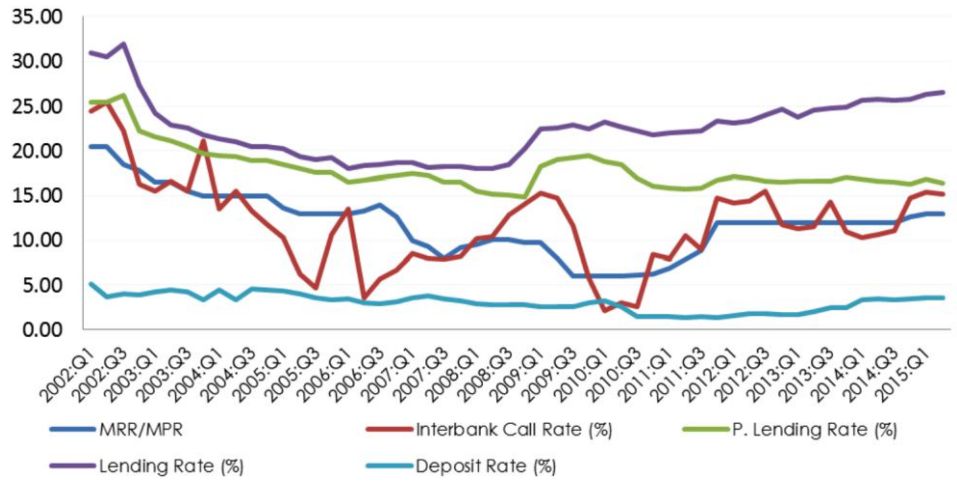
III. Stylised Facts on Interest Rate Dynamics and Real Output in Nigeria

A key objective of monetary policy has been the attainment of both internal and external balance of payments. A major policy instrument used is interest rate. Thus, with a regime of more active monetary policy interest rate where rates are reviewed every two months in order to ensure savings mobilisation and investment promotion, price stability consistent with economic growth and development remain the target of the monetary authority. The CBN uses the MPR (formally MRR) as the official interest (anchor) rate on which all other interest rates in the money market and the economy revolve. Adjustment of policy rate by central bank has implications for the behaviour of other macroeconomic aggregates. Consequently, we present the following stylised facts on interest rate dynamics and real output behaviour in Nigeria.

III.1 Trend in Interest Rates

The trend in interest rates from 2002:Q1 to 2015:Q2 are shown in Figure 3.1. The movement in the anchor rate, MRR/MPR is seen to be driving all other rates, as expected except the interbank call rate, which exhibits more volatility than other interest rates. The behaviour of interbank call rate is due to the fact that it is used largely to address liquidity issues and meet requirements placed on them among DMBs. While interest rates have generally been trending downwards from 2002 to 2008, they have been on a rising trend from 2009 up to 2015, although the MPR only maintained a steady upward trend from 2011.

Figure 3.1: Trends in Interest Rates (2002:Q1 - 2015:Q2)

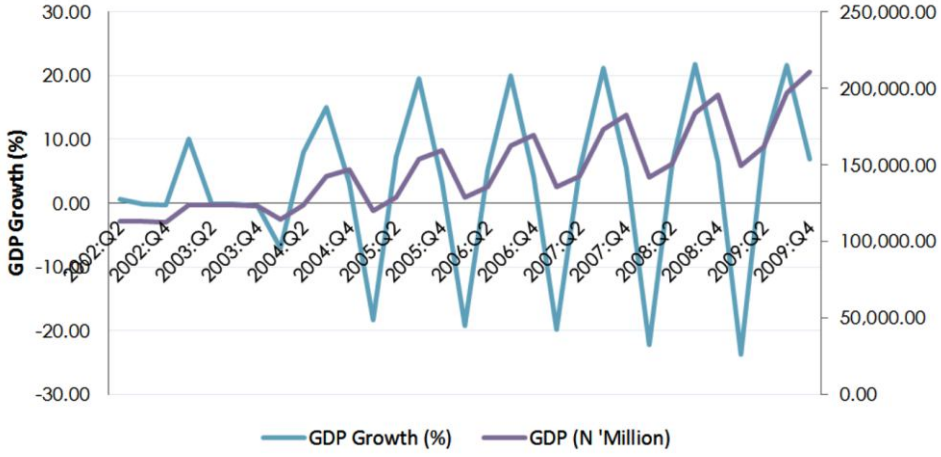


Source: Central Bank of Nigeria (Annual Reports)

III.2 Trends in Output and Output Growth

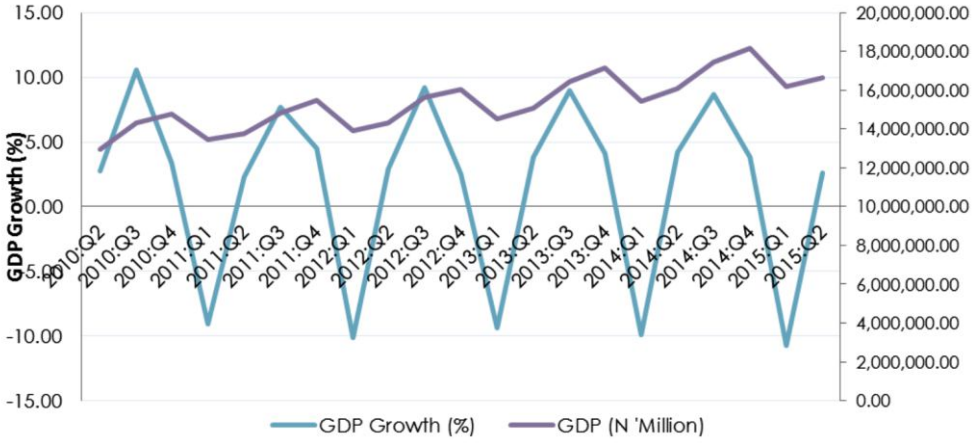
The trends in output and output growth were shown in Figure 3.2A and 2B between 2002 and 2009 and from 2010 to 2015, respectively. It can be seen that output had been trending upward, with accompanying booms and bust in business cycles both before and after the rebasing of the GDP. The Growth rates mirrored the oscillations in output in both periods. The Figure showed a trending down of output since Q1 of 2015.

Figure 3.2A: Trends in Output and Output Growth (2002:Q2 -2009:Q4)



Source: Central Bank of Nigeria (Annual Reports)

Figure 3.2B: Trends in Output and Output Growth (2010:Q2 -2015:Q2)



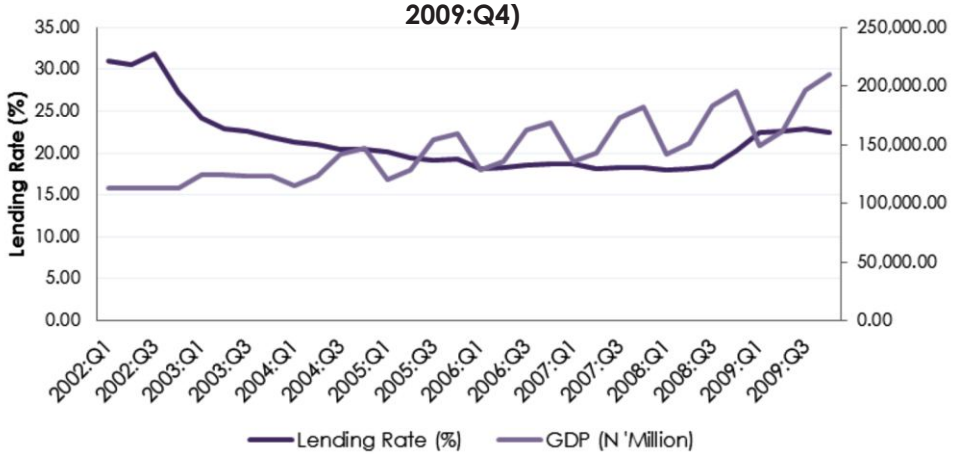
Source: Central Bank of Nigeria (Annual Reports)

III.3 Interest Rate and Output

Figures 3.3A and 3.3B showed the relationship between the maximum interest rate and movement in output before and after GDP rebasing, respectively. From the graphs, output did not seem to be responding as expected to movements in interest rates, as they tended to move in the same direction before rebasing. Although changes in money market interest rates were imperative in shaping the consumption and investment behaviour of economic agents, it did not seem to be the case with output in Nigeria, as

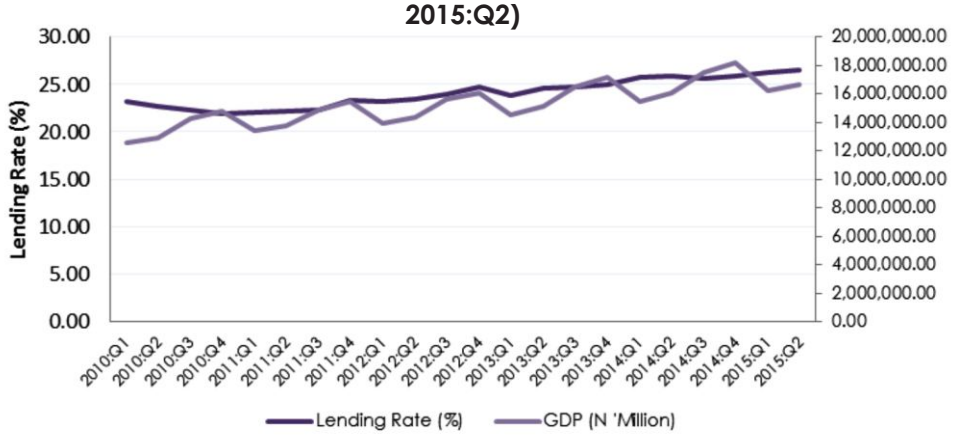
output seemed to be trending upward, with rising lending rates, albeit with the boom and bust cycles.

Figure 3.3A: Relationship between Lending Rate and Output (2002:Q1 - 2009:Q4)



Source: Central Bank of Nigeria (Annual Reports)

Figure 3.3B: Relationship between Lending Rate and Output (2010:Q1 - 2015:Q2)



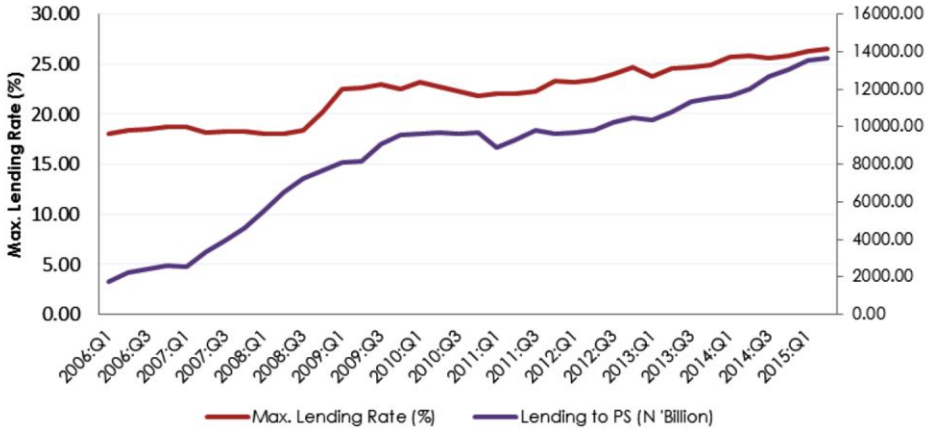
Source: Central Bank of Nigeria (Annual Reports)

III.4 Interest Rate and Lending to the Private Sector

Figure 3.4 showed the relationship between interest rate and lending to the private sector for the period 2006 and 2015. The trend showed that lending to private sector was increasing with rising interest rates, contrary to expectation.

This indicated that lending decisions of banks might not have been responding to changes in interest rates, as expected.

