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The *Economic and Financial Review (EFR)* is a quarterly publication of the Research Department of the Central Bank of Nigeria. The Review contains articles on research undertaken at the Bank, in particular, and Nigeria, in general, mainly on policy issues both at the macroeconomic and sectoral levels in the hope that the research would improve and enhance policy choices. Its main thrust is to promote studies and disseminate research findings, which could facilitate achievement of these objectives. Comments on or objective critiques of published articles are also featured in the review.

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Notes to Contributors

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

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Contents

Money, Inflation and Growth in Nigeria: A Re-Examination of the Effectiveness of Monetary Targeting

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Abstract

This paper examined the effectiveness of monetary targeting, as the framework for monetary policy in Nigeria, using co-integration and error-correction modelling techniques and quarterly data spanning 1985Q1to 2018Q2. The empirical results showed that the choice of monetary targeting framework is not misplaced, given the stability of the real money demand function all through the study period, except during the global financial crisis when orthodox monetary policy tools became less-effective and were complemented with unconventional measures. Also, gross domestic product (GDP) growth was found to predict changes in monetary aggregates and vice versa. Further evidence suggested that significant deviation of monetary growth from set targets, led to higher inflation and lower output growth. The study, therefore, emphasises the need for the implementation of relevant structural policies alongside monetary policy efforts of the Bank. In addition, the Central Bank of Nigeria should ensure that monetary expansion beyond rule-prescribed targets is minimised.

Keywords: Inflation, Monetary Targeting, GDP growth, Co-integration, Stability tests.

JEL Classification Numbers: E41, E52, E58

I. Introduction

Achieving the objective of monetary policy requires central banks to adopt an appropriate monetary policy framework, in line with the workings of their economies. Thus, the effectiveness of any given framework is gauged by its ability – given the instruments and strategies at its disposal – to meet the target objectives of monetary policy, with minimal deviations. In Nigeria, the overriding objective of monetary policy is the attainment of price stability and sustainable economic growth (CBN, 2011). Price stability in this context refers to low and stable inflation, where the central bank aims to maintain an explicit inflation target or keep inflation within an implicit single-digit band – in the case of non-inflation-targeting central banks – such as the Central Bank Nigeria (CBN).

From inception, the CBN has implemented two monetary policy frameworks, beginning with exchange rate targeting up until 1973, and subsequently, monetary targeting. However, the CBN (2012) noted that although monetary targeting remains the framework for monetary policy, in practice increased attention has been paid to short term interest rates in recent years. This perhaps implies that it may be inappropriate to ascribe monetary policy outcomes in recent times to monetary

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targeting - where the intermediate target in practice has been short-term interest rates. Tule et al. (2015) noted that the reliability of monetary aggregates as the main signal for the conduct of monetary policy has become questionable partly because of the weakening relationship between money and inflation, which was formalised in the quantity theory of money (see Goodhart, 1998). In Nigeria, the issue may be far beyond the weakening of the said theoretical relationship, as there are a number of other constraints – notably structural issues – which may be impeding the transmission mechanism of monetary policy impulses to the economy and may continue to pose challenges to monetary policy regardless of the framework adopted.

An examination of monetary targets or benchmarks and their outcomes tends to support the observation above. For example, since 2014, the actual annual monetary growth has consistently fallen short of the benchmark except in 2016, when growth in broad money supply was 27.5 per cent compared with the benchmark of 10.98 per cent for the year. However, the inflation outcome did not mirror the movement of monetary growth during the period. For instance, the average annual headline inflation (year-on-year) rose from 8.06 per cent in 2014 to 16.55 per cent in 2017, reflecting a disconnect between broad money supply (M2) and inflation outcomes. In fact, headline inflation had exceeded, and remained outside, the Bank's single-digit range, since February 2016, as it rose from 11.4 per cent to a peak of 18.72 per cent in January 2017, and thereafter maintained a downward trend to 11.26 per cent by October 2018.

Output growth has not fared any better in recent years. In its 121st Monetary Policy Communiqué of November 22, 2018, the Monetary Policy Committee (MPC) of the CBN noted the implication of tightening or loosening its stance, given the negative output gap. Output growth had been trending downwards since 2015, culminating into the recession which lasted from the second quarter of 2016 to the second quarter of 2017. Despite exiting the recession, recovery has been fragile and slow, due to the prolonged weak aggregate demand. Although there are other reasons, especially structural issues, that could have constrained monetary policy from achieving its primary objective (low and stable inflation and sustained output growth), the key question is: could the current framework (of monetary targeting) have been partly responsible for the monetary policy outcomes of the last several years?

Generally, because the demand for money is the link between monetary policy and the rest of the economy, a stable money demand function is central to the effective conduct of monetary policy, where monetary targeting is the adopted framework (see Poole, 1970; Mishkin, 1989). Accordingly, the estimation of a stable money demand function allows for an assessment of the impact of monetary policy

on macroeconomic aggregates like inflation and output (Cziraky and Gillman, 2006; Mishkin, 2007).

Several studies have examined the stability of the money demand function for Nigeria after the era of the famed TATOO debate (see, Darrat, 1986; Amadi, 1999; Nwafor et al., 2007; Owoye and Onaforuwa, 2007; Iyoboyi and Pedro 2013; Doguwa et al., 2014; Okonkwo et al., 2014; Onakoya and Yakubu, 2016; Bassey et al., 2017; among others). Interestingly, these studies established, among other findings, that the money demand function for Nigeria was stable; thus, giving credence to the continued application of monetary targeting framework for monetary policy. However, the studies fall short in two major respects: data and the questions pursued. First, most of the studies made use of low frequency annual data, the span of which did not exceed 2014 (for example, Amadi 1999; Iyoboyi and Pedro, 2013; Okonkwo et al., 2014; Onakoya and Yakubu, 2016; Bassey et al., 2017). The others that used data of higher frequency (Darrat, 1986; Nwafor et al., 2007; Owoye and Onaforuwa, 2007; Doguwa et al., 2014) did not exceed 2005, except Doguwa et al., (2014), who used data that spanned 1991Q1 to 2013Q4. Thus, their analysis may have been less robust, due to the constraint of number of observations and the inability of the data to capture all possible structural shifts since the early 1980s. Second, only the Owoye and Onaforuwa (2007) study investigated the impact of the deviations from money supply benchmarks and the actual outcome on inflation and output during the period 1986-2001. Despite the detailed analysis in the paper, the findings may no longer be useful for policy almost two decades after.

It is, therefore, evident from the foregoing that the stability or otherwise of money demand function needs to be re-examined with more updated high frequency data, in view of the changing dynamics of the macroeconomic/policy environment and possible regime shifts. Furthermore, there is the need to examine the direction of causality between income, money and inflation, as this would help to know whether changes in prices are driven by structural factors or not. We would also examine whether or not money supply exhibits both endogenous and exogenous properties. Lastly, it is imperative to assess the impact of the deviations of monetary growth from its targets and how this impact on economic growth and the general price level, as this will show the effectiveness of monetary policy in achieving low and stable inflation and economic growth. These are the gaps that this paper seeks to fill.

Overall, this paper seeks to re-examine the effectiveness of monetary targeting as the framework for monetary policy in Nigeria. Specifically, it estimates and tests the stability of the money demand function for Nigeria using quarterly data from 1981Q1 to 2018Q2 with a view to ascertaining the suitability or otherwise of money supply as an intermediate target of monetary policy in the context of regime shifts in

the data. It also estimates direction of causality among the variables and examines the impact of the deviations of the growth of money supply on inflation and output.

The remainder of the paper is structured as follows: Section 2 presents an overview of the CBN's approaches to the conduct of monetary policy; whereas Section 3 reviews the theoretical framework and empirical literature. Section 4 covers the methodology, while Section 5 discusses the results of the empirical analysis. Lastly, Section 6 concludes the paper and draws policy implications.

II. Overview of the CBN's Approaches to Conducting Monetary Policy

Over the years, the Central Bank of Nigeria has adopted numerous approaches to conducting monetary policy, ranging from the exchange rate targeting regime (1959 – 1973), to the monetary targeting regime, which began in 1974. Other monetary policy reforms implemented include the change from direct monetary control (1974 - 1992) to indirect monetary control (1993 - date) and the banking consolidation exercise (2004/2005).

Prior to the establishment of the CBN, the conduct of monetary policy in Nigeria was largely predicated upon the economic conditions in England. Exchange rate targeting was the approach to conducting monetary policy and the Nigerian pound was fixed at par with the British pound. This approach proved effective as the fixed exchange rate enhanced the maintenance of balance of payments viability alongside price stability in Nigeria. The fixed parity with the British Pound was abandoned in 1967, when the British pound was devalued and the Nigerian pound was then pegged to the US dollar. The fixed parity with the British pound was abandoned due to the deployment of resources to finance the civil war and the adverse effect of the devaluation on the domestic price of imports without a significant complementary impact on exports (composed largely of primary products). However, severe import restrictions were imposed as foreign exchange controls (Nnanna, 2001).

The dollar peg was later abandoned for the British pound in 1970, due to the international financial crisis that led to the devaluation of US dollar, and, in 1973, the peg to the British pound was once again abandoned for the US dollar. As a result of limitations of pegging the Nigerian currency to a single currency and its implications for independently managing the exchange rate, the naira was pegged to a basket of 12 currencies of her major trading partners in 1978 (Nnanna, 2001).

The significant increase in external reserves, exports earnings, government revenue, arising from crude oil sales in the 1970s, led to a structural shift in the conduct of monetary policy in Nigeria. Government expenditure also increased substantially,

due to the need to finance post-war efforts, further exacerbating inflationary pressures in Nigeria. The combination of these developments, prompted the monetary authorities to adopt a new monetary policy framework, monetary targeting, in 1974, which still subsists to date. The adoption of this framework was based on the belief that inflation was a monetary phenomenon and, as such, market (indirect) and non-market (direct) instruments were used to control monetary aggregates (Nnanna, 2001).

The CBN adopted the approach of direct monetary control during the 1974 – 1992 period. This approach involved imposing fixed interest rates and credit ceilings on banks, in addition to determining the level of credit allocation to the different sectors of the economy. Under this approach, agriculture, construction and manufacturing were given preferential treatment in terms of credit allocation and lower lending rates. The sectors of the economy were divided into three; preferred (agriculture, manufacturing and residential housing), less preferred (imports and general commerce); and others. Using this classification, therefore, the monetary authorities directed credit to priority sectors at concessionary rates, usually below the minimum rediscount rate (MRR) (Nnanna, 2001).

Empirical analysis of the control era of monetary policy revealed that credit supply to the priority sectors failed to meet stipulated targets and did not have significant positive impact on investment and price level. This was attributed to the adverse selection of banks in their credit allocation. The lack of instrument autonomy by the CBN during this era also impaired the effectiveness of monetary policy, as the policies of the apex bank were dictated by the Ministry of Finance.

The downturn in oil prices in the 1980s and the subsequent adoption of the Structural Adjustment Programme (SAP) led to both structural and policy reforms, such as the deregulation of the financial system. Consequently, there was a switch to the indirect system of monetary control in 1993. The system of fixed credit allocations and regulated interest rates were dismantled and indirect instruments of monetary control were employed. The direct system involves the use of open market operations (OMO), reserve requirements and moral suasion in the achievement of the CBN's objectives (Nnanna, 2001). In line with other reforms implemented, the banking consolidation exercise of 2004/2005 sought to strengthen Nigeria's banking sector and improve its operational efficiency. The reforms were aimed at supporting Nigeria's economic development by positioning banks to provide effective financial intermediation, and becoming major players in the sub-regional, regional and global financial markets, as well as, competing favourably with international banks (Odeleye, 2014).

The consolidation initiative of the CBN was, therefore, targeted at addressing

weakness within the banking system, primarily through the recapitalisation of banks to a minimum paid-up capital of N25 billion. Hence, post-consolidation, the number of deposit money banks (DMBs) fell to 25, from 89, due to the inability of 64 banks to meet the minimum capital requirement, as at January 2006. Other key features of the reform included: the adoption of a risk-focused and rule-based regulatory framework; enforcement of corporate governance principles; introduction of an expeditious process for rendition of returns by banks and other financial institutions through e-FASS; and revision/updating of financial laws (CBN, 2011). The result of the exercise was largely positive and led to the overall strengthening of the banking system.

III. Literature Review

III.1 Theoretical Framework

III.1.1 Traditional Quantity Theory of Money

The traditional quantity theory of money is one of oldest theories of money. The theory assumes that money supply is exogenously determined and that increase in money supply will cause proportionate increase in the general price level in an economy. This relationship is expressed as: $P = VM/Y$ where P is the aggregate prices, V is velocity of money, M is total money supply and Y is real output. Transforming the above equation into growth rates it becomes $p = v + m - y$, where the inflation rate is p, m is the growth of money stock, v and y are velocity and growth rates of output, respectively. Given the assumptions of constant velocity of money and money neutrality in the long-run, a change in money growth will induce proportional change in the inflation rate. In view of this theoretical proposition, the monetarists argued that increase in money supply will induce rise in output in the short-run, but in the long-run it only affect prices. They concluded that money plays an active role and lead to changes in output and prices. If this proposition holds, we expect unidirectional causality from money supply to output and prices. Although, this theory still remains appealing, it had been faulted because of some unrealistic assumptions. For instance, inactive balances exist in an economy because of hoardings, therefore the assumption that the means of payment MV always equals to total payment PT, not always holds. The theory also, erroneously, assumed full employment all the times.

