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Notes to Contributors

Information on manuscript submission is provided on the last and inside back cover of the Review.

Contents

Exchange Rate Volatility, Financial Development and Output Growth in Nigeria

S. Orekoya*

Abstract

Recognising the importance of output growth in improving the standard of living, this study investigates the effect of exchange rate volatility and financial sector development on output growth in Nigeria. Using 1982-20153 data, three different financial development indicators were examined in the study namely: credit to the private sector, monetary aggregate (M2) and market capitalisation (all as percentage of GDP). Exchange rate volatility was measured as a standard deviation of log of exchange rate. Bounds test, co-integration test and Ordinary Least Square estimation were explored to test whether the effect of exchange rate volatility on output growth decrease with the level of financial development in Nigeria. The findings indicate that financial development reduced the impact of exchange rate by 20 - 75 per cent depending on the measure of financial development used. Hence, policy aimed at increasing credit to the private sector or stimulating competition in the stock market, which could bring about increase in market capitalisation and monetary aggregate, would lead to increase in output growth directly as well as reduction in the effect of exchange rate volatility on output growth.

I.   Introduction

C onventional growth theory framework has been observed not to provide a strong and explicit basis for exploring the effect of exchange rate on economic growth (Adewuyi and Akpojodje, 2013). This is because most of the growth theories such as Solow (1956) and Mankiw et al (1992) assumed closed economy. And in the light of the prevailing fixed exchange rate during these periods, their theoretical model did not account for exchange rate. However, with the advent of globalisation, the growing inter-connection among countries and the collapse of Bretton-Woods exchange rate system in the 1970's, different countries including Nigeria, began adopting floating exchange rate regime.

Due to the fluctuating nature of exchange rate after the adoption of floating exchange rate, Aghion et al., (2009) developed a monetary growth theory which points out that as the exchange rate becomes more volatile, productivity growth reduces. Since productivity growth translates to output growth, we can deduce that reduction in productivity growth as a result of exchange rate volatility translates into a reduction in output growth. Aghion et al., (2009) further showed that through the availability of funds in the credit market, the impact of exchange rate on output reduces. In other words, the monetary growth theory proposed by Aghion, et al., (2009) depicts the role of financial development in reducing the effect of exchange rate volatility on output growth through the provision of funds.

Uncertainty in real exchange rate can have negative influence on both domestic and foreign investment decisions. Thus, according to Azid, et al (2005), this could translate into reallocation of resources between sectors and countries, exports and imports thereby, creating an uncertain environment for investment and consequently, lowering production.

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Since most firms in Nigeria depend on imported raw materials and equipment for production, the volatility of exchange rate could make the cost of production high and more unpredictable. It is, therefore, obvious that exchange rate volatility will hinder growth (Razin and Collins, 1997; Schnabl, 2008; Aghion et al, 2009; Aliyu, 2009 and Demir, 2010).

Premised on the effect of output growth on the long-term standard of living of a country's citizenry and the negative impact of exchange rate volatility on output growth, it becomes crucial to examine the channel through which this negative impact could be cushioned. Leveraging on findings in the finance-growth literature that financial development fosters economic performance (Levine and Zervos, 1998; Calderon and Liu, 2002; Odeniran and Udeaja, 2010; Bittencourt, 2011 and Zhang, et al., 2012), this study examines the theoretical prediction of Aghion et al., (2009) that through financial development, the impact of exchange rate on output could be minimised.

Although a multi-country study by Diallo (2012) tested the theoretical prediction of Aghion et al., (2009), Nigeria was not included in the study. Also, output growth performance has been fluctuating for most of the study period. This fluctuation to a substantial degree has been attributed to macroeconomic challenges of which exchange rate volatility is major. In the case of Nigeria, there is also a long history of financial sector reforms. Therefore, examining the moderating influence of financial development in the exchange rate volatility - output growth linkage becomes pertinent as a means of assessing the effectiveness of the reforms on the one hand and a basis for offering policy suggestions aimed at the desired sustained output growth for the economy. To the best of our knowledge, no such country-specific study on the subject-matter has been conducted on Nigeria. Thus, to address this dearth of studies, we examine the moderating role of financial development in "exchange rate volatility-output growth" nexus using various financial development measures.

Following this introduction, the study presents some stylised fact in section II. Section III provides a review of literature while Section IV presents the theoretical framework and methodology. Empirical analysis is presented in section V and section VI concludes and offers some policy recommendations.

II.   Stylised Facts

Exchange rate volatility[1] connotes fluctuation in the rate a country's currency is exchanged for another. Output growth implies percentage changes in the volume of goods and services produced in an economy. Figure 1a shows that Nigeria's exchange rate was more volatile prior to 1997. Between the periods of 1982 to 1985 when exchange rate was relatively stable, the rate of output growth was high but it declined during post SAP era when the rate was volatile. Between 1994 and 1996, when the volatility was declining, output was also growing. During the post 1998 era when the rate was relatively pegged, we observe a gradual growth in output (see figure 1b).

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[1]Exchange rate volatility is measured as the standard deviation of the log difference of the 12 month real official exchange rate. Real official exchange rate is derived by multiplying the ratio of US price level and Nigeria price level with the official exchange rate. The rate was determined through the interbank rate, except for the period 2002 to 2015, when the Dutch auction System was in operation. CBN (2016) Statistical Bulletin.

Figure 1a: Trend of Exchange Rate Volatility and Output Growth in Nigeria from 1982-2015
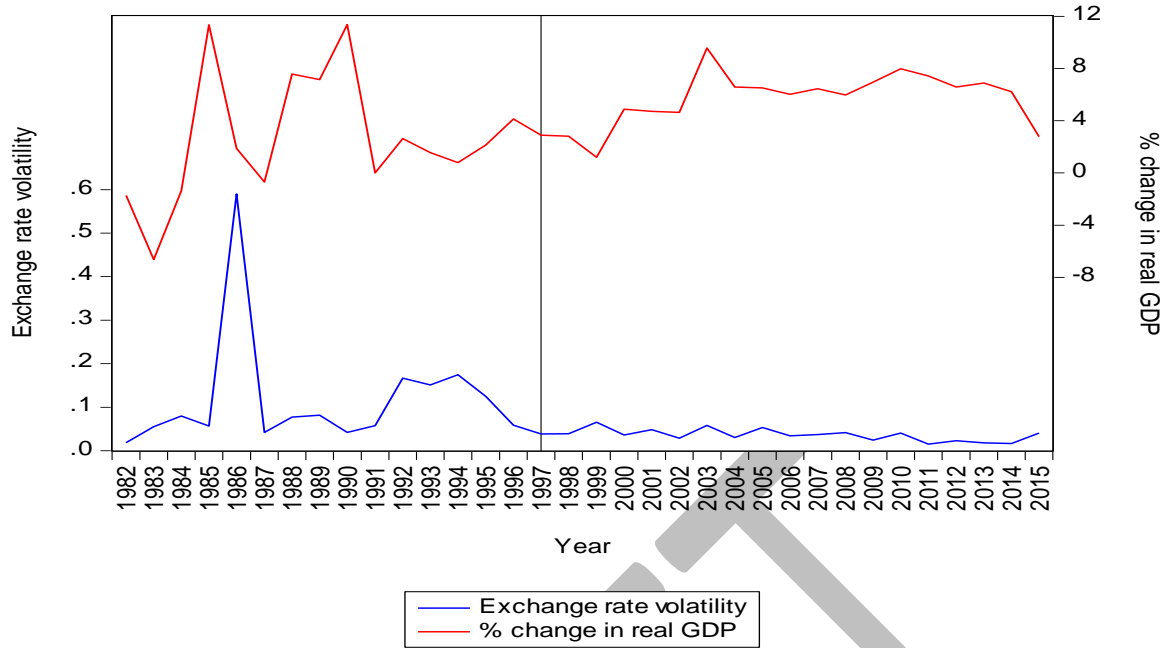

Figure1b: Trend of Exchange Rate Volatility and Output Growth in Nigeria (Pre and post SAP)
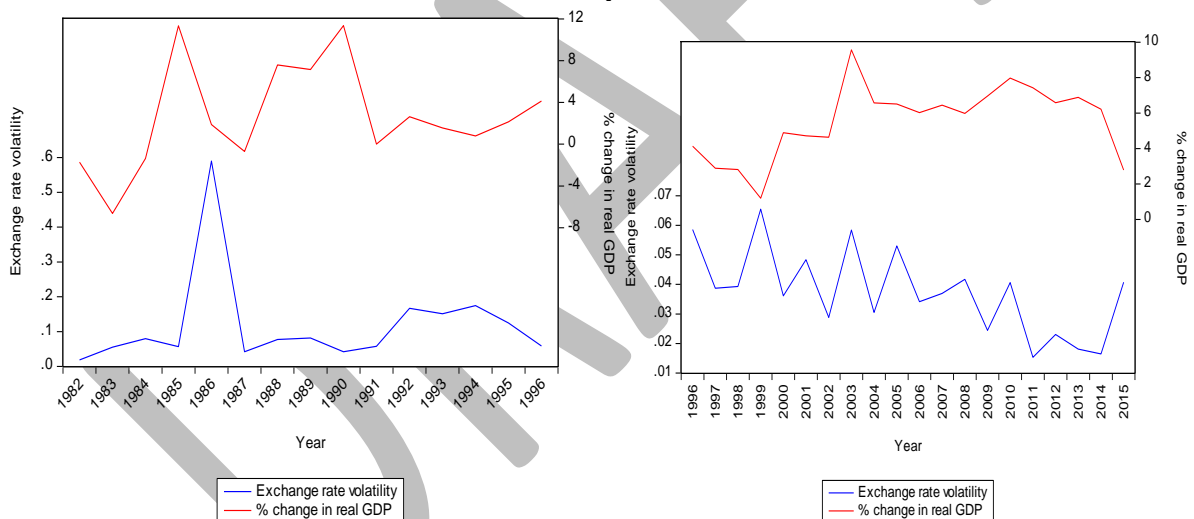
The trend of financial development with output growth, as presented in Figure 2, shows that the Nigeria financial sector had been developing at a slower pace after its liberalisation in 1986. A notable development was in 2005, when the capital base of banks was increased from ₦2billion to ₦25billion. However, the development was short lived as the financial crises of 2007/2008 affected development in the sector. The three measures of financial development used in the study namely; credit to private sector as share of GDP, monetary aggregate (broad money) as share of GDP and market capitalisation as share of GDP were observed to follow similar trend. Although we observe a slow pace in the level of development in the financial sector, the trend of the financial development and output growth depicts co-movement over the period examined. The observed co-movement here suggests that development in the financial sector contributes to output growth rather than otherwise.

Figure 2: Trend of Financial Development and Output Growth in Nigeria from 1982-2015
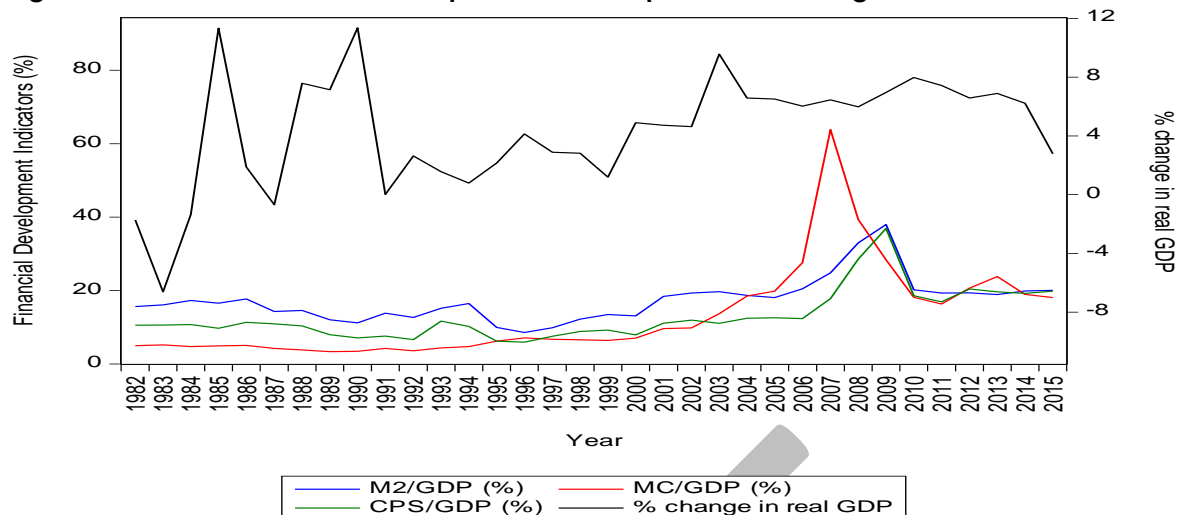
III. Literature Review

The Purchasing Power Parity (PPP) theory is based on the assumption of the Law of One Price (LOOP) which states that the price of one good is the same both at home and abroad. According to this theory, exchange rate change between two currencies over any period of time is determined by changes in the two countries` relative price level. This theory is further sub-divided into absolute and relative PPP. Absolute PPP theory assumes that the cost of a bundle of goods in one country be the same in another taking into account the exchange rate. This theory is based on the assumptions that; goods are sold in a competitive market, the world is risk neutral and that goods are traded freely without transportation cost, tariff and trade barrier. Based on these assumptions, absolute PPP is the ratio of price level between two countries. Hence, in the absence of arbitrage, the prices of a common market basket of goods in the two countries, measured in a common currency will be the same. On the other hand, relative PPP assume real exchange rate is constant and that deviation from PPP is as a result of technology, risk and uncertainty in the economy. Hence, relative PPP relates the change in two countries' expected inflation rates to changes in their exchange rate. In other words, relative PPP theory points out how exchange rate compensates/adjusts for differences in inflation rate between two countries (Dornbusch, 1985).

The Balassa-Samuelson model links PPP, exchange rates and inter-country real income comparisons in explaining why some factors account for systematic biases relating to the relationship between exchange rates and relative price. The model faults the absolute PPP on the ground that in the absence of all frictions, the prices of a common basket of goods in the two countries measured in a common currency will be the same (Asea and Corden, 1994). Also, that the deviation from absolute PPP reflect differences in the relative price of non-tradable goods, which is determined by productivity differentials in the production of tradable goods between countries.

The Interest rate parity theory on its own linked monetary policy behaviour to the determination of exchange rate. The theory is based on the assumption that the price of asset measured in terms of interest rate influences exchange rate variation. As a result, a rise in domestic interest rate relative to foreign interest rate leads to appreciation of the domestic currency, while a fall in domestic interest rate relative to foreign interest rate leads to depreciation of the domestic currency.

The Mundell-Fleming model extends the IS-LM framework to an open economy framework of IS-LM-BP. Where IS, LM and BP symbolises equilibrium in the goods, money and external markets, respectively. According to this theory, exchange rate is correlated with money supply, hence exchange rate performs crucial role in the development of an economy.

The Neoclassical Growth theory points out that physical capital accumulation, human capital and population growth affects economic growth (Solow, 1956 and Mankiw, Romer and Weil, 1992). Since, investment is an important factor in economic growth, irreversible investment theory link how uncertainty affects investment decision. The cost of investment becomes higher as uncertainty surrounding investment decision increases mainly because once an investment is undertaken, it cannot be reversed. The theory, therefore, predicts that uncertainty in an economy increase the cost of making investment decision which later result into lower investment level. The monetary growth theory developed by Aghion, et al., (2009) explains the existing interaction between credit constraints, exchange rate volatility and productivity growth to prove that availability of finance to innovative firms reduces the negative impact of exchange rate volatility. According to the theory, exchange rate volatility makes firms to face liquidity cost, and the ability to innovate which will lead to productivity growth, will only happen if the firms could overcome liquidity cost. Firms overcome liquidity cost by borrowing from the credit market, which in turns depends on the level of financial development of the economy. Hence, the theory assumed that in the face of exchange rate volatility, output and economic growth will only happen when firms are able to borrow more to overcome liquidity cost.

Empirical findings from multiple and single country studies on the nexus between exchange rate volatility and economic growth have been mixed. While multiple countries analysis (Razin and Collin, 1997; Schnabl, 2008; Bleamey and Greenaway, 2001; Arratibel, Furceri, Martin and Zdzienicka-Durand, 2011; Mirdala, 2012; and Adewuyi and Akpokodje, 2013) as well as single country analysis conducted by Bahmani-Oskooee and Kandil (2007) on Iran and Aliyu (2009) on the Nigerian economy found that exchange rate volatility hinders economic growth, study on the Pakistani economy by Javed and Farroq (2008) found that exchange rate volatility enhances economic growth.

Regarding finance-growth nexus, Levine and Zervos (1998), Calderon and Liu (2002), Bittencourt's (2011) studies on multiple countries showed that financial development stimulates economic growth while Zhang, Wang and Wang (2012) for China and Odeniran and Udeaja (2010) for Nigeria found similar results.

Razin and Collin (1997) investigates the relationship between exchange rate misalignment and economic growth using data from 1975 to 1992 on 93 developed and developing countries and averaged over five years intervals. The authors found that misalignment (deviation from long-run estimate) in exchange rate is negatively related to economic growth and that overvaluation of exchange rate reduces economic growth rate.

Bleamey and Greenaway (2001) focused on deepening the understanding of how terms of trade and exchange rate volatility impacted on investment and economic growth in sub-Saharan Africa (SSA). Using data spanning 1980 and 1995 on 14 SSA countries, they observed that economic growth in SSA countries is lower than what it ought to be due to high level of exchange rate volatility. They argued that investment and growth in sub-Saharan Africa should have been higher than what it is if the terms of trade had been more favourable.

Schnabl (2008), examined the effect of real exchange rate volatility on economic growth of European Monetary Union (EMU) periphery under the condition of free capital movement and found that exchange rate volatility has a significant negative effect on economic growth. Arratibel, et al., (2011) further investigated the influence of nominal exchange rate on economic performance in nine selected Central Eastern European (CEE) countries using indicators such as; economic growth, financial market development, foreign direct investment and current account balance between 1995 and 2008.They found that exchange rate volatility has negative relationship with foreign direct investment, economic growth and credit deviation from its long-run equilibrium but has positive effect on current account balance. Mirdala (2012), using Cholesky decomposition of variance, further examined the influence of exchange rate volatility on macroeconomic variables such as output, money supply, inflation rate, interest rate and current account balance in CEE countries and found that the impact was high in the short-run than in the long-run.

Adewuyi and Akpokodje (2013), sub-dividing Africa into Colonies of Franchises d'Afrique (CFA) and non-CFA countries, showed that anticipated changes in exchange rate positively influence economic activities in Africa while unanticipated change influence economic activities differently between the two groups. Their findings showed that the effect of unanticipated change in exchange rate was felt more in non-CFA countries than CFA countries and that unstable exchange rate hindered economic growth more in non-CFA than in CFA countries where exchange rate is pegged to Franc.

Bahmani-Oskooee and Kandil (2007) compared both the short and long-run impact of exchange rate fluctuation on output in Iran using two data set (1959 to1990 and 1959 to 2003). Their findings showed that between 1959 and 1990, exchange rate fluctuation was minimal and had no significant impact on the economy both in the short and long-run compared with the 1959 to 2003 data which showed that exchange rate fluctuation shrinks economic growth in the short-run. Results from their long-run estimation showed that anticipated exchange rate fluctuation positively influence growth while unanticipated exchange rate does not.

Unlike other studies on Pakistan, Javed and Farroq (2008) found that exchange rate volatility has positive but weak effect on Pakistan's economic growth while for Nigeria, Aliyu (2009) found that volatility in exchange rate hinders economic growth and that bi-directional causality occurs between exchange rate volatility and economic growth.

On the relationship between financial development and economic performance, Levine and Zervos (1998) examined 47 countries with data from 1976 to 1993 using cross sectional regression analysis and found that bank development and stock market liquidity influences economic growth, productivity improvement and capital accumulation. Calderon and Liu (2002) examined the direction of causality between financial development and economic growth for 109 countries comprising of 87 developing and 22 industrial countries using data from 1960 to 1994 averaging the data over a period of five (5) and ten (10) years to reduce the role of fluctuations in the series. Their result showed that financial development leads to economic growth and that the influence of financial development on economic growth is more pronounced in developing countries than industrial countries. This supports Schumpeter's (1912) position that the development of financial system support innovators in an economy by providing them with financial resources and ensuring that such funds are in efficient use.

Testing Schumpeter's hypothesis, Bittencourt's (2011) study on four Latin America countries confirmed that financial sector development positively influenced economic growth and that high rate of inflation lowers the positive effect of financial development on economic growth. Zhang, Wang and Wang (2012) and Odeniran and Udeaja (2010) also confirmed the same hypothesis for China and Nigeria respectively and concluded that the impact of financial sector development on economic growth increases with time.

Aghion, et al., (2009) empirically showed for 83 countries how financial development impacted on productivity (output per worker) growth. Confirming the negative link between exchange rate volatility and economic performance (productivity growth), their results showed that the effect of exchange rate volatility was smaller in countries with high level of financial development than what obtained in countries with low level of financial development.

Diallo (2012) confirmed and validated Aghion, et al., (2009) position in his submission that financial development conditioned the impact of exchange rate volatility on productivity growth. His submission emerged from a panel study using 1975 to 2004 data which were averaged over five (5) years for 74 countries drawn from 24 developed and 50 developing countries excluding Nigeria.

From the above literature, it can be deduced that exchange rate volatility hinders economic performance (Pazin and Collin, 1997; Bleamey and Greenway, 2001; Schnabl, 2008; Arratibel, et al., 2011; Mirdala, 2012 and Adewuyi and Akpokodje, 2013) and that financial development foster economic performance (Levine and Zerous, 1998; Calderon and Liu, 2002; Odeniran and Udeaja, 2010; Bittencourt, 2011 and Zhang, et al., 2012). It was observed that from multi-countries studies by Aghion et al., (2009) and Daillo (2012) linking financial development to the overall effect exchange rate volatility on economic growth, Nigeria was not included. This study not only fills this gap but also offer policy suggestions aimed at the desired output growth for Nigeria.

IV.   Theoretical Framework, Model Specification and Data Issue
IV.1   Theoretical Framework

Drawing from the study by Aghion et al (2009), we provide the theoretical linkage between financial development, exchange rate volatility and output growth, while clearly demonstrating how financial development helps in reducing the effect of exchange rate volatility on output growth.

In establishing the relationship, we make the assumptions that: output growth occurs in an economy as a result of the presence of innovating firms, the ability of firms to innovate is anchored on its ability to overcome liquidity cost that complement other available factors while liquidity cost arises from exchange rate volatility that impedes firms' profit. Fluctuation in exchange rate is expected to lead to fluctuation in firms' sales and reduction in profit. This is because firms' sales vary with exchange rate (international price) whereas wage bill is unaffected due to wage stickiness. Reduction in firms' profit is expected to result into lower investment, thereby impacting on their level of innovation. As firms' profit reduces, they face liquidity shock which we refer to as liquidity cost in monetary value.