Figure 3.4: Relationship between Interest Rate and Lending to the Private Sector (2006:Q1 - 2015:Q2)

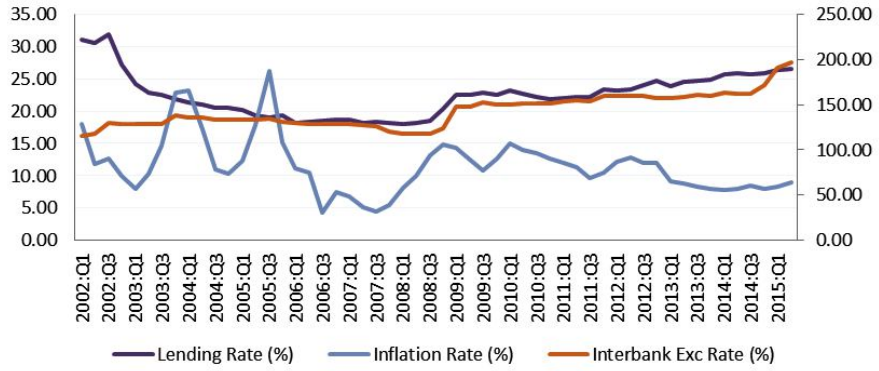


Source: Central Bank of Nigeria (Annual Reports)

III.5 Interest Rate, Inflation and Exchange Rate

Figure 3.5 showed the relationship between interest rate, inflation and Exchange Rate for the period 2002 and 2015.

Figure 3.5: Relationship between Interest Rate, Inflation and Exchange Rate (2002:Q1 -2015:Q2)



Source: Central Bank of Nigeria (Annual Reports)

IV. Data and Methodology

IV.1 Data

Data included monetary policy rate, lending rate, money supply, interbank exchange rate, inflation and output growth. The data were obtained from the Central Bank of Nigeria statistical database. Quarterly data of the variables, spanning 2000:Q4 to 2015:Q3, were used in the estimation of the model. Precisely, based on the interest rate channel, the monetary policy rate was used as the control variable, which transmitted its impulses to lending rate and captured the loan rates that influenced credit to the private sector. To ensure that the variables were devoid of measurement error, some of the data were transformed to keep them in the same magnitude. The data were subjected to diagnostic checks, to ensure that the inferences drawn from the results were not misleading.

IV.2 Model Specification

The study employed the CBN (2015) and Migliardo (2010) Bayesian vector autoregressive (BVAR) modelling approach to estimate the effect of monetary policy transmission mechanism (interest rate dynamics) on real output performance in Nigeria for the period 2000:Q4 to 2015:Q3. The strength of the methodology over the traditional VAR approach is that it is less-restrictive, as it does not suffer from the curse of dimensionality problem and it is better for forecasting (Migliardo, 2010). The approach, in this study, however, differs in terms of the identification method applied, which was based on the interest rate channel of monetary policy transmission mechanism.

The belief is that money supply mechanism follow policy rate adjustment process, which affects ultimately output performance along the pass-through to the lending rate, monetary aggregate, inflation and, ultimately, output behaviour.

Thus, the basic VAR model is expressed as follows:

$$y_t = \alpha_0 + \sum_{j=1}^{p} \gamma_j y_{t-j} + \varepsilon_t \qquad (1)$$

In equation 1, y_t represent a set of n endogenous variables with a lag order, p across t observations; ε_t, an n x 1 unobservable vector of errors, assumed to be white noise ($i.i.d\ \ N(0, \Sigma_t)$); α is an n x 1 vector of constants; and γ_j is an $n \times n$ matrix of coefficients for the j^{th} lag of order p.

Imposing restriction on equation 1, to follow the Bayesian normal distribution approach gives,

$$Y_{(nT\times 1)} = (I_n \otimes X)\beta + \varepsilon \qquad \varepsilon \sim N(0, \Sigma \otimes I_T) \tag{2}$$

Y represents a T × M matrix, stacking in columns T observations on each endogenous variable next to each other such that ε and E designate the stacking of the errors in conformity with y and Y, respectively.

Taking $x_t = (1, y_{t-1}^{'}, \ldots, y_{t-T}^{'})$ and $X = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_T \end{bmatrix}$

Thus, the vector of nT x 1, $y = vec(y_t)$, shows the stacking of T observations on the first endogenous variable and, subsequently, the T observations on rest of the other endogenous variables, in that order.

This can also be expressed in a metric-variate form with the T observations for each endogenous variable stacked in columns next to each order as follows:

$$Y_{(T\times n)} = X_{(T\times(np+1))}\beta_{((np+1)\ x\ n)} + E_{(T\times n)}\ E \sim N(0, \Sigma) \tag{3}$$

According to Canova (2007), Koop and Korobilis (2009) and Rummel (2013), equation (2) enables the decomposition of the likelihood function of the VAR of lag order p into the product of a normal density for β, given the OLS estimates of the VAR coefficients $(\hat{\beta})$ the Σ and a Wishart density for $\Sigma^{-1}(\Sigma)$. This is expressed as:

$$p(\beta \mid \Sigma, y) \sim N\left(\hat{\beta}, \Sigma \otimes (X^{'}X)^{-1}\right) \tag{4}$$

and

$$p\left(\Sigma^{-1} \mid y\right) \sim W\left(S^{-1}, T-K-n-1\right) \quad (5)$$

Where $K=1+np$, $\hat{\beta}=(X' X)^{-1} X'Y$ is the OLS estimate of β, $\hat{\beta}=vec(\hat{\beta})$ and:

$$S = \left(Y - X\hat{\beta}\right)'\left(Y - X\hat{\beta}\right) \quad (6)$$

From the foregoing, if the set of parameters, (β, Σ) is denoted by θ, the prior distribution is given as $\pi(\theta), l(y \mid \theta)$, the likelihood function, and $\pi(\theta \mid y)$, the posterior distribution of θ given the endogenous variable set $\mathbf{y}$ is obtained as follows:

$$\pi(\theta \mid y) = \frac{\pi(\theta) l(y \mid \theta)}{\int \pi(\theta) l(y \mid \theta) d\theta}$$

Where $\int \pi(\theta) l(y \mid \theta) d\theta$ is normalising constant, such that the posterior is proportional to the product of the likelihood function and the priors.

IV.3 Estimation Technique and Procedure

In evaluating the transmission mechanism of monetary policy impulses to the real output based on the BVAR approach, we conducted our analysis in two stages. First, we specified and estimated the VAR model based on the Bayesian technique and derived the impulse response functions and variance decomposition.

The BVAR model is specified as;

$$\mathbf{Z}_{i,t} = \mathbf{\Pi Z}_{i,t-p} + \varepsilon_t \qquad \forall \qquad i = 1,2$$

Where $\mathbf{Z}'_{1t} = [MPR\ PLR\ M2\ INF\ RES\ RY]$ is the vector of endogenous variables for the equation. We assumed that changes in MPR transmitted to the prime lending rate (PLR), broad money supply, exchange rate (EXR), inflation rate and output growth (GDP). The subscript 'p' represented the lag order of the BVAR. Π_p is the 6 X p matrix of the BVAR parameters to be estimated.

In estimating the BVAR, we started with the choice of appropriate lag length by conducting diagnostic tests. After series of iterative processes, using

conventional lags length selection criteria, including FPE, HQ and SIC, a lag length of one was found appropriate for the endogenous variables. This lag length is justifiable since our data is of quarterly frequency and it hedged against possible challenges, such as loss of degree of freedom. Consequently, priors were imposed on parameters to shrink the parameter set. Following Lutkepohl (2007), the Litterman/Minnesota prior type was utilised, given that it accounted for posterior independence between equations and had a fixed residual variance-covariance matrix, which indicated that the data employed followed a random walk process.

Since priors helped to capture the tightness of the information about the distribution, the hyper-parameters specification type was chosen, which enabled the assignment of values to the lambdas (λ 's) and residual (μ), based on the available information at our disposal. In the Litterman/Minnesota prior type, λ_1 was the overall tightness on the variance (of the first lag) and controlled the relative importance of sample and prior information. If λ_1 is small, prior information dominates the sample information. Similarly, λ_2 represents the relative tightness of the variance of other variables, while $\lambda_3 > 0$ represents the relative tightness of the variance lags. Setting $\lambda_2 = 0$ implies the VAR is collapsed to a univariate models. Thus, in selecting suitable values, different combinations were examined for the lambdas, ranging from 0 to 1. Thus, $\lambda_1 = 0.7, \lambda = 0.99$ and $\lambda_3 = 1$ were utilised given that the data used were non-stationary. This allowed for the persistence in the decay in the lags. Furthermore, the estimates of the regression were used to compute the impulse response functions and the variance decomposition of the Bayesian VAR.

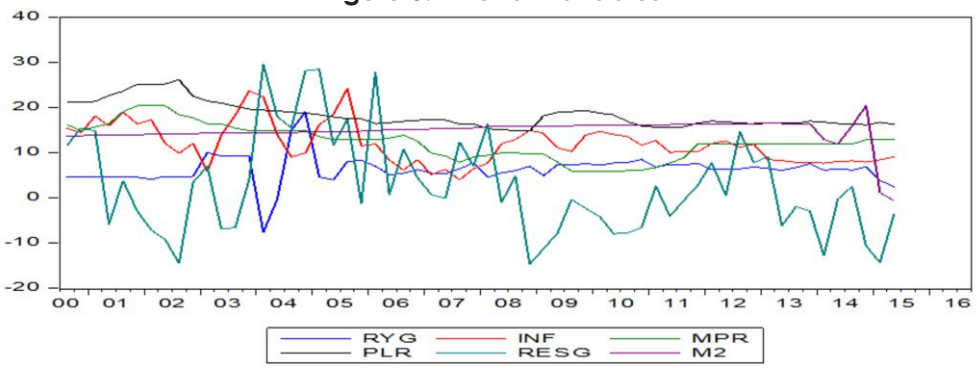
Second, we carried out sample forecasts and simulation of the policy variable from the estimates generated from the Bayesian VAR, in relation to the adjustments in the policy variable. Given that MPR is used as the policy variable, it was applied as the control variable.

V. Empirical Analysis

V.1 Diagnostic Tests

The graphical plot of all the variables was shown in Figure 5.1. This showed that most of the variables had random walk properties. Furthermore, the BVAR model which was utilised to track the transmission channel and the impact of MPR adjustments on other variables was estimated after conducting preliminary checks on the data. Nonetheless, given that Bayesian[1] VAR was insensitive to lag selection, stability of the model and identification restrictions, we followed economic theory to set appropriate structure for the transmission of the impulses. Again, we utilised the Litterman (1986) formulation approach[2], after preliminary check on the data, to set the (hyper-parameter) priors for the data.

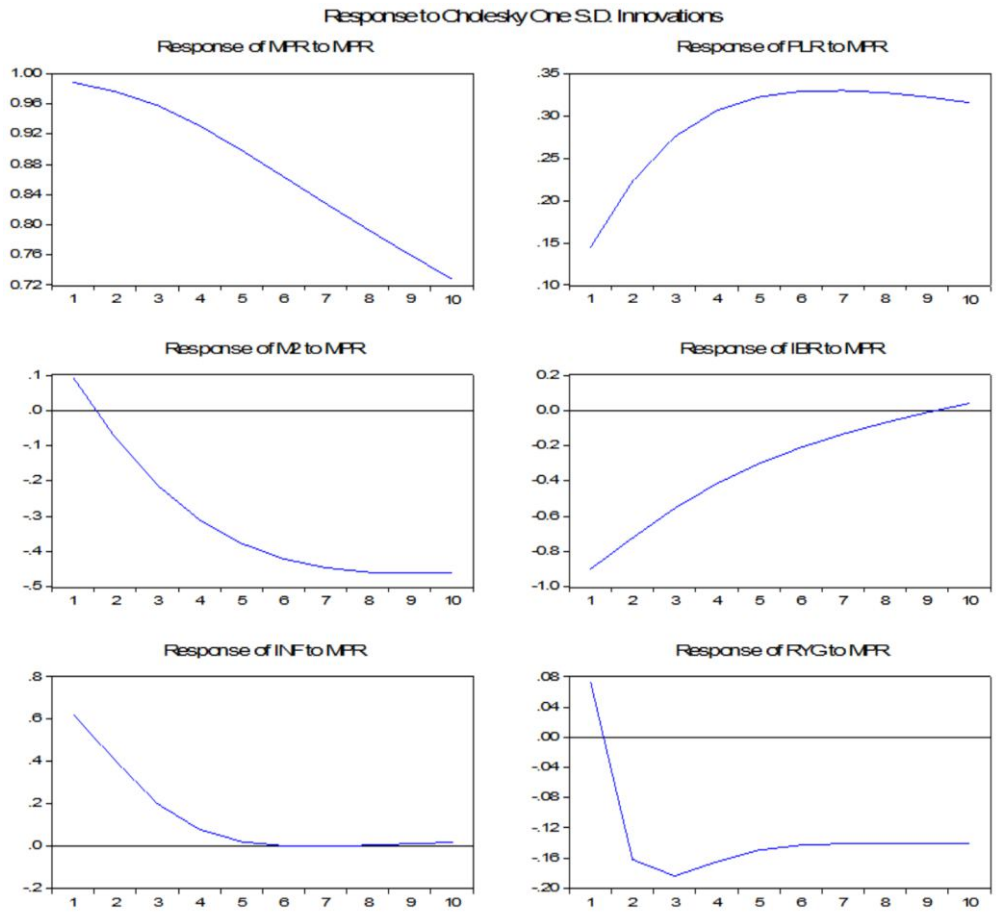
Figure 5.1 Plot of Variables



[1] *BVAR uses priors to deal with the restriction of the hyper-parameters.*

[2] *Litterma's prior holds that variables behave like a random walk with an unknown deterministic component.*