III.1.2 Keynes' Reformulated Theory of Money

Keynesian quantity theory proposes that money supply does not play a significant role in inducing income and prices. The argument is based on five basic assumptions: that the supply of productive factors are perfectly elastic as long as unemployment exists; that factors of production are homogeneous, perfectly divisible and interchangeable; assumes constant returns to scale; that prices do not rise and fall in the same proportion as output; and that quantity demand and

quantity of money changes in the same proportion when there is unemployment resources. Given these assumptions, Keynes argued that changes in money supply have indirect effect on prices through interest rate. An increase in money supply will lead to fall in interest rate and consequently increase the volume of investment. Investment in turn will raise effective demand and through multiplier effect and subsequently increase income, output and employment. Under the assumption of perfect elastic of supply of factors of production, constant wage and non-wage factors, and constant returns to scale, prices do not rise with the increase in output as long as unemployment exists. However, on the assumption of full employment in the long-run, increase in money growth will be exacted on prices because of the proportional rise in effective demand. In sum, Keynes quantity theory of money proposed that as long as there is unemployment, a rise in the money supply exacts equal change in output and there will be no change in prices; but when full employment is achieved in the long-run, prices will change in equal proportion to change in money supply. The propositions of Keynes imply that there is a unidirectional causality from income to money and that changes in prices are driven by structural factors.

In view of different theoretical propositions on the relationship among money, inflation and output, the need to re-examine this relationship in Nigeria becomes imperative for effective monetary policy implementation. Aside theoretical conflicting propositions, Cagan (1965) suggested that, in the short-run with cyclical fluctuation, money supply should be treated as endogenous variable, which is determined by changes in the real sector fundamentals. However, in the long-run, he found that money supply movements are not influenced by the real sector fundamentals (i.e. money supply is exogenously determined). Cagan (1965) findings imply that money supply exhibits both endogenous and exogenous properties. These findings further reinforce the need for a thorough re-examination of both the short-run and long-run.

III.2 Empirical Literature

The empirical literature on the suitability and effectiveness of monetary targeting framework for monetary policy centre on the stability of the money demand function, and the causal relationships among money supply, price and output. The importance of this stems from the use of historically estimated relationships for forecasting purposes.

Among the early studies that made success in estimating the demand for real money balances in the U.S. was Goldfeld (1973). He established a long-run relationship between the narrow definition of money demand (M1), output and interest rates and also captured short-run dynamics within the partial adjustment

model. Other researchers including Stock and Watson (1993) afterwards confirmed the stability of the long-run money demand (M1) over 1900 – 1989 function for the U.S. in the context of co-integrating vectors. However, estimates that were based on post-war data alone were unstable. Also, Ball (2012), contrary to received wisdom, found that the short-run demand for money (M1) was stable using U.S. post war data from 1959 through 1993 using Goldfeld (1973) partial-adjustment model. The key innovation in the paper was the use of average return on near monies. Wang (2011) tested the stability of the long-run money demand in the U.S. with the post-war data used by Stock and Watson (1993), which he extended to 1997. He endogenously determined the location of regime shifts in the data, and found that the money demand function was stable with two regime shifts.

In the euro area, Dregar and Wolters (2014) investigated how closely related money and inflation are, whether a constant parameter M3 (stable) money demand function exists, and the forecasting power of monetary indicators with respect to inflation, taking financial and economic crises into consideration. They found a stable money demand function, even during the economic and financial crises. Also, excess liquidity, 'excess' inflation and the spread were all found useful in predicting inflation.

In the West African Monetary Union (WAMU), Asongu et. al. (2018) used annual data to examine the stability of the money demand function for 13 countries that make up the Economic community of West African States (ECOWAS). They found divergence in the stability of the money demand function across member countries, accounted for by differences in co-integration, short- and long-run determinants, among others. Ben-Salha and Jaidi (2014) investigated the determinants of money demand in Tunisia. They found evidence of co-integration between broad money supply and its determinants. In the short-run, the demand for money was only affected by interest rates and expenditure on investment goods. In the light of the stability of the money demand function, they concluded that monetary policy in Tunisia should be based on a broad definition of money. In Ghana, Nchor and Adamec (2016) investigated the stability of money demand from 1990 through 2014, using co-integration and error-correction model. Their results showed that the level of demand for money was affected by GDP in the long-run, while the interest rate influenced it in the short-run. Furthermore, the money demand function was found to be stable over the period and there was no evidence of structural breaks.

In Nigeria, empirical literature on money demand and its determinants gained prominence with the TATOO debate in the early 1970s. As stimulating as the debate was, the issue remained inconclusive. However, with the array of new estimation techniques and the developments in the financial sector since liberalisation in 1986,

the relevance of the debate has since diminished. One of the early studies on money demand after the era is that by Darrat (1986), which focussed on the demand for money in three major OPEC members (Saudi Arabia, Libya and Nigeria) from 1963 to 1979. The model exhibited structural stability and the paper concluded that foreign monetary influence contributed to the stability of demand for money in the three countries. Amadi (1999) studied the demand for money in Nigeria, using the error correction model approach, without necessarily testing the stability. The study found that money demand in Nigeria is a function of GDP, exchange rate and the price level, indicating that interest rate did not seem to affect the level of money demand. Using an autoregressive distributed lag model, Akinlo (2006) examined the co-integrating property and stability of M2 money demand. The result showed that there was a long-run co-integrating relationship between M2 with income, interest rate and exchange rate. Furthermore, the result revealed a stable money demand function using the CUSUM test. In a related study, Nwafor et al. (2007) investigated the quantity theory of money within the context of the Keynesian liquidity preference theory. The results indicated a long-run relationship among demand for money (M2), real income, real interest rate and expected inflation. They concluded that since M2 was a stable function of money demand, it was a viable monetary policy tool to affect economic activities in Nigeria.

In a closely-related paper, Owoye and Onafowora (2007) examined monetary targeting, demand for money and the stability of the real M2 money demand, as well as, the effects of deviations of actual real M2 from targets on real GDP and inflation, since the introduction of the Structural Adjustment Programme (SAP). The results revealed a long-run relationship between real broad money supply and their determinants. Also, the short- and long-run parameters of the real money demand function were found to be stable, thus supporting the CBN's choice of M2 as an intermediate target in its monetary policy framework, even though they contended that the Bank was not strongly committed to its annual M2 growth targets. Lastly, the paper showed that the deviations from the M2 target growth rates impacted on real GDP and inflation adversely during the period.

Doguwa et al., (2014) estimated the money demand function in Nigeria in the context of the recent Global financial crisis, testing whether the underlying properties changed over the years or not, while accounting for possible structural breaks. The results showed that there existed a long-run stable relationship between real money supply and the included predictor variables before and after the GFC, thus providing support for monetary targeting framework in Nigeria. A similar study by Okonkwo et al. (2014) examined questions similar to Doguwa et al. (2014) although without testing for structural breaks. They, however, recommended that the monetary policy strategy of the Bank should be structured to deal with the growing challenges posed by financial innovations.

Tule et al. (2015) investigated the relationship between money growth and inflation in Nigeria, including the impact on monetary policy in Nigeria, by testing the proportionality and orthogonality assumptions of the quantity theory of money. Growth in money supply was found to be a significant predictor of inflation, stressing, however, that the predictive power of M2 growth on inflation has waned. This weak relationship, they argued could be a result of recent developments in the financial system such as new products and asset classes.

The gaps in the studies were highlighted in the introductory part. More importantly, this study covered a longer dataset than all the ones reviewed in the literature. Also, this study examined a broader range of questions, including tests for short- and long-run relationship among the variables, stability tests, and test for structural breaks in the data, as well as, estimating the impact of deviations in money growth on output and inflation.

IV. Methodology

IV.1 Model and Data

The study sought to re-examine the effectiveness of monetary targeting in Nigeria, by investigating relationship among money, inflation and growth for the period, covering 1985Q1 to 2018Q2. To achieve this objective, we employed portfolio balanced model to estimate long-run real demand for money function for Nigeria. The assumption underlining portfolio balanced model rests on the notion that economic agents hold money either as an asset for portfolio yield or for inventory purposes (i.e. to balance differences between expenditures and income) (Thomas, 1985; Owoeye and Onafowora, 2007). This suggests that demand function in an open economy, such as Nigeria, should incorporate relevant variables, such as the rate of returns to money, returns on alternative assets, and real income. The return on money is the domestic interest rate, while the return on real assets is the expected inflation rate because real assets value depend on inflation expectation.

Nigerian economy is a small open economy, characterised by relative degree of trade openness and financial deepening. This suggests that foreign factors affect domestic demand for money, through capital mobility and exchange rate variability. Therefore, estimation of real demand for money should capture domestic and foreign developments. Aside domestic factors, such as growth in real output and domestic interest rate, some studies on demand for money have used foreign interest rate and expected rate of depreciation of domestic currency to capture the effects of foreign factors (Arize et al. 1990; Bahmani-Oskooee 1991; Ibrahim 2001; Civcir 2003 and Owoeye and Onafowora, 2007). These studies suggest that economic agents vary their demand for domestic money holdings as foreign interest rate changes. For instance, a rise in the foreign interest rate surges

the return on foreign assets over the domestic assets and reduces the willingness of economic agents to hold less of domestic assets. The effects of depreciation of local currency could either be positive or negative on the demand for money function. Depreciation of domestic currency either lead residents to anticipate further depreciation and move ahead to hedge against risk by holding more of foreign currency and less demand for domestic assets or switch portfolio from domestic assets, in favour of foreign assets.

Based on these propositions, this study leveraged on Owoeye and Onafowora, 2007 and specified long-run real money demand for Nigeria as follows:

$$\Delta InRMB = \alpha_0 + \alpha_1 \Delta InRGDP_t + \alpha_2 DOI_t + \alpha_3 INF_t + \alpha_4 \Delta InEXC_t + \alpha_5 FOI_t + \varepsilon_t \quad (1)$$

where RMB represents the real money balances, defined as money stock (M_2) divided by the domestic price level (CPI), $RGDP$ represents the real GDP, DOI is the domestic interest rate proxied by Nigerian three-month Treasury bill rates, INF represents the inflation rate, EXC stands for the exchange rates proxied by the BDC rates, which reflected market more than the interbank rates, FOI represents the foreign interest rates, proxied by US three-month Treasure bill rates, In represents natural logarithm to avoid the problems of heteroscedasticity, and ε stands for the error term. The data on real GDP and inflation rate were obtained from the National Bureau of Statistics (NBS) database, while money supply and domestic interest rate were sourced from the CBN database, foreign interest rate was sourced from the IMF Financial Statistics database.

IV.2 Technique of Analysis

In exploring the long-run and short-run dynamics of demand for money in Nigeria, we adopted the Johansen (1998) and Juselius (1992) method of co-integration and vector error correction methodology (VECM) to capture the relationship among money supply, real output and inflation. The adoption of this method was informed on the ground that short-run and long-run dynamics among money, inflation and output are better captured, using the method. The approach not only provides estimates of co-integrating vectors but also allows test for the ranking of co-integration, r, which make the Johasen co-integration superior to other methods.

We leveraged on Sims (1990) and constructed an unrestricted vector autoregressive (VAR) process with k lags, as shown in Equation 2.

$$Y = \eta + \beta_i Y_{t-1} + ... + \beta_t Y_{t-k} + \varepsilon_{t-k} \; \varepsilon_t IN(0, \Sigma) \quad (2)$$

where Y_t is $(n \times 1)$ vector of endogenous variables of real money balance and other relevant variables, β_i is $(n \times n)$ matrix of parameters, the minimum lag length is k, it reduces serial correlation to zero of residuals in each of the equation in the VAR

model, the selection of lag length was based on the Ljung-Box and Q-statistics. The vector of white noise processes with non-diagonal covariance matrix was represented by ε_{t-k} The study further examined the stability of the model, using the Root of Characteristic Polynomial, the VAR is considered stable if no root lies outside the unit circle. Moreover, stationarity of the variables was examined by running a first difference dependence variable against a constant, a term trend and against its lagged difference terms. This was expressed as follows:

$$\Delta Y_t = \beta_0 + \beta_1 t + \beta_2 Y_{t-1} + \sum_{j=1}^{p} \beta_j \Delta Y_{t-j} + \varepsilon_t \quad (3)$$

The null hypothesis (H_0) that Y_t contains a unit root is rejected if the coefficient of Y_{t-1} is significantly different from zero, which implies stationary of the series i.e. $(H_0 : \beta_2 < 0)$, Y_t is not rejected, the data series is non-stationary and is said to contain unit root. We use the Augmented Dickey-Fuller (ADF) and Philips Perron (PP) tests. If the calculated value of ADF or PP is higher than the critical values, the null hypothesis is not rejected and the series is non-stationary. A non-stationary series require differencing until stationary is achieved, but VAR model in generally constructed in its first-difference.

To test the effectiveness of monetary policy in a VAR framework, especially on inflation and economic growth, impulse response function was generated. It traced the effect of one standard deviation shocks to one of the innovations on current and future values of the endogenous variables (Olorunfemi and Adeleke, 2012). We further examined the degree of causality to ascertain the causal effect of variables of interest on another. Granger causality simply measures how past variations in one variable help to explain current variations in another variable, over and above its own past variations if, otherwise, we conclude that such variable does not Granger-cause another.