Firms' ability to borrow is what determines whether they could overcome the liquidity cost. Firms can borrow in the credit market. However, credit constraints prevent them from borrowing as much as they could in the credit market. This implies that, the extent of credit constraint determines the level of financial development. Credit constraint is the reciprocal of financial development. Therefore, the extent to which firms could overcome their financial constraint depends on the level of financial development hence the extent of financial innovation. In other words, the lesser the degree of credit constraint, the higher the number of firms that would be able to overcome liquidity constraints. This implies that the number of firms that will innovate within the economy will be higher, bringing about output growth since this is assumed to be influenced by innovating firms within the economy.

From the above we can deduce that exchange rate volatility hinders output growth when, in actual fact, financial development should aid innovation hence output growth. In addition, through the positive effect of financial development in reducing financial constraint, we expect the negative effect of exchange rate volatility on output growth to reduce as the financial sector develops.

IV.2   Model Specification

Based on the theoretical framework discussed above, we specify our model drawing largely from the work of Aghion et al (2009). We have two models to be estimated of which the first includes exchange rate volatility. The essence of this model is to empirically show that exchange rate volatility, through liquidity cost, hinders output growth. The model to be estimated is specified as follows.

$$y_t = \alpha_0 + \alpha_1 EXRV_t + \alpha_2 Z_t + \varepsilon_t \qquad (1)$$
$$\text{we expect that } \alpha_1 < 0$$

In equation (1), y_t is real GDP growth rate, $EXRV_t$ is exchange rate volatility, Z_t is the vector of control variable used and ε_t is the residual term. The control variables index of industrial production and trade openness (Jajri, 2007; Aghion et al., 2009; and Bittencourt, 2011). Their inclusion enables us avoid omission bias arising from exclusion of important variables. Index of industrial production was introduced to reflect the effect of resources shift within the sectors in the economy (see Jajri, 2007) while trade openness is the likely channel through which exchange rate fluctuation could influence domestic economic activities.

In the second model, we introduce financial development, which represent the ability of the firms to access funds in order to overcome liquidity cost arising from exchange rate volatility. This model is expected to show that financial development aid output growth by stimulating firms' innovation. The second model to be estimated is expressed as follows

$$y_t = \beta_0 + \beta_1 EXRV_t + \beta_2 FD_t + \beta_3 Z_t + \varepsilon_t \qquad (2)$$
$$\text{we expect that } \alpha_1 < \beta_1 < 0 \text{ and } \beta_2 > 0$$

In equation (2), FD_t is financial development, while y_t, $EXRV_t$,Z_t and ε_t are as earlier defined. We expect that $\alpha_1 < \beta_1$, based on the notion that as firms overcome the liquidity cost arising from exchange rate volatility through access to fund provided in the credit market, the negative effect of exchange rate volatility on output growth should be lesser compared to when they could not access the credit market for finance.

IV.3   Variable Used: Definition and Measurement

Variables for the study include: Credit to private sector as a share of GDP (CPS), Monetary aggregate as a share of GDP (M2) and Market capitalisation as a share of GDP (MC) which are used to measure financial development, Growth rate of Real Gross Domestic Product (GRGDP), Exchange rate volatility (EXRV) and Index of industrial production. Growth rate of real GDP was computed from the annual real GDP. The data was obtained from CBN statistical Bulletin covering the period of 1982 to 2015. Analysis started from 1982 (to account for period before the full liberalisation of the exchange rate and the financial institution of 1986 under the Structural Adjustment Programme) and ends in 2015 to provide a significant duration for analysis.

Output Growth: This is measured as the growth rate of Real Gross Domestic Product (RGDP) which is the total monetary value of goods and services produced within an economy over a period of time based on constant price.

Exchange Rate Volatility: This implies the rate of fluctuation in the exchange rate between Naira and dollar. It is measured using standard deviation of 12 months log differences in the real exchange rate. We used standard deviation because we were concerned only with the variation in the exchange rate as evident in the changes in its value over a period of 12 months.

Financial Development: This measures the level of development of the financial market. We use three different measures namely; credit to private sector (CPS) as percentage of GDP which provides information on the extent of banks development in the country; market capitalisation (MC) as percentage of GDP which provides information on the level of development of the Stock market, and monetary aggregate (M2) as percentage of GDP which provides information on the depth of the financial market. We employ various measures of financial development so as to obtain the impact of financial development on exchange rate volatility and output growth across various indicators.

Trade Openness: This measures the extent to which an economy is opened to the world. It is the channel through which exchange rate fluctuation affects an economy and it is derived by summing the value of imports and exports and then dividing by GDP.

Index of Industrial Production: This is the index which shows the growth rates in different industry groups of the economy within the year under review.

IV.4   Estimation Techniques and Method of Analysis

Since we are considering macroeconomic variables, we shall examine the stationarity property of the variables of interest using both the Augmented Dickey Fuller (ADF) and Phillip Perron (PP) tests. This is for robustness and to ensure that our result is not biased.

If the series are found to be non-stationary at levels when our interest is in a long-run analysis, we shall proceed to test for the existence of long-run relationship using the Bounds tests autoregressive distributed lag (ARDL) framework developed by Pesaran et al (2001). This approach was preferred over other co-integration tests because it allows for the inclusion of both I(0) and I(1) series.

The ARDL model for this study is presented in equation (3) below.

$$\Delta y_t = \delta_0 + \delta_1 y_{t-1} + \delta_2 ERV_{t-1} + \delta_3 FD_{t-1} + \delta_4 Z_{t-1} + \sum_{i=1}^{l} \tau_{1i} \Delta y_{t-i} + \sum_{i=0}^{m} \tau_{2i} \Delta ERV_{t-1} +$$
$$\sum_{i=0}^{n} \tau_{3i} \Delta FD_{t-1} + \sum_{i=0}^{p} \tau_{5i} \Delta Z_{t-1} + \varepsilon_t \tag{3}$$

According to Pesaran et al (2001), long-run relationship is determined by a test of joint significant on the coefficients of the lagged levels of all the variables presented on the right side of the equation. The test is based on Wald test restriction with the null hypothesis that $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$.

To ascertain co-integration, Pesaran et al (2001) provided two sets of critical values for co-integration test. The lower critical bound assumes that all the variables are I(0), implying there is no co-integration among the variables. The upper critical bound assumes the opposite, that there is co-integration. If the computed F-statistic is greater than the upper bound, then the null hypothesis will be rejected implying that there exists a co-integrating relationship among the variables and *vice versa*. However, if the F-statistics falls in-between the two bounds, then the test is inconclusive. Based on the result obtained from the co-integrating test, we proceed to conduct the long-run estimation for equations (1) and (2) based on Ordinary Least Square (OLS) estimation technique.

V.   Empirical Analysis
V.1   Preliminary Analysis

The descriptive statistics in Table 1a shows that average growth rate of output over the period is 4.32 per cent while the minimum and maximum are -6.625 per cent and 11.358 per cent respectively. From the correlation matrix in Table 1b, growth in real GDP was found to be negatively correlated to exchange rate volatility but positively correlated to the level of financial development, trade openness and the index of industrial production.

Table 1a: Descriptive Statistics

	GRGDP (per cent)	EXRV (SD)	M2 (per cent)	MC (per cent)	CPS (per cent)	OPENNESS (per cent)	IIP (per cent)
Mean	4.453	0.076	17.428	13.117	13.177	37.462	106.996
Maximum	14.604	0.590	37.957	63.811	36.893	66.767	138.325
Minimum	-7.577	0.015	8.577	3.348	5.917	11.073	86.599
Std. Dev.	4.462	0.100	5.867	12.515	6.648	16.079	18.658
Skewness	-0.209	4.073	1.554	2.237	1.697	0.110	0.471
Kurtosis	3.265	21.061	6.551	8.995	6.173	2.005	1.591
Jarque-Bera	0.358	572.472***	32.479***	81.615***	31.487***	1.515	4.192
Observations	35	35	35	35	35	35	35

*Note: *, **, and *** denote significant at 10 per cent, 5 per cent and 1 per cent significant level respectively*
Source: Author's computation.

Table 1b: Correlation Matrix

	GRGDP	EXRV	M2	MC	CPS	OPENNESS
EXRV	-0.266					
M2	0.289*	-0.102				
MC	0.336**	-0.246	0.711***			
CPS	0.208	-0.158	0.924***	0.661***		
OPENNESS	0.448***	-0.342**	0.273	0.512***	0.180	
IIP	0.369**	-0.320*	0.529***	0.618***	0.644***	0.291*

*Note: *,**, and *** denote significant at 10 per cent, 5 per cent and 1 per cent significant level respectively*
Source: Author's computation

Table 2 shows that not all the variables used in the study were stationary at level. Real GDP growth rate, exchange rate volatility and index of industrial production were found to be stationary at 5 per cent significant level based on Phillip Perron (PP) test. Though exchange rate volatility was not stationary at level based on Augmented Dickey-Fuller (ADF) test, we decided to follow PP test because of it robustness over ADF test. The other variables were found stationary after first differencing. Based on the mixed order of integration of the variables, we proceed to use Bounds test co-integration approach developed by Pesaran et al (2001) to determine if long-run relationship exist by jointly examining the variables.

Table 2: Unit Root Test Results

Unit Root Test	ADF		PP		
Variable	Level	First difference	Level	First difference	Decision
GRGDP	-4.490b***		-4.400b***		I(0)
EXRV	-3.591c***		13.159b***		I(0)
M2/GDP	-2.547b	-5.544c***	-2.577b	-6.025c***	I1)
MC/GDP	-2.577b	-6.084c***	-2.672b	-6.597a***	I(1)
CPS/GDP	-3.208b	-5.873c***	-2.632b	-10.263b***	I(1)
OPENNESS	-1.728a	-7.972b***	-1.728a	-9.393b***	I(1)
IIP	-2.461b	-5.398c***	-2.528c	-5.398c***	I(1)

*Note: The assumption underlining the reported unit root is represented by the alphabet, "a" denotes constant, "b" denotes constant and trend while "c" denotes none. The reported value is the t-statistics while *, ** and *** denote significant at 10 per cent, 5 per cent and 1 per cent respectively.*
Source: Author's computation

Bound test co-integration approach was found to be the most appropriate co-integration approach given the mixed order of stationarity of our variables, I(0) and I(1), from the unit root tests. The Bound test results in Table 3 involve three stages. The first stage requires determination of the optimal lag lengths for the first difference terms in the Bound test specification. Next is an unrestricted Vector Autoregressive model to determine the optimal lag length which yields two (2) lags based on Akaike Information Criteria. From this result, we ran the ARDL model for the Bound test with the restriction that $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$.

Our ARDL estimation for the Bound test was based on the assumption of unrestricted intercept and no trend. From Table 3, our results show that long-run relationship holds for all the estimated co-integrating equations. This is because the computed F-statistics were found to be greater than the upper critical value at 5 per cent significant level for the four estimated equations.

Table 3: Bound Test Co-integration Result

	Lag length	K	F-statistics	Decision
F(grgdp/exrv, openness,iip)	3	3	13.699***	Co-integrated
F(grgdp/ exrv, m2, openness,iip)	2	4	6.631***	Co-integrated
F(grgdp/ exrv, mc, openness,iip)	2	4	5.974***	Co-integrated
F(grgdp/ exrv, cps, openness,iip)	3	4	4.383**	Co-integrated

Note: The estimation is based on the assumption of unrestricted intercept and no trend. The upper (lower) bounds critical values at 1 per cent, 5 per cent and 10 per cent are 5.61 (4.29), 4.35 (3.23) and 3.77 (2.72) respectively when k=3. The upper (lower) bounds critical values at 1 per cent, 5 per cent and 10 per cent are 5.06 (3.74), 4.01 (2.86) and 3.52 (2.45) respectively when k=4. Where k denotes the number of independent variables.

V.2 The Moderating Role of Financial Development in Growth-Exchange Rate Volatility link

Table 4, Column 1 presents the result obtained for equation (1) while columns 2 to 4 are the results obtained for equation (2) based on different measures of financial development. A quick look at the result shows that exchange rate volatility impacts negatively on output growth. In addition, we found that financial development indicators have significant effect on output growth which reflects the underdeveloped nature of the financial sector. Trade openness and index of industrial production have positive impact on output growth.

Table 4: Regression Analysis Result.

	1	2	3	4
EXRV	-2.972	-3.402	-2.915	-2.869
	(6.428)	(6.71)	(6.569)	(6.553)
M2		0.061		
		(0.092)		
MC			-0.009	
			(0.040)	
CPS				-0.028
				(0.079)
Openness	0.098**	0.095*	0.101*	0.098**
	(0.047)	(0.050)	(0.055)	(0.048)
IIP	0.058	0.048	0.062	0.065
	(0.039)	(0.041)	(0.041)	(0.040)
Constant	-5.260	-5.086	-5.584	-5.607
	(4.897)	(5.084)	(5.348)	(4.964)
Diagnosis test:				
R-square	0.267	0.271	0.267	0.268
Adj R-Square	0.196	0.174	0.169	0.170
F-statistics	3.755***	2.789**	2.730**	2.740**
Normality test (prob)	0.250	0.256	0.258	0.259
Breusch-Godfrey Serial autocorrelation test (prob)	0.174	0.205	0.189	0.179

*Note: The value in the parentheses is the Standard error. *, ** and *** denote significant at 10 per cent, 5 per cent and 1 per cent respectively* Source: Author's computation

Table 4 column 1 result shows that increase in exchange rate volatility by 1 standard deviation leads to reduction in output growth rate by 2.97 per cent though the effect was not significant. The implication of this finding is that a significant fluctuation in exchange rate could lower the economy's growth rate. This follows the study's theoretical prediction that fluctuations in exchange rate will have an associated cost that may lower economic transactions. The insignificant effect of exchange rate volatility on output growth can be attributed to the relative stability in the exchange rate as the country employed managed floating exchange rate policy. Nevertheless, the study points out that exchange rate volatility can be a constraint to output growth.

In Table 4 Column 2 where we introduce monetary aggregate (a measure of financial depth) as financial development indicator, the magnitude of impact of exchange rate volatility on output growth increased. Here, financial development was found to have positive effect on output growth. The coefficient of exchange rate volatility increased from -2.972 per cent to -3.402 per cent, although still insignificant. The coefficient for M2 was found to be 0.061 and insignificant, suggesting that an increase in M2 by 1.0 per cent will lead to increase in output growth by 0.061 per cent. The result revealed that appropriate monetary policy is important in lowering the consequence of exchange rate

volatility on output growth. This suggests that as the financial depth of the economy improves and as more money is in circulation for economic activities, the impact of exchange rate volatility on the economy reduces. This is because adequate currency needed to support economic activities will be widely available and accessible, while its deficiency could heighten economic hardship thereby lowering output growth.

Column 3 measures the impact of stock market development (firms' access to raise fund from the public for business) on the economy's output using stock market capitalisation to GDP as a financial development indicator. Here, the coefficient of exchange rate volatility falls from -2.972 per cent to -2.915 per cent, though not significant. The observed decline in the negative effect of exchange rate volatility on output growth suggests that financial development helps in reducing liquidity cost associated with exchange rate volatility, which follows the study's theoretical prediction. In addition, the coefficient for MC was found to be -0.009 and significant. We can infer from this that, through the financing role of the stock market, the impact of exchange rate volatility can be lowered if firms have access to raise funds/finance needed to acquire equipment and facilities to boost their production level. The result obtained show that stock market development has an insignificant effect on output thus reflecting the underdeveloped nature of Nigeria's capital market. Given the import-dependent nature of Nigerian firms for factor input, as the exchange rate becomes more volatile, the amount needed to purchase input outside the country increases. However, through the stock market, they could raise fund to meet the required additional cost of purchasing input. Inability of firms to access fund through this market in the face of exchange rate volatility denotes reduction in acquisition of imported factor input and consequently output.

Column 4 Table 4 introduced credit to private sector to GDP, a measure of banks development, as financial development indicator. Here, the magnitude of the effect of exchange rate volatility on output growth reduced further to -2.869 per cent, showing that access to fund through this channel is relatively easier than stock market. Given the liquidity challenge associated with exchange rate volatility, provision of funds by banks and other financial institutions reduces firms' constraint consequently boosting their access to fund, increasing their activities as well as output.

The diagnosis test shows the appropriateness of the estimated models. The Adjusted R-Square for the estimated model ranges between 0.169 and 0.196. This suggests that more than half of the variation in output growth is captured in the study. The low value obtained does not invalidate the result since our concern is not to determine output growth but to examine whether through financial development, the impact of exchange rate volatility on output growth could be reduced. In both the normality test and the serial autocorrelation test, we accept the null hypothesis that the model is normal and free from serial autocorrelation problem.

V.3   Robustness Checks

In checking the sensitivity of our result to output growth measurement adopted, we use the growth of real per capita output as another measure of output growth. This measures growth in the output produced by each person in the economy. The robustness test result is similar to earlier result as presented in Table 5. It revealed that exchange rate volatility hinders output growth and that development of the financial sector leads to output growth and reduction in the impact of exchange rate volatility on output growth.

Table 5: The result of the Robustness

	1	2	3	4
EXRV	-2.902	-3.288	-2.830	-2.783
	(7.304)	(7.469)	(7.438)	(7.434)
M2		0.055		
		(0.139)		
MC			-0.011	
			(0.077)	
CPS				-0.003
				(0.134)
Openness	0.097**	0.094*	0.100*	0.097**
	(0.045)	(0.046)	(0.051)	(0.046)
IIP	0.054	0.045	0.058	0.062
	(0.039)	(0.045)	(0.048)	(0.050)
Constant	-7.434	-7.278	-7.842	-7.834
	(4.408)	(4.486)	(5.268)	(4.772)
Diagnosis test:				
R-square	0.264	0.268	0.265	0.266
Adj R-Square	0.193	0.171	0.167	0.168
F-statistics	3.716**	2.751**	3.956**	2.717**
Normality test (prob)	2.874	0.245	0.248	0.247
Breusch-Godfrey Serial autocorrelation test (prob)	0.177	0.206	0.194	0.182

*Note: the value in the parentheses is the Standard error. *, ** and *** denote significant at 10 per cent, 5 per cent and 1 per cent respectively. Source: Author's computation*

The empirical findings support the study's theoretical prediction on the role of financial development in reducing the effect of exchange rate volatility on output growth and as well confirm the significance of finance in bringing about output growth. Credit to private sector was found to have the highest influence in minimising the impact of exchange rate volatility on output growth. This supports the view that liquidity cost is associated with exchange rate volatility could be addressed through the financial market. In essence, as the market becomes more developed, more firms could access the market for the required fund. Bank development which is measured as credit to private sector as percentage of GDP was also found to be more effective in reducing exchange rate effect on output growth. This is because, due to volatility exchange rate, illiquid firm can easily acquire fund through banks compared to stock market.

Though contributing most to output growth, monetary aggregate (M2) as percentage of GDP which measures financial depth was found to contribute less in reducing the impact of exchange rate volatility on output growth. This measure centres on the availability of currency in circulation for economic activities not necessarily financial support. Since, the medium of exchange is done through currency, its impact was more felt on output growth directly.

VI.   Conclusion and Policy Recommendations

Development of the financial market has both a direct impact on output growth and an indirect effect by minimising the impact of exchange rate volatility. The development of the sector needs to be given more attention by policy makers as a driver of output growth.

The study results confirmed the importance of the financial sector development in reducing the negative effect of exchange rate volatility on output growth, reflecting the role of finance in the development of an economy. Based on different measures of financial development, this study reveals that the development of the banking sector, as measured by credit to private sector as share of GDP, helps in reducing the impact of exchange rate volatility more compared to financial deepening and stock market development.

Based on the study findings, we propose the following policy actions to cushion possible adverse effects of exchange rate volatility on output growth. The government should intensify their support to banks and other financial institutions in the country by facilitating loan provision so as to increase access to credit by firms. This recommendation should be followed with strict regulation and guidelines to avoid huge non-performing loan, which might undermine the role of financial sector in stimulating growth[2]. Furthermore, efforts towards enhancing trading activities on the floor of the Nigeria Stock Exchange should be encouraged as such could enhance its development and position it for raising capital for business activities.

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Impact of External Borrowing on Unemployment in Nigeria

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Abstract

This study examined the impact of to external debt on unemployment in Nigeria through the investment channel. The study adopted a system of equation approach where unemployment and investment are treated as mutually dependent variables in a two stochastic-equations model. The model was estimated using indirect least squares method. The findings show that external debt stock negatively but significantly affected unemployment indirectly through domestic investment. The main lesson derived herein is that external debt does not impact positively on the Nigerian economy because as external debt stock mounts, domestic investment is depressed due to crowding-out effects of debt service payments on domestic funds.

I.   Introduction

Unemployment rate is one of the key macroeconomic indices for gauging the wellbeing of any economy. It defines the percentage of total labour force who are willing but not able to gain employment at a particular time and prevailing wage rate. Unemployment in Nigeria became pronounced in the 1980s following Nigeria's persistent neglect of its real sectors occasioned by the oil boom of the 1970s. It reached an all-time high of 29.5 per cent in 2013. The National Bureau of Statistics (NBS) reported a rise in unemployment rate from 7.5 per cent in the first quarter of 2015 to 8.2 per cent in its second quarter and this represented a 9.58 per cent increase in unemployment. This left Nigeria with about 19.6 million between the ages of 18 and 65, who are either unemployed or underemployed by the second quarter of 2015 as compared with about 17.7million people in the first quarter of 2015 (NBS, 2015).

Unemployment has several adverse implications for an economy. It leads to low aggregate demand, erodes human capital, lowers individuals' self-esteem and confidence, widens inequality gap, exclusion and marginalization; furthermore, it breeds social dislocation, social unrest, conflicts, and consequently negative growth rate.

Literature recognises borrowing as an avenue for financing an economy and consequently, effectively engaging its productive resources. Nations incur external debts in line with the principle of loan finance, which rationalises loans as providing for intergenerational equity, pay as you use options, funds for capital formation, old age insurance, self-liquidating projects, and reduction of tax friction. Anyanwu (1993) averred that external borrowing may be considered as a second best alternative to money creation, especially during periods of unemployment. External borrowingcan be used to fill the domestic savings gap, especially in the face of dwindling government revenue It is a fiscal instrument that can be used to boost domestic investment and invariably grow the economy. It is also preferred to domestic borrowing, as the latter could crowd out domestic investment in the long-run.