Figure 5.2: Response of Interest Rate, Inflation and Output Growth to Shock in MPR



V.2 Analysis of Results

V.2.1 Response of the Variables in Impulse Response Function (IRF) and Variance Decomposition

The results of the impulse response functions and forecast error variance decomposition based on the cholesky factorisation approached were presented in Figure 5.2 and Table 5.1, respectively. The result indicated that a one standard deviation shock to the monetary policy rate would bring about a positive change in the lending rate but a decline in broad money supply. This essentially follows the typical transmission mechanism in monetary economics. Similarly, a positive shock in the policy rate increases inflation in the first month

before it gets insulated and moderated in the preceding months. Nonetheless a positive shock to the policy variable produces negative but small impact on output over time before the impact dies off after a one period/quarter period policy lag. This development is seen to decelerate output gradually the next six quarters. In other words, macroeconomic variables such as prime lending rate, money supply, interest rate and output are sensitive to the dynamics of the policy rate. The IRF also shows that a one period shock in MPR produces immediate impact on lending rate and inflation but a small lag impact on output. Thus, the modest impact on output follows the interest rate channel indicating the ability of policy rate adjustments in stimulating output.

V.2.2 Forecast Error Variance Decomposition

To justify the result of the impulse response function, the variance decomposition which helped to reveal the share of variation in each of the endogenous variables due to shocks to the control variable was also presented and the result is quite revealing. The result shows that the shocks to MPR exerted impact on lending rate, inflation and output growth. This supported the results of the impulse response functions. It indicated that variation in MPR exerted significant impact on itself (99.0 per cent) and less than (1.0 per cent) on other variables in the first quarter, reinforcing the policy lag effect. This also indicated that the magnitudes of the impact of the shocks were not very high in the immediate. (Table 5.1).

Table 5.1: Forecast Variance Decomposition Results

FVD MPR: Quarter/Period	S.E.	MPR	PLR	M2	IBR	INF	RYG
1	0.988363	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	1.395529	99.10100	0.080201	0.001615	0.026384	0.574670	0.216128
3	1.704063	98.07071	0.221161	0.016401	0.083938	1.420570	0.187223
4	1.955923	97.09773	0.361712	0.043191	0.159314	2.195897	0.142155
5	2.167297	96.26731	0.477056	0.074964	0.244931	2.806546	0.129195
6	2.347435	95.59163	0.564365	0.106858	0.338442	3.263603	0.135106
7	2.502765	95.04559	0.628154	0.136635	0.439982	3.603188	0.146455
8	2.638076	94.59610	0.673863	0.163570	0.550514	3.858754	0.157201
9	2.757011	94.21439	0.705973	0.187624	0.671119	4.055283	0.165616
10	2.862376	93.87868	0.727788	0.209008	0.802728	4.210131	0.171668

V.3 Simulation Analysis

To further estimate the impact and magnitude of the changes in MPR on key macroeconomic variables, we conducted a simulation exercise based on the baseline and three alternative scenarios. Scenario one was the reduction in MPR by 100 basis points, on the other hand, scenario 2 was a reduction of MPR by 300 basis point, while scenario 3 was an increase in MPR by a 100 basis points. The results showed that if MPR remained unchanged at 13.0 per cent, PLR is expected to decline from 16.42 per cent in 2015Q3 to 15.96 per cent in 2015Q4 and further to 15.03 per cent by the end of 2016Q3. Similarly, inflation rate is expected to fall to 8.76 per cent and 7.61 per cent by the end of 2015Q3 and 2016Q3, respectively. In the same vein, output growth would increase slightly to 2.57 per cent and 3.33 per cent, over the projected period. The implication of this is that both the lending and inflation rates would moderate, while output growth would increase marginally over the period.

Table 5.2: Baseline and Scenario Analysis of the Liquidity Channel

	Baseline (13%)			Reduce MPR to 12% (100BSP)			Reduce MPR to 10% (300BSP)			Increase MPR to 14% (100BSP)		
	PLR	INF	RY	PLR	INF	RY	PLR	INF	RY	PLR	INF	RY
2015Q1	16.84	8.5	3.95	16.84	8.5	3.95	16.84	8.5	3.95	16.84	8.5	3.95
2015Q2	16.42	9.17	2.35	16.42	9.17	2.35	16.42	9.17	2.35	16.42	9.17	2.35
2015Q3	16.42	9.2	2.35	16.42	9.2	2.35	16.42	9.2	2.35	16.42	9.2	2.35
2015Q4	15.96	8.76	2.57	15.88	8.77	2.66	15.72	8.79	2.84	16.05	8.74	2.48
2016Q1	15.60	8.29	2.88	15.45	8.31	3.01	15.17	8.35	3.27	15.74	8.27	2.75
2016Q2	15.29	7.91	3.14	15.10	7.92	3.30	14.71	7.95	3.60	15.48	7.89	2.99
2016Q3	15.02	7.61	3.33	14.79	7.61	3.50	14.33	7.62	3.84	15.26	7.61	3.16

In scenario 1, a reduction in MPR by100 basis points to 12 per cent would lower prime lending rate to 15.88 and 14.79 per cent in 2015Q4 and 2016Q3, respectively. Inflation is expected to fall to 8.77 and 7.61per cent at end of 2015Q4 and 2016Q3 while output growth is expected to rise to by 2.66 per cent in 2015Q4 and 3.50 per cent at the end of 2016Q3, if the monetary policy rate was reduced to 12 per cent. In the same vain, a further reduction of the MPR by 300 basis points (i.e. to 10.0 per cent) is expected to bring lending rate to 15.72 and 14.33 per cent in 2015Q4 and 2016Q3, respectively, reinforcing the interest rate sensitivity to money supply mechanisms. This, however, is expected to reduce inflationary pressure to 8.79 and 7.62 per cent over the same period.

Nevertheless, the inflationary impact of reducing MPR by 300 basis points was higher than the 100 basis points corroborating the tendency of inflation rising, due to increased money supply. Thus, for a hawkish central bank, whose primary mandate is price stability, tightening appeared to be the best option to control inflation. However, this is expected to boost output growth from 2.35 to 2.84 per cent in 2015Q4 and 3.84 in 2016Q3. This result suggested that output growth can be triggered by a significant reduction of the policy rate.

On the other hand, an increase in the policy rate by 100 basis points is expected to raise lending and inflation rates to 16.05 per cent and 8.74 by end 2015Q4 respectively. Similarly, output growth is projected to slow down to 2.48 per cent and 3.16 per cent in 2015Q4 and 2016Q3, respectively. This was below the baseline projection and the other scenarios due to the increase in policy rate. This indicated that MPR played a significant role in stimulating output growth.

From the foregoing, it is evident that adjustment in policy rate is a major tool to influence output in Nigeria. This is because a downward review in the policy rate is expected to lead to a downward trend in prime lending rate and, this in turn, will impact on investment as many economic agents can afford to borrow funds for investment purposes. Ultimately, this will also have a positive impact on output growth.

VI. Conclusion

The study established the existence of a direct relationship between output performance and monetary policy rate in Nigeria. This implies that policy rate adjustments could be used to enhance real output growth and reduce unemployment. On the basis of these findings, the monetary authority should monitor effectively developments in the financial markets (money, capital and foreign exchange markets) to gauge adequately market sentiments in setting the policy rate. The monetary authority should also endeavour to formulate policies that would guarantee a sustainable and sound financial system since the efficient functioning of the financial system, is indispensable to achieving output and growth and reducing unemployment. Furthermore, the MPC should consider output behaviour in setting the policy rate for the economy.

References

Aksoy, Y. and M. A. León-Ledesma (2005). Interest Rates and Output in the Long-run, European Central Bank, *Working Paper Series*, No. 434, pp. 1-33

Andries, A. (2012). Monetary Policy Transmission Mechanism onto the Real Economy: A Literature Review, *The USV Annals of Economics and Public Administration,* Vol. 12, No. 1., pp. 211-217

Aron, J. and J. Muellbauer (2002). Interest Rate Effects on Output: Evidence from a GDP Forecasting Model for South Africa, *IMF Staff Papers*, Vol. 49, pp. 185-213.

Bank of England http://www.bankofengland.co.uk/monetarypolicy/Pages/how.aspx

Bank of England, "The Transmission Mechanism of Monetary Policy", the Monetary Policy Committee, available at http://www.bankofengland.co.uk/publications/Documents/other/monetary/montrans.pdf

Bannock, G., Baxter, R. E. and Davis, E. (1998). *The Penguin Dictionary of Economics*, New York: Penguin Group Publishers.

Bayangos, V. B. (2010). Does the Bank Credit Channel of Monetary Policy Matter in the Philippines?, Paper Presented at the *Third Annual Asian Research Network Workshop*, Japan, 2010, pp. 25-26.

Canova, F. (2007). *Methods for Applied Economic Research*, Princeton University Press, USA.

Central Bank of Nigeria (2010). *Monetary Policy Transmission Mechanism in Nigeria*, Research Department.

Central Bank of Nigeria (2011a). What is Monetary Policy?, *Understanding Monetary Policy Series No. 1*, Monetary Policy Department.

Central Bank of Nigeria (2011b). Central Bank of Nigeria Monetary Policy Framework, *Understanding Monetary Policy Series No. 3*, Monetary Policy Department.

Central Bank of Nigeria (2012). *Monetary Sector Model for Nigeria*, Research Department.

Central Bank of Nigeria (2015). A *Bayesian Vector Autoregressive Model for Monetary Policy Analysis in Nigeria*, Research Department.

Central Bank of Nigeria, Annual Reports (various years).

Cheng, K. C. (2006). A VAR Analysis of Kenya's Monetary Policy Transmission Mechanism: How Does the Central Bank's REPO Rate Affect the Economy? *International Monetary Fund, Working Paper Series*, WP/06/300.

Christiano, L. J., Eichenb Aum, M., and Evans, C. L. (1998). Monetary Policy Shocks: What Have We Learned and to What End? *NBER Working Paper No. 6400*, National Bureau of Economic Research.

Colander D. C., (2001) *Economics*. Boston McGraw Hill Irwin.

Ćorić, B., Perović, L. M., and Šimić, V. (2012). *Monetary Policy Effects on Output and Prices: International Evidence*. Faculty of Economics, University of Spli.

European Central Bank (2015). Transmission Mechanism of Monetary Policy, available at https://www.ecb.europa.eu/mopo/intro/transmission/html/index.en.html

Ezeanyeji, C. I. (2014). An Assessment of the Impact of Interest Rate Deregulation in Enhancing Agricultural Productivity in Nigeria, *Journal of Economics and Sustainable Development*, Vol. 5, No. 8, pp. 17-23.

Federal Reserve Bank http://www.frbsf.org/us-monetary-policy-introduction/real-interest-rates-economy/

Fisher, I. (1974). *The Theory of Interest: As Determined by Impatience to Spend Income and Opportunity to Invest it,* Augustus M. Kelly Publishers, Cliffton.