The next procedure was to conduct Johansen co-integration test to identify co-integrating vectors in non-stationary time series. Johansen framework employs the maximum likelihood procedure to identify co-integrated vectors. It starts with estimation of unrestricted VAR, where:

$$Y_t = \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \ldots + \alpha_p Y_{t-p} + \delta X_t + \varepsilon_t \quad (4)$$

where Y_t is a k vector of first-difference endogenous variables and X_t was a first-difference vector of exogenous variables and $\alpha_1 \ldots\ldots \alpha_p$, δ were matrices of coefficients in the model, and ε_t was a vector of innovations that are uncorrelated with the right-hand variables, its own lagged values, but contemporaneously correlated. The Johansen co-integration uses two test statistics, namely, the trace test and maximum eigenvalue test statistics. The trace test λ_{trace} is the rank test for

non-zero eigenvalues (λ_i) The maximum eigenvalue test statistics is the test of the significance of the largest λ_r with the null hypothesis of at most r co-integrating vectors against the alternative of n co-integration vectors. This is expressed as follows:

$$\lambda trace = -T\sum_{i=r+1}^{n} In(1-\lambda_i) \quad r = 0,1,2...,n-2,n-1 \tag{5}$$

The maximum eigenvalue test statistics is the test of the significance of the largest λ_r with the null hypothesis of r against the alternative of $r+1$ co-integrating vectors as in:

$$\lambda_{\max} = TIn(1-\lambda_{r+1}) \quad r = 0,1,2,...,n-2,n-1 \tag{6}$$

Upon the confirmation of co-integrating relationship among the variables, then error correction mechanism was constructed. A vector error correction model (VECM) is a restricted VAR used for modelling co-integrated non-stationary variables. The VECM is represented as follows:

$$\Delta X_t = \theta_0 + \lambda_1 ECM_{t-1}^1 + \sum_{i=1}^{m}\theta_i \Delta X_{t-i} + \sum_{j=1}^{n}\theta_j \Delta Y_{t-j} + \varepsilon_{1t} \tag{7}$$

$$\Delta Y_t = \varphi_0 + \lambda_2 ECM_{t-1}^2 + \sum_{i=1}^{m}\varphi_i \Delta Y_{t-i} + \sum_{j=1}^{n}\varphi_j \Delta X_{t-j} + \varepsilon_{2t} \tag{8}$$

where, the lag one of error correction term was ECM_{t-1} λ represented the short-run coefficient of the error correction term, the value raged $(-1 < \lambda < 0)$, while ε represented the white noise. The ECM_{t-1} of the estimated equations show how short-run deviations from the long-run path of dependent variables adjust toward the long-run equilibrium condition. It limits the long-run behaviour of the endogenous variables included in the model to converge to long-run steady state while permitting short-run adjustment dynamics (Mishra et al, 2010). The signs of error correction term indicate whether the model is explosive or converging toward the long-run equilibrium state. It is termed explosive if the sign is positive, while a negative and significant sign indicates convergence towards the long-run equilibrium state and presence of long-run causal relationship.

V. Empirical Results and Analysis

V.1 Unit Root Tests

Table 1 presented the stationarity tests of the variables at levels and first difference using both augmented Dickey-Fuller (ADF) and Phillips-Peron (PP) unit root tests.

Table 1: Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) Tests

	LEVELS				FIRST DIFFERRENCE			
Variable	ADF1	ADF2	PP1	PP2	ADF1	ADF2	PP1	PP2
LRM2	-0.671	-2.681	-0.486	-1.871	-3.729***	-3.791**	-10.929***	-10.905***
DOI	-2.815	-3.577**	-2.938**	-3.219	-10.147***	-10.119***	-10.418***	-10.377***
FIR	-1.623	-4.336***	-2.196	-3.017	-8.053***	-8.020***	-8.094***	-8.067***
INF	-3.381**	-3.900**	-2.553	-2.756	-7.973***	-7.955***	-7.583***	-7.557***
LRGDP	-0.942	-2.011	-0.434	-3.593**	-2.201	-2.064	-14.689***	-14.599***
DEV	-3.742**	-4.339***	-3.483	-4.290**	-12.974***	12.917***	-14.940***	-14.883***
LEXC	-2.238	-1.807	-2.371	-1.681	-8.815***	-9.008***	-8.716***	-8.869***

ADF1 and PP1 refered to unit root tests conducted with intercept, while ADF2 and PP2 were conducted with intercept and trend. The asterisk *** and ** indicated statistical significance at 1% and 5% levels, respectively

Using the ADF test at levels, the results suggested that some of the variables were stationary at levels, while in most cases, PP test suggested non-stationary of the variables at levels. The PP test was preferred to augment the ADF test, due to the validity of its results even when disturbances are serially correlated and heterogenous, unlike the ADF test, which is non-parametric test. We, therefore, concluded that all variables were first difference, as indicated in Table 1.

V.2 Optimum Lag Length and Stability Tests

Estimation of a reliable VAR model requires the choice of appropriate lag length to ensure that the residuals are Guassian. In view of this, a maximum lag length of 8 was allowed in the selection process and appropriate lag length of one was selected based on SC Table 2).

Furthermore, we tested the reliability of the model using an autoregressive (AR) root stability test. This is to ensure the reliability of the coefficients of the normalised long-run and short-run vector error correction models. The test indicated that all roots had modulus less than one and lie inside the unit circle. This satisfied the stability condition (Table 3).

Table 2 : VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-888.4111	NA	0.074179	14.42599	14.56245	14.48142
1	-119.4142	1451.171	5.45E-07	2.603455	3.558712*	2.991503
2	-47.81582	128.1842	3.08E-07	2.029287	3.803335	2.749947
3	46.35879	159.4893	1.22E-07	1.090987	3.683827	2.14426
4	110.9741	103.176	7.82E-08	0.629451	4.041082	2.015335
5	194.226	124.8779	3.76e-08*	-0.132677	4.097745	1.585820*
6	231.1812	51.85658*	3.89E-08	-0.148085	4.901129	1.903025
7	269.8687	50.54329	3.98E-08	-0.191431	5.676575	2.192291
8	309.6443	48.11567	4.11E-08	-0.252328*	6.434469	2.464006

* indicates lag order selected by the criterion,
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 3: Roots of Characteristic Polynomial

Root	Modulus
0.995814	0.995814
0.949831	0.949831
0.896157 - 0.132904i	0.905959
0.896157 + 0.132904i	0.905959
0.833126	0.833126
0.105058	0.105058

No root lies outside the unit circle.
VAR satisfies the stability condition.

V.3 Causality Test

The causality result in Table 4 showed that the null hypothesis of INF does not Granger-cause LM_2 was accepted at the 5 per cent level of significance, while null hypothesis of LM_2 does not Granger-cause INF was rejected at the 5 per cent level of significance. It implied, unidirectional causality exist between money and general price level and the direction of causality was from money to inflation. Moreover, the null hypothesis of LRGDP does not Granger cause LM_2 and LM_2 does not Granger-cause LRGDP were both rejected at the 5 per cent level of significance. This indicated that bidirectional causality existed between real GDP and money. Deducing from the causality test results, it could be inferred that change in output and change in money supply caused each other.

Table 4: Results of Granger Causality Test

Null Hypothesis:	F-Statistic	Probability	Decision
INF does not Granger Cause LM_2	1.12935	0.3459	Accept
LM_2 does not Granger Cause INF	2.33744	0.0591	Reject
LRGDP does not Granger Cause LM_2	2.14508	0.0793	Reject
LM_2 does not Granger Cause LRGDP	3.4014	0.0113	Reject
LRGDP does not Granger Cause INF	0.90718	0.4621	Accept
INF does not Granger Cause LRGDP	1.15321	0.335	Accept

However, the null hypothesis of LRGDP does not Granger-cause INF and the null hypothesis that INF does not Granger cause LRGDP were accepted at the 5 per cent significance level. This showed that no causality between the two variables.

V.4 Johansen Co-integration Test

Based on the unit root test results, we proceeded to test for the existence of a long-run co-integrating relationship among the variables in the real money demand function in Equation (1), using the unrestricted co-integration rank test formalised by Johansen and Juselius (1990). The results of the co-integration test (presented on Table 5) indicated that for both trace and maximum eigenvalue tests, the null hypothesis of no co-integration between real M_2 money balances and the specified predictors, was rejected at the 5 per cent level of significance, as both

Table 5: Johansen Maximum Likelihood Co-integration Test Results

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	Prob.**	Trace Statistic	5 Percent Critical Value	Prob.**
None *	0.51	75.90	36.63	0.00	132.65	83.94	0.00
At most 1	0.19	22.01	30.44	0.38	56.75	60.06	0.09
At most 2	0.14	15.91	24.16	0.43	34.74	40.17	0.16
At most 3	0.10	11.12	17.80	0.37	18.83	24.28	0.21
At most 4	0.05	5.78	11.22	0.37	7.71	12.32	0.26
At most 5	0.02	1.92	4.13	0.19	1.92	4.13	0.19

Max-eigenvalue and Trace tests indicated 1 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

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

tests indicated the existence of one co-integrating equation.
This implied that there was a unique stable long-run relationship among real money holdings, real output, inflation, domestic interest rate, exchange rate and foreign interest rate. Accordingly, we proceeded to interpret the normalised coefficients of the long-run real money demand function shown on Table 6.

In line with *a priori* expectations, the relationship between real M_2 money demand and income is positive and highly significant in the long-run, indicating increase in real money holdings as income increased during the period. Similar, studies, which reported highly elastic income coefficient (1.6551) for Nigeria include Owoye and Onafowora (2007), Nwafor et al. (2007) and Doguwa et al. (2014).

The three-month Treasury Bill Rate (TBR), which was used as proxy for the domestic interest rate, was not statistically significant at the 5 per cent level, implying that even though the opportunity cost of money affects money holdings, its effect was statistically insignificant, due probably to the developing nature of Nigeria's financial markets. Studies such as Nwafor (2007) reported similar insignificant results for Nigeria and other developing countries

Interestingly, the relationship between money demand and inflation was positive and strongly significant, although with a small magnitude. This is line with the liquidity preference theory, as higher costs of living mean higher demand for cash/liquidity to meet day-to-day needs. Again, because rising inflation reduces the real return on portfolio holdings, demand for cash balances increases as inflation rises (see, for example, Nwafor et al., 2007).

The impact of the developments in the foreign exchange market was captured by the coefficients of the BDC exchange rate and foreign interest rate (proxied by the three-month Treasury bill rate in the US). The coefficients of the two variables were negative but highly significant, indicating the influence of currency substitution and capital flight/mobility, respectively, in the long-run money demand function for

Table 6: Long-run Co-integrating Coefficients of the Real Money Demand Function (LRM2)

Variable	Constant	LRGDP	DOI	INF	LEXC	FOI
Coefficient	-13.97721	1.655158***	-0.018769	0.015795***	-0.336246***	-0.093440***
Standard Error		-0.20092	-0.00993	-0.00245	-0.05522	-0.03186
t-statistic		[-8.23789]	[1.89013]	[-6.44693]	[6.08920]	[2.93283]

Nigeria. These results confirmed those of Owoye and Onafowora (2007).
Having established the existence of a long-run co-integrating relationship between real money demand and its predictors, we moved further to analyse the short-run dynamics, using a vector error correction model (VECM). First, a VECM with four lags was estimated using the differenced series of the explanatory variables. The idea was to capture the main dynamic processes in the model. Second, we eliminated most of the insignificant lags through the general-to-specific method to arrive at the parsimonious error correction model reported on Table 7.

From the results, the coefficient of the error correction term (ECT_{t-1}) carried the expected negative sign and was statistically significant at the 5 per cent level. It showed that short-run deviations from the long-run path of dependent variables adjust toward the long-run equilibrium condition. The absolute value of the coefficient indicated that about 22 per cent of the disequilibrium in real money demand was offset by short-run adjustment in each quarter.

Interestingly, in the short-run only inflation was statistically significant and negatively-related to real money demand, implying lower demand for money when the rate of return on alternative assets rises in the short-run. Also, foreign interest rate was not statistically significant, suggesting perhaps that capital flight did not matter significantly in the short-run. However, the diagnostic tests shown below the parameter estimates suggested that the model fits the data adequately well. Thus, we proceeded to the test of the structural stability of the real money demand function, to ascertain the suitability or otherwise of monetary targeting for monetary policy in Nigeria.

Table 7: Short-run Estimates of the Parsimonious Real Money Demand Function (LRM2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LRM2(-1)	0.997***	0.019	52.976	0.0000
RGDP	-0.002	0.003	-0.785	0.4343
RGDP(-1)	0.003	0.003	1.220	0.2249
DOI	0.002	0.002	1.319	0.1898
INFL	-0.002***	0.000	-4.965	0.0000
LEXC(-1)	0.008	0.008	1.023	0.3086
FOI	-0.018	0.014	-1.249	0.2140
FOI(-1)	0.025	0.014	1.764	0.0803
ECT(-1)	-0.221**	0.104	-2.128	0.0354
Constant	-0.005	0.234	-0.023	0.9818

Adjusted R -squared = 0.99143; F -statistic = 1517.754 [0.00000]; Standard Error of Regression = 0.068201; Sum of Squared Residual = 0.54885; Durbin-Watson statistic = 2.03199.

To test for the stability of the real money demand function, we relied on the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) tests (Brown et al., 1975). The tests were applied to the residuals of short-run real money demand equation specified in the methodology section. This is because it is standard practice to incorporate short-run dynamics in testing the stability of the long-run parameters of money demand equation.