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Nigeria's total debt stock has been on the increase having amounted to ₦11.243 trillion as at December 2014, rising to ₦12.60 trillion or $65.42 billion in December 2015. As at September 30, 2013, the external debt in Nigeria contributed about 13.59 percent to the total debt stock of N8.32 trillion compared to the figure as at December 31, 2012 which was ₦7.55 trillion. In 1970, external debt was at ₦488.8 million; ₦349.9 million in 1975; ₦1,866.8 million in 1980; and ₦100, 787.6 million by the second quarter of 1987 (DMO, 2016). Nigeria's external debt stock has been on the increase, and reached its all-time high in 2004 when it became a major source of concern. Following this, Nigerian government sought and obtained debt relief from Paris club in 2005 and this debt relief drastically brought down the country's debt profile. However, about a decade after obtaining this relief, Nigeria's external debt position is beginning to surge again, thus creating some level of worries among the policy makers and analysts. But more worrisome are the usefulness and the impact of the debt in the economy. Over the reference period, gross capital formation (used as a proxy for domestic investment in this study) has nose-dived while unemployment rates continue to rise as shown in Figure 1.

Figure 1: Growth Rate of Gross Capital Formation and Unemployment Rate in Nigeria (1980 – 2015)
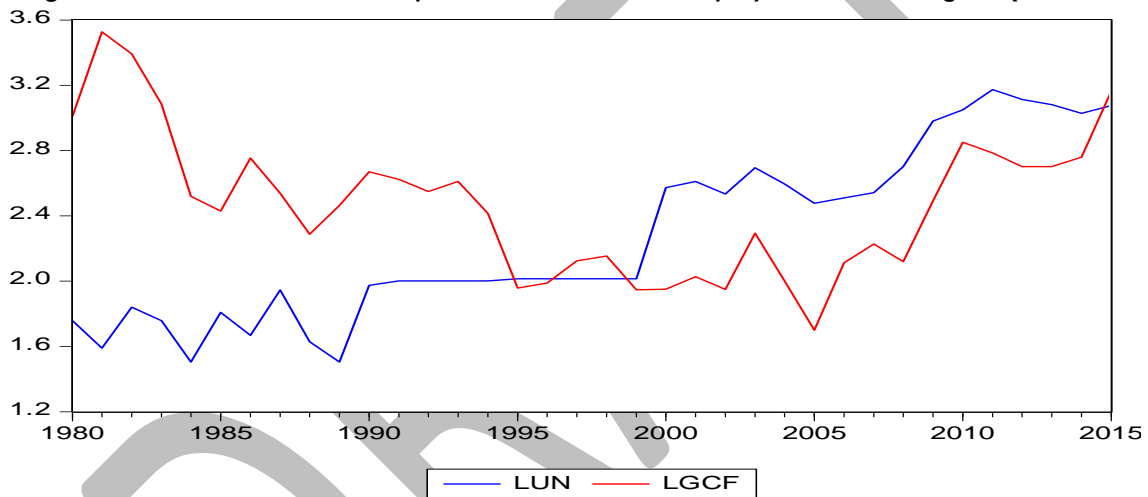
Source: Central Bank of Nigeria Statistical Bulletin (2015)

The Nigerian economy is battling with duo problems of increasing debt burden that exerts depressing effects on its gross capital formation and unemployment problem, occasioned by inadequate investment and production in the real sectors.

The main objective of this study is to determine the impact of external debt stock on unemployment in Nigeria and the justification for this study lies in the dearth of studies which engaged the simultaneous equation model in investigating the impact of external debt on unemployment in Nigeria while appreciating the indirect relationship between these two variables. To this end, the rest of the paper is structured into five sections. Following the introductory section is Section two which contains a review of relevant literature. Section three outlines the method of study. Section four presents and discusses the results while Section five concludes the study and proffers some policy recommendations.

II.   Review of Related Literature
II.1   Review of Basic Theories
II.1.1   James Buchanan Theory of Debt

Buchanan debt theory asserts that public debt is generally connected with the assertion that debt allows the burden of public activity to be moved onto future generations. This principle treats a generation as being unitary and Buchanan's preliminary point of study is in the consideration of the incidence of public debt. In providing answers to 'who pays for public debt, and when do they pay' he maintained that public debt constitutes a repression on future taxpayers. Since the essence of public debt is to provide opportunities for intended costs of currently financed expenditure projects to be postponed to the future, the interest of the tax payer is that public debt delays the necessity of transferring authority over resource to the treasury. In Buchanan's opinion, bond holders lend voluntarily by selecting from numerous investment opportunities, and in the future they get back their invested principal plus interest.

Buchanan debt theory draws a division between subjective and objective costs, arguing that the voter-taxpayer's conception of the cost of debt is based on his subjective evaluation of forgone alternatives at the moment of choice, rather than on the objective effect of future cash flows of interest and principal: *Cost or burden* is not meaningful except it can be transformed into effects on a number of economic agents at some time. The objective cost is the actual *burden* of debt which is the value of resources sacrificed by future taxpayers. The decision to incur debt, however, is made by present taxpayers, based on an evaluation of the subjective cost to them, which is negligible in the case of public debt (Wagner, 2014).

The relevance of Buchanan's theory is that if these debts incurred are unable to repay themselves, then the burden of debt becomes stronger on the future taxpayers, adversely affecting employment opportunities and ultimately increasing unemployment.

II.1.2   Theory of Debt Overhang

The theory of debt overhang migrated to international finance literature in the mid-1980s, when the debt crisis motivated a series of influential papers including that of Krugman (1988) and Sachs (1988, 1989). These authors argued that as sovereign states service their debt by taxing firms and households thereby incurring high levels of debt and this implies an increase in the private sector's expected future tax burden. Debt overhang makes out a situation in which this future debt burden is perceived to be very high that it is a disincentive to present investment, as investors think that the proceeds of any new project will be taxed-away for the service pre-existing debts. Lower levels of present investment, in turn, lowers growth and, for a given tax rate, it lowers government revenue; it lowers a country's ability to pay, and it lowers the expected value of the debt. Countries that suffer from debt overhang will not have net resource flows because, by definition, any new loan that might be issued would be worth less than its nominal value, and no new creditor will be willing to lend when a loss is certain.

The relevance of this theory lines in the fact that countries that suffer from debt overhang may also be placed on the wrong side of the *debt laffer curve* which is typified by a situation where partial debt cancellation reduces the expected tax burden. This can make both lenders and borrowers better off by raising investment and growth (while increasing the prospects of employment), and thus raises tax revenues and the value of

debt. The theory further maintains that debt cancellation requires a coordination mechanism that compels creditors to accept some losses and where this coordination mechanism is absent, each individual creditor will prefer to hold out while other creditors cancel part of their claims.

II.1.3 The Dual Gap Theory

This theory was propounded by the foremost works of Hollis Chenery and rests on the assumption that to achieve a reasonable level of development in an economy, investment is a key player. However, such investment cannot be successively achieved without huge domestic savings meaning that for a country to achieve a sustainable level of growth; huge domestic savings which translate into investment expenditures are required as this will increase the employment potentials of the country thereby reducing the rate of unemployment. However, in attaining comprehensive growth, domestic savings may be insufficient hence the need for borrowing. This implies that the combination of domestic savings, investment and external debts are explanatory factors to economic growth. The relevance of this theory is in its ability to link explanatory gap to desirable economic growth (by extension, increase in employment opportunities) through domestic investment. Therefore, this study adopts the dual gap theory as its theoretical framework.

II.2   Review of Empirical Literature

Scholars investigating external debt, domestic investment and unemployment relationship have concentrated on the impact of external debt on domestic investment on one hand and impact of domestic investment on unemployment on the other hand. One of such studies addressing the relationship between external debt stock and unemployment is Iyoha (1999) who examined the impact of external debt on economic growth in sub-Saharan African countries, using a small macroeconomic model for 1970-1994. The findings indicate that there is a significant effect of debt overhang on investment. He suggests that debt forgiveness could provide a much needed stimulus to investment recovery and economic growth in sub-Saharan Africa. Earlier, Borensztein (1990) studied debt overhang, debt reduction and investment and found that debt overhang had an adverse effect on private investment in Philippines. The effect was stronger when private debt rather than total debt was used as a measure of the debt.

Mbanga and Sikod (2001) investigated the impact of debt and debt service payments on investment in Cameroon using the ordinary least square method while engaging the country's time series data. The study finds that there exist a debt overhang and crowding out effects on private and public investments respectively in Cameroon. Were (2001) carried out a similar study on the impact of external debt on economic growth and private investments in Kenya, using error correction formulation and estimation. Again, the study finds evidence that there is a debt overhang problem in both the growth and investment equation.

Udeaja and Okeke (2005) examined the issue of external debt management in Nigeria, and the subsequent impact of external debt stock on economic growth and investment in Nigeria. Using the neoclassical production function estimated with the co-integration and error correction framework, the study reveals that debt flows has negative effect on

economic growth and investment in Nigeria. In a similar study, Ajisafe, Nassar, Fatokun, Soole and Gidado (2006) re-examined the causal relationship between external debt and foreign private investment (FPI) in Nigeria from 1970-2003. The study indicates that a bi-dimensional relationship exists between external debt and foreign private investment.

Onwuka, Oyinlola and Onwube (2009) looked into the effect of the size of foreign debt on the flow of foreign direct investment to Nigeria using the Johansen and Juselius maximum likelihood, co-integration technique and the fully modified ordinary least square method to estimate the long-run parameters using Nigerian times series data 1970 to 2008. The study finds that the size of the foreign debt was not an impediment to the flow of FDI to Nigeria. Ebi, Abu and Clement (2013) examined the relative potency of external domestic debts on economic performance in Nigeria, with emphasis on which of the debt types exert more influence on the major macroeconomic variables of per capita GDP and gross domestic investment. The result reveals that real exchange rate is a positive and significant determinant of economic growth while interest rate is a negative and significant determinant of domestic investment in Nigeria.

Recently, Igberi, Odo, Anoke and Nwachukwu (2016) studied the implications of rising public debt on unemployment in Nigeria. Using Nigerian times series data from 1980 to 2015, the auto regressive distributed lag model and the Wald test econometric analytical tools were employed and the study finds a long-run relationship between unemployment and that a 1 per cent increase in public debt brings about 1.6 per cent increase in unemployment rates rises. The foregoing brings to bare the death in the usage of the simultaneous equation model in investigating the impact of external debt on unemployment in Nigeria while appreciating the indirect relationship between these two variables, and thus serves as a justification for the present study.

III.   Methodology
III.1   Specification of Empirical Model

This section presents a macro econometric model consisting of two equations that aid the study of the effect of external debt on unemployment in Nigeria, through investment channel. These are the unemployment and gross capital formation equations incorporating external debt stock variable.

III.1.1 Unemployment Equation

In line with Baker (2011), Aurangzeb and Asif (2013) and Maqbool, Sattar and Bhalli (2013), this paper specify an unemployment equation thus:

$$UN = f(GDP, GCF, POPR, EXPR) \qquad (1)$$

When put in a stochastic and log linear form, the relationship is expressed as follows:

$$\overset{<0}{} \qquad \overset{<0}{} \qquad \overset{>0}{} \qquad \overset{<0}{}$$
$$LnUN_t = \beta_0 + \beta_1 LnGDP_t + \beta_2 LnGCF_t + \beta_3 LnPOPR_t + \beta_4 LnEXPR_t + U_t \qquad (2)$$

Where UN_t is unemployment rate at time t; GDP_t is gross domestic product at time t, which measures the size of the economy, GCF_t is gross capital formation; $POPR_t$ is population growth rate; $EXPR_t$ is the value of export earnings. U_t is a stochastic error term assumed to

be Gaussian white noise and Ln is natural logarithm. The variables are expressed in log form in order to standardise them and then interpret the coefficients as elasticities.

III.1.2 Gross Capital Formation Equation

In line with Iyoha (1999) and Kassu, Mishra and Asfaw (2014) a gross capital formation equation is specified as:

$$GCF = f(GDP, UN, TDS, EXPR) \tag{3}$$

Again, rendering Equation 3 stochastic and putting it in log linear form, the following relationship is obtained:

$$\begin{array}{cccc} >0 & <0 & >0 & <0 \end{array}$$
$$LnGCF_t = \Pi_0 + \Pi_1 LnGDP_t + \Pi_2 LnUN_t + \Pi_3 LnTDS_t + \Pi_4 LnEXPR_t + Z_t \tag{4}$$

Where GCF, GDP, UN and EXPR are as defined earlier. TDS is the total external debt stock in Nigeria and Z_t is the stochastic error term which is assumed to be Gaussian white noise, Ln is natural logarithm.

III.1.3 Simultaneous Equation Model of Unemployment and Gross Capital Formation Equations

In order to make explicit allowance for interaction between debt and unemployment in Nigeria, a simultaneous equation model is specified. A system of equation approach (simultaneous equation) is preferred to a single equation approach for some reasons:
   a. In our model (Equations 1 and 2) we have assumed that the dependent variables (UN and GCF) are not truly exogenous, but stochastic;
   b. The error term in each equation is not independent of the dependent variables. Specifically, the unemployment and gross capital formation equations are now considered as system of structural equations and the simultaneous equation system is given:

$$LnUN_t = \beta_1 lnGDP_t + \beta_2 LnGCF_t + \beta_3 LnPOPR_t + \beta_4 LnEXPR_t + U_t \tag{5a}$$

$$LnGCF_t = \Pi_1 LnGDP_t + \Pi_2 LnUN_t + \Pi_3 LnTDS_t + \Pi_4 LnEXPR_t + Z_t \tag{5b}$$

The intercepts are constrained in each of the structural equation in line with theory because retention of the intercept warrants the introduction of a dummy variable (Gujarati, 2004). From the structural equations above, the reduced form of the model can be derived. The reduced form model is the model in which the endogenous variables are expressed as a function of the predetermined variables only. It captures the total (direct and indirect) effect of the predetermined variables on the endogenous variables.

First, substituting the GCF function (Equation 4) into the UN function (Equation 2) to obtain the reduced form parameters for the unemployment equation, a new equation emerges:

$LnUN_t = \beta_1 lnGDP_t + \beta_2 (\Pi_1 LnGDP_t + \Pi_2 LnUN_t + \Pi_3 LnTDS_t + \Pi_4 LnEXPR_t + Z_t) + \beta_3 LnPOPR_t + \beta_4 LnEXPR_t + U_t$

$LnUN_t = \beta_1 lnGDP_t + \beta_2 \Pi_1 LnGDP_t + \beta_2\Pi_2 LnUN_t + \beta_2\Pi_3 LnTDS_t + \beta_2\Pi_4 LnEXPR_t + \beta_2 Z_t + \beta_3 LnPOPR_t + \beta_4 LnEXPR_t + U_t$

$LnUN_t - \beta_2\Pi_2 LnUN_t = \beta_1 lnGDP_t + \beta_2\Pi_1 LnGDP_t + \beta_2\Pi_3 LnTDS_t + \beta_4 LnEXPR_t + \beta_2\Pi_4 LnEXPR_t + \beta_3 POPR_t + \beta_2 Z_t + U_t$

$(1 - \beta_2\Pi_2)LnUN_t = (\beta_1 + \beta_2\Pi_1) LnGDP_t + \beta_2\Pi_3 LnTDS_t + (\beta_4 + \beta_2\Pi_4) LnEXPR_t + \beta_3 POPR_t + \beta_2 Z_t + U_t$

$$LnUN_t = \frac{\beta_1 + \beta_2\Pi_1}{1 - \beta_2\Pi_2}LnGDP_t + \frac{\beta_2\Pi_3}{1 - \beta_2\Pi_2}LnTDS_t + \frac{\beta_4 + \beta_2\Pi_4}{1 - \beta_2\Pi_2}LnEXPR_t + \frac{\beta_3}{1 - \beta_2\Pi_2}POPR_t + \frac{\beta_2 Z_t + U_t}{1 - \beta_2\Pi_2}$$
(6)

Explicitly, the unemployment equation in its reduced form is expressed as:

$$LnUN_t = \Phi_1 LnGDP_t + \Phi_2 LnTDS_t + \Phi_3 LnEXPR_t + \Phi_4 LnPOPR_t + \varepsilon_{1t} \qquad (7)$$

Where:

$$\Phi_1 = \frac{\beta_1 + \beta_2\Pi_1}{1 - \beta_2\Pi_2}; \Phi_2 = \frac{\beta_2\Pi_3}{1 - \beta_2\Pi_2}; \Phi_3 = \frac{\beta_4 + \beta_2\Pi_4}{1 - \beta_2\Pi_2}; \Phi_4 = \frac{\beta_3}{1 - \beta_2\Pi_2}; \varepsilon_{1t} = \frac{\beta_2 Z_t + U_t}{1 - \beta_2\Pi_2}$$

The Φ's are the reduced form coefficients. Substituting the unemployment function (Equation 2) into the gross capital formation function (Equation 4), the reduced form parameters for the unemployment equation is obtained as.

$LnGCF_t = \Pi_1 LnGDP_t + \Pi_2 (\beta_1 lnGDP_t + \beta_2 LnGCF_t + \beta_3 LnPOPR_t + \beta_4 LnEXPR_t + U_t) + \Pi_3 LnTDS_t + \Pi_4 LnEXPR_t + Z_t$

$LnGCF_t = \Pi_1 LnGDP_t + \Pi_2\beta_1 lnGDP_t + \Pi_2\beta_2 LnGCF_t + \Pi_2\beta_3 LnPOPR_t + \Pi_2\beta_4 LnEXPR_t + \Pi_2 U_t + \Pi_3 LnTDS_t + \Pi_4 LnEXPR_t + Z_t$

$LnGCF_t - \Pi_2\beta_2 LnGCF_t = \Pi_1 LnGDP_t + \Pi_2\beta_1 lnGDP_t + \Pi_2\beta_3 LnPOPR_t + \Pi_4 LnEXPR_t + \Pi_2\beta_4 LnEXPR_t + \Pi_3 LnTDS_t + \Pi_2 U_t + Z_t$

$(1 - \Pi_2\beta_2) LnGCF_t = (\Pi_1 + \Pi_2\beta_1) LnGDP_t + \Pi_2\beta_3 LnPOPR_t + (\Pi_4 + \Pi_2\beta_4) LnEXPR_t + \Pi_3 LnTDS_t + \Pi_2 U_t + Z_t$

$$LnGCF_t = \frac{\Pi_1 + \Pi_2\beta_1}{1 - \Pi_2\beta_2}LnGDP_t + \frac{\Pi_2\beta_3}{1 - \Pi_2\beta_2}LnPOPR_t + \frac{\Pi_4 + \Pi_2\beta_4}{1 - \Pi_2\beta_2}LnEXPR_t + \frac{\Pi_3}{1 - \Pi_2\beta_2}LnTDS_t + \frac{\Pi_2 U_t + Z_t}{1 - \Pi_2\beta_2} \quad (8)$$

Explicitly, the gross capital formation equation in its reduced form is expressed as:

$$LnGCF_t = \Theta_1 LnGDP_t + \Theta_2 POPR_t + \Theta_3 LnEXPR_t + \Theta_4 LnTDS_t + \varepsilon_{2t} \qquad (9)$$

Where:

$$\Theta_1 = \frac{\Pi_1 + \Pi_2\beta_1}{1 - \Pi_2\beta_2}; \Theta_2 = \frac{\Pi_2\beta_3}{1 - \Pi_2\beta_2}; \Theta_3 = \frac{\Pi_4 + \Pi_2\beta_4}{1 - \Pi_2\beta_2}; \Theta_4 = \frac{\Pi_3}{1 - \Pi_2\beta_2}; \varepsilon_{2t} = \frac{\Pi_2\mu_{1t} + \mu_{2t}}{1 - \Pi_2\beta_2}$$

And the Θ's are the reduced form coefficients.

The reduced form equations of Equations 7 and 9 measure the total effect of the explanatory variable on the dependent variable. This total effect is decomposed into direct and indirect effects and this is summarised on Table 1.

Table 1: Unemployment Model (Equation 7)

Variable	Total Effect	Direct Effect	Indirect Effect	Expectation
$LnGDP_t$	$\beta 1 + \dfrac{\beta 2\,\Pi 1}{1 - \beta 2\Pi 2}$	$\beta 1$	$\dfrac{\beta 2\,\Pi 1}{1 - \beta 2\Pi 2}$	< 0
$LnTDS_t$	$\dfrac{\beta 2\Pi 3}{1 - \beta 2\Pi 2}$	-	$\dfrac{\beta 2\Pi 3}{1 - \beta 2\Pi 2}$	-
$LnEXPR_t$	$\beta 4 + \dfrac{\beta 2\Pi 4}{1 - \beta 2\Pi 2}$	$\beta 4$	$\dfrac{\beta 2\Pi 4}{1 - \beta 2\Pi 2}$	< 0
$POPR_t$	$\beta 3 + \dfrac{1}{1 - \beta\, 2\Pi 2}$	$\beta 3$	$\dfrac{1}{1 - \beta\, 2\Pi 2}$	< 0

Source: Authors' compilation

Table 2: Gross Capital Formation Model (Equation 9)

Variable	Total Effect	Direct Effect	Indirect Effect	Expectation
GDP_t	$\Pi 1 + \dfrac{\Pi 2\beta 1}{1 - \Pi 2\beta 2}$	$\Pi 1$	$\dfrac{\Pi 2\beta 1}{1 - \Pi 2\beta 2}$	> 0
$POPR_t$	$\dfrac{\Pi 2\beta 3}{1 - \Pi 2\beta 2}$	-	$\dfrac{\Pi 2\beta 3}{1 - \Pi 2\beta 2}$	-
$EXPR_t$	$\Pi 4 + \dfrac{\Pi 2\beta 4}{1 - \Pi 2\beta 2}$	$\Pi 4$	$\dfrac{\Pi 2\beta 4}{1 - \Pi 2\beta 2}$	> 0
TDS_t	$\Pi 3 + \dfrac{1}{1 - \Pi 2\beta 2}$	$\Pi 3$	$\dfrac{1}{1 - \Pi 2\beta 2}$	> 0

Source: Authors' compilation

III.2   Model Identification

Here, the problem of identification precedes the problem of estimation. The essence of identification is to ascertain whether one can obtain unique numerical estimates of the structural coefficients from the estimated reduced-form coefficients. The order condition for identification reveals that both equations are exactly identified. The reduced form models indicate that there exist eight reduced form parameters, when zero restriction is imposed on the constant terms. There are also eight structural parameters. This result implies that the model is exactly identified.