Ganev, G., Molnar, K., Rybinski, K. and Wozniak, P. (2002). Transmission Mechanism of Monetary Policy in Central and Eastern Europe", *CASE Network Reports, No. 52.*

Hafer, R. W., and Kutan, A. M. (2002). Detrending and the Money-Output Link: International Evidence, *Southern Economic Journal,* Vol. 69, No. 1, pp. 159-174.

Hetzel, (2000). The Taylor Rule: Is it a Useful Guide to Understanding Monetary Policy?, Federal Reserve Bank of Richmond, *Economic Quarterly*, Vol. 86, No. 2, pp. 1 - 33.

Hofmann, B. and Bogdanova, B. (2012). Taylor Rules and Monetary Policy: A Global Great Deviation? *BIS Quarterly Review*, September 2012, pp. 37-49.

Idoko, I. A. and Kpeyol, K. (2010). An Assessment of the Impact of Interest Rates Deregulation on Economic Growth in Nigeria, available at serialsjournals.com/serialjournalmanager/pdf/1436435216.pdf

Ireland, P. N. (2005). The Monetary Policy Transmission Mechanism, *Federal Reserve Bank of Boston Working Papers*, No. 06-1.

Ishioro, B. O. (2013). Monetary Transmission Mechanism in Nigeria: A Causality Test, *Mediterranean Journal of Social Sciences*, Vol. 4, No. 13, pp. 377 – 388.

Koop G. and D. Korobilis (2009). *Bayesian Multivariate Time Series Methods for Empirical Macroeconomics Foundations and Trends in Econometrics*, Vol. 3, No.4, pp.267–58.

Lutkepohl, H. (2007). Econometric Analysis with Vector Autoregressive Models. *European University Working Paper*, EUI/ECO/WP/07/11, pp. 22-30.

Migliardo, C., (2010). Monetary Policy Transmission in Italy: A BVAR Analysis with Sign Restriction, *Czech Economic Review,* vol. 4(2), pp. 139-167, June.

Mishkin, F. S. (1995). Symposium on the Monetary Transmission Mechanism, *Journal of Economic Perspectives*, Vol. 9 No. 4, pp. 3 - 10.

Mishkin, F. S., (1996). The Channels of Monetary Transmission: Lessons for Monetary Policy, *NBER Working Paper Series* No. 5464.

Modigliani, F., (1971). *Monetary Policy and Consumption, in Consumer Spending and Monetary Policy: The Linkages*, Boston, Federal Reserve Bank of Boston.

Mohanty, D. (2013). Speech to the Association of Financial Professionals of India (AFPI), available at http://www.bis.org/review/r130823c.pdf

Odhiambo, N. M. (2009). Interest Rate Liberalisation and Economic Growth in Zambia: A Dynamic Linkage, *African Development Review*, Vol. 21, Issue 3, pp.541-557.

Ogundipe, A. A. and P. O. Alege (2013). Interest Rate Pass-Through to Macroeconomic Variables: The Nigerian Experience, *International Journal of Economics and Finance*; Vol. 5, No. 10; ISSN 1916-971XE-ISSN 1916-9728.

Ojima, D. and Fabian, E. (2015). Impact of Interest Rate on Investment in Nigeria, *Journal of Developing Country Studies*, Vol. 5, No. 3, pp. 103 – 109.

Ojo, M. O. (1993). Monetary Policy Instruments in Nigeria: Their Changing Nature and Implications, *The Nigerian Banker*, April-June, 6-8, pp. 103 - 109.

Petursson (2001). The Transmission Mechanism of Monetary Policy, *Monetary Bulletin*, Vol. 4, pp. 62 – 77.

Robinson, W. and Robinson, J. W. (1997). The Transmission Mechanism of Monetary Policy in the Jamaican Economy, *Annual Conference of the Caribbean Centre for Monetary Studies.*

Rummel, O. (2013). Introduction to Multivariate Bayesian Modelling, Centre for *Central Banking Studies*, Bank of England.

Smal, M. M., De Jager, S. and Bank, S. A. R. (2001). *The Monetary Transmission Mechanism in South Africa*, South African Reserve Bank.

Starr, M. A. (2005). Does Money Matter in the CIS? Effects of Monetary Policy on Output and Prices, *Journal of Comparative Economics*, Vol. 33, Issue 3, pp. 441-461.

Taylor, J. B. (1999). The Monetary Transmission Mechanism and the Evaluation of Monetary Policy Rules, *Banco Central de Chile Working Papers* No. 87.

Uchendu, O. (1993). Interest Rate Policy, Savings and Investment in Nigeria, *CBN Economic and Financial Review*, Vol. 31, No. 1, pp. 34- 52.

Udoka, C. O., and Anyingang, R. A. (2012). The Effect of Interest Rate Fluctuation on the Economic Growth of Nigeria, 1970-2010, *International Journal of Business and Social Science*, Vol. 3, No. 2), pp. 295-303.

Were, M. and Tiriongo, S. (2012). Central Bank's Response to Economic Crises from a Developing African Economy Perspective: Lessons from Kenya's Experience, Unpublished Manuscript, *Central Bank of Kenya*, Nairobi.

Xu, X. E. and Chen, T. (2012). The Effect of Monetary Policy on Real Estate Price Growth in China, *Pacific Basin Finance Journal*, 20, pp. 62-77.

Cost of Governance and Fiscal Deficit in Nigeria: Evidence from State Government Data

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Abstract

Fiscal deficit has remained a predominant occurrence at both the Federal and state government levels, and this has become a source of concern for economic managers. At the individual state level, a quarter of the state governments consistently ran deficit for more than six consecutive years, from the period 2007 to 2014. More importantly, the combined overall fiscal balance of the state governments has resulted frequently in deficit in the past two decades. Fiscal deficit is not bad in itself, but most of the state governments are running fiscal deficit to sustain recurrent expenses, rather than infrastructure development. Available studies on the determinants of fiscal deficit have not considered cost of governance as an important determinant. Thus, the authors investigated the effect of cost of governance and other determinants, on fiscal deficit across the Nigerian states for the period 2008-2015. Using the dynamic panel of the Arellano-Bond (Difference) GMM Estimators in the Keynesian framework, the results revealed that cost of governance had fueled fiscal deficit at the state level in Nigeria. It also showed that inflation, population size and economic growth had significant impact on fiscal deficit across the Nigerian states. The authors underscored the need for strengthening public financial management reforms, particularly, the Fiscal Responsibility Act, the Medium Term Expenditure Framework, and the treasury single account, at the sub-national level to ensure fiscal discipline. This will enable the state governments to be more prudent and ensure that fiscal deficit is geared towards infrastructure development.

Keywords: Fiscal Deficit, Governance, Heterogeneity.
JEL Classification Numbers: H62, H11, O38

I. Introduction

In Nigeria, fiscal deficit[1] has remained a predominant occurrence at both the Federal and state government levels, even during economic boom, and this is becoming a source of concern for economic managers. At the

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[1] *De La Dehesa (2010) defined fiscal deficits as a situation where governments spend more than they collect as revenue.*

individual state level, a quarter of the state governments have consistently been in deficit for more than six years, from 2007-2014. Over the past two decades, the combined overall fiscal balance of the state governments has, more often than not resulted in deficits. The fiscal deficits of the state governments averaged N176.20 billion during the period 2008 and 2013. It increased from N86.80 billion in 2008 to N272.50 billion in 2012, dropped to N141.40 billion in 2013, and thereafter rose to N311.0 billion in 2014, because of the drastic drop in international crude oil prices, which affected the share from the Federation account.

Fiscal deficit in itself is neither good nor bad. However, it can be assessed in relation to the economic situation. A country experiencing budget deficit, due to building infrastructure or making profitable investments that will generate higher revenue or taxes in the future, is often considered healthier than countries experiencing deficit, due to unsustainable expenses. Incidentally, state government expenditures have been geared mostly towards (unsustainable) recurrent spending, with little resources for capital outlay. Consequently, infrastructure and socio-economic conditions in most of the states have remained in deplorable condition. Though budget deficits are always a warning signal for analysts and investors, it is important to understand why any country or state is experiencing a deficit.

The crash in international crude oil prices, which started in November 2014, did put government finances in Nigeria, particularly, state governments finances, in a precarious condition; such that the accumulation of salary and contractor arrears becomes prominent. Despite the bail-out by the Federal government to enable some of the state governments pay salary arrears, the unabated downward pressure in crude oil prices continued to exert negative impact on the revenue and finances of the state governments. Consequently, states are forced to run fiscal deficit that could undermine their fiscal sustainability in the medium-to-long-term. Aside the dwindling federation revenue, the undue concentration of the bulk of financial resources at the states on recurrent outlay (the cost of governance is seen as another major cause of the perennial fiscal deficit observed at this level of government. Evidence indicates that productive government expenditure improves economic growth, while high administrative cost (high operating cost) dampens economic growth and increases poverty (Adeolu and Osabuohien, 2007) and, by extension, increases fiscal deficit. Other determinants of fiscal deficits from the literature have also been put forward, including high unemployment rates, economic

crisis, expansion opportunities, and economic performance. While there seem to be empirical studies, regarding the determinants of fiscal deficit, the role, cost of governance plays has not been properly investigated in the literature.

Available studies on the determinants of fiscal deficit have undermined the cost of governance as an important determinant (Onafowora and Owoye, 2006; Rangarajan and Srivastava, 2005; Krause, 2000; Ijah, 2014; Fluvian, 2006; Darrat, 1988; Barro, 1979; Attiya, et al., 2011; Adeolu and Osabuohien, 2007; and Woo, 2003). This study, therefore, attempts to fill the gap by ascertaining the role of cost of governance on the fiscal balance of State government in Nigeria, using panel data econometric approach. The thrust of this paper, therefore, is to empirically ascertain the determinants and, particularly, the effect of cost of governance on states' fiscal deficit. The research questions this paper seeks to answer are: what are the determinants of fiscal deficit across states in Nigeria? What is the effect of cost of governance on fiscal deficit across States in Nigeria? The import of the paper is the ability to draw the attention of the state governments to the fact that prudent and effective application of the budget is sine-qua-non to minimising fiscal deficit, if empirical evidence is established for the cost of governance.

The rest of the paper is structured as follows. Following the introduction is Section 2, which deals stylised facts on state government and fiscal deficit in Nigeria. Section 3 focused on the literature review and theoretical framework, while Section 4 was on methodology. Section 5 presented the analysis of results on fiscal deficit and cost of governance in Nigeria, while Section 6 concluded the paper.

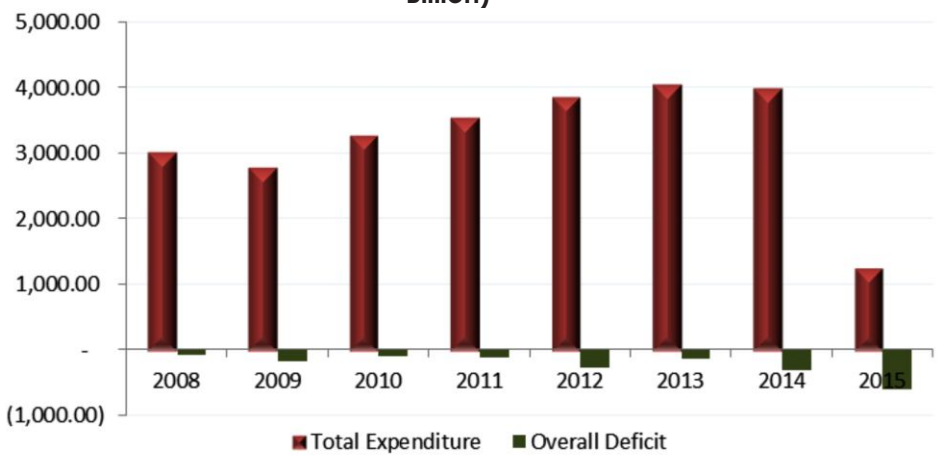
II. Stylised Facts: State Governments and Fiscal Deficit in Nigeria

Nigeria operates a federal system of government, whereby both the Federal and the sub-national units derived their powers from the constitution. The Nigerian fiscal federalism is such that the sub-national governments have powers to expenditure, but not much power to revenue generation. Accordingly, states and local governments depend on statutory allocation for their sustenance, as the more lucrative revenues are collected and pooled into the Federation account and shared in accordance with the subsisting formula. However, the share of the Federal government, in the pooled revenue, remained slightly higher than the share of the 36 states of the

federation. Thus, the Federal government, to a large extent, is still saddled with the responsibility of providing social amenities in all parts of the federation.