Thus, for the parameters of the real money demand function to be deemed stable, the recursive residuals of the estimated money demand function must be located within the 5 per cent critical bounds represented by two straight lines. The results in Figures 1 and 2 showed that while the CUSUM test confirmed stability of the real money demand function all through the estimation period, the CUSUMSQ test showed that the money demand function was not stable through the period, as one breakpoint moved outside the critical bound of 5 per cent. The breakpoint was between 2008Q1 to 2009Q1, a period which coincided with the Global financial crisis (GFC). This confirms the finding of Doguwa et al. (2014). The parameters were, however, stable before and after the GFC. To further confirm that there was indeed a structural break, we applied chow breakpoint test (see Table 8) and the null hypothesis of no break at specified breakpoint of 2008Q1 was rejected.
We therefore inferred from the findings that the real money demand function for

Table 8: Chow Breakpoint Test Result

Chow Breakpoint Test: 2008Q1
Null Hypothesis: No breaks at specified breakpoints
Varying regressors: All equation variables
Equation Sample: 1986Q3 2018Q2

F-statistic	2.634675	Prob. F(10,108)	0.0065
Log likelihood ratio	27.94149	Prob. Chi-Square(10)	0.0018
Wald Statistic	26.34675	Prob. Chi-Square(10)	0.0033

Nigeria, during the study period, was stable, except during the GFC. It would be recalled that during the GFC, conventional monetary policy was no longer effective in meeting the objectives of monetary policy, leading to the use of unconventional monetary policy measures. Thus, apart from the GFC period, the findings lend credence to the CBN's use of monetary targeting as framework for monetary policy.

Figure 1: Plot of Cumulative Sum of Recursive Residuals

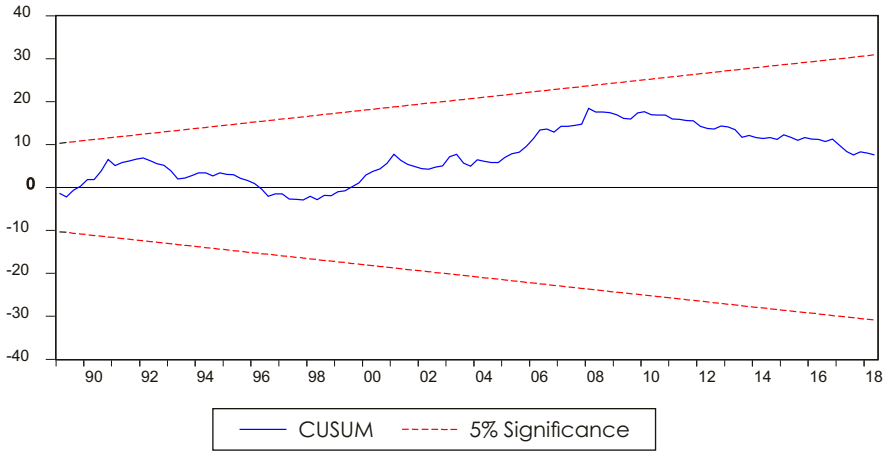
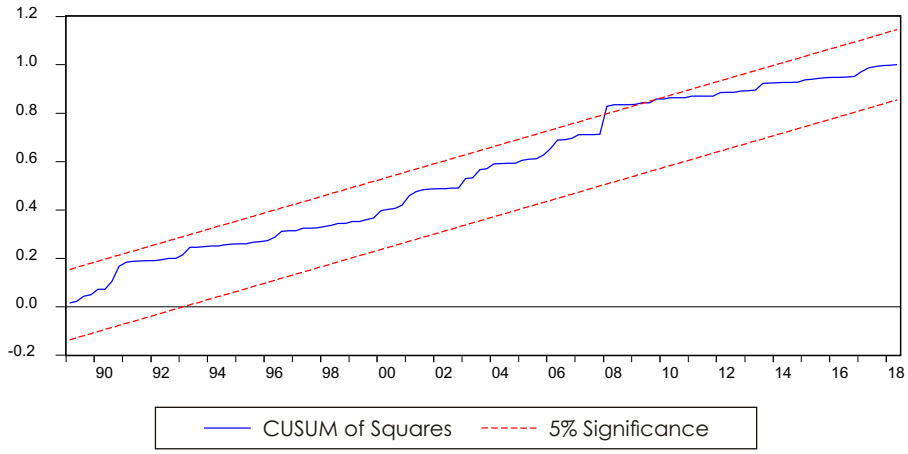


Figure 2: Plot of Cumulative Sum of Squares of Recursive Residuals



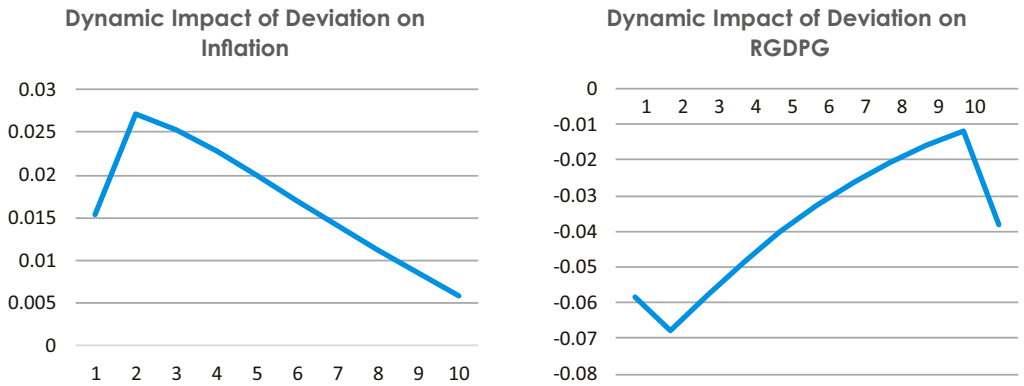
V.5 Impact of Actual M_2 Deviations from Target on Inflation and Output Growth

Following the work by Kydland and Prescott (1977) seminal paper on the cost of rules and discretion to policy making, studies have suggested that the inability of central banks to commit to rules and targets, negatively affect the achievement of objectives. While the previous sections of this paper had shown that monetary targeting was effective in achieving the objectives of the CBN, this section was aimed at assessing the impact of deviations of the growth rate of actual M_2 from its target on the level of growth and inflation. In order to achieve this objective, impulse responses were used to generate dynamic impacts, which examine how much of the variations in the objectives were occasioned by innovations in the deviation of

actual M_2 from target. If the variations in deviation explain significant proportions of the changes in the objectives, then it could be inferred that the inability to meet targets has impacted negatively on the achievement on the Bank's objectives.

Figure 1 reveals that inflation responds positively to shocks to the deviation of actual M_2 from its target and as such, increases in the deviation lead to higher inflation. Conversely, lower deviations can be associated with lower inflation and the average dynamic impact over the entire estimation horizon was 0.017. In relation to output growth, Figure 3 revealed a negative relationship between output growth and deviations in money supply, suggesting that higher deviations in actual money supply from target led to lower output growth, while sustained increases in real GDP growth were associated with lower deviations in actual M_2 from target. The dynamic impact of deviation on output growth averaged -0.038 over the estimation horizon.

Figure 3: Response of Output Growth and Inflation to M_2 Deviations



These findings which were in line with Owoye and Onafowora (2007), suggest that when the growth rate of M_2 deviated significantly from the target, the ability of the CBN to achieve its objectives (stable prices and sustainable economic growth) was impeded significantly.

VI. Summary, Policy Implications and Conclusion

This paper investigated the relationship among money, inflation and growth in Nigeria, with a focus on a re-assessment of the effectiveness of monetary targeting as the monetary policy framework of the Central Bank of Nigeria. Using quarterly time series data spanning 1985Q1 to 2018Q2, the real M_2 money demand function was estimated within the context of a co-integration and vector error correction model (VECM). This allowed us to test the stability of the real money demand

function, using the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) tests. Next, the relationship among real broad money (M_2), real GDP and inflation was examined in order to ascertain the predictive ability of the variables on each other, using pair-wise Granger-causality tests. Finally, we estimated the impact of the deviations of monetary growth from its targets on output and inflation, to assess the effectiveness of monetary targeting on inflation and growth, using the impulse responses and variance decomposition from a 6-variable VECM.

The findings revealed that the real money demand function for Nigeria during the study period was stable, except during the 2008Q1-2009Q1 period, which coincided with the GFC. This implied that the CBN's reliance on monetary targeting as framework for monetary policy was in order, except during the GFC, when orthodox monetary policy tools became less-effective in meeting monetary policy objectives. Hence the use of unconventional measures to complement conventional instruments, during that period.

From the causality test results, it was found that causality ran from money to inflation. It could thus, be inferred that money matters in predicting inflation outcomes in Nigeria. There is, therefore, the need for the monetary authority to remain focussed in adjusting policy instruments to ensure that monetary growth does not exceed set targets. Furthermore, the bidirectional causality found to exist between monetary aggregates and GDP growth, implied that structural factors also affect Inflation in Nigeria, indicating the need for the implementation of relevant structural policies alongside monetary policy efforts of the Bank.

Lastly, we found evidence suggesting that significant deviations of monetary growth from its target, led to higher inflation and lower output growth over time; thus, impeding the effectiveness of monetary policy and the achievement of the Bank's primary mandate. Accordingly, the CBN should ensure that excessive monetary expansion beyond rule-prescribed targets is minimised.

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Determinants of Bank Lending Behaviour in Nigeria: An Empirical Investigation

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Abstract

This study examined some key bank-specific and macroeconomic determinants of bank lending behaviour in Nigeria, using panel autoregressive distributed lags (PARDL) analysis on quarterly data, spanning 2010q1 to 2018q2. The major determinants in the study included total deposit (LTD), prime lending rate (PLR), liquidity ratio (LR), number of bank branches (LNBR), interbank rate (INTB), real gross domestic product (LRGDP), inflation rate (INF) and Treasury bills rate (TBills). Findings from the study showed the existence of a long-run relationship between bank lending behaviour (bank credit to private sector) and all the bank specific and macroeconomic explanatory variables in the model, indicating their impact on bank's lending behaviour in the long-run. The study also found a positive relationship between credit to the private sector and total deposits, non-performing loan ratio, interbank and inflation rates. The result further revealed a negative relationship between bank credit to private sector and prime lending rate, liquidity ratio, number of bank branches, real gross domestic product and treasury bills rate. Finally, the study recommends that banks should deepen their intermediation efforts towards mobilising more deposits to expand their lending behaviour to the private sector. Also, banks need to enhance their capabilities towards improved credit management to deepen economic growth via private sector participation. Government, on its part, should source its funds from capital market and design policies that could discourage banks from investing in treasury bills, but encourage lending to the core private sector. This will minimise the crowding-out of domestic private investment in the long-run.

Keywords: Bank Lending Behaviour, Credit to Private Sector, Lending Rate, Total Deposits, Gross Domestic Product and Treasury Bills Rate

JEL Classification: *C13, C23, G21*

I. Introduction

The contribution of financial sector to growth and development is ascribed, largely, to the performance of the banking industry. Banks play a very important role in the economy through the provision of variety of products and services to their clients. The banks' ability to provide such financial services efficiently, define the depth of financial intermediation. This intermediation process involves the use of deposit that comes from the surplus economic units and channelling them to the deficit units in a form of lending. Therefore, lending has been identified as one of the major activities that banks offer to their customers. This credit creation process, in the form of loan and advance to individuals, government and business organisations either for a short, medium or long-term, facilitates economic growth (Moussa and Chedia, 2016).

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Credit creation is one of the major investment decisions that banks take to maximise profit. Moreover, the manner in which banks determine the level of what it lend to customers is important for effective monetary policy implementation. Therefore, identifying what inform the behaviour of banks towards lending becomes very crucial. Specifically, proper analysis of key determinants of lending behaviour is necessary for understanding the operation, performance of banks and the channels through which monetary policy transmits to the real economy. As lending services remain a crucial economic activity, several studies had been conducted to examine the determinants of bank lending behaviour so as to contribute to the growing body of empirical literature. However, assessing the determinants of bank lending behaviour, empirically appears to be a complex exercise (Han and Elekdag, 2012; in Pham, 2015).

Broadly, there are a number of factors that influence bank lending behaviour. Olokoyo (2011) maintains that banks' lending decisions are strongly determined by several endogenous and exogenous factors, such as the prevailing interest rate, the volume of deposits, the level of their domestic and foreign investment, banks liquidity ratio, prestige and public recognition, among others. These determinants may be demand-side or supply-side factors. Other determinants include inflation, policy rate and level of economic development. The peculiarities of a country's macroeconomic and institutional fundamentals also influence the behaviour of banks to lend. In Nigeria, for instance, other factors may include security and infrastructural challenges. Policy rate, being the anchor rate in the economy, also influences banks' lending behaviour and, consequently, the cost of funds to economic agents.

In Nigeria, one of the major challenges facing the real sector is lack of access to long-term financing and high interest rate. Liquidity condition in the banking system is expected to determine the behaviour of banks to lending, but excess liquidity, in the Nigerian banking system, does not translate into more lending to private sector in the short-term, as widely believed. The banking industry has witnessed remarkable growth in aggregate deposits in recent time; however, there is no corresponding increase in lending. Risk of lending to the real sector has increased considerably, due to poor operating environment. Despite moderation in non-performing loan in recent time, banks have remained indifferent to lend to the private sector, as credit to the sector continue to decline.

There is a growing level of risk aversion by Nigerian banks towards lending to private sector. Banks now prefer to lend to government by purchasing treasury bills and other government securities, at a considerably higher interest rate than to the private sector. Government domestic borrowing from banking system has contributed to the unwillingness of banks to lend to the real sector of the economy.