III.3   Estimation Procedure/Techniques

Prior to the estimation, the stationarity status of the variables that entered the model was ascertained to forestall the incidence of spurious regression. In order to test for stationarity, the Ng-Perron modified test statistics was used. Ng and Peron (2001) proposed some modifications to the Phillips (1987)'s test (MZa), Phillips and Perron (1988)'s test (MZt), Bhargava (1986)'s test (MSB), and Elliot, Rothenberg and Stock (1996)'s point optimal test (MPT). These tests (MZa, MZt, MSB and MPT) now constitute the four test statistics in Ng-Perron approach. After that co-integrating regression was obtained from the normalised coefficients of the model generated from the co-integrating vector. In all, the diagnostic tests of the stochastic properties of the models were carried out. Given that the model is exactly identified, the system of equations was estimated using the method of Indirect Least Squares (ILS). First, each of the structural equations was estimated to account for the direct impact of the explanatory variables on the dependent variable. Second, the reduced equation versions of the model (Equations 7 and 9) were estimated. The Wu-Hausman test of endogeneity of the regressors was also employed.

III.4   Sources and Measurement of Data

This study used annual time series spanning from 1980 to 2015 for Nigeria. The data set was sourced from Central Bank of Nigeria Annual Bulletin various issues, World Bank Development indicators (WBDI) and the World Economic Outlook.

GDP is gross domestic product which is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resource. It measures the size of the economy. The gross domestic product is expressed in billions of naira. POPR is the growth rate of population measured as annual population growth rate. Population measure is based on the *de facto* definition of population, which counts all residents regardless of legal status or citizenship. GCF is the Gross capital formation which consists of outlays in additions to the fixed assets of the economy plus net changes in the level of inventories. The GCF is measured as the percentage of GDP expressed in billions of natural currency. TDS is the total external debt stock measured as the total of external debt stock. TDS is expressed in billions of domestic currency. EXPR is the export earnings measured as the total receipt for export of goods and services expressed in billions of natural currency.

IV.   Empirical Results and Discussion
IV.1   Summary Statistics

The summary statistics takes a look at the behaviour of the individual variables overtime. Specifically, the individual variable's mean values, standard deviation, and the maximum and minimum values are shown on Table 3.

Table 3 reveals that the average value of Nigeria's external debt outstanding between 1980 and 2015 was ₦1,098.933 billion (recall that Nigeria's external debt stock reached on time high in 2004 with a value of ₦4,890.270). The average value of gross capital formation and unemployment over these periods were about ₦13.03 billion and 11.2 per cent respectively, these values implies that on the average GCF takes 11.8 per cent share of the GDP. The highest rate of unemployment during this period was 23.9 per cent. These unemployment values are higher than the acceptable unemployment rates of between 4.5 per cent and 5.5 per cent. This result implies that on the average, Nigeria is not operating at full employment level. GDP, export income and population growth rate had average values of ₦6,395, 7.49 and 0.95 respectively. In other words, the average size of Nigerian economy is ₦6,394.94, while the average export earning is about ₦1,790.05 and average population growth rate was about 2.60 per cent during this period. The skewness results indicate that the series are normally distributed since the asymmetry (skewness) of each variable lies between -2 and +2 (i.e. ±2).

Table 3: Descriptive Statistics for the Variables (1980 – 2015)

	TDS	GCF	GDP	EXPR	POP	UN
Mean	1098.93	13.03	6394.68	1790.05	2.60	11.12
Max.	4890.27	34.02	15347.21	1500.	30.86	23.90
Min.	1.87	5.47	3038.04	502.50	2.50	4.50
Ste Dev.	1339.14	6.42	3666.89	608	0.08	6.06
Skewness	1.52	1.54	1.08	1.02	0.86	0.81
Obs.	36	36	36	36	36	36

Source: Authors' computation using E-view 8.0

We also use the Hodrick - Prescott filter to decompose our main series (unemployment, external debt stock and gross capital formation) into trend and cyclical components. The HP filter helps to remove a cyclical component of a time series from raw data in order to obtain a smoothed curve representation of a time series, one that is more sensitive to long term than to short term fluctuation. The results are shown in the figures that flow.

Figure 2: Cycles/Variation in Unemployment Rate in Nigeria
Hodrick-Prescott Filter (lambda=100)
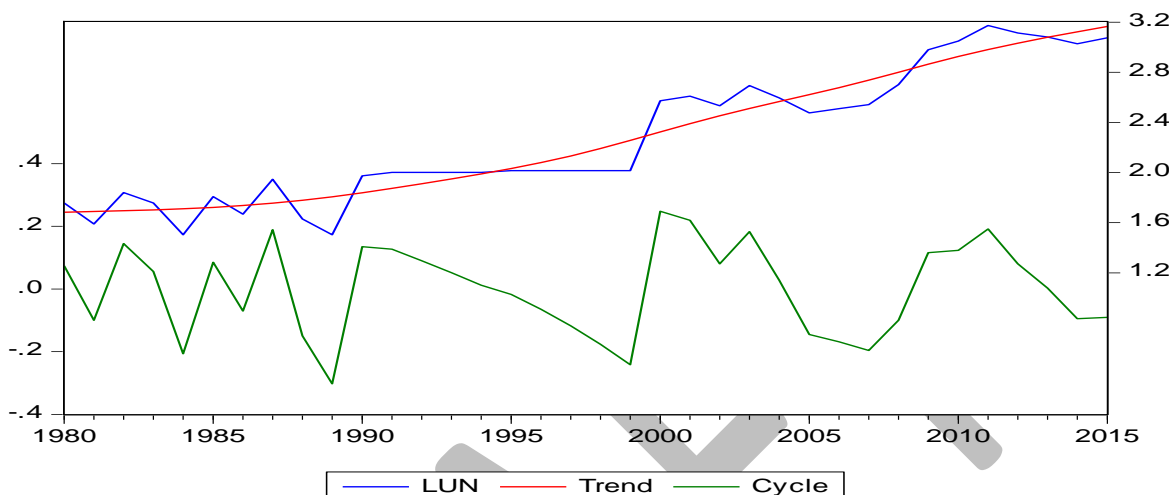
Source: Authors' computation using E-view 8.0

On Figure 2, the trend component of the series reveals that unemployment rate in Nigeria has been on the rise. Evidently, the 1980s and the early 1990s witnessed mild unemployment rate, somewhere between 4.5 per cent and 6 per cent. Starting from the mid- 1990s upward, unemployment has been growing in the country. On the other hand, the cyclical component of unemployment which is about its long-term growth paths, representing the real business cycles or the fluctuations in the economy shows that unemployment rate exhibit serious cyclical fluctuations.

Figure 3 shows both the trend and cyclical components of external debt stock in Nigeria from 1980 to 2015. The trend component reveals that the external debt stock exhibits somewhat an n-shaped parabola.

Figure 3: Cycles/Variation in External Debt Stock in Nigeria
Hodrick-Prescott Filter (lambda=100)
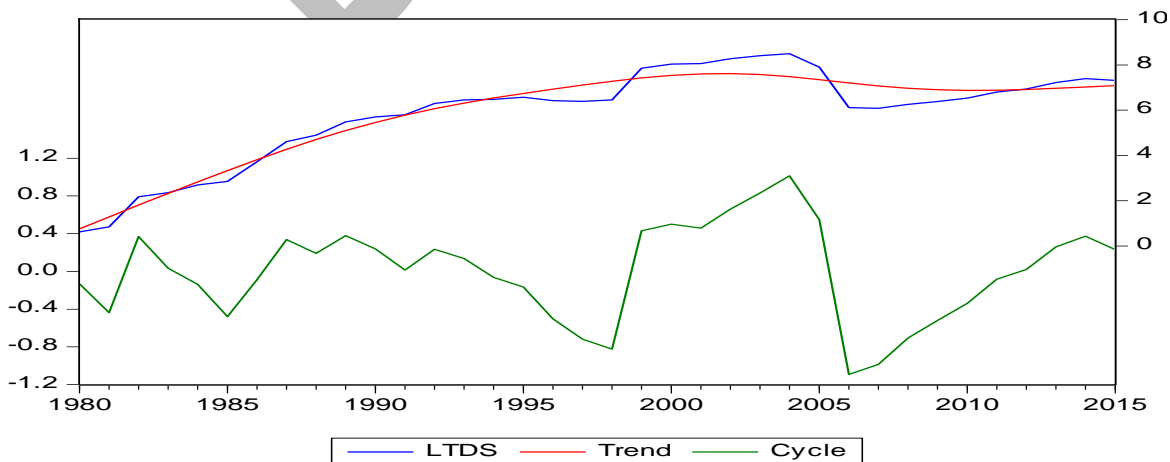
Source: Authors' computation using E-view 8.0

From Figure 3, external debt stock has been on the increase and reached its peak in 2014, then stated declining. This fall in external debt stock is solely due to the debt relief granted the Nigerian government by the Paris club. In October 2005, Nigeria and the Paris Club announced a final agreement for debt relief worth $18 billion and an overall reduction of Nigeria's debt stock by $30 billion. The deal was completed on April 21, 2006, when Nigeria made its final payment and its books were cleared of any Paris Club debt. On the other hand, the cyclical component shows that unemployment rate exhibit serious cyclical fluctuations.

Figure 4: Cycles/Variation in Gross Capital Formation in Nigeria
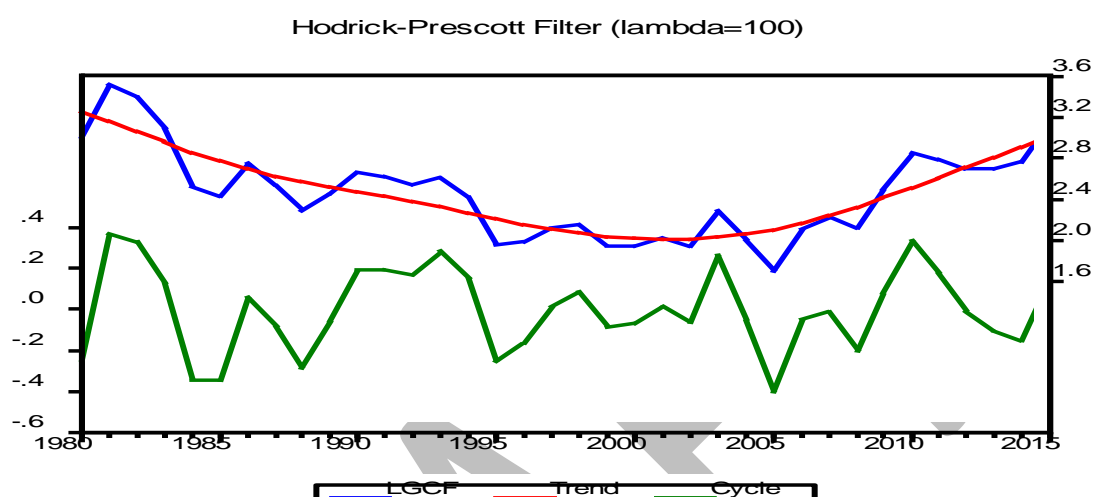
Source: Authors' computation using E-view 8.0

Figure 4 shows both the trend and cyclical components of gross capital formation in Nigeria from 1980 to 2015. The trend component reveals that the external debt stock exhibits somewhat a U-shaped parabola indicating that the gross was falling up to a certain level and then begin to rise. The cyclical component which is about its long-term growth paths, representing the real business cycles in the economy has been fluctuating.

IV.2   Unit Root Test

The unit root test result using modified Ng-Perron approach is presented on the Table 4:

Table 4: Summary of Ng–Perron Modified Unit Root Test

Variable	MZa	MZt	MSB	MPT	I(d)
ΔLnTDS	-15.5399***	-2.7755***	0.1786**	1.6213**	I(1)
ΔLnGDP	-10.2315**	-2.2528**	0.2202**	2.4295**	I(1)
ΔLnUN	-16.6463**	-2.8780***	0.1729***	1.4976***	I(1)
ΔLnGCF	-12.7480**	-2.5065**	0.1966**	1.9919**	I(1)
LnEXPR	-16.8962***	-2.9011***	0.1717***	1.4701***	I(1)
ΔLnPOPR	-7.1229*	-1.8206*	0.2556*	3.6726*	I(1)
1 per cent	-13.8000	-2. 58000	0.17400	1.78000	
5 per cent	-8.10000	-1.98000	0.23300	3.17000	
10 per cent	-5.70000	-1.62000	0.27500	4.45000	

Note ***, ** and * denote significance at 1 per cent, 5 per cent and 10 per cent significant levels respectively

Source: Authors' computation using E-view 8.0

On Table 4, we present the result of Ng-Perron unit root test. The result shows that all the variables are stationary at first difference and are integrated of order one. This result provides the basis to investigate the possibility of co-integration among the variables.

IV.3   Co-integration Test

The study adopted the Johansen multivariate co-integration technique and the results for the two structural equations are presented thus:

Table 5: Summary of Co-integration Result (Equation 2)

H_0	H_1	Trace stat.	5 per cent critical value	P-value	$\lambda - Max$	5 per cent critical value	P-value
$r \leq 0$	$r = 1$	82.72**	69.82	0.0033	40.05**	33.88	0.0081
$r \leq 1$	$r = 2$	42.67	47.86	0.1409	23.55	27.58	0.1511
$r \leq 2$	$r = 3$	19.11	29.80	0.4848	13.73	21.13	0.3878
$r \leq 3$	$r = 4$	5.39	15.49	0.7666	3.83	14.26	0.8769

*Note: ***** denotes significant at 5 per cent level*
Source: Authors' computation using E-view 8.0

The co-integration test using the Trace Statistic and Maximum Eigen values indicate one co-integrating equation at 5 per cent significant level. This finding implies that the null hypothesis of no co-integrating equation is rejected at 5 percent significant level. Hence this study concludes that there is a long-run relationship among variables (unemployment; gross domestic product; gross capital formation; population growth and export earnings) in Nigeria over the period 1980 to 2015. This result suggests that these variables are moving together over the period, and hence are policy instruments.

Table 6: Summary of Co-integration Result (Equation 4)

H_0	H_1	Trace stat.	5 per cent critical value	P-value	$\lambda - Max$	5 per cent critical value	P-value
$r \leq 0$	$r = 1$	82.57**	69.81	0.0034	33.11	33.88	0.0615
$r \leq 1$	$r = 2$	49.46**	47.86	0.0350	28.14**	27.58	0.0425
$r \leq 2$	$r = 3$	21.32	29.80	0.3377	11.58	21.13	0.5895
$r \leq 3$	$r = 4$	9.75	15.49	0.3008	6.49	14.26	0.5507

*Note: ***** denotes significant at 5 per cent level*
Source: Authors' computation using E-view 8.0

While the Trace Statistic indicates one co-integrating equation at 5 per cent significant level, the Maximum Eigen statistic indicates no co-integrating equation at 5 per cent significant level. Relying on the trace statistic value, this study rejects the null hypothesis of co-integration and concludes that there is a long-run relationship among these variables: gross capital formation, unemployment, gross domestic product, export earnings and external debt stock. This result suggests that these variables are moving together over the period, and hence are policy instruments.

Having established the existence of co-integration the identified model is estimated using the indirect least squares (ILS) approach. The estimates of the structural model of equations 5 are also expressed.

IV.4   Estimation by Indirect Least Squares Method (ILS)[1]

This section presents the total effect from reduced form coefficients: The direct and indirect effects. In decomposition, the total effects are equal to the direct effects plus the indirect effects. The direct effects are those influences unmediated by any other variable in the model while the indirect effects are mediated by at least one intervening variable. The results are shown in Tables 7 and 8.

Table 7 reveals that the total effect of GDP on unemployment is positive and statistically significant. A percentage rise in GDP will cause unemployment to rise by about 0.47 per cent. This result is not in tandem with our a priori expectation. Theoretically, unemployment is expected to fall as output rises, since rise in output is occasioned by rise in employment. The contradiction aptly describes the Nigeria's economic environment, where unemployment rate rises with rise in gross domestic production. Perhaps, this can be attributed to the phenomenon of un-inclusive growth that is prevalent in almost all of the developing economies. Decomposing the total effect into direct and indirect effects reveals that the direct effect of GDP on unemployment, though still positive is insignificant. Also, the result shows that the indirect effect of GDP on unemployment in Nigeria is positive, and mediated by two other intervening variables in our model – gross capital formation and unemployment itself.

Table 7: Unemployment Model (Equation 7)

Variable	Coef.	total effect	direct effect	indirect effect	expectation[2]	outcome
$LnGDP_t$	Φ_1	0.470**	0.156	0.314	< 0	> 0
		(0.185)	(0.185)			
		[2.547]	[0.843]			
$LnTDS_t$	Φ_2	-0.064**	nil	-0.064**	>0	< 0
		(0.031)				
		[-2.044]				
$LnEXPR_t$	Φ_3	0.134**	0.170**	-0.036**	< 0	> 0
		(0.039)	(0.036)			
		[3.455]	[4.687]			
$POPR_t$	Φ_4	-3.338**	2.378**	-5.716**	> 0	mixed
		(1.273)	(1.147)			
		[-2.623]	[2.073]			
		R^2 = 0.86	*R^2 = 0.88*			
		DW = 1.89	*DW = 1.62*			

*Note: ** denotes significant at 5 per cent level, standard error in ( ) and t-statistics in [ ]. [2]the expectation is based on the signs of total and direct effects.*
Source: Authors' computation using E-view 8.0

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[1] The estimates of the structural equations are:
LÛN = 0.1560*LGDP − 0.381*LGCF + 2.378*LPOPR + 0.170*LEXPR
          (0.185)   (0.104)   (1.147)   (0.036)
          [0.842]   [-3.651]   [2.073]   [4.687] R^2 = 0.88, DW = 1.62   (equation 5a)
LGĈF = 0.484*LGDP − 0.617*LUN − 0.096*LTDS − 0.192*LEXPR
          (0.036)   (0.186)   (0.038)   (0.051)
          [13.52]   [-3.310]   [-2.549]   [-3.795] R^2 = 0.72, DW = 1.53   (equation 5b)

External debt stock affects unemployment indirectly through gross capital formation. Our result shows that the indirect effect of external debt stock on unemployment is negative and statistically significant. This suggests that as Nigeria's external debt stock mounts, investment falls as a result of debt services which crowds out funds. And a fall in investment will cause unemployment to rise. The estimates of the structural model reveal that one percent rise in investment will cause unemployment to fall by about 0.38 per cent.

The total and direct impacts of export earnings on unemployment in Nigeria for the period are positive and statistically significant. A percentage rise in export earnings will cause unemployment rise by 0.13 per cent and 0.17 per cent. Their signs contradict our theoretical expectation. This behaviour of export earnings (total and direct effects) vis-à-vis unemployment in Nigeria raises two pertinent questions (1) what do we produce in Nigeria? (2) And how do we produce? Nigeria is an import dependent economy that export mainly one line of product — crude oil. This implies that most of our export earnings are from oil export. The production of oil is capital intensive and there is a great tradeoff between labour-use and capital-use. Using more capital will mean using less labour and this probably could be the reason why unemployment has been on the increase in Nigeria amidst increasing export earnings. The indirect effect on the other hand is negative and statistically significant. The indirect effect of export earnings on unemployment rate in Nigeria is mediated by gross capital formation.

The combined effect of population growth on unemployment in Nigeria is negative and statistically significant. Though not as expected, the result indicates that one percent increase in population growth will cause unemployment rate to fall by about 3.34 per cent. While the direct effect of population growth on unemployment is positive and statistically significant as expected, the indirect effect mediated majorly by gross capital formation is negative and statistically significant. Evidently, the negative effect of rising population on unemployment is driven by the intervening variables. This further indicates the dampening effects a fall in investment exerts on employment generation.

Table 8: Gross Capital Formation Model (Equation 9)

Variable	Coef.	total effect	direct effect	indirect effect	expectation[3]	outcome
$LnGDP_t$	Θ_1	0.822** (0.241) [3.414]	0.484** (0.036) [13.52]	0.338**	< 0	> 0
$POPR_t$	Θ_2	2.391 (1.6510) [-1.441]	nil	2.391	> 0	> 0
$LnEXPR_t$	Θ_3	-0.116** (0.051) [-2.289]	-0.192** (0.051) [-3.795]	-0.308**	< 0	> 0
$LnTDS_t$	Θ_4	-0.137** (0.041) [-3.336]	-0.096 (0.038) [-2.549]	-0.233**	< 0	< 0
		$R^2 = 0.64$ DW = 1.77	$R^2 = 0.72$ DW = 1.53			

*Note: *** denotes significant at 5 per cent level, standard error in ( ) and t-statistics in [ ]. [3]the expectation is based on the signs of total and direct effects*
Source: Authors' computation using E-view 8.0

Table 8 reveals that the total effect of GDP on gross capital formation (investment) is positive and statistically significant. One percent rise in GDP will cause gross capital formation to rise by about 0.82 per cent. This is in tandem with our a priori expectation. Decomposing the total effect into direct and indirect effects reveals that the direct and indirect effect of GDP on gross capital formation, are also positive and significant. The indirect effect of GDP on gross capital formation is mediated by GDP and unemployment in our model.

Population growth here affects investment indirectly through unemployment. The estimate of the structural model shows that the effect of population growth on unemployment is positive and statistically significant, while unemployment affects investment negatively. This suggests that as Nigeria's population increases, unemployment also rises. And a rise in unemployment rate will cause investment to plummet. The estimates of the structural model reveal that one percent rise in unemployment will cause investment to fall by about 0.62 per cent.

The total and direct impacts of export earnings on gross investment in Nigeria for the period are negative and statistically significant. This outcome is contrary to our expectation as theoretically, it is expected that investment should rise with rise in export earnings. Findings show that one percent rise in export earnings causes investment to decline by 0.12 per cent and 0.19 per cent respectively. The indirect effect of export earnings (mediated by gross capital formation and unemployment) on investment is also negative and statistically significant.

The combined effect of external debt stock on investment in Nigeria is negative and statistically significant. Contrary to expectations, the result indicates that a percentage increase in debt stock will cause investment to fall by about 0.14 per cent. The direct and indirect effects of debt stock on investment are also is negative and statistically significant as expected. The indirect effect of debt stock on investment is mediated majorly by unemployment and investment. This further indicates the dampening effect of a rising debt stock on investment in Nigeria.