Considering that the states are sovereign in their own right, they are expected to deliver public goods and services in order to achieve the fundamental objectives and directive principles of state policy, enshrined in Section 16 of the 1999 Constitution of the Federal Republic of Nigeria. To achieve this, the states obviously adopt a budgetary framework that sets the substantive policy priorities of the state government, the expected revenue and expenditure for the fiscal year. It also determines the sources of borrowing to finance approved expenditures in the case of a fiscal deficit. Incidentally, fiscal deficit have remained the general norm for the state governments over the years. Fiscal deficit of the state governments averaged N230.44 billion for the period 2008 to 2015. It increased from N86.80 billion in 2008 to N272.50 billion in 2012. It dropped to N141.40 billion in 2013, but resumed its upward trend and rose to N610.1 billion in 2015, due to the drastic drop in international crude oil prices that affected the share from the Federation account. As a ratio of GDP, fiscal deficit averaged 0.4 per cent during the review period. The trend in fiscal deficit could be explained by the increasing level of state governments' expenditure for most part of the review period. State governments' total expenditure grew on the average by 0.5 per cent per annum during the period. It increased from N3,021.60 billion in 2008 to N4,046.80 billion in 2013, but declined to N1,246.30 billion in 2015. As a ratio of GDP, state governments' total expenditure averaged 2.3 per cent in the review period (Figure 2.1).

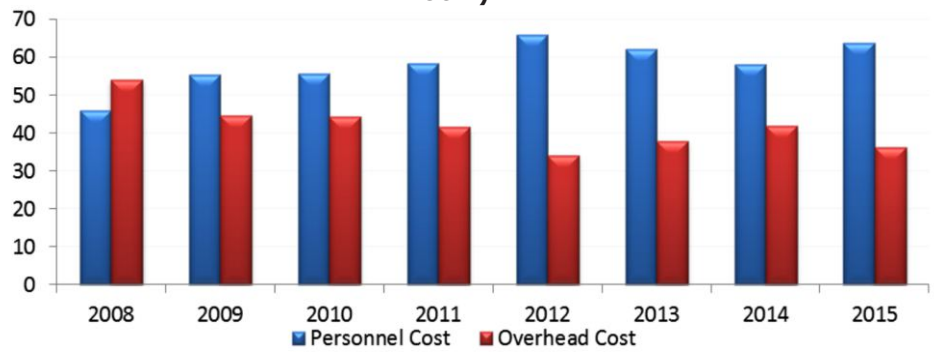
Figure 2.1: State Governments' Expenditure and Fiscal deficit GDP Ratios (N' Billion)



Source: Computed from data from the Central Bank of Nigeria

The increasing expenditure status of the states, in the review period, could be attributed to the growing cost of governance, including overhead cost; personnel cost; and other economic factors, such as inflation. Cost of governance increased by 53.2 per cent above the level in 2008 to N687.23 billion in 2014, but dropped to N507.70 billion in 2015. As a ratio of total states' recurrent expenditure for the period 2008 to 2015, cost of governance averaged 64.1 per cent, increasing from 55.0 per cent in 2008 to 77.5 per cent in 2015. Further breakdown of the cost of governance showed that personnel cost accounted, averagely, for 58.1 per cent of the total during the period. It trended upward for most part of the review period and rose from 45.9 per cent in 2008 to 65.8 per cent in 2012, dropped to 58.2 per cent in 2014, but increased to 63.7 per cent in 2015 (Figure 2.2).

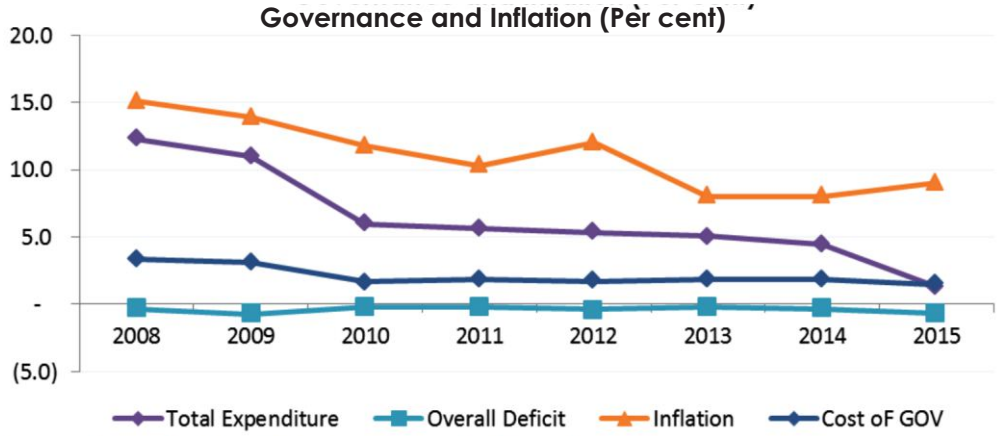
Figure 2.2: Decomposition of State Governments' Cost of Governance (Per cent)



Source: Computed from Data from the Central Bank of Nigeria

Another factor attributed to the rising government expenditure and hence fiscal deficit is the pressure on domestic prices, as captured by the trend in the inflation rate. The inflation rate declined from 15.1 per cent in 2008 to 10.3 per cent in 2011. It rose again to 12.0 per cent in 2012, trended downward to 8.0 per cent in 2013, but rose by 100 basis points to 9.0 per cent in 2015 (Figure 2.3).

Figure 2.3: Movements in State Governments' Deficit, Expenditure, Cost of Governance and Inflation (Pèr cent)



Source: Computed from Data from the Central Bank of Nigeria

Overall, the trend analysis showed some of the factors responsible for the persistent rise in state governments' fiscal deficit over the review period were to a large extent the rising cost of governance and inflation. However, it is important to carry out a further empirical investigation to give credence to the stylised facts, as we cannot rule out some other macroeconomic and demographic factors.

III. Literature Review

III.1 An Overview of Theories on Fiscal Deficit

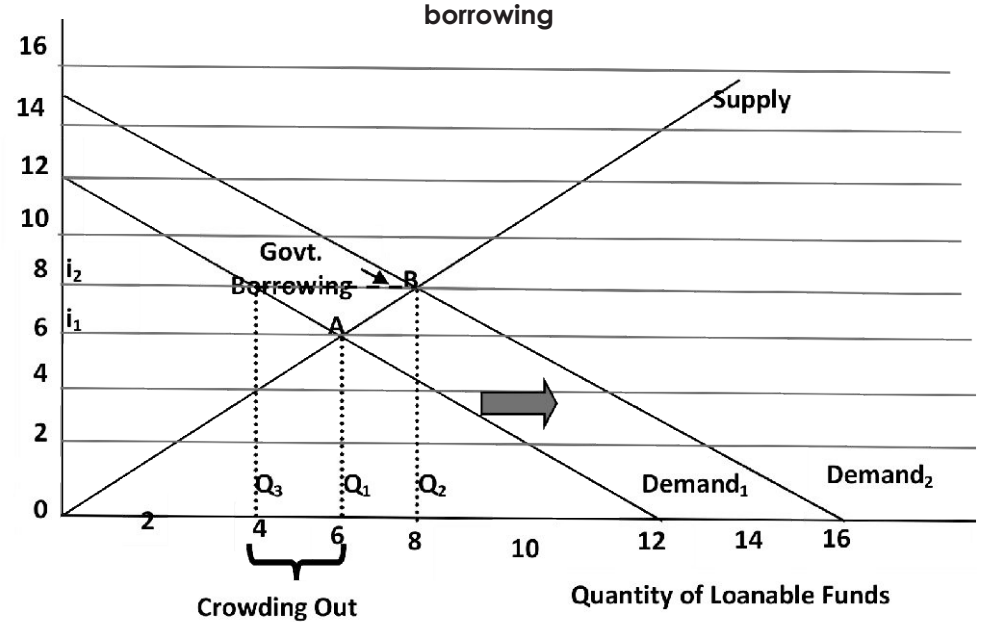
There are three schools of thoughts on deficit financing: the Classical, the Keynesian, and the Ricardian schools. According to the classical theory of deficit, budget deficit (fiscal deficit) has the effect of increasing current consumption by government or consumers, but this is counterbalanced by a fall in investment. Perry (2014) opined that, by definition, if consumption rises, savings must fall. A fall in savings raises interest rates, which then reduces investment. Thus, crowding-out occurs when the budget deficit brings about increase interest rates and reduction in investment. This is explained with a graphical illustration in Figure 3.1 of the loanable fund theory, propounded by Robertson (1934). Savings is represented by the supply curve, while demand for investment funds is captured by the demand curve, which is downward sloping. As interest rates rise, individuals are more likely to save, but businesses tend to invest less, all things being equal, provided all other economic factors are held constant.

If government borrows money to run a budget deficit, the demand for loanable funds curve will shift out. This will raise interest rates and make investment more expensive. Point A in Figure 3.1 represents the initial equilibrium in the model, and Q1 is the quantity of loanable funds available to private business at the initial equilibrium. When government borrows from the money market to finance a deficit, the demand curve will move from demand1 to demand2, and this will push interest rates (the cost of borrowing) up. Invariably, businesses have to borrow at a higher interest rate, and will eventually borrow less. The reduction in business demand for investment, the difference between Q1 and Q3 in Figure 3.1 is the amount of crowding-out.

In a nutshell, government borrowing crowds out private business by increasing the interest rate from 1 to 2, and reducing the quantity that business will be willing to borrow from Q1 to Q3. The Classical economists, however, posited that the loanable funds market, if left to itself, would balance savings and investment, and keep the economy at or close to full employment. In that case, there would be no need for government deficit spending, which they believed is counter-productive in the sense that the crowding out effect implied that deficit spending shifts funds from investment to government consumption. For this reason, classical economists generally opposed government deficit spending.

The Keynesian postulates differ from the standard Classical paradigm, as they did not believe that an economy would experience full crowding out, if there are slack in the economy. First, they allowed for the possibility that some economic resources are unemployed and second, they presupposed the existence of a large number of myopic or liquidity-constrained individuals. Accordingly, they argued that the economy would experience only partial crowding out, with practically no crowding out at times of deep recession. There are several facets to this argument as the Keynesians believed that savings and investment decisions are not only dependent on the rate of interest. They argued that investment decision is a function of not only interest rates, but primarily expectations of future profit and such expectations are usually calculated by businesses, based on a number of factors, including the "animal spirits" or the state of mind or emotional psychology of the investors.

Figure 3.1: Supply and Demand for Loanable Funds meant for Government borrowing



Source: Adapted from Perry (2014)

In the simplest Keynesian model, increasing the budget deficit by N1.00 causes output to increase by the inverse of the marginal propensity to save. Many traditional Keynesians, however, argued that deficits need not crowd out private investment because of unemployed resources. They opine that increase in aggregate demand enhances the profitability of private investments, leading to higher investments at any level of interest rate. Thus, deficits can stimulate aggregate savings and investments, despite the fact that they raise interest rates. Since increased consumption is gotten from otherwise un-utilised resources, interest rate cannot be assumed to be the only variable that drives investment. Thus, investment might not necessarily decrease if businesses have a positive view of economic prospects, despite the fact that government spending raises interest rates.

Reducing government fiscal deficit is not easy, at least, politically. Following the traditional Keynesian theory, if the policy maker manages to reduce the government deficit, the country can slide into recession. Budget deficit is not totally bad, despite its evil reputation. The good news about fiscal deficit, following McDermott and Wescott (1996), is that it indicates that the government is buying goods and services, paying wages to its employees, and

making transfers to its needy citizens. This helps to put money into the economy and raises the level of economic activity. Thus, a sudden break by the government, even when in pursuit of well-intentioned attempt to balance the budget, will lead to reduced business inventories, job cuts, and drastic reduction in the flow of money into the economy.