This continued preference by banks for a relatively safer fixed income assets, rather than direct lending to the real sector of the economy, has continue to reduce the amount of bank credit in the economy. High interest rate inhibits credit expansion and lowers growth prospects. Lending at single digit interest rate has become difficult due to the attractiveness of treasury bills and flight-to-safety. This has contributed to high lending rates, making access to credit difficult; thereby, impacting on business activities negatively. This has remained a critical challenge to the current monetary policy stance of the Bank. For this reason, this study revisits and re-examines the possible determinants of bank lending behaviour in Nigeria.

Studies on Nigeria in the past, empirically analysed several factors that determine commercial banks' lending behaviour, concentrating more on the volume and bank lending rate. This study contributes to the existing body of knowledge by employing a combination of bank-specific and macroeconomic variables, as well as, introducing all potential demand- and supply-side determinants of bank lending behaviour in the estimation process. In addition, the study incorporates some institutional factors that affect banks' lending behaviour in Nigeria. The study further extend its empirical analysis to wider sample, covering different levels of economic and financial development and using quarterly data, spanning Q1:2010 to Q2:2018.

The objective of the study is to investigate the determinants of banks' lending behaviour in Nigeria. Specifically, it will attempt to:

- Empirically identify bank-specific and macroeconomic determinants of banks' lending behaviour in Nigeria;
- Examine the effect of key determinants of banks' lending behaviour on credit to the private sector, both in the short- and long-run; and
- Provide some policy recommendations based on the findings of the study.

The study is structured into six Sections. Following the introduction, Section 2 provides a review of theoretical and empirical literature on determinants of bank lending behaviour. Section 3 discusses features and trend analysis on determinants of bank lending behaviour in Nigeria, while Section 4 presents methodology, estimation process and data analysis. Section 5 provides summary of major findings, policy implications and recommendations, while Section 6 summarises and concludes the study.

II. Review of Theoretical and Empirical Literature

II.1 Review of Theoretical Literature

According to various theories, the lending behaviour of banks stems from several external and internal factors. However, each theory presents the impact of similar variables on banks' lending behaviour. For example while the bank lending channel theory analyses the effects of reserve requirements on bank lending, the pro-concentration theory discusses how the value of a bank's capitalisation affects its lending behaviour. Some of these theories are discussed.

II.1.1 Loan Pricing Theory

This theory posits that banks cannot set high interest rates at all times. Thus, to maximise interest income, banks study the challenges posed by moral hazards and adverse selection, based on the difficulty of forecasting borrower types at the beginning of a banking relationship, due to the high credit market information asymmetry (Stiglitz and Weiss, 1981). The theory added that if banks set interest rates too high, they might induce adverse selection problems, as high risk borrowers are likely to be more willing to accept these high rates. These borrowers may then develop moral hazard behaviour, as they are expected to take on highly-risky projects (Chodechai, 2004). The theory argues that it might be difficult to find interest rates commensurate with the risk of the borrowers at all times. Hence, it concluded that lending to the public may or may not increase.

II.1.2 Credit Market Theory

The neoclassical credit market theory suggests that credits terms clear the market. According to this theory, the interest rate is the only price mechanism that could clear the credit market, assuming that the loan collateral remained constant. The interest rate can only increase if the credit market is clear, given that the demand for credit is growing, and loan and advances supply by the banks is limited. Hence, the higher the default risks of a borrower, the higher the interest premium to compensate against possible losses (Ewert et al., 2000). Thus, the central bank must adjust the interest rate to increase the cost of borrowing, which would, in turn, mean that commercial banks must increase their rates. This chain reaction contracts their lending activities in the long-run.

II.1.3 Quality Uncertainty Theory

The idea of quality uncertainty was introduced by Leland and Pyle (1977) and Ramakrishnan and Takor (1984). According to them, quality uncertainty occurs on

financial markets and affects market partakers. The theory states that information asymmetry in the market meant that participants were unsure of the quality of the service or product being offered. This information asymmetry between buyers and sellers might result in a diminishing quality of goods traded in the market; thus, leaving low quality goods in the market. When quality uncertainty exists, there is bound to be adverse selection, leading to a situation where high quality performance or products, in this case loans, deteriorate, due to comparably low pricing or lending levels.

II.1.4 Moral Hazard Theory

This theory states that two types of moral hazard occurs when a contract is executed among two parties. These are hidden information and hidden action (Arrow, 1985). Hidden information transpires when one party does not divulge the full range of options and consequent risk factors in the contract, while hidden action arises when one contract party chooses options that are not in the interest of the counterparty and cannot be observed and managed. Relative to credit markets and the lender-borrower relationship, financial institutions might not have the capacity to ensure that the borrower invests the borrowed loan in productive investments and, as a result of this information asymmetry, the borrower may decide to invest in risky projects, leading to defaulting. This eventuality might discourage banks from lending.

II.1.5 Signalling, Bankruptcy and Risk Return Theories

The signalling hypothesis states that higher capital and volume deposited in banks would imply a positive sign for the bank (Ommeren, 2011; Tomola, 2013). Therefore, the bank would perform better as it can raise more equity and surpass the performance of others who cannot raise their equities sufficient enough to withstand the weakening productivity effect from loan defaulting. In addition, the signalling argument also states that good companies should provide more collateral so as to signal the banks that they are less risky type borrowers and can enjoy lower interest rates. The bankruptcy theory, as posited by Berger (1995), suggested that more equity is held by a bank to avoid distress periods where bankruptcy costs are all of a sudden high. In this case, both the signalling and bankruptcy cost hypotheses maintain existence of a positive relationship between capital and resources (assets) owned by commercial bank. According to the risk-return hypothesis, higher expected returns exist a result of cumulating risks through increasing leverage of the firm. Thus, there is a need to take up more risks by increasing leverage and, consequently, increase the amount of loans to the general public (credit) if banks expect increased returns (Sharma and Gounder, 2012).

II.1.6 Firm Characteristics Theory and Circuitist Model

This theory predicts that over time, the number of borrowing relationships between banks and small high quality information-opaque and constraints firms, would decrease, all other things been equal (Godlewski & Ziane, 2008). The Circuitist theory distinguishes between hard money, money that is exchangeable at a given rate for some commodity such as gold and credit money. It considers credit money created by banks as primary rather than that derived from the central bank. In circuitism, a monetary transaction is not bilateral transaction (between buyer and seller), but rather tripartite transaction between buyer, seller and bank.

II.1.7 Interest Rate Theory

Loan pricing or interest rate is a significant term in the lending decision process. Banks charge loan rates that are not too low because the revenue from the interest income needs to be enough to cover the cost of deposits, general expenses and the loss of revenue from non-performing loan portfolio. They, however, cannot charge too high loan rates to protect the banking relationship they have with the borrowers. Interest rate is the rate of return on investment and the cost of borrowing funds. It is determined by the supply of and demand for money. Long-term interest rates are paid to a borrower of immaculate solvency for a loan of unfixed duration. Crowley (2007), describes interest rates as a price for the use of funds and if rapid monetary expansion contributes to excessive demand and inflation, it also contributes to rising interest rates.

II.2 Conceptual Framework: Determinants of Bank Lending

Economic literature has generally divided the determinants of banks' lending behaviours into two (2) categories, namely; internal and external factors. The internal determinants are within the control of the bank's management (e.g. profitability) and could be classified broadly into two, namely; financial statement and non-financial statement variables. Financial statement variables refer to items in the balance sheet and income statement, while non-financial variables such as number of bank branches, states of banks, location or size of bank, among others have no direct relationship to the financial statement (Haron-Sudin, 2004). The external factors are factors that are not controlled by the bank management, such as competition, regulation, market share, ownership, money supply and inflation.

A review of other factors affecting the lending activities of banks showed that some of the factors responsible for banks' willingness to extend more credit to some sectors of the economy, over others, while some deliberated on the effect of such

credits on productivity and output. Most of these studies show that it is logical for banks to apply basic lending principles to check their lending activities.

II.3 Review of Empirical Literature

Several empirical studies have been carried out to identify factors, which influence the lending behaviour of bank, across varying geographical locations and time periods. In Europe, Laidroo (2012) investigated the determinants of the growth in lending of banks in 15 central eastern European countries from 2004 to 2010. The author found that a significant and positive relationship existed between profitability of a bank and lending. Vazakidis and Adamopoulos (2009) investigated the relationship between economic growth and credit market development in Italy. He adopted a log-linear regression model and the results indicated that economic growth had a positive effect on credit market development, while prime rate affected banks' lending behaviour, negatively. This supported a previous study by Dell'Ariccia and Marquez (2006) whereby bank credit expansions tended to be pro-cyclical. That is, high rate of growth in GDP induces a high rate of growth in bank credit. Ehrmann et al., (2003) adopted the OLS estimation method and found that financial contraction had a strict negative impact on undercapitalised banks' lending. The findings demonstrated a sharp contrast from the results of Olokoyo (2011), who concluded that a positive relationship between growth in GDP and bank credits. Other empirical studies with the same conclusion include Cargill and Meyer (2006), Montoro and Moreno (2011), and Glocker and Towbin (2012).

In Asia, Timsina (2014) tested for the determinants of commercial bank lending behaviour in Nepal, using time series OLS regression approach with data, spanning 1975 to 2014. The results showed that GDP and liquidity ratio of banks had the greatest impact on their lending behaviour. This implied that GDP was the driver of the economy and commercial banks should pay their attention to the overall macro-economic condition of the country, in general, and their liquidity ratio in particular, while making lending decision. In another study, Gunji and Yuan (2010) investigated how the profitability of banks affect lending in China, during the period 1985 to 2007. The result indicated that there was positive and significant relationship between bank profitability and lending for the Chinese banking sector.

In Jordan, over the period 2005 to 2013, Rababah (2015) studied 10 commercial banks. The results showed that the ratio of non-performing loans, liquidity ratio and window rate had a negative but significant impact on the ratio of credits facilities, while bank size and economic growth had a positive and significant impact on the

ratio of credit facilities granted by commercial banks in Jordan. Alkhazaleh (2017), utilised data for the period 2010-2016 using OLS model and found that both credit risk and liquidity had a statistically and significant adverse effect on bank lending, while there was a significant positive effect of the return on assets, size of the bank measured by assets, inflation, money supply and growth in gross domestic product in determining the level of lending. In addition, the study did not show a significant and statistical effect among investments, the volume of deposits and bank lending in the same time period.

Karim, et al. (2011), using the OLS estimation, investigated the impact of interest rates on the banks' lending in Malaysia from 1993 to 2008. The study concluded that bank liquidity was core and significant in determining the supply of loans by banks. They added that interest rates negatively impacted lending among the banks, while controlling for macroeconomic variables like GDP and inflation. This was in line with the earlier study by Aisen and Franken (2010) who concluded that during the 2008 Global financial crisis, banks were faced by liquidity stress and capped their lending ability. Thus, it was concluded that a pro-cyclical relationship existed between economic growth and bank lending, because in periods of economic recession, demand for credit dropped.

A study by Chernykh and Theodossiou (2011) revealed that in Russia, banks size influenced commercial lending behaviours and the likelihood of long-term lending. This supported the debate that a big balance sheet allowed banks to invest more in different geographical and business segments to address the issues of asymmetric shocks. The author suggested that large banks had an advantage by providing a large variety of financial services to their clients since they are capable of mobilising more funds. Unlike small banks, which adopt small business loan underwriting practices that are riskier, larger banks, ultimately determine the available credit to the public. Hanh (2014) investigated the determinants of bank credits by using a large data set covering 146 countries at different level of economic development over the period 1990 to 2013. The study discovered a country-specific effect of economic growth on bank credit. The empirical results suggested that the health of the domestic banking system played a relevant role in boosting bank lending. However, the dependence on foreign capital inflow of a country could make its banking sector more vulnerable to external shocks and then to face credit boom-bust cycle.

Studies in Africa such as Malede (2014) examined the determinants of commercial banks' lending in Ethiopia using panel data from eight banks from 2005 to 2011. The

results of the study indicated that a significant relationship existed between banks' lending and banks size, credit risk, gross domestic product and liquidity ratios. However, deposit, investments, cash reserve ratios and interest rates were found to have no significant effect on Ethiopian banks' lending activities. In Kenya, Ayieyo (2015) employed ordinary least square (OLS) method to test the degree of correlation between the variables from 2002 to 2011. The findings revealed that lending interest rates had a negative but significant effect on the total loans extended. With respect to liquidity, the study showed that banks with more liquid assets extended more credit to borrowers. Similarly, volume of deposit and liquidity ratio had a significant and positive effect on the total loan offered by banks. While in Ghana, Ladime, et. al., (2013) employed Generalised Methods of Moments (GMM) estimation technique and found that banks' lending behaviour had a positive and statistically significantly influenced by bank size and capital structure. Also, they found that a significant and negative relationship existed between exchange rate and total loans advanced by commercial banks.

Moussa and Chedia (2016) studied the internal and external factors of bank credits in Tunisia, using a panel data for a sample of 18 banks, spanning 2000 to 2013. They found that, among the internal factors, only the return on assets, net interest margin and liquidity had a significant impact on bank loans. Among the external factors, only the inflation rate had a significant impact on bank loans. Ngomsi and Djiogap (2012) examined the determinants of long-term bank lending behaviour in the Central African Economic and Monetary Community (CEMAC). The authors adopted OLS estimation technique and affirmed that the ownership of a bank was important in determining the total loans and advances extended by a bank. They concluded that foreign banks tended to exhibit higher long-term loan ratios, compared with the state-owned in the Central African region. The study further revealed that competition in the banking industry had a positive and significant effect on lending behaviour. Also, the macroeconomic environment within which a bank operates determined the lending decision of the bank.