Some assumptions informed the methodological approach adopted in this study. For instance, in our modeling we have assumed explicitly that unemployment rate and gross capital formation are not mutually independent (there is simultaneity), while the other variables (gross domestic product, external debt stock, export earnings and population growth rate) are truly exogenous. To substantiate this claim, tests for simultaneity (endogeneity) and exogeneity are conducted. The paper followed the Hausman's specification error test procedure and the result is shown here:

Table 9: Test for simultaneity (Endogeneity) of the Model

Dependent Variable: LGCF
Included observations: 36

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LUN-CAP	-0.128948	0.147610	-0.873573	0.3887
ERROR TERM	0.473876	0.123350	3.841719	0.0338
C	2.762462	0.343353	8.045540	0.0000

Source: Authors' computation using E-view 8.0

From the result on Table 9, the coefficient of error term 0.47 is statistically significant at 5 per cent significant level. This result implies that unemployment rate and gross capital formation are not mutually independent, and suggests that unemployment rate and error term ($\varepsilon 1t$) in equation 7 are correlated, thus rendering unemployment rate stochastic in that model. By and large, OLS estimation technique will yield biased and inconsistent estimates; hence, the choice of indirect least square (ILS) is in order.

V.   Conclusion and Policy Recommendations

This study examined the impact of external debt stock on unemployment in Nigeria through the investment channel. The complete simultaneous equations model consisted of two equations (unemployment and investment functions). The simultaneous equations model was estimated using the indirect least squares techniques. First, the study estimated each of the structural equations to account for the direct impact of the explanatory variables on the dependent variable, and the structural equations for the direct effect. Second, the study estimated a reduced form equation to obtain the total effects. The indirect effects are the differences between the total and direct effects.

The study finds, among other things, that external debt stock affects unemployment indirectly through gross capital formation. Result shows that the indirect effect of external debt stock on unemployment is negative and statistically significant. This suggests that as Nigeria's external debt stock mounts, investment falls. This finding is in line with the earlier finding by Iyoha (1999) that there is a significant debt overhang effect as well as a *crowding out* effects of external debt on investment. This study also confirms that an excessively high stock of external debt depresses investment, dampens employment rate and lowers growth.

Accordingly, there is a need for Nigerian government to articulate strategies for bringing about debt reduction, such as seeking multi - year rescheduling rather than year – by – year basis. Well considered and transparent guidelines for external loans should be developed and followed. Such guidelines should define the purpose of the loan, its duration, moratorium requirements and commitments, negotiation fees and so on, including the conditions under which the government can approve and guarantee such loans.

Another strategy is for government to devise other means of financing its programmes, instead of rushing to borrow each it runs out of cash. It does appear that external borrowing has not helped in Nigeria. Though, borrowing in itself is not wrong. But borrowing for consumption is, since there is a strong trade-off between consumption and investment, especially in countries that are still overloaded with infrastructural and institutional problems. A naira earned and consumed today is investment denied; the consequence is towering unemployment rate in the country today.

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The Effects of Currency Fluctuation on Economic Activity in Nigeria

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Abstract

The study examined the effects of currency fluctuation on economic activity in Nigeria, using quarterly data for the period 1995q1-2015q2. The result showed that fluctuations in output growth are driven by overvaluation of exchange rates and government spending. The impact of exchange rate devaluation is not significant in explaining variation in output, but devaluation of exchange rate has lagged effect on domestic prices, implying that devaluation of exchange rate has pass-through effect on inflation rate with lag effect. Furthermore, both current and lagged overvaluation of exchange rates impacted significantly on price inflation

I.   Introduction

The debate on appropriate exchange rate policy in the face of external and domestic shocks in most developing countries has been ongoing. This debate remains an important discourse in the policy circle, because fluctuations in exchange rate have grave consequences on output, inflation and other components of aggregate demand (Kandil et al., 2007). Exchange rate is a price and an important tool of macroeconomic policy management. As such it is a major factor in determining the volume of imports and exports of goods and services. It also plays an important role in the welfare of the citizens of any nation. Exchange rate is also a major element in determining the cost and returns on foreign investment. Thus, changes in exchange rate have implications for macroeconomic performance.

Episodes of falling oil prices have intensified the fluctuations in exchange rates in most oil exporting countries, including Nigeria. Oil price shocks have contributed significantly to reduction in government revenue, decline in the level of external reserves and depreciation in the exchange rate of *naira*. For example, from ₦155/US$1 in November 2014, the naira steadily depreciated to ₦197/US$1 in February 2015. Among measures to restore stability in the foreign exchange market, the Bank imposed a limit on foreign currency withdrawal outside Nigeria. It also restricted access to foreign exchange for the importation of some 41 items and reduced the amount sold to Bureau De Change (BDCs). Despite these measures, high demand for foreign exchange continued. Also, the premium between the official and BDC exchange rates continued to widen, giving impetus for rent-

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seeking activities in the foreign exchange market. This scenario has generated great concern among policy makers.

In view of the foregoing, this study sets out to investigate the asymmetry effect of currency depreciation on economy, specifically on real output growth, price inflation and aggregate demand in Nigeria.

Following the introduction, the rest of the paper is structured as follows: section two focuses on the theoretical framework and reviews empirical literature. Section three, reviews foreign exchange management in Nigeria and its impact on macroeconomic fundamentals. The fourth section discusses data sources and method of analysis. The empirical analysis, interpretation and discussion of results are contained in section five. The last section of the study concludes and proffers policy recommendations.

II.   Literature Review

Exchange rate is a key macroeconomic variable in the context of general economic policy making and economic reform programmes. It is defined as the rate at which one currency will be exchanged for another. Two broad concepts of exchange rate are commonly identified: Nominal Exchange Rate (NER) and Real Exchange Rate (RER). NER is the price of one currency in terms of another currency and can be viewed in two ways: (1) as the price of a foreign currency in terms of the units of the local currency, and (2) as the price of local currency in terms of units of a foreign currency. The real exchange rate (RER) is defined as the ratio of the price level abroad and the domestic price level, where the foreign price level is converted into domestic currency units via the current nominal exchange rate. In contrast to the nominal exchange rate, the real exchange rate is always "floating", since even in the regime of a fixed nominal exchange rate , real exchange rate can move via price-level changes.

Devaluation and depreciation are concepts that are often wrongly used interchangeably likely because both refer to a reduction in value of a national currency relative to foreign countries'. However, the difference between the two arises from the method of arriving at the reduction in the foreign exchange values of the local currency. For devaluation which is the relevant concept under a fixed exchange rate regime, the government or the monetary authority deliberately reduces the foreign exchange value of the national currency whose exchange rate was fixed. On the other hand, depreciation applies to currencies that are floating. It refers to a reduction in the foreign exchange value of a national currency as a result of the operation of the market forces of demand and supply as obtained in a flexible exchange rate system (Obadan, 2012).

Depreciation in exchange rate could stimulate economic activities and growth by increasing the price of imported goods relative to domestically produced goods. It can also reduce the price of exports, thereby stimulating export growth and earnings. It has expansionary effect that would stimulate aggregate demand and output by bringing about a substitution of foreign goods for home produced goods through changing relative prices. It has, however, been argued in the literature that the change in the relative prices of foreign goods could adversely affect the terms of trade and reduce the gains from

trade. Therefore, currency depreciation could lead to substitution and income effects. Both effects could reduce the demand for imports and increase foreign demand for exports. Also, depreciation of local currency could reduce balance of payment deficit if the Marshall-Lerner condition which requires the sum of the elasticities of import demand and foreign export demand to exceed unity is satisfied (Meade, 1951).

On the other hand, currency depreciation could also have negative effect on growth of economic activity. For a country that is highly import dependent, with less diversification of the local productive base like Nigeria, depreciation could have a negative impact on prices and growth. Furthermore, the inflationary effect of deprecation could push the interest rate upwards and reduce aggregate demand, ceteris paribus. (Krugman and Taylor (1978)). Also, domestic firms that use bank loans for production would also be affected as a result of the increase in interest rate (Bird and Rajan, 2003; Domac, 1997).

Shahzad and Afzal(2013) underscored two mechanisms through which currency devaluations affect output: (1) Expenditure-Switching Effect, whereby currency devaluation affects relative prices and, therefore, increases the domestic price of imports and decreases the foreign price of exports. Overall, the effect means that it decreases imports and increases exports. In effect, it encourages export, while local output grows. The second is the Balance Sheet Effect, which presupposes that if debts are denominated in dollars, while firms' revenues are denominated in domestic currency, unexpected changes in the exchange rate will affect firms' balance sheets. Due to deterioration of balance sheet, debts become expensive and it negatively affects the production capacity of the country. If the Marshall-Lerner condition is satisfied, currency devaluation enhances the GDP and trade balance in the long-run (Taye, 1999).

Extensive body of empirical literature on the effects of currency devaluation or depreciation on economic activity had been reported. Diaz-Alejandro (1963) examined the impacts of devaluation on some macroeconomic variables in Argentina for the period 1955–61. He observed that devaluation was contractionary for Argentina because it induces a shift in income distribution towards savers, which in turn depresses consumption and real absorption. He equally observed that current account could improve because of the fall in domestic absorption relative to output.

Kreuger (1983) says that transactions under contract completed during the period of devaluation/ depreciation may affect the trade balance negatively in the short-run but over time, export and import quantities adjust which give rise to elasticities of exports and imports to increase and quantities to adjust. As a result of this, the foreign price of the devaluing/depreciating a country's export is reduced and   the price of imported goods is increased,   directly reducing the demand for imports at the long-run with improvement in trade balance. Williamson (1994), however, held a different view from Kreuger's elasticity theory. He argued that higher import prices that are caused by devaluation /depreciation could stimulate increase in the domestic prices of non-traded goods. This leads to a rise in inflation and potentially reduces the advantages of devaluation/depreciation as manifested in the increase in trade balance.

Agénor (1991) selected a sample of twenty-three developing countries, and specified an estimated equation with output growth as dependent variable and current and lagged levels of the real exchange rate and deviations of actual changes from expected real exchange rate, government spending, money supply, and foreign income as independent variables. He found that surprises in real exchange rate depreciation actually boosted output growth, but that depreciations in the level of the real exchange rate exerted a contractionary effect on output.

Morley (1992) examined the effect of real exchange rates on output for twenty eight devaluation cases in developing countries, controlling for factors that are likely to simultaneously induce devaluation and reduce output. Factors used as control variables were terms of trade, import growth, money supply and fiscal balance. The results showed that devaluation of the level of the real exchange rate generally contributed to output decline.

Upadhaya and Dhakal (1997) opined that devaluation/depreciation decreases the real supply of money which gives rise to the excess demand for money, the effect of this is hoarding and an increase in trade balance. From the point of view of the monetarist, the role of relative prices in the analysis of devaluation/depreciation is not important in explaining the effect of devaluation/depreciation on trade balance.

Kamin and Klau (1998) used error correction model technique to estimate the relationship between output and real exchange rate for a group of twenty seven countries. There were no established effects on output through devaluation in the long-run. They further argued that depreciation could raise the domestic price of imported goods, which forces consumers to substitute imported goods or domestic products, hence raising the level of domestic goods through enhanced demand. They confirmed that this substitution could take place if there are similar domestically produced goods.

Omojimite and Akpokodje (2010) investigated the effect of exchange rate reforms on Nigeria's trade performance during the period 1986-2007. The study reported that in spite of devaluation, the growth of non-oil exports was normal. He argued that the structure of imports was mainly consumer goods, which remained unchanged even after the devaluation. Hence, they suggested that exchange rate reforms/devaluation is not sufficient to diversify the economy nor is it sufficient to change the structure of imports.

Cottani, et al (1990) evaluated the growth effects of real exchange rate (RER) misalignments and their volatility. They calculated RER misalignments as deviations of actual RERs from their equilibrium for 60 countries over 1965-2003, using panel and time series co-integration methods. Using dynamic panel data techniques they found out that RER misalignments hinder growth but the effect is non-linear: growth declines were larger, the larger the size of the misalignments. They found that, although large devaluations hurt growth, small to moderate ones enhanced growth. These results are robust when controlling for movements in the equilibrium real exchange rate. However, they established that it was difficult to follow a pro-growth RER policy. Finally, growth was found to be hampered by highly volatile RER misalignments.

In analysing the Mexican Financial Crisis of 1994/1995, Musacchio (2012) noted that the Central Bank of Mexico adopted a fixed exchange rate against the US dollar by the end of 1994 in response to the currency crisis. The crisis resulted from the devaluation of the Peso against the US$ in the presence of weak regulation in the banking system and series of reforms aimed at attracting inflows of portfolio capital, foreign direct investment and expansion of domestic financial system. Some of the lessons drawn from the Mexican crisis include: first, the devaluation took place from a position of weak external reserves. Second, the devaluation was announced in a policy vacuum, without adequate bands to which the Central Bank could defend the local currency, thereby reassuring foreign investors and lastly, the information of a pending devaluation led to increase in demand for dollars, and this not only increased pressure on the peso but also discouraged foreign investors from accelerating their investment in the country.

Fidelis (2014) examined the perceptions of citizens on currency devaluation and the Performance of Poverty Alleviation Programmes in Nigeria using sampled data from 1,350 respondents drawn from three senatorial districts of Edo State. The study revealed among others that devaluation exacerbated poverty in Edo state and Nigeria in general. He recommended proper funding of the programmes; safety-net protection of the vulnerables; and the need for people oriented policy rather than externally dictated ones. Voir (1997) argued that devaluation raises the profit of rent-seeking activities such as building construction but stifles activities of small scale businesses. Thus, these groups of small businesses mainly suffer the scourge of devaluation, since most of them do not produce export products.

III   Foreign Exchange Management and Nigeria's Macroeconomic Fundamentals

Nigeria's Foreign Exchange Management

Nigeria in its history of nationhood had adopted several foreign exchange management modifications. The reasons for these were to achieve price stability, preserve external reserves, diversify the economy, and to achieve exchange rate stability. The fixed regime was adopted from 1959 to June 1986. Under the regime, ad hoc administrative measures were applied, when the country's exchange rate maintained parity with the pound sterling until the devaluation of the sterling by 10 per cent in November 1967.

Subsequently, the currency was allowed to move independently of the pound sterling and the US dollar was included in the basket of other seven currencies (the US dollar, Deutsche mark, Swiss franc, French franc, Dutch guilder, Japanese yen and Canadian dollar) for determining the value of the naira. The seven currency basket method of calculating the exchange rate of the naira were assigned different weights, based on the relative shares of their trade with Nigeria but the weights of both the pound sterling and the dollar were relatively higher than that of the other five, reflecting the importance of the two currencies in Nigeria's external payments. Following the conversion of the Nigerian pound to the naira in 1973, the fixed naira exchange rates were established for both the pound sterling and the US dollar at 0.5833 pounds and US$1.5200 to N1.00, respectively. In 1985, to

minimise the persistent problem of a high incidence of arbitrage in the naira exchange rate quotation, the fixed exchange rate regime was adopted to determine the value of other currencies in terms of the naira (to maintain the US$/N exchange rate at a point) and derive the cross rates of other currencies against the naira through such a quotation. As a result of the Structural Adjustment Programme (SAP), a flexible exchange rate regime through the Second-tier Foreign Exchange Market (SFEM) was adopted in 1986. Under the SFEM, official transactions were conducted at the fixed pre-SFEM rate, while private sector transactions were done at the market based rate. The dual exchange rate system was merged into a single system in July 1987 and was aimed at reversing the structural distortions in the economy as a result of the introduction of a flexible exchange rate regime.

Following the dismal performance of the De-regulation policy, the dual exchange rate policy was introduced in1995. The Autonomous Foreign Exchange Market (AFEM) was introduced for trading privately sourced foreign exchange, while the fixed exchange rate of N22/US$1 in the official market was retained for bona fide government transaction. The rate at the AFEM was market determined, while the CBN intervened periodically in order to regularly monitor developments in the market and ensure stability. The pressure on the naira eased with the exchange rate at N81.98/US$1 until 1997. The Inter-bank Foreign Exchange market (IFEM) which traded daily with banks as the major participants and the CBN engaged in moderating the conduct of the market, through intervention was introduced on October 25, 1999. The retail Dutch Auction System (rDAS) was introduced in 1987 following the failure of the other mechanisms of exchange rate management. The rDAS was, therefore, introduced against the backdrop of the widening premium between the parallel and the official market exchange rates and the rising demand for foreign exchange.

The Central Bank of Nigeria (CBN) effected the transition from rDAS to wDAS in 2006. This was part of the sequence of financial sector reforms intended to further liberalise the foreign exchange market. The adverse external shock of the decline in the price of crude oil in the international market resulted in low foreign exchange earnings and decline in autonomous foreign exchange inflows. This exacerbated the demand pressure at the foreign exchange market, hence, the exchange rate of the naira depreciated by 20.1 per cent in 2008. In order to promote stability in the foreign exchange market, the Bank re-introduced rDAS in February, 2009 and suspended the sales of foreign exchange to the BDCs. The wDAS was sustained from 2010 to the third quarter of 2013 when it was replaced with the rDAS. In the last quarter of 2014, however, the market witnessed high exchange rate volatility, as a result of excessive demand pressure and developments in the external sector, especially the crash in international crude oil prices and the dwindling external reserves. To ensure market stability, the Bank undertook market reforms to stem demand pressure in the spot and BDC segments. In the spot segment, the mid-point of the official exchange rate was adjusted from N155/US$ to N168/US$. Also, the exchange rate band was widened by 200 basis points, from +3.0 per cent to +5.0 per cent and the net foreign currency trading position of authorised dealers was moved from 1.0 per cent to zero. Furthermore, transactions other than raw materials and premium motor spirit (PMS) were moved from the rDAS to the interbank segment.

In February 2015, the CBN scrapped its window of direct sale of foreign exchange to end users. The Bank directed that all foreign exchange needs be sourced from the inter-bank market. The managed float exchange rate regime, which was adopted following the liberalisation of the foreign exchange market, was scrapped to avert the emergence of a multiple exchange rate regime and preserve the country's foreign exchange reserves. The CBN noted that with the sharp decline in the global oil prices and the resultant fall in the country's foreign exchange earnings, the margin between the rates in the interbank and the rDAS window widened, engendering rent seeking behaviors such as round-tripping, speculative demand, spurious demand, and inefficient use of scarce foreign exchange resources by economic agents. Consequently, the Dutch Auction System rDAS/wDAS foreign exchange window was closed in favour of the interbank.

Other measures taken by the CBN to ensure exchange rate stability include the restriction on the importation of certain goods and services from the Nigerian foreign exchange market. Similarly, there was a restriction on the importation of foreign exchange by banks without the Bank's approval in order to prevent money laundering.

IV.   Data and Methodology
This section employs Error Correction Model in testing the impact of exchange rate devaluation on economic activities in Nigeria. The choice of the methodology is predicated because it captures better the dynamics of the models. Therefore, the empirical framework intends to provide comprehensive investigation of the impact of fluctuations in exchange rates (devaluation and overvaluation) on output growth, prices and other components of aggregate demand such as exports and imports in Nigeria.

IV.1   Sources of Data
The models were estimated using quarterly data for the period 1995q1-2015q2. The data used were sourced from the Central Bank of Nigeria Statistical Bulletin and the International Monetary Fund, International Financial Statistics. The data properties were examined using unit root test.

IV.2   Unit Root Tests
Table 1 presents the result of the Augmented Dickey-Fuller (ADF) test. The null hypothesis (t-statistics values) states that the variables have a unit root and (*) suggest a 1 per cent level of significance. The test shows the all variables are I(1) stationary.

Table 1: Augmented Dickey Fuller Unit Root Test

Variables:	In Levels	Order of Integration	In First Difference	Order of Integration
LGEXPA	-1.9	I(0)	-7.68	I(1)
LM2	-1.5	I(0)	-9.96	I(1)
LOIP	-1.38	I(0)	-7.07	I(1)
LNGDP	-1.55	I(0)	-8.81	I(1)
LCPI	-1.3	I(0)	-8.97	I(1)
LES	-1.72	I(0)	-6.74	I(1)
LIMP	-1.55	I(0)	-13.13	I(1)

IV.3 Model Specification and Estimation Procedures

The impact of shocks on the output is estimated, under the assumption that each dependent variable usually fluctuates in response to changes in exchange rate shocks, we also controlled for fiscal spending, monetary aggregate and oil price, such that:

$$DPV_{y,f,e,i} = \alpha_0 + \alpha_1 \text{Gexpa}_t + \alpha_2 M2_t + \alpha_3 Oip_t + \alpha_4 App_t + \alpha_5 Dep_t) + \varepsilon_t$$

$\alpha_0....\alpha_4$ are coefficient of variables. The $DPV_{y,f,e,i}$ represents each dependent variable for log of output(GDP), log of price level (*CPI*), log of exports (*ES*) and log of import (*IMP*).

The independent variables included *Gexpa_t*, *M2_t* and *Oip_t* which represent government expenditure, money supply and oil price, respectively. To examine the impact of exchange rate shocks (overvaluation and undervaluation) on macroeconomic conditions in Nigeria, we leverage on Kandil and Mirzaie (2002) and Kandil et al. (2007) that hold assumption of rational expectation whereby changes in real exchange rates are decomposed into permanent and transitory components. We separated the transitory component of real exchange rate into positive (overvaluation) and negative (undervaluation), using the formula proposed by Clover (1992) given as follows:

$$negshock_t = -0.5\left\{abs(D_{rs_t}) - D_{rs_t}\right\} \qquad posshock_t = 0.5\left\{abs(D_{rs_t}) + D_{rs_t}\right\}$$

This formula was used to generate *App_t* , which represents overvaluation and *Dep_t* stand for devaluation of real exchange rate, while ε_t is the error term. Also App_t and Dep_t are not logged because they are in ratios. In oil exporting country, such as Nigeria, devaluation of exchange rate could stimulate aggregate demand and output by bringing about a substitution of foreign goods for home produced goods through changing relative prices. However, changing relative prices of foreign goods and services induced by devaluation could positively affect the terms of trade and improvement in the gains from trade. On the other hand, the effect of currency devaluation could have negative effect on the growth of economic activity, if oil sector dominates at the expense of non-oil sector. Therefore, we state a priori expectations as follows:

- Currency devaluation could either be positive or negative on output.
- That exchange rate devaluation would stimulate domestic output because exports would be relatively cheaper than the imported goods. However, appreciation may signal loss of price competitiveness and subsequently trigger reduction in output. The final effect of devaluation and overvaluation would be determined by the interactions of aggregate demand and supply.

V. The Empirical Results

To put into context the asymmetric shocks of exchange rate (devaluation/overvaluation) on the Nigerian economy, we test the effect of both current and lagged values of the four independent variables, namely, real exchange rate fluctuations, government expenditure,

oil price and money supply on output growth, price level, exports and imports. As shown in table 2, the entire estimated models are stable and not explosive as all the associated ECM coefficients are significant and negative. All the fit (except column 2) and DW statistics of the entire estimated models are good which implies reliability of the models.