The central argument in the Ricardian observation is that fiscal deficit merely postpones taxes. Accordingly, rational agents tend to see beyond the inter-temporal veil and assume that the present discounted value of taxes is a function of real government spending, and not of the timing of taxes. This foresight, as argued by Bernheim (1989), gives rise to the "Say's Law" for deficits: the demand for bonds always rises to match government borrowing. Since the timing of taxes does not affect an individual's lifetime budget constraint, it cannot alter his consumption decisions. As a result, budget deficits (both temporary and permanent) have no real effects. This logic, however, does not depend on full employment of resources.

III.2 Theoretical Framework

The theoretical framework adapted is the Keynesian postulates on fiscal deficit. The theory is closer to explaining quite well the behaviour of government deficit or why government experience fiscal deficit. The Keynesian theory provides a complete explanation of the recent phenomenon: the rapid accumulation of government deficit at the sub-national level, even in relatively boom and peaceful times.

Recall that under the Keynesian framework, fiscal deficits need not crowd out private investment, since there are lots of unemployed resources. Accordingly, the ensuing increase in aggregate demand boosts the profitability of private investments, and brings about higher investments at any level of interest rate. Thus, deficit may stimulate aggregate savings and investment, despite the fact that they raise interest rates. Again, fiscal deficit indicate that government is purchasing goods and services, paying employee's wages and making transfers to its needy citizens. This helps to put money into the economy and raises the level of economic activities, as such, most of the macroeconomic variables, like unemployment, cost of governance, population size, economic growth, and price level derive their existence therefrom.

The corollary to the foregoing is that governments also run persistent annual fiscal deficits when tax revenues are insufficient to fund government spending, meaning that the state must borrow from the public, using bonds. Other similar reasons, in tandem with the Keynesian postulates, are short-term, as well as deeper structural, issues facing the country.

Some of the short-term reasons include the business cycle (economic performance) effect in the country as earlier stated. Where countries experience recession or sustained period of slow growth, the economic downturn will produce minimal revenue inflow from the sources of revenue, particularly direct and indirect taxes, notwithstanding the fact that government is still expected to meet its statutory welfare spending. In other words, the tax and government spending changes that happen automatically at different stages of the business cycle will not be helpful. This means that part of the fiscal deficit may be the consequence of the automatic stabilisers.

Following the Keynesian postulate, a large and rising fiscal deficit may be a deliberate action by the government to employ expansionary fiscal policy to boost aggregate demand, output and employment, specifically when private and external sector demand are low, falling or stagnant. The Keynesians have long favoured the use of targeted and timely fiscal stimuli, like labour-intensive public works and investment in infrastructure projects, designed specifically to kick-start a chronic lack of inadequate demand in the economy. Typical factors that can contribute to fiscal deficit therefore include: slower economic growth, high public spending; high unemployment rates; economic crisis; high operating costs; expansion and business opportunities or a combination of these factors. Fiscal deficit therefore, evolve to accommodate changes in receipts (mainly taxes) and government expenditures. Surpluses increase during period of robust GDP growth, when receipts are up and public expenditures are down. Deficits, mostly occur and rise during economic slowdowns, because receipts drop (driven by the declines in income tax, arising from job losses), while expenditures rise (driven by increase in unemployment insurance claims due to job losses).

III.3 Empirical Literature

Although, there are few or no empirical studies on the cost of governance and fiscal deficits, empirical studies abound on other determinants of fiscal deficits. Krause (2000) showed that higher unemployment rates resulted in a rise in fiscal deficit. Barro (1986) estimated the tax-smoothing theory of deficit model using the United State data for two periods, 1920-40 and 1948-82, to determine if deficit during the period represented structural shift in government fiscal policy or usual reaction to other influences such as recession, inflation and government spending. He concluded that fiscal deficit and the near-term projections of deficit in the United States were mainly a reflection of the usual responses to recession and, turned to anticipated inflation. Woo (2003) discovered that in developed and developing countries, inflation, income, financial depth, and population exerted a positive impact on fiscal deficits.

Attiya et. al. (2011) examined the economic, political and institutional sources of budgets deficit of South Asia and the ASEAN countries by applying the dynamic panel model and generalised method of moments of Blundell and Bond (1998) for the period 1984 to 2010. The results showed that high income, high inflation rate, trade openness and large budget to GDP ratio were the macroeconomic factors, associated with large budget instability. They also discovered that small countries with low population growth had more volatile budget deficit, indicating that budget deficit decreased as population increased, while high corruption, low institutional quality (legal and bureaucracy) and conflicts (internal, external, ethnic and religious) caused more variations in budget deficit. Also, Cameron (1978), Rodrik, (1998), and Sanz and Velázquez, (2003), found a positive relationship between trade openness and fiscal deficit. The major inference that could be drawn from these studies was that citizens demanded more redistribution via additional public expenditures, as trade openness increased in other to hedge against external risk.

Darrat (1988), investigated the relationship between federal budget deficit and trade deficit by applying the multivariate Granger-causality tests on the U.S. quarterly data, covering the period 1960: 1 to 1984: IV. He tested four hypotheses, namely: budget deficit cause trade deficit (the conventional view); trade deficit cause budget deficit; and both variables (although highly

correlated) were causally independent, and there was a bi-directional causality between the two variables. Although, his findings partially supported the conventional view, strong evidence was found for the causality from trade-to-budget deficit.

Murwirapachena et al., (2013) investigated the determinants of budget deficit in South Africa for the period 1980-2010, using the vector error correction model (VECM). Their results revealed that foreign reserves foreign debt, unemployment, economic growth and government investment explained the variations in fiscal deficits during the study period.

Generally, literatures on the determinants of fiscal deficit are sparse for Nigeria. Ijah (2014) showed that budget deficit was driven by trade deficit in Nigeria. Onafowora and Owoye (2006) also confirmed this. They applied co-integration and Granger-causality tests to data from 1970-2001 and found that budget deficit in Nigeria were driven by trade deficit. Udoh, et. al. (2012) examined the relationship between government-type and fiscal deficit in Nigeria by applying ordinary least square (OLS) on time series data for the period 1970-2010. They found that government-type did matter for fiscal operations in Nigeria. Specifically, the authors found that democratic regimes in Nigeria did accumulate fiscal deficit, contrary to earlier expectation. In addition, the findings showed that there was a strong inclination for fiscal deficit to decrease with financial liberalisation, while liberalisation of foreign trade led to increase in fiscal deficits.

Basically, the empirical evidences differ across countries, and even within countries because of the use of different methodologies for the same country data. Equally apparent is the fact that most of the studies concentrated on the experiences of industrialised countries. There are relatively few empirical studies on the determinants of fiscal deficits for the developing countries, particularly for Nigeria. This study intends to extend the literature in this area by establishing or otherwise, the relationship between cost of governance and fiscal deficit at the state governments level in Nigeria.

IV. Methodology

IV.1 Model Specification

Based on the adapted theoretical framework for this study and previous related studies, the empirical model is presented in Equation (1) as:

$$Fdef_{it} = B_0 + \beta_1 cog_{it} + \beta_2 totrev_{it} + \beta_3 pop_{it} + \beta_4 \inf l_{it} + \beta_5 unemp_{it} + \beta_6 ecog_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

Where 'i' indexes states't' indexes time, 'μ_i' is the error, arising from individual state heterogeneity or differences (as we assume that there are unobserved states' individual heterogeneity)[2]; and 'ε_{it}' is the error term across time and individual specific effects. 'Fdef' is fiscal deficit. Similarly, 'cog', 'totrev', 'pop', 'infl' 'unemp' and 'ecog' are cost of governance, state total revenue, state population size, inflation, state unemployment rate and economic growth rate, respectively.

The a priori expectations of the parameters in equation 1 are as follows:

- $\beta_1 > 0$; that is, an increase in the ratio of cost of governance (or government expenditure on overhead and personnel cost) is expected to increase fiscal deficit;
- $\beta_2 < 0$; that is, a decrease in the ratio of state total revenue to total shared federal collectible revenue will increase fiscal deficit;
- $\beta_3 > 0$; that is, an increase in the population (especially non-working population) of individual states, will raise the demand for public services, which will drain the state treasury, causing an increase in government spending and, in the absence of increase in revenue, lead to fiscal deficit;
- $\beta_4 > 0$; that is, an increase in the rate of inflation will lead to a drain of the treasury as the cost of borrowing will increase, leading to increase in fiscal deficit;
- $\beta_5 > 0$; that is, an increase in the rate of unemployment will raise the demand for social services and in the absence of increase in revenue, will drain the treasury, leading to increase in fiscal deficit; and

[2] *The basic idea in the panel data analysis that the individual relationships will have the same parameters known as the pooling assumption is most times not correct*

- $\beta_6 < 0$: that is, a decrease in the rate of economic growth will mean decrease in government revenue, in the face of increase in expenditure, due to statutory and discretionary spending, probably to stimulate economic activities, thus leading to increase in fiscal deficit.

One of the characteristics of panel data is that it can provide information on individual state's behaviour. It can also capture features across states and over time; having both the cross-sectional and time series dimensions. However, endogeneity issues are usually of concern, especially in panel data analysis. To overcome this problem, variants of the dynamic panel data models in equation 2 i.e. the dynamic GMM, dynamic difference GMM and dynamic two stage GMM are estimated.

$$Fdef_{it} = B_0 Fdef_{it-1} + \beta_1 cog_{it} + \beta_2 totrev_{it} + \beta_3 pop_{it} + \beta_4 \inf l_{it} + \beta_5 unemp_{it} + \beta_6 ecog_{it} + \mu_i + \varepsilon_{it} \ldots..(2)$$

This dynamic model is specified because the static panel estimates, as do the OLS models, omit dynamic effects causing the problem of dynamic bias (Bond, 2002; Baum, 2006) and, as such, do not allow for the study of dynamics of adjustment (Baltagi, 2008).

Omitted dynamics means that such models are mis-specified, because they omit the entire history of the explanatory variables (Greene, 2008; Bond, 2002). Second, many authors posit that the dynamic panel model is designed specially for a situation where "T" is smaller than "N" to control for dynamic panel bias (Bond, 2002; Baum, 2006; Roodman, 2006; Roodman, 2009, and Baltagi, 2008)[3]. The problem of potential endogeneity is also much easier to address in the dynamic panel models than in the static and OLS models that do not allow the use of internally-generating instruments. An underlying advantage of the dynamic GMM estimation is that all variables from the regression that are not correlated with the error term (including lagged and differenced variables) can be potentially used as valid instruments (Greene, 2008). It also gives room for the choice of the most appropriate GMM, whether it is "difference-GMM", developed by Arrelano and Bond (1991); or the "System-GMM, established by Arrelano and Bover (1995) and Blundel and Bond (1998).

[3] *There are generally three panel data types; namely, short panel with many individuals and few time periods which is our case in this study. Others are long panel comprising many periods and few individuals, and large panel comprising many time periods and many individuals.*

The study, however, chose the difference GMM of Arellano and Bond (1998), because the estimated equation gave the best result and fulfilled the underlying assumptions for dynamic panel methodology. The objectives of the study were, therefore, investigated by estimating variants of the dynamic panel data model in Equation (2). Dynamic models are very important, especially in economics, because many economic relationships are dynamic in nature and should be modeled, as such (Asteriou and Hall, 2011).

IV.2 Data and Measurement

The data for the study were sourced from the National Bureau of Statistics (NBS), and the Central Bank of Nigeria (CBN) Annual Report and Statistical Bulletin. The data covered the 36 states of Nigeria including the Federal Capital Territory, between the period 2007 and 2014. The period is justified by availability of data. Data on fiscal deficit of the states and total revenue were sourced from the CBN Annual Report for the period of study, while inflation was sourced from the CBN Statistical Bulletin. Data on unemployment rates were obtained from the NBS Publication, while population data were sourced from the 2006 population census report. However, the population figures for the 2007 to 2014 were estimated by the authors on the assumption that annual population growth rate for Nigeria would be 2,8 per cent.