In sub-Saharan Africa, Amidu (2013) used both micro-bank and macro-country level data of 264 banks across 24 SSA countries. The study discovered that the structure of banking influenced credit delivery in SSA, particularly in an environment where the financial sector was reformed and banks were allowed to operate freely. In addition, it suggested that a link existed between bank credit and the financial strength of banks. In Nigeria, Olokoyo (2011) studied the determinants of the commercial banks' lending behaviour for the period 1980 – 2005, using a fixed effects regression model. The results showed that a long-run relationship existed

among banks' lending, deposits, interest rate, minimum cash reserve requirement, investment portfolio, ratio of liquidity, foreign exchange and gross domestic product. The study also showed that the volume of deposit had the highest impact on the lending of commercial banks and a change in deposits would yield the highest change in banks' loans and advances. The study concluded that bigger banks were in a position to attract more investments in the form of deposit and enhance their ability to extend credit.

An overview of the empirical work showed that most of the studies were carried out on developed financial systems. Some of the determinants identified by these studies included: total loan advanced; volume of deposits; bank's investment portfolio; lending rate; cash reserve ratio; liquidity ratio; credit risk; GDP; interest rate spread; investment portfolios; capital structure; and exchange rate (Olokonyo, 2011; Chernykh and Theodossiou, 2011; Olusanya et al., 2012; Ladime, et al. 2013; Irungu, 2013 and Malede, 2014). Some of the studies on developing financial markets identified the few variables using simple estimation methods that did not address identified bias (Olokoyo, 2011; Olusanya, 2012; Ayieyo, 2015; Kimura, 1997; Karimi, 2006; Olweny, 2011; Muriuki, 2013; and Were and Wambua, 2013).

This study intends to fill a gap in the areas of methodology and using more recent data.

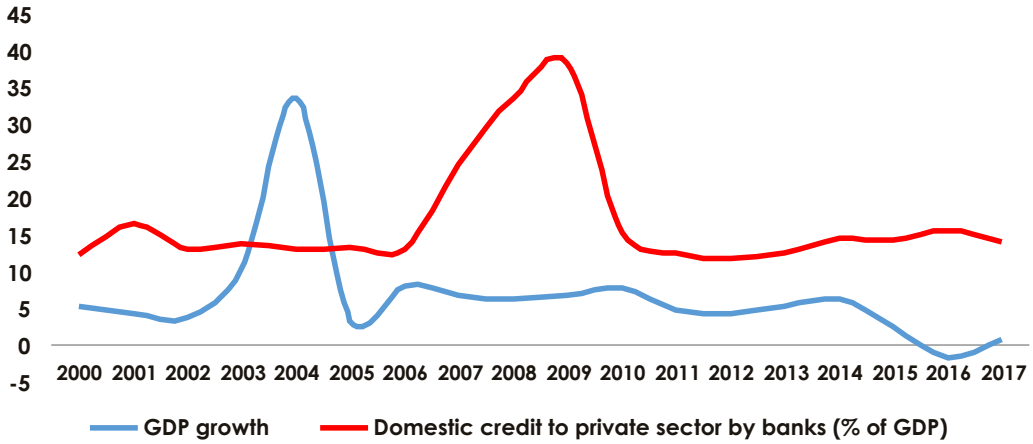
III. Trend Analysis on Determinants of Bank Lending in Nigeria

Bank lending in Nigeria is influenced by both macroeconomic and bank- specific factors. The macroeconomic factors include GDP growth rate, money supply, inflation rate, cash reserve requirements, and treasury bills rate, while the bank specific factors include total deposit, excess capital, liquidity ratio, and lending rate, among others. The underlying relationship among the variables and the trend over time is examined in this section.

It is expected that high rates of growth in GDP tend to increase bank credits. However, the reverse is the case in Nigeria, as revealed in Figure 1, where economic growth fails to translate into more credits to the private sector by banks from 2002 to 2017.

The relationship between Treasury bills rate and credit to private sector by banks is depicted in Figure 2, showing that as Treasury bills rate rises, less credit is advanced to the private sector by commercial banks and vice versa. This revealed that commercial banks in Nigeria prefer to advance loans to the government rather than to the private sector due to the safe nature of government securities.

Figure 1: Economic Growth and Credit to Private Sector by Banks



An increase in the rate of inflation drives down the real rate of return on investment, signifying a negative relationship between inflation and lending by banks as shown in Figure 3. This demonstrates that in Nigeria, increase in the rate of inflation adversely affects financial sector performance, and therefore, credit advances to private sector by banks.

Figure 2: Treasury Bill Rate and Credit to Private Sector by Banks

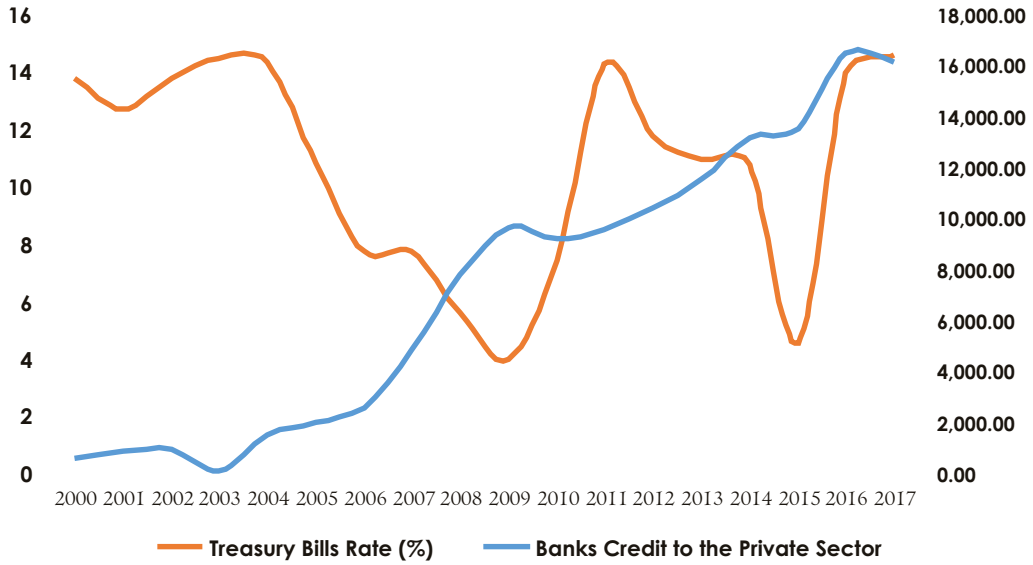


Figure 3: Inflation Rate and Credit to Private Sector by Banks

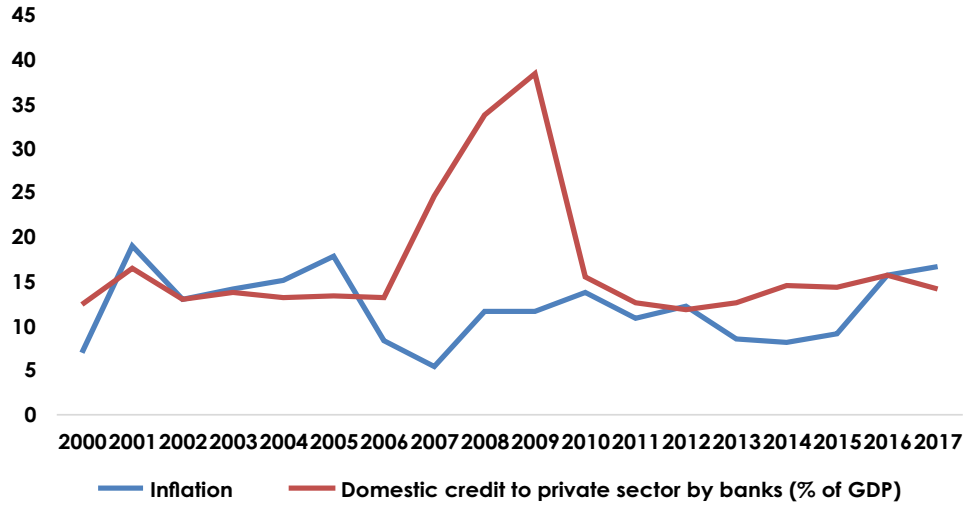


Figure 4 depicts a positive relationship between volume of bank deposits and credit to the private sector in Nigeria, as more deposits banks can mobilise from their customers, the more they can lend. Thus, we expect a positive relationship because deposit growth is an indication of growing demand for loans.

Figure 4: Bank Deposits and Credit to Private Sector by Banks

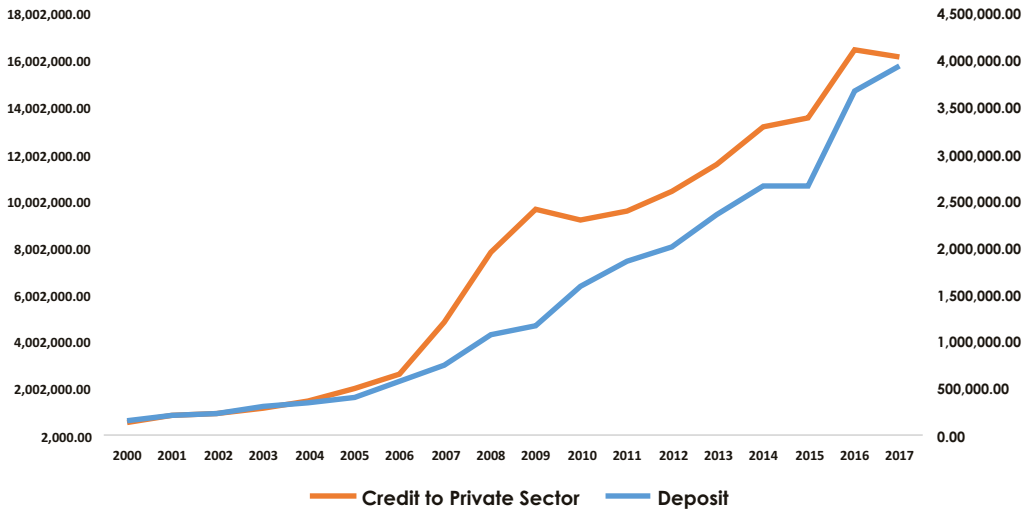


Figure 5 shows that liquidity ratio have a negative impact on the amount of loan commercial banks can grant to the private sector in Nigeria. If the ratio is high, commercial banks will have less loans to grant to the private sector, whereas, they will have more loans to give out, when the liquidity ratio is low.

Figure 5: Liquidity Ratio and Credit to Private Sector by Banks

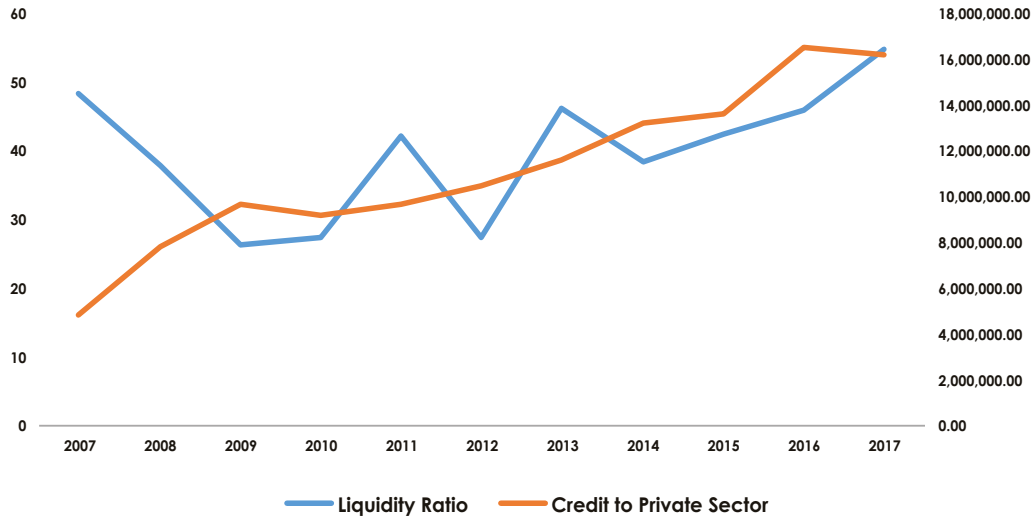
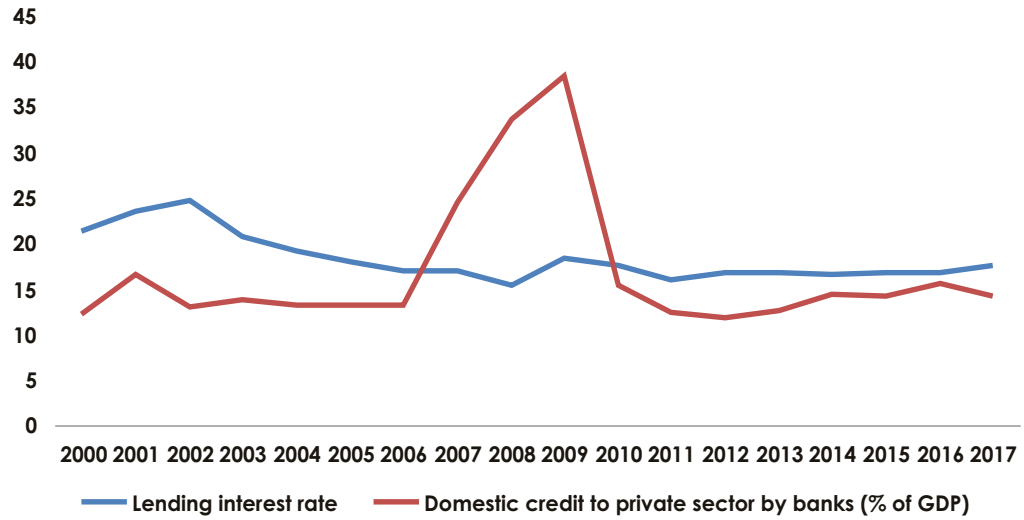


Figure 6 shows a negative relationship between lending rate and domestic credits to private sector by banks. As interest rate on loan decreases, domestic credits advanced by commercial banks to the private sector increases.