V.1   Impact on Output Growth
The result in column 1 of Table 2 showed that fluctuations in output growth is driven by current government spending (DLGEXPA), current overvaluation of exchange rates (APP2) and lagged GDP. The impact of exchange rate devaluation is not significant in explaining variation in output. However, the effect of current overvaluation in exchange is significant. An increase in current appreciation would reduce output by 0.01 per cent, as expected due to loss of price competitiveness. This implies that as economic agents noticed overvaluation of domestic currency and the subsequent loss of price competitiveness they reduce the output supply. Also, government expenditure (DLGEXPA) significantly impacted on output; a unit increase in government spending elicits 0.2 per cent raises output as expected.

V.2   Impact on Domestic Prices
In column 2 of Table 2, it is evidence that devaluation of exchange rate has lagged effect on domestic prices of about 0.004 per cent, a unit change in the variable. This implies that devaluation of exchange rate has pass-through effect on inflation rate with lag effect. Also, both current and lagged overvaluation of exchange rates impacted significantly on price inflation by 0.01 per cent each for a unit change. The positive effect of both coefficients shows that overvaluation of exchange rate driven by capital inflows owing to liberalisation of capital account increases the monetary base and fuels price inflation. The results further showed that other variables such as oil price and lag of domestic prices also affect domestic prices in Nigeria.

V.3   Impact on Exports
Analysis of exports demand in column 3 of Table 1 indicated that depreciation of exchange rate and oil price have impacts on export demand according to a priori expectation. Unit devaluation in current exchange rate would elicit 0.02 per cent reduction in exports, contrary to expectation. This implies that since oil exports constituted larger portion of total exports in Nigerian, devaluation of exchange rate would hurt exports demand, more also, that non-oil exports constituted only small portion of total exports However, a unit increase in oil price would increase exports demand by 1.1 per cent.

V.4   Impact on Imports
The fourth column of table1 indicated that all variables included in the model are not significant except current government spending (DLEXPA). The coefficient of current government expenditure is positive; implying that a unit increase in the variable would elicit 0.6 per cent rise in imports demand. Increased liquidity due to government spending, in an import dependent economy, stimulates appetites of consumers and producers to demand for more foreign goods and services.

Table 2: Models of Output, Price Level, Exports and Imports

Dependent Variables	1	2	3	4
Variables	DLNGDP	DLCPI	DLES	DLIMP
C	-0.024	0.056**	0.262	0.108
	(-0.186)	(2.493)	(1.280)	(0.404)
DEP2			-0.022	-0.002
			(-2.933)**	(-0.709)
DEP2(-1)	-0.001	0.004**	0.008	
	(-0.383)	(2.089)	(1.091)	
APP2	-0.014**	0.007***		0.021
	(-2.586)	(3.769)		(0.900)
APP2(-1)		0.005*		-0.021
		(1.729)		(-1.348)
DLGEXPA	0.244***		0.208	0.629***
	(3.471)		(1.568)	(3.052)
DLGEXPA(-1)	-0.084			
	(-1.136)			
DLM2A		0.054	0.387	
		(1.104)	(1.516)	
DLM2A(-1)	-0.094			
	(-0.679)			
DLOIP	0.079	0.055**	1.050	0.285
	(1.241)	(2.603)	(8.309)***	(1.407)
DLOIP(-1)			0.175	
			(1.325)	
LNGDP(-1)	1.005***			
	(115.29)			
DLCPI(-1)		0.992***		
		(175.72)		
DLES(-1)			0.978***	
			(65.296)	
DLIMP(-1)				0.993
				(48.447)
ECM_GDP(-1)	-0.194			
	(-3.013)**			
ECM_CPI(-1)		-0.071*		
		(-1.690)		
ECM_EXPORT(-1)			-0.266	
			(-3.520)***	
ECM_IMPORT(-1)				-0.590
				(-5.279)***
R-squared	0.998705	0.368444	0.986031	0.974459
Adjusted R-squared	0.998557	0.244046	0.984457	0.971975
Durbin-Watson stat	1.803652	1.598078	1.929827	2.097780

VI.   Conclusion

The study examined the effect of currency depreciation on economic activity in Nigeria using quarterly data for the period 1995:q1-2015:q2. The theoretical nexus of the effect of exchange rate depreciation or devaluation on domestic activities was provided. The result showed that fluctuations in output growth are driven by current appreciation of exchange rates, current government spending and lagged GDP. The impact of exchange rate devaluation is not significant in explaining variation in output. An increase in government spending elicits 0.24 per cent rise in output as expected. Also, the effect of current overvaluation on exchange rate is significant. An increase in current appreciation would reduce output by 0.01 per cent, as expected due to loss of price competitiveness.

Our estimation showed that depreciation of exchange rate has lagged effect on domestic prices of about 0.004 per cent for a unit change in the variable. This implies that devaluation of exchange rate has pass-through effect on inflation rate with lag effect. Also, both current and lagged appreciation of exchange rates impacted significantly on price inflation by 0.01 per cent each for a unit change. Devaluation of exchange rate and oil price has impact on export demand. Devaluation in current exchange rate would elicit 0.02 per cent reduction in exports. This implies that since oil exports constituted larger portion of total exports in Nigeria, devaluation of exchange rate would hurt exports demand, more also, that non-oil exports constituted only small portion of total exports.

The result also indicated that all variables included in the model did not influence import except current government spending (DLEXPA). The coefficient of current government expenditure is positive; implying that a unit increase in the variable would elicit 0.5 per cent rise in imports demand. Increased liquidity due to government spending in an import dependent economy stimulates appetites of consumers and producers to demand for more foreign goods and services.

The reviewed empirical literature showed that timing of devaluation matters and that devaluation without a robust adjustment program simultaneously could impact negatively on the economy. Second, countries with high reserves are better able to weather exchange rate devaluation. Also, composition of capital flow matters, and that exchange rate regime should be taken into cognisance before devaluation.

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Depleting Nigerian Foreign Reserves: Causes, and Policy Options

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Abstract

The rate of depletion of Nigeria's foreign reserves over the years has posed serious challenges to the monetary authority, especially in exchange rate management and maintaining low and stable inflation. Consequently, this paper estimates the extent to which the included determinants have impacted on the reserves using the Canonical Co-integration Regression (CCR) technique on monthly data spanning 2008M1 to 2015M6. . The results validate the position that fall in oil price and persistently high import demand constitutes the main drainers of reserves in Nigeria. Foreign debt service and the monetary base do not significantly contribute to dwindling reserves. The paper recommends the need to intensify efforts at exports diversification and value addition in agriculture and oil sectors to stimulate steady accretion to the reserves even in the face of crude oil price swings. In addition, periodic review of the import basket with a view to determining genuine imports and blocking illegal channels of foreign exchange outflows is advocated.

I.   Introduction

The International Monetary Fund defines adequate level of external reserves as the level that ensures sustainable balance of payments and macroeconomic adjustment, resulting from external price shocks or reversal in short-term foreign capital flows (IMF, 2011). In view of its importance, central banks hold foreign reserves for several reasons, among which are to: avoid and manage crisis in the external sector; stabilise the exchange rate through currency market interventions; settle foreign trade debt obligations; curtail capital flight and attract foreign investment.

Although the accumulation of foreign exchange reserve above the optimum level could attract substantial economic, financial and social costs, the incentive behind such accumulation cannot be overlooked. High foreign reserves do not only serve as insurance against financial shocks but also reduce the likelihood, severity and depth of a crisis, should it occur. It also helps in building investors' confidence, thus enhancing investment opportunities. In addition, accumulation of reserves allows the central bank to intervene in the foreign exchange market so as to ensure stability of the exchange rate and keep inflation low (Elhiraika and Ndikumana, 2007).

Reserves depletion may arise from lower export earnings, rising imports, capital flight, currency market interventions, sale of equities by non-residents, foreign debt payments, among others. When reserves are depleted below optimum level, it portends grave

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implications that create economic instability, such as such as greater vulnerability to external shocks, decline in investors' confidence, heightened capital flight, demand pressure depreciation and inflationary pressure.

The main objectives of reserve management are ensuring availability and liquidity of the reserves. In this context, a reserve management entity (central bank or other) is normally responsible for the management of reserves and its associated risks. The managing entity must, therefore, work to ensure that the level of foreign reserve is adequate and liquid to meet the needs of the country for payment of obligations. The management of external reserves ensures that adequate official public sector foreign assets are readily available to and controlled by the authorities for meeting a defined range of objectives for a country such as achieving macroeconomic and price stability. In addition, reserves should be adequate for macroeconomic adjustment to address any challenges arising from external price shocks or reversals in short-term foreign capital flows. Traditional metrics are often used in determining adequacy of reserves. The metrics have the attraction of being intuitive, simple and transparent but are also arbitrary and narrow in scope. They include metrics such as months of import cover, short-term debt, ratio of reserves to broad money (M2), or a combination of metrics. Recently, cost-benefit models are now being applied to identify the optimal reserve level (IMF, Monetary and Capital Markets Research, 2011).

Nigeria has achieved substantial accretion to external reserves since 1999. Data from the Central Bank of Nigeria (CBN) shows that the external reserves, which stood at US$5.24 billion as at end-December, 1999 rose to US$62.08 billion as at end-September, 2008, but has been on a declining trend afterwards. By the end of June 2015, it had declined to US$28.33. Noteworthy is the fact these episodes of high accretion and depletion mirror the fluctuation in crude oil prices at the international market. In particular was, the sharp drop in June 2014 that forced a persistent decline in the level of foreign reserve. This is amplified by the high level of dependence on imports, increased demand for foreign exchange for invisibles, and capital outflows. The attendant pressure in the foreign exchange market intensified exchange rate depreciation of naira, with the pass-through effect to domestic inflation as well as, an adverse effect on the profitability of both domestic and multinational firms.

Undoubtedly, the depletion of external reserves poses a serious challenge to the monetary authority, in spite of the several measures being undertaken to mitigate it.. As part of the measures, the retail Dutch Auction System (rDAS) was closed in February 2015. This decision was followed by a devaluation of the naira to curb speculative attacks on the currency and thus, curtail the continued use of reserve by the CBN to defend its value. Additional measures taken by the CBN to ensure exchange rate stability comprise the inclusion of some imported goods and services on the list of items not valid for foreign exchange from the Nigerian foreign exchange market in June, 2015; restriction of importation of foreign exchange by banks without the Bank's approval in order to prevent money laundering; among others. Although these actions are beginning to have some impact with the level of reserves judging from its recent rise to US$31.60 billion as at July 7, 2015, there is no assurance that the upward trend would continue given the uncertainties surrounding oil

price movements; the import dependent nature of the economy and external debt service burden.

While studies on external reserves in Nigeria abound (see Abdulazeez and Omade, 2013; Oputa and Ogunleye, 2010; Irefin and Yaaba, 2012; Ibrahim, 2014), those specific to key drivers of reserves depletion and the extent to which they affect the reserves are sparse. Whereas Oputa and Ogunleye (2010) revealed that high capital flight resulting from unfriendly investment and political instability were behind reserves depletion, Irefin and Yaaba (2012) as well as Ibrahim (2014) concluded that income and variability in export earnings were the key drivers of reserve holdings, respectively. The current study, therefore, incorporates some key reserve depleting and accumulating variables in the estimation, which the past studies mentioned above did not consider. This is with a view to determining their degree of impact on the reserves so that policy intervention measures could be well targeted to curtail the problem.

The paper is organised in seven sections. Following the introduction is section 3, which provides the literature review covering theoretical issues and related empirical literature. Section 3 presents some stylised facts comprising trends in Nigerian foreign reserves and recent CBN initiatives to address reserves depletion. Section 4 highlights some country experiences and lessons for Nigeria, while section five presents the methodology describing the data and analytical framework. Section 6 analyses the empirical results, whereas the paper concludes and makes policy recommendations in section seven.

II.   Literature Review
II.1   Theoretical Review

A country's foreign reserve encompasses all financial instruments denominated in foreign currencies that embody claims on non-residents, which are readily available to the monetary authority. It refers to a portfolio of financial assets, from which the monetary authority's liabilities towards foreign entities are deducted[1]. The dynamics of reserves are influenced by external and domestic factors, such as export earnings, current and capital accounts vulnerabilities, opportunity cost of holding reserves, financial crises, exchange rate regime for foreign exchange management and possibility and extent of capital flight(Antal and Gereben, 2011; Gupta and Agarwal, 2004; Wijnholds and Kapteyn, 2001). (

II.2   Empirical Literature

Various studies have examined the determinants of foreign reserves in different countries. Shcherbakov (2002) investigated the major drainers of external reserves in Russia and identified import bills, short-term debt payments and the monetary base as main reserves drainers. Aslaner, et al. (2015) employed bank level data from Turkey to study reserve option mechanism (ROM), a new policy instrument fashioned by the Central Bank of the Republic of Turkey (CBRT) to increase the resilience of the economy against external shocks arising from the volatility in capital flows. The study established that short-term

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[1] Reserves are, in a strict sense, only the foreign currency deposits and bonds held by central banks. However, the term in popular usage commonly refers to all international reserves, including gold, SDRs and IMF reserve positions, as well as other reserves including repo receivables.

domestic interest rates are vital in the automatic stabilisation role that ROM was designed to play, while foreign currency liquidity was not significant in driving this stabilisation role.

Aizenman and Sun (2010) explored the impact of financial crisis on international reserves in Emerging Markets and observed that countries using their reserves as buffer stocks were better able to internalise their exposure to trade shocks. However, financial factors were more vital than trade factors for countries that refrained from sizable reserves depletion during the first phase of the crisis. The paper concluded that the adjustment of emerging markets was constrained more by their fear of losing reserves than their fear of floating.

Irefin and Yaaba (2012) adopted a modified form of the "Buffer Stock Model" proposed by Frenkel and Jovanovic (1981) and used the Autoregressive Distributed Lag (ARDL) approach to estimate the determinants of foreign reserves in Nigeria. The findings debunked the buffer stock model for reserves accumulation and provided strong evidence in favour of income as the key driver of holdings of international reserves in Nigeria. Delatte and Fouquau (2009) adopted a panel smooth transition model under two restricting hypotheses of homogeneity and time-stability to examine the dynamics of international reserves holdings in emerging countries. The study established the presence of a non-linear behaviour in the demand for international reserves with coefficients that change smoothly as a function of two threshold variables (the misalignment of the real exchange rate and the level of the US real interest rate) out of the seven variables tested. The results supported the mercantilist view and de-emphasised the importance of precautionary factors, suggesting that the US real interest rate would trigger significant slowdown in the accumulation of international reserves.

Ibrahim (2014) examined the short and long-run determinants and sustainability of international reserves accumulation in Nigeria between 1970 and 2010, using an error correction mechanism and bounds testing approach to co-integration within the autoregressive distributed lag framework. The variability of export earnings and own lagged of international reserves were found to have positive impact on reserves holding in Nigeria, while oil price was found to have adverse long-run effects on reserves holding, though the short-run impact was positive. Per capita GDP and environmental (CO_2 emission) measures of sustainable development also have long-run impacts on international reserves accumulation, suggesting the need for diversification of the international reserves accumulation towards more environmentally and economically sustainable sources to minimise the negative effects of volatile oil export earnings and extraction of crude oil.

Dash and Narayanan (2011) employed maximum-Likelihood Vector Error Correction Model (VECM) techniques to explore the key determinants of foreign reserves in India using monthly and annual data. The results established the existence of long-run co-integration among international reserves, imports and nominal exchange rate. The results further indicated that import shocks and exchange rate have permanent effects on reserves level as well as its volatility, suggesting that any target level of reserves could only be feasible in the short-run in view of the stationary equilibrium relationship among the three core variables of the standard reserve demand function.

Puah, et al., (2011) examined the determinants of international reserves in Malaysia, using annual data over 1975 to 2007. The results indicated that the size of the economy, exchange rate, balance of payments and the opportunity cost of holding reserves are co-integrated with the level of international reserves in Malaysia.

Nor, Azali and Law (2011) investigated the existence of long-run relationship between international reserve holdings and the current account balance in five ASEAN countries during the 1970 to 2005 period using the autoregressive distributed lag (ARDL) model and bounds testing approach. The results suggest that current account surplus triggered increases international reserves in Malaysia, Singapore and Indonesia. Majority of the countries were found to experience consistent current account surplus during the period.

Oputa and Ogunleye (2010) estimated external reserve accumulation and the adequacy level of reserves in Nigeria using an adjusted form of the Scherbakov (2002) approach. Their analysis revealed that periods of high negative reserve gaps were associated with the period of high capital flight induced by the unfriendly investment environment and political instability. They, therefore, recommended that reserve accumulation be sustained, while factors that precipitate massive outflows be curtailed.

Several other studies have examined determinants of reserves, and the impact of financial crisis on international reserves in several countries, including Nigeria. Although the work by Oputa and Ogunleye (2010) used the Scherbakov(2002) reserves drainers approach in estimating external reserve accumulation and adequacy level of foreign reserves in Nigeria, this work differs in terms of the scope and choice of variables. This study intends to capture both the reserve drainers and accumulators in a single equation framework using the canonical co-integrating regression. Anderson (2002 and 1999), observed that canonical equation allows linear specification of joint dependent variables in a regression with fairly non-restrictive[2] distributional assumptions.

### III.   **Stylised Facts**
III.1   **Trends in Nigeria's Foreign Reserves**

Nigeria's foreign reserves position had fluctuated in the past 18 months (January, 2014 to June, 2015). Figure 1 show that the country's reserves declined from US$40.67 billion in January 2014 to US$35.40 billion in May, 2014 after which there was a brief upward movement to US$39.07 billion in July 2014. From August, 2014, the reserves declined steadily and reached a low of US$29.36 billion in March 2015. Although a marginal increase (US$29.57 billion) was recorded in April 2015, the reserves stood at US$28.3 billion as at end-June 2015.

The factors responsible for the observed fluctuations in Nigeria's external reserves include, oil price movements, level of capita importation (foreign direct, portfolio and other investments) and foreign trade activities. Each of these is discussed in turn.

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[2] The variables in the equation may or may not zero-mean and the equation may or may not contain a constant term.

Figure 1: External Reserves Movement ($ Billion)
**Jan. 2014 - June 2015**
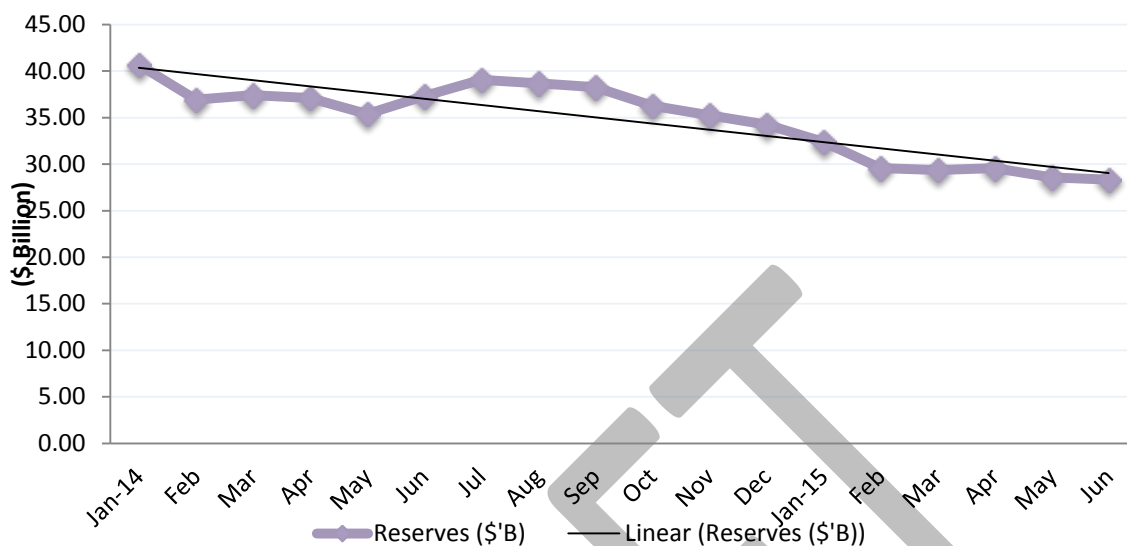
Source: CBN Statistical Database

III.1.1 Reserves and Oil Prices

The price of oil in the international market has a direct relationship with the quantum of Nigeria's foreign reserves. Crude oil revenue alone accounts for over 75 per cent of the total foreign exchange earnings. The recent plunge in the price of crude oil in the international market since the mid-2014 occasioned by the discovery of shale oil in the US and its subsequent export to the international oil market has continued to impact negatively on oil revenues and hence the external reserves position.