Cost of governance was defined as the recurrent expenditure, associated with personnel and overhead costs. It was believed that this category of cost represented the administrative cost of running government at this level, whose data were not available on individual state basis. The cost of governance was taken as a ratio of the state total expenditure and multiplied by 100 to normalise the data along the other data on consumer price index, unemployment rate and population rate, which were all in percentage. Similarly, to bring the other variables to the same unit of measurement, total revenue was taken as a ratio of federally collectible-revenue (the net amount designated for sharing amongst the three-tiers of government) and multiplied by 100, while fiscal deficit was taken as a ratio of total state revenue, multiplied by 100.

IV.3 Estimation Issues and Procedures

This study focused on investigating the role of the explanatory variables, particularly the cost of governance on fiscal deficit across states in Nigeria, using the dynamic panel data approach. Ordinarily, the number of states (37) and the period make it practically impossible to go for pooled regression so that we do not lose the states' individual differences. Since the time dimension is less than 30, the more robust estimation model turned out to be the dynamic panel GMM approach. The dynamic panel Generalised Method of Moments (GMM) estimation employs the appropriate lags of the instrumental variables to generate internal instruments, while employing the pooled dimension of the panel data. In other words, it does not impose restrictions, regarding the length of each individual time dimension in the panel. There is, therefore, the use of suitable lag structure to exploit the dynamic specification of the data. The study estimated the variants of the dynamic GMM; differenced GMM and system GMM. Sometimes the lagged levels of the regressors are poor instruments for the first-differenced regressors. In such case, one augments with "system GMM". The system GMM estimator uses the levels equation to obtain a system of two equations: one differenced and one on levels. By adding the second equation, additional instruments can be obtained.

Thus, the variables in levels in the second equation are instruments with their own first differences and this usually increases efficiency (Mileva, 2007). However, two important points to note is that first, because system GMM uses more instrument than the difference GMM, it may not be appropriate to use system GMM with a dataset with a small number of states or countries. When the number of instruments is greater than the number of states or countries, the Sargan test may be weak.

The system GMM was also estimated because the difference GMM had been found to have poor finite sample properties, in terms of bias and imprecision, particularly when the lagged levels of the series were only weakly-correlated with the subsequent first differences (weak instruments). Difference GMM may be subject to a large downward finite-sample bias, especially when the number of time periods available is very small. Hsiao (1986) argues that OLS levels will give an estimate of the coefficient of and AR(1) model that is bias upwards in the presence of individual-specific effects, and that within groups

estimate will give an estimate of the coefficient that is seriously biased downwards in short panels (Nickel, 1981). Thus, a consistent estimate can be expected to lie between the OLS level and within the groups estimates. In other words, a difference GMM estimate that has coefficient close to that of within group estimates is downward bias. Difference GMM with weak instruments will also be downward bias. Despite all these, the difference GMM turned out to be the best in all the variants of the dynamic GMM estimated.

To investigate the specific objectives, various models (one-step and two-step difference GMM estimators) were estimated for Equation (2). The objective of examining the effect of cost of governance on fiscal deficit was duly carried out. Other explanatory variables, namely: total revenue, population size, inflation, and unemployment rates were also incorporated to ascertain their respective effects. The dependent variable was the change in fiscal deficit, divided by its lag which, taken to be the change in fiscal deficit as a function of the growth in the explanatory variables in this study.

In investigating the specific objective of the study, reference is made to 'β1' in Equation (2). The heterogeneity of the cost of governance across the states was taken into consideration. Xtabond2 was used in the estimation of the one-step and two-step difference GMM estimation because of its usefulness in fitting two closely related dynamic panel data models, that is, the Arellano-Bond (Difference) GMM estimator and the Blundell-Bond (System) GMM estimator.

In the first set of models for the one-step difference GMM estimator, the first option model had no lag interval specified for the instruments. However, in the second option model, lag interval for the instruments and with collapse was included. Different lag intervals (1 5) and (2 4) were employed, with the best result reported with lag interval (1 5).

The Sargan's test (1958, 1988) and Hansen's J test (1982) were used to verify the validity of the instruments. This was to ensure the validity of the instruments and that the number of instruments produced by the lag interval did not exceed the number of groups (states) in the model. The third option model modified the second option model by allowing for the computation of Difference-in-Hansen tests for exogeneity of instrument subsets. This involved suppressing the nomata

option from the option 2. In the second set of models on two-step difference GMM estimator, the first option model was the inclusion of 'two-step' option in the former model without a lag. However, in the second option, we specified lag interval for the two-step GMM estimator with collapse and in the third option we included both the lag interval and 'mata' options with collapse.

V. Analysis of Results

Table 4.1 presented the descriptive statistics of the variables that went into the empirical estimations. This was crucial to ensure that the data met the assumptions that were required for a more robust statistical test.

Table 4.1: Summary Statistics
Sample: 2007 - 2014

	FDEF	COG	UNEMP	TREVR	INFL	POP	GR
Mean	-4.146655	44.83203	19.82368	1.354595	10.71250	4.306588	7.573750
Median	-2.750000	44.05500	18.88000	0.980000	11.05000	3.960000	7.670000
Maximum	78.70000	97.56000	67.40000	10.58000	15.10000	11.73000	8.600000
Minimum	-354.1900	0.000000	1.300000	0.000000	6.600000	1.450000	6.940000
Std. Dev.	30.47979	18.79096	9.602577	1.345940	2.834296	1.955311	0.519915
Skewness	-5.401482	0.314214	0.923641	3.601022	0.059192	1.688125	0.494133
Kurtosis	61.90728	2.784251	5.725409	19.01166	1.701081	6.434003	2.488965
Jarque-Bera	44236.85	5.444791	133.6971	3801.660	20.98153	286.0278	15.26652
Probability	0.000000	0.065717	0.000000	0.000000	0.000028	0.000000	0.000484
Sum	-1227.410	13270.28	5867.810	400.9600	3170.900	1274.750	2241.830
Sum Sq. Dev.	274060.2	104164.6	27201.80	534.4084	2369.804	1127.856	79.74194
Observations	296	296	296	296	296	296	296

Source: Computed by the Authors

The description of the data was shown in Table 4.1. Fiscal deficit (FDEF) averaged at negative 4.1 per cent, indicating that the fiscal deficit across the states was moderately low. The low range was indicative of the years of surplus across some states. The cost of governance (COG) recorded an average of 44.8 per cent, while the unemployment rate, across the states was 19.8 per cent. Inflation (INFL) was also relatively high at 10.7 per cent, while the average GDP growth rate, population (POP) and ratio of state total revenue to total

shared federal collectible revenue were 7.6, 4.3, and 1.4 per cent, respectively. The distribution of the variables showed that they were leptokurtic and positively-skewed. The probability of the Jarque-Bera showed that the variables were normally-distributed at 1 and 5 per cent respectively, except cost of governance that was normally-distributed at 10 per cent. The number of observations was the same across all the variables, indicating that the panel variable was strongly balanced.

Table 4.2 displayed the correlation matrix of all the variables. The apriori expectation of the variables was also depicted with the correlation matrix. All the variables maintained their apriori expectations, except GDP growth rate, which posted a positive correlation with the dependent variable. From Table 4.2, cost of governance (COG), and economic growth, had positive correlation with fiscal deficit (FDEF). However, only the cost of governance was significant. Other variables, including unemployment, ratio of state total revenue to total shared federal collectible revenue, inflation, and population, all had negative relationship with the dependent variable. Ratio of state total revenue to total shared federal collectible revenue and population was significant, while unemployment and inflation were not.

Table 4:2 Covariance Analysis: Ordinary

Sample: 2007 - 2014

Correlation Probability	FDEF	COG	UNEMP	TREVR	INFL	POP	GR
FDEF	1.000000						

COG	0.134550	1.000000					
	0.0206	-----					
UNEMP	-0.014472	-0.014564	1.000000				
	0.8042	0.8030	-----				
TREVR	-0.156866	-0.097240	0.060088	1.000000			
	0.0068	0.0949	0.3028	-----			
INFL	-0.011445	0.029106	-0.139598	-0.227614	1.000000		
	0.8445	0.6180	0.0162	0.0001	-----		
POP	-0.165997	-0.047871	-0.030308	-0.254960	-0.046520	1.000000	
	0.0042	0.4119	0.6035	0.0000	0.4252	-----	
GR	-0.028395	-0.118318	-0.046776	-0.022437	-0.102424	-0.048950	1.000000
	0.6266	0.0419	0.4227	0.7007	0.0785	0.4014	-----

Source: Computed by the authors

V.1 Empirical Analysis

The results of the models (one-step and two-step difference GMM estimators) were shown in Table 1.3. For all the models estimated, the Hansen diagnostics tests showed that the models were suitable. The Hansen J-test statistic indicated that the instruments were appropriately uncorrelated with the disturbance process. Thus, this made the instruments valid and satisfied the orthogonality conditions. Also, autocorrelation tests (AR1and AR2) indicated that there was no problem of serial correlation in the models.

V.2 Fiscal Deficit and Cost of Governance

Table 1.3 presented the three models each for one-step and two-step Arellano-Bond (Difference) and system GMM, respectively. In each of the models, the number of instruments did not exceed the number of states (groups). The diagnostics were also satisfactory, but the DGMM2 option was preferred to other options. Since diagnostics were also confirmed to be satisfactory, any statistical inference drawn from the regression results was assumed to be valid. The interpretation focused on the significance, sign and size of the estimated coefficients.

The DGMM2 model showed the relationship among fiscal deficit, cost of governance and other explanatory variables. The findings indicated that cost of governance had a significant and positive influence on fiscal deficit and portended an important driver in the variation of fiscal deficit across states in Nigeria. In other words, cost of governance contributed to the variation in fiscal deficit across states in Nigeria. From Table 4.3, it explained 59.5 per cent of the variation in fiscal deficit across states in Nigeria. Unemployment, state total revenue, population, economic growth and inflation, all maintained their respective a priori expectations. However, while inflation, population and economic growth significantly affected fiscal deficit across States in Nigerian, unemployment, and state total revenue as a ratio of federally-collectible revenue do not affected fiscal deficit across State in Nigeria, significantly.

In terms of size and explanatory power, population and cost of governance explained more than 50. 0 per cent of the variation in fiscal deficit across states in Nigeria and found to be significant at 1.0 per cent. Unemployment rate and

state total revenue as a ratio of federally-collectible revenue explained less than 12.0 per cent of the variation in fiscal deficit across states and were found not to be significant. Overall, cost of governance could explain a substantial variation in fiscal deficits across State in Nigerian during the study period.