Figure 6: Lending Interest Rate and Credit to Private Sector



IV. Data and Methodology

IV.1 Model Specification

According to literature, long-run banks' lending is expected to mirror domestic monetary and fiscal policies, worldwide issues and the peculiarities of individual banks. These interactions can be evaluated using a panel autoregressive distributed lag model (PARDL), based on the assumption that cross-sections contain information about long-run relationships. The model evaluates the dependent variable to its lags, contemporaneous and lags of all variables.

This study has a panel of 17 banks, considered within a period of 30 quarters, which makes it sufficiently large for this estimation. Given the panel structure of this study, the dynamic regression model proffered by Pesaran et al., (1997) was adopted. The basic structure of the model is as follows:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta_{i,j}^{'} X_{i,t-j} + \chi_i^{'} d_t + \varepsilon_{i,t} \quad (1)$$

Where:

y_{it} is the dependent variable, and the cross-sections, I = 1, 2,...,N, instigate the heterogeneity of the model. The panel is unbalanced, with cross sections less than time periods *(N<T)*. The number of periods is represented by t=1, 2,...T. X_{it} is the $k\,x\,1$` vector of explanatory variables, which varies across time and group; d_t is fixed regressors vector, such as intercepts and trends or variables, that vary with time only; the coefficients of lagged dependent variables, $\lambda_{i,j}$, are scalars, while $\delta_{ij,}$ and χ_i are the $k\,x\,1$ and $s\,x\,1$ coefficients of unidentified parameters for the explanatory variables and fixed regressors, respectively; μ_i represents the cross-section specific effects, while $y_{i,t-j}$ and $x_{i,t-j}$ are $j-$ period lagged values of the dependent variable and the explanatory variables, respectively, which can be fixed or selected based on a lag selection criteria. The error term $\varepsilon_{i,t}$ is independently-distributed across i and t with likely zero means and constant variances, σ^2_i. The distributions of these are also independent of the regressors, X_{it} and d_t, d_t, which is a necessity for reliable estimation of short-run coefficients. In a situation where variables in the model are integrated of order one or less, implying that the error term from their long-run relationship is I(0) for all i, it means that a re-parametrised error correction representation of Equation 1 can be used in this form:

$$\Delta y_{it} = \theta_i y_{i,t-1} + \beta_i^{'} x_{i,t} + \sum_{j=1}^{p-1} \lambda_{i,j}^{*} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{i,j}^{'*} \Delta X_{i,t-j} + \chi_i d_t + \varepsilon_{i,t} \quad (2)$$

$i = 1,2,...,N$ and $t = 1,2,...,T$,

Where

$\theta_i = -(1-\sum_{j=1}^{p} \lambda_{i,j})$, $\beta_i = \sum_{j=0}^{q} \delta_{i,j}$, $\lambda_{i,j}^{*} = -\sum_{m=j+1}^{p} \lambda_{i,m}$, $j = 1,2,....p-1$ and $\delta_{i,g}^{*} = -\sum_{m=j+1}^{q} \delta_{i,m}$,

$j = 1,2,.....q-1$

The parameter θ_i is the error correction term (ECM) defining the speed of adjustment from short-run deviation to long-run equilibrium. The ECM is expected to be negative and statistically significant. The vector β'comprised the long-run coefficients which relates the dependent and exogenous variables in the model. λ^*_{ij}, and δ^*_{ij} signify short-run coefficients.

IV.2 Description of Variables

The dependent variable used in the model is the total bank credit to the private sector. Consistent with most studies in the literature, the determinants of bank lending behaviour are categorised into bank-level and macroeconomic factors. There are five (5) bank-specific and four (4) macroeconomic variables in the model. The choice of variables was guided by theory on the determinants of bank lending behaviour.

The following bank-specific factors were considered in the study: bank lending (credit to the private sector); total deposit (LTD); prime lending rate (PLR); liquidity ratio (LR); number of bank branches (LNBR); while the macroeconomic determinants are the interbank rate (INTB); gross domestic product (LGDP); inflation rate (INF); and Treasury bills rate (TBills). The description of the variables and their *apriori* expectations are presented in Table 1.

IV.3 Source of Data

The data consist of both bank-level and macroeconomic variables. The bank-specific data, which capture heterogeneous responses of banks to macroeconomic and bank-specific variables were obtained from returns of seventeen (17) banks at the CBN, over 2010:Q1 to 2018:Q2. The banks considered in the study constituted over 80 per cent of the Nigerian banking industry total assets and deposits. Data on macroeconomic variables, which included interbank rate, real growth of GDP, inflation and treasury bills rate, were obtained from the National Bureau of Statistics (NBS) and the CBN Statistical Database. The period of study was chosen to avoid structural breaks in the data, as the major reforms in the banks were carried out prior to the period.

Table 1: Variables Description

	Variable	Description	*A priori* Expectation
Dependent Variables	**Credit to Private Sector (CPS)**	Total credit to the private sector	
Bank- Specific Determinants	***Total Deposit (LTD)***	Log of bank total deposit by customers	A positive relationship between bank deposit and lending behaviour.
	Prime Lending Rate (PLR)	The rate on loans to prime customers	We expect a negative relationship between prime lending rate and bank lending behaviour.
	Liquidity Ratio (LR)	Total current asset to total current liabilities	A negative relation is expected between liquidity ratio and bank lending behaviour.
	Non-performing Loan Ratio (NPLR)	Non-performing loans divided by outstanding total loans and advances.	A negative relati onship between non -performing loan ration and banks' lending behaviour is expected.
	Number of Bank Branches	Log of Number of commercial bank's branches.	The relationship between bank branches of commercial banks and their lending behaviour is indeterminate.
Macroeconomic Determinants	***Real GDP (LRGDP)***	Log of real GDP.	Vary positively or negatively with bank lending behaviour.
	Headline Inflation (INF)	Year-on-year change of the composite consumer price index.	Expected effects of inflation in bank lending would be positive.
	Inter-Bank Rate (INR)	The interest rate at which banks access funds overnight from each other to square their books.	A positive association is expected between inter-bank rate and bank lending behaviour.
	Treasury Bills Rate	91-Day Treasury Bill discount rate	A negative relationship between treasury bills and bank lending behaviour is expected

Source: Authors' compilation

IV.4 Descriptive Statistics and Correlation Analysis

The descriptive statistics containing the mean, median, maximum, minimum and standard deviation is presented in Table 2. The mean and standard deviation show the range and coverage of the data. The data showed a maximum, median and mean values of the credit to the private sector (CPS) as 28.31, 26.9 and 26.76 per cent, respectively. The wide ranges and high standard of deviation suggest that CPS varies greatly in Nigeria. Generally, the data, as presented, show that there

were no outliers observed, although some variables showed variability. Particularly, few variables had kurtosis lower than 3, while most of the variables were leptokurtic. The probability values of the Jacque-Bera statistics was really low, suggesting that the null of normality is rejected for all variables.

Table 2: Summary Statistics

	LCPS	LTD	PLR	LR	NPLR	LNBR	INTB	LRGDP	INF	TBILLS
Mean	26.76	27.21	17.13	51.99	0.28	5.22	12.33	16.57	11.91	10.05
Median	26.90	27.26	17.00	46.67	0.08	5.35	14.22	16.59	11.25	10.36
Maximum	28.31	28.63	28.00	129.91	22.82	6.45	33.11	16.74	18.55	14.49
Minimum	22.21	25.16	0.00	11.13	-0.03	2.08	0.50	16.35	7.78	1.04
Std. Dev.	0.91	0.78	4.74	20.62	1.37	0.94	6.93	0.10	3.28	3.33
Skewness	-0.73	-0.15	-0.48	1.18	12.34	-1.55	0.51	-0.32	0.46	-0.92
Kurtosis	4.02	2.25	4.60	4.13	176.05	5.46	4.06	2.39	2.00	3.48
Jarque-Bera	66.32	13.81	72.44	142.15	636557.80	327.36	45.28	16.44	38.20	74.97
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum	13382.43	13607.33	8566.12	25995.23	141.06	2612.08	6165.52	8285.79	5953.02	5026.41
Sum Sq. Dev.	414.83	300.13	11224.59	212079.40	941.22	438.81	23996.01	5.12	5372.58	5523.57
Observations	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00	500.00

The Correlation analysis between the variables is presented in Table 3. The cross-correlation matrix suggests that credit to the private sector (CPS) is highly correlated with the total deposits and number of bank branches; and moderately correlated with others. Multi-collinearity is anticipated among some of the variables, which is normal in a panel regression. The dependent and independent variables are generally correlated with the expected signs and minimal exceptions.

Table 3: Correlation Matrix

	LCPS	LTD	PLR	LR	NPLR	LNBR	INTB	LRGDP	INF	TBILLS
LCPS	1.00									
LTD	0.87	1.00								
PLR	-0.07	-0.19	1.00							
LR	-0.44	-0.21	-0.21	1.00						
NPLR	-0.05	-0.05	0.10	0.00	1.00					
LNBR	0.65	0.54	-0.05	-0.54	-0.14	1.00				
INTB	0.21	0.20	0.09	-0.10	0.03	0.06	1.00			
LRGDP	0.35	0.34	0.07	-0.21	0.08	0.10	0.39	1.00		
INF	0.09	0.03	0.05	-0.05	0.11	-0.02	0.33	-0.02	1.00	
TBILLS	0.17	0.21	0.01	-0.02	0.06	0.07	0.75	0.39	0.12	1.00

IV.5 Unit Root tests (Stationarity)

This study conducted unit roots using the three standard tests, namely, Levin, et al. (2002), Im, Pesaran, and Shin (IPS) (1997) and an ADF-Fisher chi-square. This was done to achieve a robust set of estimates. The Results of the test is presented in Appendix 1. The decisions as highlighted in the Table are based on the associated probability values, and serve as grounds for rejection of the null hypothesis of unit root.

The overall results show that the variables were of a mixed order of integration. The mixture of I(0) and I(1) variables, suggests that the model can be tested for the existence of long-run co-integration relationship between CPS and its determinants. If a significant long-run relationship and short-run adjustment coefficient is established, it can be implied that a long-run co-integration relationship exists among the variables.

V. Presentation of Results and Findings

V.1 Estimated Results: Long-run and Short-Run Equations

The dependent variable (credit to the private sector) was identified to be sensitive to bank-specific and macroeconomic determinants. Variables that conformed to *apriori* expectations and statistically significant were discussed. The average speed of adjustment to long-run equilibrium was relatively moderate at 20.7 per cent, while the short-run speed of adjustment to long-run equilibrium of some selected individual banks are presented in Table 6.

Disparity existed in the speed of adjustments of individual banks to long-run equilibrium. This development was due, mainly to the peculiarities of the specific banks in the model. However, in the long-run, all the significant banks were sensitive to specified factors. As observed in Tables 4 and 5, the main determinants of the lending behaviour of banks (credit to the private sector) were the total deposits, prime lending rate, liquidity ratio, interbank rate, real GDP growth, inflation rate and Treasury bills rate.

Table 4: Long-Run Equation

Variable	Coef.	S.E.	t-Stat	Prob.
LTD	0.858	0.047	18.313	0.000
PLR	-0.021	0.003	-6.310	0.000
NPLR	0.373	0.163	2.293	0.023
LR	-0.015	0.001	-12.289	0.000
LNBR	-0.036	0.055	-0.656	0.513
INTB	0.014	0.002	8.268	0.000
LRGDP	-0.726	0.099	-7.301	0.000
INF	0.028	0.002	13.907	0.000
TBILLS	-0.015	0.004	-3.665	0.000

Table 5: Short-Run Equation

Variable	Coef.	S.E.	t-Stat	Prob.
ECM	-0.207	0.083	-2.489	0.013
C	3.417	1.361	2.509	0.013

*Note: p-values and any subsequent tests do not account for model selection.

Table 6: Short-Run Speed of Adjustment of Some Selected Banks

Banks	Variable	Coefficient	Std. Error	t-Statistic	Prob. *
3	ECM	-0.232	0.009	-25.558	0.000
4	ECM	-0.324	0.011	-29.086	0.000
5	ECM	-0.314	0.009	-33.964	0.000
6	ECM	-0.163	0.003	-49.835	0.000
7	ECM	-0.491	0.028	-17.620	0.000
8	ECM	-0.342	0.023	-14.939	0.001
9	ECM	-0.057	0.003	-22.492	0.000
12	ECM	-0.095	0.004	-23.336	0.000
16	ECM	-0.304	0.054	-5.665	0.011
17	ECM	-0.178	0.002	-78.905	0.000

V.2 Discussion of Results/Summary of Major Findings

The study found that, with the exception of a number of bank branches, all variables included in the model were found to be statistically significant in explaining bank lending behaviour in Nigeria in the long-run. However, none of the variables was found to be statistically significant in the short-run.