Figure 2: External Reserves and Oil Price Movements Jan. 2014 - Jun. 2015
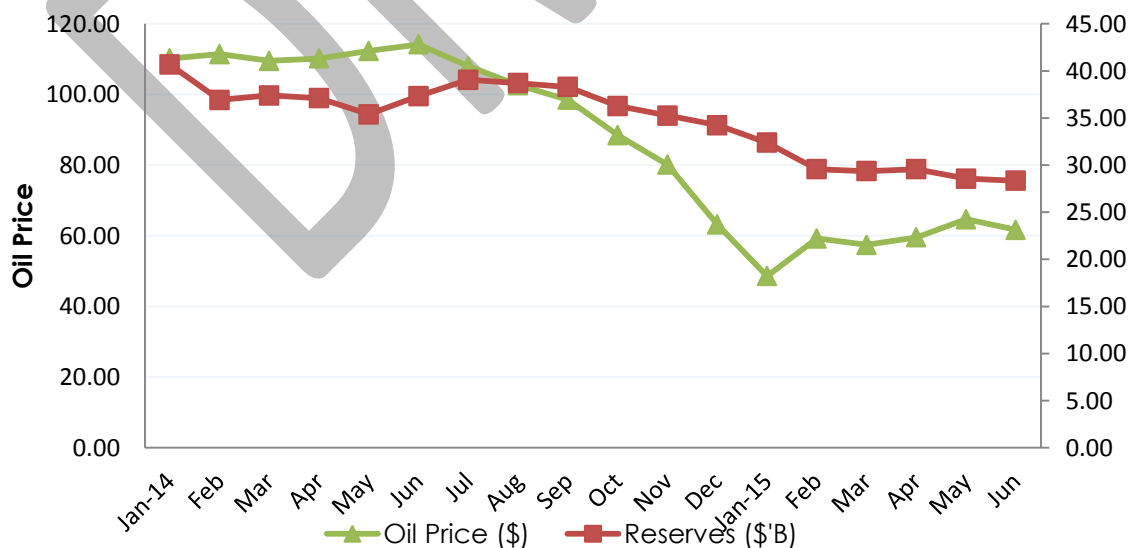
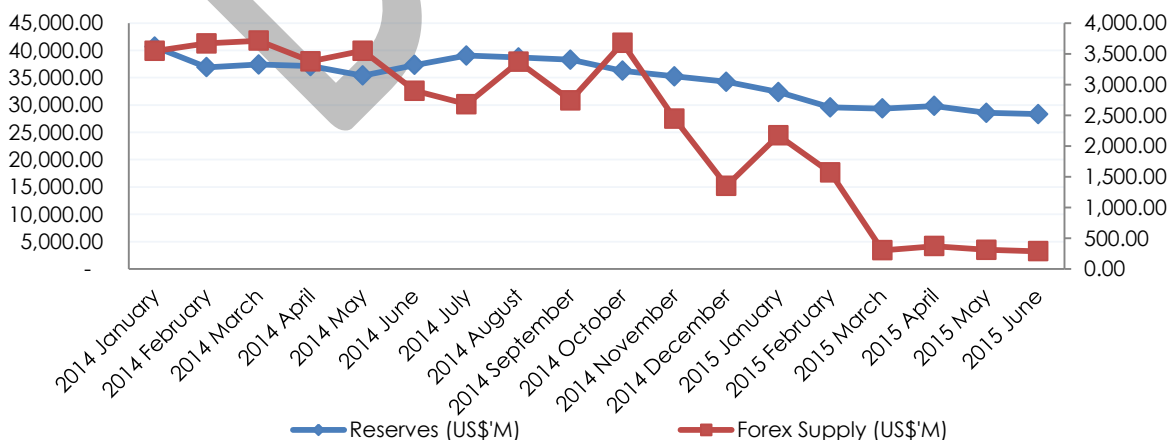Source: CBN Statistical Database

Figure 2, which shows external reserves and oil price movements in Nigeria, reveals that between January and June, 2014, the price of oil ranged between US$110.19 and US$114.17, while reserves hovered between US$40.67 billion and US$37.33 billion. This suggests that during the January-June, 2014 period, the movement in external reserves could have been impacted more by other factors like capital outflows and high imports demand. However, from August 2014, Figure 2 shows a remarkable co-movement of oil price and external reserves position, as oil prices declined, external reserves position also dwindled remarkably from August 2014 to June 2015. External reserves had declined from US$39.1 billion in June 2014 to US$28.3 billion as at end-June, 2015 (i.e. a drop of US$10.8 billion in twelve months).

III.1.2 External Reserves and Supply of Foreign Exchange
For a country like Nigeria that operates a managed-float exchange rate regime, the relationship between external reserves and foreign exchange supply is very vital. This is principally because reserves are used to influence the exchange rate as a result of changes in the demand for foreign exchange. Expectedly, supply of foreign exchange following high demand should lead to a fall in the level of reserves and vice-versa as authorities would use the reserves to stabilise the exchange rate.

Figure 3 shows that between January 2014 and June 2015 both supply of foreign exchange at the rDAS/wDAS and external reserves declined although at varying rates. This showed that foreign exchange supply is determined by the movements in reserves. For example, Figure 3 further shows that with monthly reserves rising briefly between June and August 2014 from US$37.33 billion to US$38.71 billion, monthly foreign exchange supply also rose from US$2.89 billion to US$3.37 billion. Thereafter, monthly foreign exchange reserves fell steadily to US$28.34 billion at the end of June 2015. In the same vein, monthly foreign exchange supply fell steadily to US$0.287 in June 2015, except the sudden spike in October 2014 to US$3.67 billion, followed by a sudden drop to US$1.35 billion in December 2014. The low accretion to the reserves due to dwindling oil prices had necessitated substantial capital flight, which is reflected in the level of reserves, owing to routine interventions of the CBN in the foreign exchange market.

Figure 3a: External Reserves and Foreign Exchange Supply (Jan. 2014 - Jun. 2015)

Source: CBN Statistical Database

**Figure 3b: External Reserves and Foreign Exchange Demand
(Jan. 2014 - Jun. 2015)**
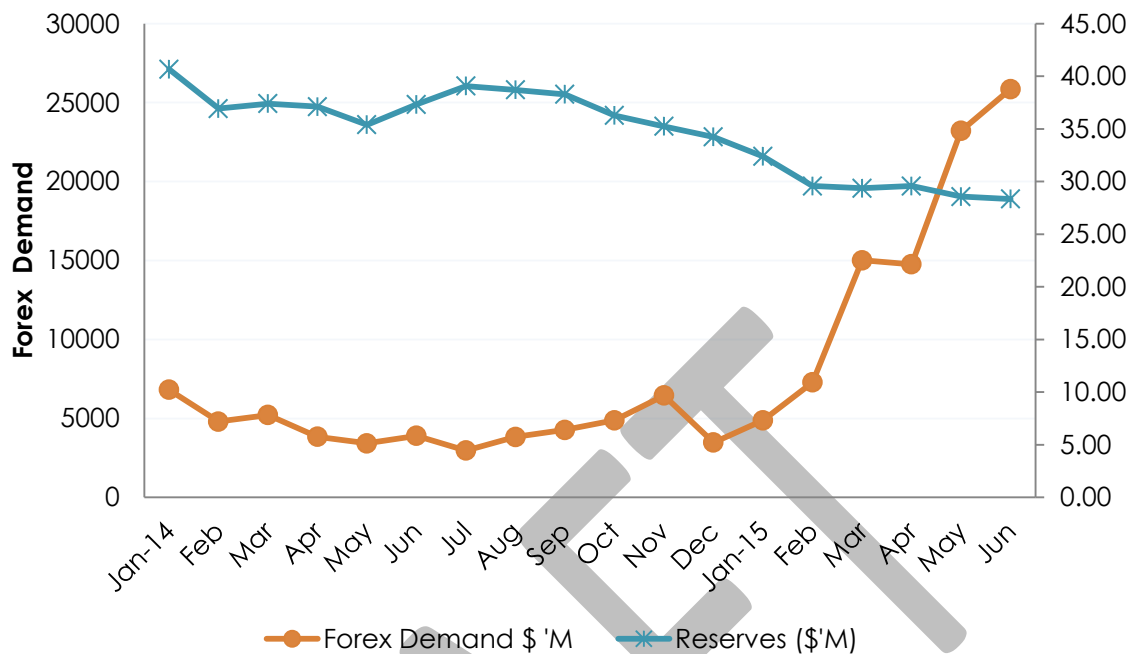
Source: CBN Statistical Database

Table 1:   Sectoral Utilisation of Foreign Exchange (US Dollars Billion)

Sectors	Jan. - Jun. 2013	Jul. - Dec. 2013	Jan. -Jun. 2014	Jul. - Dec. 2014	Jan. -Jun. 2015
A. Imports	14.46	14.**52**	**16.63**	17.57	13.72
B. Invisibles	12.48	13.78	16.27	15.51	9.58
TOTAL (A+B)	26.94	28.30	32.91	33.08	23.30

Source: CBN Statistical Database

Table 1 indicates that sectoral utilisation of foreign exchange for visible imports, which forms 58.88 per cent of total foreign exchange utilisation in 2015 had been rising since January-June 2014 to July-December 2014. However, it dropped substantially from US$17.57 billion to US$13.72 billion in the first half of 2015, following the interventions (such as closing of the rDAS foreign exchange window and barring of 41 imported goods and services from accessing foreign exchange from the official foreign exchange window) by the CBN to reduce the rate of depletion of external reserves. In the same vein, the utilisation of foreign exchange for invisible imports, which accounted for 41.12 per cent of total demand for foreign exchange in the first half of 2015, followed a similar trend but started declining in the second half of 2014 to US$9.58 billion from January to June 2015.

According to CBN (2015), while the industrial and oil sectors accounted for about 62 per cent of the utilisation of foreign exchange for visible imports in the first half of 2015, the financial services sector accounted for a whopping 80 per cent of foreign exchange utilised by invisible imports. This provides an indication of sectors where policy actions could be directed to stem the tide of depleting reserves.

III.1.3   External Reserves and Capital Flows

While capital inflows in the form of foreign direct, portfolio and other investment may have some definite advantages, a reversal may lead to painful adjustments in the BOP account. Capital inflow is a veritable source of foreign exchange reserves accumulation for many economies. Nonetheless, it responds to a lot of incentives in the domestic economy such as macroeconomic stability and interest rate. The degree of capital inflows to economies also has a preponderance effect on reserves accumulation and utilisation. Furthermore, the internal constraints are directly related to the management of the pressure in foreign exchange demand and utilisation.

Figure 4 shows the movement in external reserves vis-à-vis FDI, FPI and other investments. The chart shows that the movement in reserves to a substantial degree mirrors the movement in capital inflows and, in particular, the movement in FPI which is highest and most volatile of the three components. At US$40.66 billion in January 2014, the external reserves declined steadily to US$28.33 billion at end-June 2015. Accordingly, FPI fell from US$1.2 billion to US$0.78 with a very high degree of volatility during the same period. For example, between January and February 2014, reserves dropped 9.2 per cent sharply from US$40.67 billion to US$36.9 billion, when there was a 43 per cent drop in FPI from 1.2 billion to 0.682 billion, indicating that cash outflows might have a reasonably serious impact on reserves. A similar trend can be observed between September and December 2014, when reserves dropped from US$38.3 billion to US$34.2 billion following FPI's decline from US$1.99 to US$0.098 billion.

Figure 4: External Reserves and Capital Inflows

(Jan. 2014 - Jun. 2015)
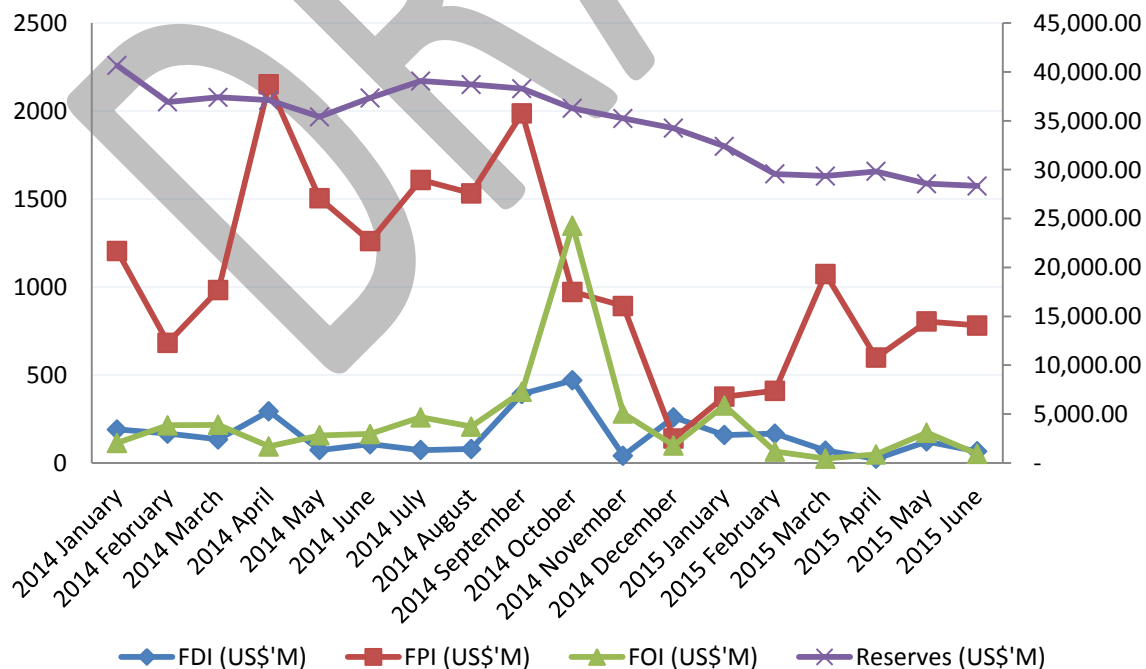
Source: CBN Statistical Database

III.1.4 External Reserves and Import Bills

The relationship between the external reserves position and the amount of imports it can sustain is a vital one, hence the traditional indicator of reserves adequacy, which is months of imports cover. Generally, a sound reserves position should finance at least 3 months of imports if all other inflows and outflows cease. A look at Figure 5 below reflects this relationship, namely that as imports rise, reserves are likely to fall, all other things remaining unchanged. Thus, the graph has in the main pictured this theoretical inverse relationship. Between January and April 2014, reserves have declined from US$40.67 billion to US$37.11billion, following the rise in import bills from US$4.58 billion to US$6.23 billion during the same period.

However, a reversed trend was observed from June to September 2014 as reserves rose moderately from US$37.33 billion to US$38.29 billion, which corresponded with a fall in imports from US$5.26 billion to US$4.68 billion. Thereafter, monthly imports continued to rise, reaching a remarkable level of US$6.93 billion in November 2014 before it fell to a low of US$3.43 billion in February 2015, then rose again to US$4.31 billion in June 2015. During these episodes, the reserves have been on a steady decline though at a slower rate than the fluctuations in monthly imports. The observed dramatic swings in the movement in monthly imports reflect the various interventions by the CBN. In November 2014, the Bank raised the MPR from 12 to 13 per cent. This was followed by a devaluation of the naira from ₦157/USD to ₦168/USD. Also in February 2015, the rDAS foreign exchange window was closed followed by another devaluation of the currency from ₦168/USD to ₦197/USD. In May 2015, the CRR for public and private sectors were harmonised at 31 per cent, and was later relaxed to 25 per cent in September, 2015.

Figure 5: External Reserves and Imports (Jan. 2014 - Jun. 2015)
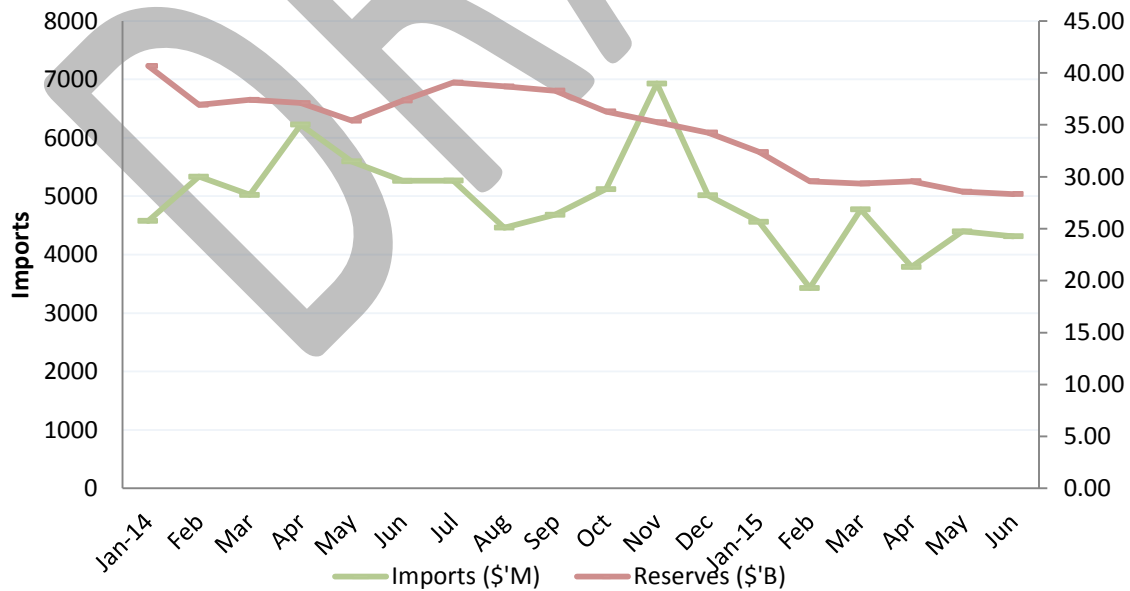
Source: CBN Statistical Database

III.2   Recent CBN Initiatives to Address Reserves Depletion and Implications

Several measures have been put in place in the recent past to mitigate demand pressure on the nation's foreign reserves. Some of these are noted below:

- The Bank on June 23, 2015 excluded non-essential imports of goods and services from the official foreign exchange market;
- On July 1, 2015, the Bank re-affirmed that Bureaux de Change (BDCs) were only authorised to sell dollar cash of not more than $5,000 per each transaction involving BTA/PTA, credit card and life insurance premium payments, school fees, utility bills and monthly mortgage payments;
- The Bank increased the cash reserve requirement (CRR) on public sector funds from 50.0 to 75.0 per cent and left that of the private sector unchanged in January 2014. Subsequently, in May 2015, both private sector CRR were harmonised at 31.0 per cent. The MPR was raised from 12.0 to 13.0 per cent in November 2014. These actions were meant, among other things, to reverse the downward trend in portfolio inflows;
- The limit on the usage of naira denominated cards overseas was cut from US$150,000 to US$50,000 to minimise round-tripping and other unwholesome practices. Daily cash withdrawal limit on cards, per person, per day was pegged at US$300;
- A prohibition on the use of foreign exchange for domestic transactions to forestall the dollarisation of the Nigerian economy was reinforced;
- The net foreign exchange trading position of individual authorised dealers was reviewed down to zero percent, from 1.0 percent but was later raised to 0.5 percent in 2015;
- The value of the naira was officially devalued from N157/US$ to N168/US$ and the band widened from +/-3 per cent to +/-5 per cent with effect from November 2014;
- In order to stem unwholesome practices and reduce speculation at the rDAS and ensure stability of the exchange rate, the rDAS window was closed on February 18, 2015. Transactions were conducted at the interbank market and were trade-based with an exchange rate of N196.95/US$;
- The remunerable daily placement by banks and discount houses at the standing deposit facility (SDF) was limited to N7.5 billion at 11.0 percent;
- Reduced sales of foreign exchange to BDCs from US$50,000 to US$15,000 weekly (to minimise abuses). The sales amount was later reviewed upward to US$30,000 in 2014;
- Cross border transaction system requirements were developed to monitor foreign exchange inflows and outflows on real time basis;
- A restriction of importation of foreign exchange by banks prior to CBN approval was emplaced in order to prevent money laundering and capital outflow;
- Withdrawal charges on domiciliary accounts were imposed.

IV.   International Experiences

In this section, the experiences of some countries that went through similar economic problem of fast depleting reserves, as well as the options they adopted to contain the problem, are presented. This is with a view to drawing some useful lessons that could be beneficial to the Nigeria situation.

IV.1   Malaysia

Malaysia is Asia's major oil exporter and second largest gas exporter in the world. Its total gross international reserves had grown to USD139.1 billion in 2012 before plunging to USD116.0 billion as at December 31, 2014, owing to deterioration in international oil prices. The reserves position further declined to USD105.5 billion as at June 30, 2015 but was sufficient to finance 8.2 months of retained imports. The foreign exchange reserves have been under intense pressure with Bank Negara intensifying its defense of the ringgit since January 2015. The negative risk perception could hurt the country and its currency, even with the milder reductions in gas prices. The drop in oil prices has also compelled the Malaysian government to expand its 2015 budget deficit gap. The following is a summary of policy actions taken by Malaysia in managing its external reserve.

- Malaysia does not restrict current account transactions in order to boost international trade. Unlike before, residents have the option of using local currency to settle transactions with non-residents, towards enhancing trade. This has helped to lessen pressure, thereby reducing the need for the central bank to intervene in the foreign exchange market at regular intervals (Abdul-Aziz, 2013).
- Rules for investment in foreign currency assets were increasingly liberalised to allow for greater flexibility for resident corporations.
- Foreign currency accounts were also allowed to be maintained with local banks for the purpose of investment and retention of export proceeds, leading to rising foreign currency deposits with commercial banks and greater decentralisation of reserves. This reduced the dependence on the central bank by businesses and financial institutions to access foreign currency (Abdul-Aziz, 2013).
- The government of Malaysia had to borrow from the US dollar bond for the first time in 4 years to shore up the country's foreign exchange reserves towards refinancing existing foreign debts that would accrue in the second half of 2015. This was considered a better option than creating new ringgit to buy foreign currency from the open market to shore up the country's forex assets.

IV.2   Indonesia

The foreign exchange reserve in Indonesia stood at US$111.9 billion by the end of December 2014, and was sufficient to cover six and a half months of imports, including debt payments (Sambijantoro, 2015). The following are some of the measures taken by Indonesia to shore up its reserve level.

- The central bank intervened in the forex market to stabilise the rupiah, but it eventually absorbed the dollars through its dual monetary instruments of forex

swaps and dollar-term deposits by commercial banks on special rates for specified period.

- In Indonesia, the central bank conducts foreign exchange interventions through agent banks. The agent banks buy and sell foreign currency, particularly US dollars consistent with the supply or demand conditions in the market. The main objective is to reduce the volatility in the exchange rate and align it with the market fundamentals.

- The central bank intervene mainly using spot transactions, but swap and forward transactions were also conducted on the basis of needs and liquidity conditions in the foreign exchange market.

- Banks enjoying surplus foreign exchange liquidity were provided a foreign exchange term deposit window via weekly auctions since mid-2012 (Warjiyo, 2013).

- The central bank has strengthened foreign exchange interventions since 2011 through the secondary purchase of government bonds, specifically in periods of huge capital outflows. The secondary purchase of government bonds by the central bank helps in stabilising the exchange rate in view of its capacity to ease the upward pressure on the exchange rate via the reversals of foreign portfolio investments, the larger chunk of which is in government bonds.

- The central bank conducts additional interventions to boost forex supply to meet foreign investors' rising demand often required to divest portfolio investments in Indonesia, in particular their holdings of government bonds. The dual intervention helps to strengthen the overall stability of the financial system by ensuring stability in two of the three financial markets (the foreign exchange market and the bonds market). On the downside risk, the central bank's purchase of government bonds re-injects domestic currency liquidity earlier withdrawn through foreign exchange intervention back into the financial system.

- To shore up its reserves, Bank Indonesia is going beyond its interventions in the forex market to sign swap lines with other central banks, specifically the Asian counterparts (The Nation, 2013). The major outcome of these interventions was effective in the management of the volatilities in the exchange rate in line with the goal of attaining the inflation target and stabilising the financial system. As such, Indonesia has witnessed a gradual appreciation of the rupiah up to August 2011 before experiencing a gradual depreciation in the wake of the recent developments in the economy which was triggered by changes in global environment. As a result of swaps, the reserves consequently increased to US$95.7 billion by end September 2013, an increase of $3 billion over the level in July 2013. Nonetheless, the rate of depletion in the forex reserves rank among the fastest in Asia, with 15 per cent decline in 2013.