Table 4:3 One-Step and Two-Step Arellano-Bond (Difference); and System GMM Regression for Fiscal Deficit and Cost of governance (2007-2014)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
VARIABLES	DGMM1-CL-a	DGMM2	DGMM2-CL-a	SGMM1	SGMM1-CL-a	SGMM2	SGMM2-CL-a	SGMM2-END-CL-a	SGMM2-END-CL-b
L.fdef	-0.231	-0.00115	-0.231	0.185**	0.169***	0.183**	0.216***	-0.211	-0.286
	(0.229)	(0.0965)	(0.229)	(0.0729)	(0.0627)	(0.0757)	(0.0513)	(0.536)	(1.227)
L2.fdef								-0.0485	0.0482
								(0.247)	(0.515)
Cog	0.487***	0.595***	0.487***	0.321**	0.341***	0.354***	0.331**	0.371	0.0920
	(0.165)	(0.178)	(0.165)	(0.129)	(0.128)	(0.125)	(0.130)	(0.418)	(0.368)
unemp	-0.0667	-0.0811	-0.0667	-0.0294	-0.0553	-0.0313	-0.0854	-1.097	1.951
	(0.244)	(0.218)	(0.244)	(0.211)	(0.185)	(0.227)	(0.154)	(4.002)	(10.51)
Trevr	-11.59	-12.04	-11.59	-7.425	-7.743	-7.511	-7.653	0.340	13.02
	(9.883)	(8.507)	(9.883)	(6.563)	(6.657)	(5.982)	(4.984)	(12.23)	(21.41)
Infl	-3.514**	-4.984***	-3.514**	1.171	0.991	1.001	-0.205	-4.292*	-1.249
	(1.512)	(1.667)	(1.512)	(1.910)	(1.907)	(1.514)	(1.092)	(2.336)	(8.674)
Pop	-66.80***	-83.85**	-66.80***	-1.510	-1.551	-1.268	-0.0723	-42.06	29.97
	(25.72)	(35.06)	(25.72)	(1.348)	(1.278)	(1.344)	(0.986)	(31.20)	(85.09)
Gr	-11.93**	-12.48**	-11.93**	0.392	-0.918	-0.295	0.242	-7.178	9.759
	(5.088)	(5.240)	(5.088)	(2.418)	(2.940)	(1.734)	(1.899)	(6.427)	(24.49)
Constant				-18.09	-6.043	-14.33	-6.571	276.7	-258.6
				(12.45)	(10.63)	(14.10)	(12.15)	(186.7)	(770.9)
Observations	222	222	222	259	259	259	259	222	222
Number of sid	37	37	37	37	37	37	37	37	37
state effect	YES	YES	YES	YES	YES	YES	YES	YES	YES
year effect	NO	NO	NO	NO	NO	NO	NO	NO	NO
Hansen_test	3.513	22.35	3.513	29.08	5.020	29.08	5.020	4.537	0.158
Hansen Prob	0.476	0.322	0.476	0.308	0.414	0.308	0.414	0.475	0.691
Sargan_test	7.587	60.72	7.587	84.11	11.78	84.11	11.78	5.534	0.605
Sargan Prob	0.108	5.50e-06	0.108	4.80e-08	0.0379	4.80e-08	0.0379	0.354	0.437
AR(1)_test	-1.494	-1.489	-1.494	-1.846	-1.883	-1.642	-1.681	-1.037	-0.331
AR(1)_P-value	0.135	0.136	0.135	0.0650	0.0596	0.101	0.0927	0.300	0.740
AR(2)_test	0.357	0.769	0.357	1.047	1.123	1.030	1.049	0.713	-0.875
AR(2)_P-value	0.721	0.442	0.721	0.295	0.261	0.303	0.294	0.476	0.382
No. of Instruments	11	27	11	34	13	34	13	14	10

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

V.3 Post Estimation Results

The post estimation results verified the validity of the instruments, as well as the heterogeneity test. Also confirmed were the AR(1) and AR(2) tests. The results in table 4.3 presented strong evidence against the null hypothesis that the over-identifying restrictions were valid. Again, the number of instruments was not more than the number of groups (the states). The result for AR(1) process was rejected, while the result for AR(2) in the first difference for DGMM2, was not rejected. This is more important as it detected the autocorrelation in levels.

VI. Conclusion and Policy Recommendation

This study was able to establish that cost of governance has significant effect on fiscal deficit across the Nigerian states. This empirical evidence alluded to the structuralists' theoretical view that governments, most times, are inefficient and this leads to fiscal deficit. One of the major concerns in fiscal management is the manner in which public resources are managed. From the empirical results, we can infer that undue concentration of the bulk of the financial resources at the state level of government towards recurrent outlay, and particularly cost of governance, contributes to the perennial fiscal deficit observed at this level of government. This underscores the need for strengthening public financial management reforms (like Fiscal Responsibility Act, the Medium-Term Expenditure Framework, and the Treasury Single Account) in states where such reforms are in operation and domesticate where it has not. This will engender fiscal discipline and, thus, propel states to cut down on fiscal deficit over time, as they channel more resources to infrastructure development.

References

Adeolu, M. A. and E. S. C. Osabuohien (2007). Analysis of the Cost of Governance and Options for Its Reduction in Nigeria. *Nigerian Journal of Economic and Social Studies*, Vol. 49, No. 1. Pp. 137-159

Arellano, M. and O. Bover (1995). Another Look at the Instrumental Variable Estimation of Error-Components Models. *Journal of Econometrics* 68, 29-51.

Arellano, M., and Bond, S. (1991). Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application of Employment Equations. *Review of Economic Studies*, 58 (2): 277-297.

Arellano, M., and Bond, S. (1998). Initial Conditions and Moment Restrictions in Dynamic Panel Data Model. *Journal of Econometrics* 87: 143.

Asteriou, Dimitrios and Stephen G. Hall (2011). *Applied Econometrics*. Palm Grave/Macmillan Second Edition.

Attiya Y. J, Avid, Umaima Arif, and Asma Arif (2011). Political and Institutional Determinants of Budget Deficits Volatility in Selected Asian Countries, *The Pakistan Development Review*, Vol. 50, No. 4, pp. 649-662.

Baltagi, B H. (2008). *Econometric Analysis of Panel Data*. John Wiley and Sons Ltd. 3rd Edition.

Barro, Robert J. (1979). On the Determination of the Public Debt, J*ournal of Political Economy*, 87: pp. 940-971.

Barro, Robert J. (1986). The Behaviour of United States Deficits. *National Bureau of Economic Research*. Pp. 361-394.

Baum, C. F. (2006). *An Introduction to Modern Econometrics Using Stata*. College Station, TX: Stata Press.

Bernheim, B. Douglas (1989). A Neoclassical Perspective on Budget Deficits. *Journal of Economic Perspectives*. Vol. 3, No. 2, pp. 55–72.

Blundell, Richard and S. Bond (1998). Initial Conditions and Moment Restrictions in Dynamic Panel Data Models. *Journal of Econometrics*, 87, Pp. 115-143. Elsevier.

Bond, S (2002). Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice. The Institute for Fiscal Studies Department of Economics, *UCL Cemmap Working Paper* Cwp09/02.

Cameron D. (1978). The Expansion of the Public Economy: A Comparative Analysis, *American Political Science Review*, 72, pp.1243-1261.

Central Bank of Nigeria Annual Report and Statement of Accounts, various Years.

Combes and Saadi-Sedik (2006). How Does Trade Openness Influence Budget Deficits in Developing Countries? *IMF Working Paper*, WP/06/3.

Constitution of the Federal Republic of Nigeria 1999 accessed from www.icnl.org/research/library/files/Nigeria/constitution2.pdf.

Dafflon, B., and F. Pujol (1999). Fiscal Preferences and Fiscal Performance: Swiss Cantonal Evidence. Paper Presented at the *11th Annual Conference on Public Budgeting and Financial Management, Washington*.

Darrat, Ali F. (1988). Have Large Budget Deficits Caused Rising Trade Deficits? *Southern Economic Journal*, Vol. 54, No. 4, pp. 879-887.

De La Dehesa, Guillermo (2010). *Deficits and Debt Dynamics in Fiscal Sustainability, European Parliament's Committee on Economic and Monetary Affairs*, IP/A/ECON/FWC/2009_040/C6.

Drucker, P. (2007). Governance, *Harvard Business Review*, 45(2), pp. 82- 98.

Edwards, S. and Tabellini, G. (1991). Explaining Fiscal Policies and Inflation in Developing Countries. *Journal of international Money and Finance*. 10, pp. 16 – 48.

Elmendorf, D. and N. Mankiw (1999). Government Debt, in Taylor, J. and Woodford, M. (eds.), *Handbook of Macroeconomics*, Vol. 1C: 1615-1669.

Fatas, Antonio and Mihov, Ilian (2006). The Macroeconomic Effects of Fiscal Rules in the US States, *Journal of Public Economics*, 90:101–117.

Fluvian, G. (2006). The Rising Cost of Governance in Africa. *Journal of Public Administration*, 22(9) 441 – 463.

Fluvian, G., (2006). The Rising Cost of Governance in Africa. *Journal of Public Administration*, 22(9) 441 – 463.

Greene, W. H. (2008). *Econometric Analysis* 6th Edition. New York University.

Hsiao, C. (1986). Analysis of Panel Data, Econometric Society *Monographs* No. 11 New York: Cambridge University Press

Ijah, Afrrev (2014). The Impact of Budget Deficit on Trade Balance in Nigeria: An Empirical Analysis, 1980 – 2011. *International Journal of Arts and Humanities* Bahir Dar, Ethiopia Vol. 3 (1), pp. 145-159.

Iyoha F. O., Gberevbie, D. E., Iruonagbe, C. T. and Egharevba, M. E. (2015). Cost of Governance in Nigeria: In Whose Interest?, *International Journal of Social Behavioral, Educational, Economic and Management Engineering* Vol: 9, No:1. Pp 245 -252

Krause, George A. (2000). Partisan and Ideological Sources of Fiscal Deficits in the United States. *American Journal of Political Science* Vol. 44, No. 3, pp. 541-559.

McDermott, C. J., and R. F. Wescott (1996). Fiscal Reforms that Works: *Economic Issues* 4. International Monetary Fund, Washington DC. 4(13), pp.561-569

Mileva, Elitza (2007). Using Arellano – Bond Dynamic Panel GMM Estimators in Stata. *Tutorial with Examples using Stata* 9.0 (xtabond and xtabond2)

Murwirapachena, G., Maredza, A and Choga, I (2013). The Economic Determinants of Budget Deficits in South Africa. *Mediterranean Journal of Social Sciences*, Vol 4(13), pp. 556-569

Nickell, S. (1981). Biases in Dynamic Models with Fixed Effects. *Econometrica*, 1981, Vol. 49, issue 6, 1417-26

Onafowora, Olubenga A. and O. Owoye, (2006). An Empirical Investigation of Budget and Trade Deficits: *The Case of Nigeria. The Journal of Developing Areas* Vol. 39, No. 2, pp.153-174

Pasten, R. and Cover, J. P. (2010). The Political Economy of Unsustainable Fiscal Deficits. Cuadernos De' *Economia* Vol. 47, No.136, pp.169-189.

Perry, N. (2014). Debt and Deficits: Economic and Political Issues, Global Development and Environment Institute Tufts University, available at http://www.ase.tufts.edu/gdae/education_materials/modules/DebtAndDeficits.pdf

Pesaran, M. H, Y. Shin, and R. Smith (1999). Pooled Mean Group Estimation of Dynamic Heterogenous Panels. *Journal of the American Statistical Association*, 94, pp621-34.

Rangarajan, C. and Srivastava, D. K. (2005). Fiscal Deficits and Government Debt: Implications for Growth and Stabilisation. *Economic and Political Weekly* Vol. 40, No. 27, pp. 2919+2921-2934.

Robertson, D. H. (1934). Industrial Fluctuation and the Natural Rate of Interest. *The Economic Journal*: 650–656.

Rodrik D. (1998). Why do more Open Economies have bigger Governments? *Journal of Political Economy*, Vol.106, No.5, pp. 997-1032.

Roodman, D (2006). How to do Xtabond2: An Introduction to "Difference" and "System" GMM in Stata. *Center for Global Development Working Paper* Number 103.

Roodman, D. (2009). A Note on the Theme of too Many Instruments. *Oxford Bulletin of Economics and Statistics*, Volume 71, Issue 1 February 2009. Pp 135–158.

Rose, S. (2010). Institutions and Fiscal Sustainability. *National Tax Journal*, Vol. 63 No.4, Part 1, pp. 807–838.

Roubini, N. J. and D Sachs (1989b). Government Spending and Budget Deficits in the Industrialised Countries. *Economic Policy* 8: 99 – 132.

Roubini, N., J. and D. Sachs (1989a). Political and Economic Determinants of Budget Deficits in Industrial Democracies, *European Economic Review* 33: 903- 933.

Sanz, I., and Velázquez F.J. (2003). Does Globalisation Increase Government Size? An Analysis of the Effects of Foreign Direct Investment on Total Government Expenditures and its Components, *Mimeo*.

Soludo, C. C. (2011). Towards the Economic Transformation and Viability of Nigerian States: Can We Break the Oil Resource Curse? Being an Inauguration Lecture Delivered in Minna, Niger State on May 28, 2011, as Part of the Special Events to Mark the Second Inauguration of Dr. Mu'azu Babangida Aliyu, OON as the Chief Servant/Governor of Niger State.

Udoh, N. and Ekemini A. Etok (2012). Political Regime Type, Liberalisation and Fiscal Deficits in Developing Countries: Evidence from Nigeria. E*uropean Scientific Journal*. (ESJ) Vol. 8 No. 1.

Woo, J. (2003). *Economic, Political and Institutional Determinants of Public Deficits*, 87:387-426.

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