IV.3   Turkey

The Turkish economy in the past few decades experienced massive short –term capital inflows. These short–term inflows have aggravated concerns over financial stability. The foreign exchange reserves in Turkey averaged USD 45.8 billion from 1981-2015 with an all-time high of USD150.4 billion in end July 2014 and a record low of USD1.2 billion in end June 1981. As at April 2015, Turkey's external reserves stood at USD140.7 billion. A major outcome of capital inflows was an appreciation of the Turkish lira, undermining

competitiveness, adding to inflationary pressures, increasing imports and pushing up credit utilisation. The appreciation of the lira was above what the Central Bank of the Republic of Turkey (CBRT) considered to be consistent with prevailing economic fundamentals. The CBRT took a series of measures to maintain economic and financial stability in the economy which include;

- Cutting its policy rate from 16.75 per cent to 6.50 per cent between November 2008 and 2009, in order to mitigate the adverse effects of the crisis and to avoid large downward deviations from the inflation target and discourage short–term capital flows (Kenc, Turhan and Yildirin, 2011).

- Introduction of the asymmetric interest rate corridor, a set of repo facilities through which liquidity is injected, reserve requirement ratios, and regular and irregular foreign exchange auctions, buying or selling.

- Direct interventions in the foreign exchange market (IMF, 2012).

Of particular interest are the asymmetric interest rate corridor (AIRC) and the reserve option mechanism (ROM) which were designed and implemented by the CBRT to smoothen out volatility in the foreign exchange markets reduce credit expansion and remove volatility in short–term interest rates. The asymmetric interest rate corridor was introduced in 2010 while the implementation of ROM started in 2011. These two policy actions were instrumental monetary policy tools and therefore require a detailed analysis and evaluation.

IV.3.1 Reserve Option Mechanism

The reserve option mechanism is a new policy instrument designed and implemented by the CBRT. The aim is to increase the resilience of the economy against volatility in capital flows and external finance shocks. The mechanism provides banks with an option of holding a fraction (reserve option ratio) of their mandatory required reserves for Turkish lira liabilities in USD, euro (no longer allowed since Aug 2014) and gold. The CBRT manages the ROM by altering the reserve option coefficient (ROC). The ROC is the amount of foreign currency/gold that should be held by a bank for each unit of reserve requirement in the domestic currency. The fraction of the domestic currency required reserves that can be held in foreign exchange or gold is determined by the Reserve Option ratio (ROR).

An example will help to improve an understanding of these concepts. Assume bank A decides to take the option of holding a fraction of their mandatory required reserves in foreign exchange or gold. Assume also that the ROR is set at 90 per cent and the ROC is 1. This implies that bank A can hold up to 90 per cent of its mandatory reserve requirements in foreign exchange and can hold one unit of the domestic currency equivalent of foreign exchange per unit of the mandatory reserve requirement. If bank A's total reserve requirement amounts to ₦100,000.00 and the exchange rate is ₦196.5/ 1USD, then bank A would hold ₦90,000.00 equivalent of USD which is 90,000/196.5= USD458.02 plus ₦10,000.00 to complete the ₦100,000.00 mandatory reserve requirement. If the ROC is set at 2 instead of 1, then Bank A will have to hold ₦2.00 equivalent of foreign exchange per 1 unit of reserve requirement. In this case, if Bank A wishes to utilise its facility fully, it will hold

₦90,000*2 = ₦180,000.00 equivalent of foreign exchange and ₦10,000.00. Amounting to ₦180,000/196.5 = USD916.03 in Foreign exchange and ₦10,000.00 in local naira currency. In this example, the ROC was held constant through all the tranches but it could vary at the discretion of the monetary authorities.

Currently, the ROM allows banks to convert up to 60 percent of their reserve requirements into foreign exchange (with ROCs ranging from 1.4 to 2.8) and up to 30 percent into gold (with ROCs ranging from 1.4 to 2.5) (IMF, 2013). Every bank is thus expected to solve its own maximisation problem. This facilitates the system to work as an automatic stabiliser in the face of external shocks. However, for the ROM to act as an automatic stabiliser, the threshold ROC under normal conditions has to be lower than the maximum ROR. During capital inflows, the cost of borrowing in foreign currency would fall and would motivate banks to keep a higher fraction of their required reserves in foreign currency. Hence, the demand for foreign currency would increase, smoothing the exchange rate and or credit impact of capital flows.

ROM is an innovative mechanism that is unique in its ability to raise the external reserves while smoothing exchange rate volatility. The feasibility of the reserve option mechanism may also be fraught with some challenges. These range from lack of full disclosure of the foreign portfolio baskets by DMBs, the difficulty of meeting up with foreign exchange liabilities (customers withdrawing their forex), to the appropriate determination of the ROC. The first challenge may be addressed through proper surveillance and improved supervisory framework while the second problem could be tackled through the monetisation of foreign exchange withdrawals. Again, some kind of incentives should be given to depositor of foreign exchange as in the case of foreign exchange swap. The last challenge could be efficiently managed if the autonomous sources of foreign exchange accretion are very liquid.

The duration of the CBRT's new framework is short and the fact that the framework was used in conjunction with other measures makes an assessment rather difficult. However, the track record seems to be mixed. Some of the noted trends in the use of ROM include:

- Banks in Turkey have accumulated more than USD50 billion of reserves since the introduction of ROM (Aslaner etal, 2015)
- Oduncu et al (2013) using GARCH models found that the use of the ROM has reduced the volatility of Turkish lira.
- The seasonal patterns of the money multiplier became significantly less volatile after the introduction of ROM (Akturk, et al, 2015);
- The ROM utilisation rate (defined as the fraction of Turkish lira reserve requirements held in foreign currency) showed significant fluctuations in the utilisation across time. The ROM utilisation rate by banks is determined by;
  a. The relative cost of foreign exchange funding to naira funding
  b. The reserve option coefficient
  c. Since banks need foreign exchange to use ROM, their foreign currency liquidity condition may also affect ROM utilisation. There may be cases where utilisation rate is less than expected because of foreign currency liquidity shortage.

   d. Exchange rate movements could also affect the utilisation rate of some banks through valuation effects
   e. Global risk appetite may also affect the ROM utilisation rate.

IV.3.2   Asymmetric Interest Rate Corridor

The asymmetric interest rate corridor is a macro-prudential instrument designed by the CBRT to mitigate against volatility in cross border capital flows and to smoothen financial cycles as well as ensure less volatility in short–term interest rates and development of the interbank market. Interest rate corridor refers to the distance between the overnight deposit and borrowing rates. It is traditionally used by central banks using an inflation targeting regime. The interest rate corridor under an inflation targeting regime is defined as a symmetric and narrow band around the policy rate. The band (as seen in figure 7) is used to ensure that the short-term market rates do not deviate significantly from the policy rate. The role of the corridor is essentially that of guiding and maintaining a boundary. Several studies have attested to the efficacy of using the interest spread as an effective tool of monetary policy (Curdia and Woodford, 2010; Fendoğlu, 2011; and Gilchrist and Zakrajsek, 2011).
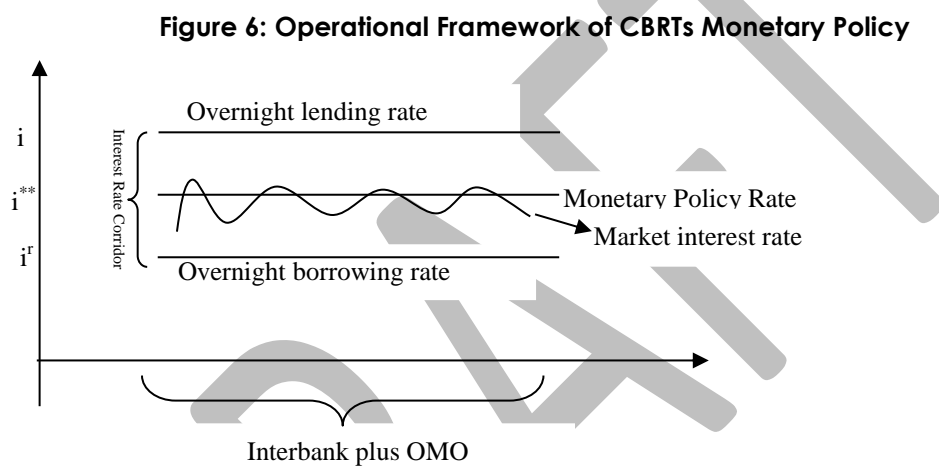
The asymmetric interest rate corridor is an active policy instrument tool where both the width and the asymmetry of the corridor may be used to effect desired behaviour in the credit-deposit spread, an important indicator of banks' appetite for lending and hence credit supply. The use of the unequal width of the corridor as a policy instrument makes the asymmetric interest rate corridor unique. The interest rate corridor not only facilitates a faster and more flexible reaction to volatility in short-term capital movements but is also used as an effective instrument against volatile credit growth and ensuring less volatility in short–term rates (Degerli et al, 2013; Alper et al, 2013b).

Figure 6 below shows the operational framework of CBRT's monetary policy. The area between the overnight borrowing and lending rates is called the interest rate corridor. Market rates are formed within the corridor which serves as a two sided buffer to prevent markets rates from deviating significantly from the policy rate. In a symmetric interest rate corridor, the band is generally unchanged round the policy rate unlike the asymmetric interest rate corridor where the width of the band can be adjusted possibly in an asymmetric way. Market interest rates can be changed on a daily basis if needed unlike in the symmetric interest corridor where interest rates are fixed for a predetermined period, usually between monetary policy meetings. Asymmetric interest rate corridor therefore facilitates a quicker and more malleable response to volatility in short-term capital movements and can also be used as an effective mechanism against credit growth (Alper, Kara and Yorkoglu, 2013b).

The underlying principle of the interest rate corridor policy is that a narrow spread is associated with loose credit conditions while a wider spread is typically associated with tighter credit conditions (Bernanke et al., 1996; Gilchrist and Zakrajsek, 2011). When the interest spread widens, competition amongst banks intensifies forcing the spread to

narrow. On the other hand, the cycle is reversed during slowdown periods, when less competition widens the spread.

At the initial stage, the CBRT used the asymmetric interest rate corridor to realign the exchange rate with economic fundamentals. In order to do this, the interest rate corridor was widened downwards during high capital inflows to mitigate against short–term capital flows (Binici et al, 2013). But during periods of high capital outflows, the corridor was widened upwards to discourage the massive capital outflows. The required reserve ratios were also increased at this time to slow down the surge in the volume of credit. The active use of macro-prudential policy (both interest rate corridor and the reserve ratios) has played a significant role in the slowdown of credit growth to more reasonable levels consistent with financial stability (Binici et al. 2013).

Figure 6: Operational Framework of CBRTs Monetary Policy

Source: Modified version of Alper, Kara and Yorukoglu, 2013b

IV.3.3 Comparing Asymmetric Interest Rate Corridor with the Reserve Option Mechanism

The asymmetric interest rate corridor and the reserve option mechanism are similar in several respects. They were both designed and implemented by the CBRT as monetary and macro-prudential policy instruments. Although they have similarities in their goals, the transmission mechanism differs considerably. Asymmetric Interest rate corridor works through altering the behaviour of short–term portfolio agents while ROM changes the way foreign exchange flows are channeled in and out of the banking system.

ROM reduces the need for a wide interest rate corridor as far as exchange rate smoothing is concerned. Interest rate corridor however has other functions which include the control of the credit-deposit spread. However, both the ROM and the asymmetric interest rate corridor are involved in liquidity management.

ROM and interest rate corridor also play complementary roles. The presence of the corridor provides a degree of flexibility in terms of sterilisation of liquidity movements within the use of ROM (Alper, Kara and Yorukoglu, 2013ᵃ). For instance, during a surge of capital inflows, the central bank will have the option of not fully sterilising liquidity withdrawn through the ROM by letting short-term interest rates decline. A fall in short-term interest

rates may discourage short-term capital inflows fostering the role of ROM as an exchange smoother and automatic stabiliser.

IV.4   Lessons for Nigeria

Nigeria can learn from the Malaysian experience by allowing residents the option of settling transactions in goods and services with non-residents using local currency to enhance trade while at the same time warding-off pressure and the need for the central bank to intervene in the foreign exchange market. Another learning point borders on further liberalisation of the rules for investment in foreign currency assets to allow for greater flexibility for resident corporations in the sourcing and use of foreign currency funds for investment purposes as this has enabled resident corporations in Malaysia to invest more in foreign currency assets and improve direct investment abroad. This would create room for better management of foreign currency risks by resident corporations. The government of Malaysia has also planned to borrow from the US dollar bond for the first time in 4 years to shore up the country's foreign exchange reserves towards refinancing existing foreign debts that would accrue in the second half of 2015. Nigeria could tinker with some of the above options to increase her stock of foreign reserves.

The use of foreign exchange swaps as monetary instruments in Indonesia has encouraged local banks to place foreign currency (dollars) in Bank of Indonesia at specific rates within a certain periods. Nigeria could embrace the above variant of reserve option mechanism to shore up the CBN reserves. The foreign exchange swaps transactions in Indonesia were estimated to have increased Bank of Indonesia's reserves by $8.5 billion by the end of December 2014.

The use of unconventional monetary and macro-prudential policy by Turkey is commendable. This is innovative and allows policies to be tailored towards the fundamentals of individual countries. The ROM was engineered at a gradual pace to avoid an additional shock to the banking system arising from a rapid increase in ROC. The CBRT increased ROM and ROC gradually and took account of the course of capital inflows and the pace of credit growth. The assumption was that banks would respond to volatility in capital flows by adjusting their ROM utilisation.   Nigeria can borrow a leaf from this. The CBN could therefore take a closer look at the Asymmetric Interest Rate Corridor and the Reserve Option Mechanism with a view to adapting the rudiments to Nigeria. Turkey made her environment and the banking system conducive and attractive for foreign investors. Nigeria needs to make her system attractive for foreign investors.

These are in-fact two areas of concern to the Nigerian financial system, particularly the Central Bank. Nigeria has a large amount of foreign exchange in unofficial /autonomous sources. These arise through receipts from the sale of non-oil exports, invisible purchases and other external account purchases. The banks in turn monetise these receipts directly through the black market making quite a margin in the process. ROM is a mechanism that could be used to encourage the mop up of such foreign exchange into the reserves. ROM will also assist the CBN in liquidity management.

V.   Methodology

V.1   Data, Sources and Description

This study utilised monthly data spanning the period 2008M1 to 2015M6. This covers the period of high reserve accretion and the current oil price and exchange rate crises. The variables used are broadly categorised into reserve accumulators and reserve drainers. The reserve accumulation variable is oil price while the reserve drainers include import bills, debt service payments and base money. These variables were obtained from the Central Bank of Nigeria Statistical database. To keep the data in the same magnitude, a log transformation of the data were carried out to avoid error of measurement and heterogeneity bias. The data were also subjected to diagnostic checks such as the unit root tests to ensure that the inferences drawn from the results are not misleading or spurious.

Reserves as used in this study refer to the amount of official foreign assets held by the central bank or monetary authority. Oil price reflects the price of crude oil per barrel at the international market. Imports cover the total value of goods and services imported from foreign countries, while debt service payments is the total amount of money paid to service external debts owed by a country. Base money is the net domestic asset plus net foreign asset of the monetary authority.

V.2   Analytical Framework

To determine the factors accounting for the depletion of reserves in Nigeria, we follow the analytical models[3] of Shcherbakov (2002) for the Russian economy but modified to capture the fundamental characteristics of the Nigerian economy, and Oputa and Ogunleye (2010) for the Nigerian economy[4]. From the issues discussed in the literature, there are two main factors affecting the depletion of reserves in Nigeria. These are the reserve accumulation factors and the reserves drainers.   We begin by specifying the analytical function as:

$$RES_t = \alpha + Z_t + X_t + \varepsilon_t \tag{6}$$

Where RES_t represents external reserves, Z_t captures the reserves accumulation variable while X_t is a vector of reserve draining variables. As stated earlier, oil price bears a direct relationship with reserve movement in Nigeria. Thus, reserve accumulation is a function of oil price dynamics; hence we redefine Zt in equation 6 as;

$$Z_t = OP_t \tag{7}$$

Where Z_t, is as specified in equation 6 and OP_t is oil price. The assumption is that when oil price increases, reserves also rise and vice versa. The equation for reserve drainers is specified as;

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[3] The generic model is known as the buffer stock model developed by Frankel and Jovanovic (1981).
[4] Nigerian external reserves moves in same direction with oil price movement.

$$X_t = M_t + EDS_t + MB_t + \square\square \tag{8}$$

Where M_t is import, EDS_t represents short-term debt service payments and MB_t is base money. Imports have an inverse relationship with reserve movement. Thus, an increase in imports depletes reserves and *vice versa*. Similarly, an increase in debt service payments also increases the level of reserve depletion, while the relationship between the monetary base and the depleting reserves would depend on the domestic component of the monetary base.

Transforming equation 7 and 8 into equation 6 yields equation 9, which is specified in general form as;

$$RES_t = \alpha + OP_t + M_t + EDS_t + MB_t + \varepsilon_t \tag{9}$$

Equation 9 is the standard equation for measuring the impact of reserve drainers and accumulators on external reserves, where Y_t is used to measure reserve movement, OP_t captures oil price dynamics, M_t represents imports, EDS_t is debt service payment while MB_t represents monetary base.

V.3   Estimation Techniques

Given the stochastic behaviour of time series data, we subject the data to diagnostic checks such as the unit root tests and co-integration tests. The Augmented Dickey Fuller (ADF) and the Philips-Peron (PP) tests were used to determine the presence or otherwise of a unit root in the series while the Johansen technique was also applied to determine the existence of long-run relationship among the variables.

Furthermore, since the variables were all integrated of order one (see table 5.1 below) and satisfy a long-run relationship among the variables, the Canonical Co-integrating Regression (CCR) technique of the least squares method was applied to estimate the determinants of external reserves in Nigeria in equation 9. The choice of the technique is because of its appealing feature to joint co-integration of variables of the same order. Furthermore, CCR yields asymptotically efficient estimator for joint dependent variables in a regression with fairly non-restrictive distributional assumptions, which these models exhibit (see, Dahl, et al 2006, Anderson 2002, Montalvo 1995, and Park 1992).

VI.   Empirical Analysis
VI.1   Unit Root Test Results

The results of the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests are presented in Table 5.1. All the variables under consideration namely, external debt service, imports, oil price, reserves and base money are I(1) process, which means that they are stationary at first difference. Consequently, there is the need to test for the long-run relationship among the variables as this is necessary to justify the choice of estimation technique.

Table 6.1: Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) Unit Root tests at 5 per cent level of significance

VARIABLES	ADF		PP		Decision
	LEVELS	1ST DIFF	LEVELS	1ST DIFF	
RES	−1.59	−6.53	−1.19	−6.60	I (1)
EDS	−1.61	−5.66	−0.90	−5.66	I (1)
M	−2.79	−8.84	−3.52	−40.00	I (1)
OP	−2.40	−5.65	−1.79	−5.66	I (1)
BM	−2.11	−10.82	−2.12	−11.96	I (1)

Source: Authors own computation

VI.2   Co-Integration Test Results

The result of the Johansen co-integration test shows that there is at least one co-integrating relationship among the variables in both the trace and max–eigen statistics at 5 per cent level of significance (see appendix 1).

VI.3   Model Estimation Results

The results of the CCR are presented in Table 3. The results show that most of the variables conform to *a priori* expectations. For instance, oil price, imports and external debt service possess the expected signs. The results indicate that a one per cent change in oil price will significantly induce a 0.36 per cent change in reserves movement. This implies that a percentage fall in oil price will induce a substantial impact of about 0.36 per cent decline in external reserves accumulation.

Furthermore, import has a negative statistically significant relationship with reserve movement in Nigeria. The result reveals that a one per cent rise in imports would induce a 0.72 per cent fall in reserves. This suggests that imports have a substantial impact on reserve behaviour in Nigeria. This result indicates that imports would continue to be a dominant drainer of reserves given her import dependent economy. Thus, it is reasonable to conclude from the empirical finding of this study that import is the main drainer of reserve in Nigeria. In a similar vein, the empirical result indicates that if external debt service changes by one per cent, reserve is likely to decrease by 0.53 per cent even though it is not statistically significant. Again, this suggests that debt service is not a major drainer of reserve on the interim given the low level of external debt to GDP. The debt relief package granted to Nigeria by her creditors in 2005 substantially reduced the country's short-term debt payment obligations, thus its insignificant impact on reserves.

The results show that base money does not significantly impact on reserves and that 51 per cent of the changes in reserves are accounted for by the explanatory variables. Specifically, the result indicates that increasing demand for imports and the falling crude oil prices are the main factors fuelling reserves depletion in Nigeria. This implies that there is need to direct policy actions to reducing imports (especially of consumables) and diversifying the export base to mitigate shocks arising from oil price slumps.

Table 6.2: Model Estimation Results

Dependent Variable	RES		
Variables	Coef.	Std. Error	Prob.
OP	0.358598	0.082324	0.0000**
M	–0.717007	0.111635	0.0000**
EDS	–0.053075	0.122976	0.6671*
BM	0.189215	0.307149	0.5395*
C	16.39417	3.100671	0.0000**
R^2 = 0.51 per cent significance Level	** 5 per cent significance level; *10 per cent		

VII. Conclusions and Policy Recommendations

The growing concern over the macroeconomic costs underlying the sharp depletion of external reserves in Nigeria has necessitated the need to empirically investigate the role which movements in oil price, import bills, external debt service and monetary base variables played. This was done using monthly data spanning 2008:1 to 2015:6 and applying a canonical co-integration regression (CCR) technique. The results show that fluctuations in oil price and rising import demand are the main drainers of reserves in the country. In addition, the study reviewed the experiences of Malaysia, Indonesia and Turkey in reserve management, with a view to draw lessons from same.

To engender adequate level of external reserves in Nigeria, the following recommendations arising from our empirical findings and the reviewed country experiences are proposed:

- Conduct a periodic review of the import basket with a view to expanding the current import prohibition list beyond the 41-items to include all commodities which can readily be produced domestically;

- Intervention by the CBN in the foreign exchange market should be sustained to check speculative attacks on the naira and also, reduce demand pressure;

- Sustain the implementation of the Treasury Single Account (TSA), especially for those Ministries, Departments and agencies (MDAs) which generate revenue in foreign currency, such as Nigeria Ports Authority (NPA), Nigeria Maritime Administration and Safety Agency (NIMASA), Liquefied Natural Gas (LNG), Nigeria National Petroleum Corporation (NNPC). This would enhance the accretion of such funds to the reserves held by the Central Bank.

- Adopt a modified version of the reserve option mechanism as a tool to efficiently manage the autonomous reserves with the DMBs. This entails keeping part of banks' CRR with the CBN in foreign currency. The determination of the ratio of ROM for banks should be determined by CBN based on banks foreign asset position and balance at the inter-bank market operations.

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