V.2.1 The Bank Specific Determinants

With respect to the bank specific determinants, total bank deposits was found to be statistically and positively related to bank lending behaviour in Nigeria. The higher the deposit the banks can mobilise from their customers, the more they can lend to the private sector. This is consistent with the classical loanable funds theory, which maintains that bank loans depend on pre-existent savings. The result also indicated that volume of deposit has the highest impact and influence on the bank lending behaviour, as per cent rise in total deposit would increase the banks' lending to the private sector by 0.85 per cent. Similarly, banks relied heavily on the deposits mobilised from their customers as a source of funds for loans and advances to the private sector. This result also supported the findings of Ayieyo (2014), Olokoyo (2011), Mc carthy *et al.* (2010), Sebastian (2009), Malede (2014). As Olokoyo (2011) asserted that increase in deposits enhanced the ability of banks to lend to their customers. Prime lending rate, which is the average rate of interest, deposit money banks extend loans to their most credit-worthy customers. The result as expected, revealed a negative but significant relationship between prime lending rate and bank credit to the private sector in Nigeria. This point to the fact that increase in lending rate discourages investors to take more credit from banks for investment, and hence decrease the amount of bank credit to the private sector and vice versa. This finding is inconformity with the finding of Ayeiyo (2014), Usman (1999), Vazakidis and Adamopoulos (2009).

According to Guo and Stepanyan (2011), non-performing loan ratio is expected to be negatively related to credit to the private sector, as the rise in the proportion of the non-performing loan weakens the ability of the banking sector and the behaviour of banks to lend to the private sector. The findings contradict the *a priori* expectation, as it establishes a positive and significant association between NPL ratio and bank credits. This implies that the ratio of NPL has no negative impact on bank lending behaviour in Nigeria in the long-run. As earlier noted, despite decline in non-performing loan in Nigeria, in recent time, banks have remained apathetic to lend to the private sector, as credit to the sector continue to slow down.

The study found an inverse and significant relationship between liquidity ratio and bank credit to the private sector, which was consistent with *apriori* expectations

and the findings of Rababah (2015) and Ehrmann et al., (2003), This result indicated that the higher the liquidity ratio the lower the amount of credits granted by banks to the private sector in Nigeria. This implies that when liquidity ratio in the banking system is high, interest rate on loans also increase, and that discourages borrowing from banking system. Consequently, this would negatively impact on the amount of lending to the private sector, and vice versa. Other empirical studies with the same conclusion included Cargill and Meyer (2006), Montoro and Moreno (2011), Glocker and Towbin (2012). However, some studies such as Olokoyo (2011), Ayieyo (2014) found a positive relationship between bank credit and liquidity ratio, showing that the proportion of liquidity does not affect bank lending negatively.

It is expected that the larger the number of bank branches in different locations, across the country, the more banks' ability to provide large variety of financial services to their clients. This is also expected to enhance the banks' ability to mobilise more funds and extend credit to its teaming customers. The relationship between the bank branches and credit to private sector is therefore, expected to be positive. Contrary to the expectation, the empirical results revealed an inverse and insignificant relationship. This implies that number of bank branches is not an important determinant of bank lending behaviour in the Nigeria. This confirmed that majority of bank branches, especially in the rural areas, are not channelling credits to boost private sector investment.

V.2.2 Macroeconomic Determinants

The result indicated a positive and significant relationship between interbank rate and bank lending behaviour. Increase in interbank rate led to increase profitability of the lending bank and thereby increase the amount of bank lending. This finding is in conformity with that of Olokoyo (2011). With respect to the economic growth, the apriori expectation suggest a positive relationship between real GDP growth and bank credit to the private sector. When an economy is performing well, more liquidity will be made available, and hence more loan and advances by banks. Contrary to theoretical expectations, the findings showed a negative but significant relationship between economic growth and credit to the private sector, suggesting that economic growth in Nigeria is not driven by bank credit. Therefore, the economic growth in Nigeria is not private sector driven. The finding of this study is consistent with the study conducted by Ladime *et al*. (2013) and Danilowska (2008). However, the result differs from what is expected and contrary to the findings of previous studies, such as Rababah (2015), Imran and Nishatm (2013), Vazakidis and Adamopoulos (2009), and Timsina (2014).

The apriori expectation suggest a negative relationship between inflation rate and loan and advances, as increase in the rate of inflation serve as a drag to the real

rate of return on assets, which reduces lending and resource allocation with adverse implications long-term investment. Contrary to this analogy, the study found a positive and statistically significant association between inflation rate and growth of bank lending in Nigeria. This result, by implication, indicated lack of adverse effect of a rise in inflation rate on the proportion of credit facilities extended by banks. When inflation rate increase by 1 per cent, bank lending increase by 0.03 per cent. The finding is similar to that of Omondi (2014), Alkhazaleh (2017), Moussa and Chedia, (2016), who found a positive relationship between inflation and bank credit, but contrary to result found by Yigit (1999).

Due to the safe nature of Treasury bills and other government securities, investors, including banks, lend money to the government through the purchase of Treasury bills. Investors see Treasury bills is as a risk-free investment, since they are backed by the full faith of the government. The study found a negative relationship between bank credit to private sector and Treasury bills rate. This result conform with the *apriori* expectation as Treasury bills rate rises, less credit is advanced to the private sector by commercial banks and vice versa. This shows that commercial banks in Nigeria prefer to lend to the government rather than to the private sector. The implication is that public sector borrowing from the banking system crowds-out domestic private investment in the long-run. The finding is consistent with that of Ladime et al. (2013).

VI. Summary, Conclusions and Recommendations

VI.1 Summary and Conclusions

Bank lending is an important channel in monetary policy transmission mechanism, as it finances production, consumption, and capital formation, which in turn affect economic growth, particularly in a developing country, like Nigeria. The study focused on identifying the major determinants of bank lending behaviour in Nigeria for the period 2010q1 to 2018q2. The study was carried out to test the hypothesis that all variables used in the model (bank specific and macroeconomic explanatory variables) are statistically significant in explaining bank lending behaviour in Nigeria.

The major determinants used in the study included total deposit (LTD), prime lending rate (PLR), liquidity ratio (LR), number of bank branches (LNBR), interbank rate (INTB), real gross domestic product (LRGDP), inflation rate (INF) and Treasury bills rate (TBills). Interestingly, the study, with the exception of number of bank branches, found the existence of a long-run and significant relationship between bank lending behaviour (bank credit to the private sector) and all other bank specific and macroeconomic variables. Specifically, the empirical result revealed a positive relationship between credit to private sector and total deposits, non-performing

loan ratio, interbank and inflation rates. The result further showed evidence of inverse relationship between bank credit to private sector and prime lending rate, liquidity ratio, number of bank branches, real gross domestic product and Treasury bills rate.

VI.2 Policy Recommendations

From the findings of this study, policy makers need to understand the key drivers of bank lending behaviour in Nigeria to carefully address some of the challenges associated with high cost environment and operating expenses in the banking system, which may impact more on lending rate. Also, due to the important influence of the bank total deposit on bank lending behaviour in Nigeria, it is, therefore, recommended that banks should deepen their intermediation efforts towards mobilising more deposit to expand credit to the private sector.

High interest rate on CBN deposit window provides a profitable alternative to commercial banks, and that reduces lending to the private sector. It is, therefore, necessary that the CBN maintain a low level of the interest rate in its deposit window. Lower interest rate on CBN deposit window will prompts the banks to reduce their deposits in the window and increase the credit facilities granted to their customers and encourage more lending to the private sector. On the positive impact of non-performing loans on lending, banks need to improve their credit management to contribute to economic growth positively. This is necessary as it is becoming increasingly worrisome, despite decline in non-performing loan and increase in deposit, Nigerian banks have remained indifferent to lend to the private sector, as credit to the sector continue to decelerate. This may not be unconnected to the banks flight to safety and preference for government security.

Another cause for concern is the empirical result that establishes a negative relationship between real GDP and bank lending. This implies that, policy makers should focus on long-run policies to promote economic growth through the provision of efficient financial market, and development of modern banking sector. This effort will go a long way in increasing the proportion of private sector credits, which is instrumental in promoting growth in the long-run. The findings also call for concerted effort by the government and banks to review the lending and growth policies, provide appropriate macroeconomic environment and required infrastructures, to encourage investment-friendly lending and borrowing by banks.

Another striking finding is the existence of positive relationship between inflation rate and bank credit to the private sector. It is generally believed that increase in the rate of inflation interfere with the ability of the financial sector to allocate resources, effectively, even when they are predictable. This has a lot of policy implication for

the CBN in discharging its mandate of maintaining monetary and price stability. The study, therefore, recommends that in curtailing inflationary pressure, the CBN should focus more attention on the excessive bank lending on unproductive activities and speculative sectors of the economy.

Government borrowing from banks through the sales of Treasury bills and other government securities has been identified as one of the major issues that discourage banks from lending to the private sector. Government, on its part, should source its funds from the capital market and design policies that could discourage banks from investing in Treasury bills, thereby channeling their funds to the core private sector in the form of lending. This will minimise the crowding-out of domestic private investment in the long-run.

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Appendix 1

	LL&C					IP & S W-Stat					ADF				
	Level		First diff		Decision	Level		First diff		Decision	Level		First diff		Decision
Variable	*Stat*	*Prob*	*Stat*	*Prob*		*Stat*	*Prob*	*Stat*	*Prob*		*Stat*	*Prob*	*Stat*	*Prob*	
LCPS	-3.97	0.00	-	-	I(0)	-0.15	0.44	-14.77	0.00	I(1)	28.65	0.73	262.65	0.00	I(1)
LTD	-4.78	0.00	-	-	I(0)	-3.06	0.00	-	-	I(0)	60.13	0.00	-	-	I(0)
PLR	-0.98	0.16	- 8.64	0.00	I(1)	-2.17	0.02	-	-	I(0)	48.86	0.03	-	-	I(0)
LR	-1.13	0.13	-11.05	0.00	I(1)	-2.66	0.00	-	-	I(0)	58.00	0.01	-	-	I(0)
NPLR	-3.19	0.00	-	-	I(0)	-2.37	0.00	-	-	I(0)	70.84	0.00	-	-	I(0)
LNBR	-3.81	0.00	-	-	I(0)	-1.44	0.08	-10.68	0.00	I(1)	66.83	0.00	-	-	I(0)
INTB	0.09	0.54	-9.09	0.00	I(1)	-5.74	0.00	-	-	I(0)	89.60	0.00	-	-	I(0)
LGDP	-9.61	0.00	-	-	I(0)	-6.90	0.00	-	-	I(0)	107.96	0.00	-	-	I(0)
INF	-0.73	0.23	-3.53	0.00	I(1)	-1.27	0.10	-3.25	0.00	I(1)	33.46	0.49	55.08	0.01	I(1)
T-BILLS	-7.31	0.00	-	-	I(0)	-8.38	0.00	-	-	I(0)	132.56	0.00	-	-	I(0)

Interest Rates and Investment in Nigeria: Is the Monetary Policy Rate a Signaling Instrument for Portfolio Investors?

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Abstract

This paper adopted structural vector autoregression (SVAR) approach to examine whether or not the monetary policy rate (MPR) of the Central Bank of Nigeria (CBN) was a signaling instrument for foreign portfolio investors, using monthly data spanning January 2007 to September 2018, with the MPR as the key monetary policy instrument. The results revealed that changes in the monetary policy rate of the CBN impacted the behaviour of foreign portfolio investment in Nigeria. Specifically, the structural coefficient indicated that a one per cent increase in MPR would raise portfolio investment by 0.21 per cent. On the strength of the empirical evidence, the authors submitted that monetary policy was indeed a signaling instrument for portfolio investors in Nigeria. The results further showed that increase in MPR had the potential to attract more foreign portfolio investment into the country. This implies that interest rates in Nigeria matters to foreign portfolio investors in their decision to invest in the country. This further indicates that the volume of portfolio inflows into Nigeria, despite perceived risks, may be due, largely, to the relatively higher interest rates in the country. It is, therefore, our conviction that the monetary authority can, through the instrumentality of the MPR, attract higher foreign portfolio investments if it so desires by providing the right signals to foreign portfolio investors. To this end, it is recommended that the Bank should sustain its forward guidance strategies, so as to anchor more appropriately the expectations of portfolio investors on the future path of interest rates.

Keywords: Foreign Portfolio Investment, Monetary Policy, Structural Vector Autoregression

JEL Classification Numbers: E37, E47

I. Introduction

Investment plays a key role in the economic life of any country. Many countries rely on investments to alleviate major economic problems, such as unemployment and poverty. However, investment in developing countries is constrained by the relatively low level of domestic savings and access to foreign financing. This, perhaps, account for the growing need for developing countries to attract more foreign capital to complement the persistent low domestic savings. Foreign capital, in addition to improving capital accumulation, can bring in new

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technology that may lead to expansion in productive capacities, thereby improving a country's balance of payments, employment and income levels, required to engender economic growth and development.

Several factors determine the level of investment in any economy. Key among these factors is the real interest rate. Real interest rate is imperative in the monetary policy transmission mechanism; and monetary policy impulses can be transmitted to the real economy through this channel to impact the level of investment. Several institutions, including the CBN, has in recent times, conducted studies that revealed that the real interest rate is an important channel in the transmission mechanism of monetary impulses in the economy. Understanding the link between interest rate and investment is, therefore, of great imperative to policy makers. High interest rates amount to high cost of credit, which raises the cost of production, and dampens private investment.

High interest rates in Nigeria have been attributed to some recent reforms implemented in the banking industry, including the adoption of a Structural Adjustment Programme (SAP) in 1986, leading to the liberalisation of the Nigerian financial sector, upward pressure on interest rates and additional savings to the banking sector. This was followed by consolidation of the banking industry in 2005, which led to substantial increase in portfolio investments. Despite its contribution to banks' capital base, the sudden rise in portfolio investments endangered financial stability, particularly monetary and exchange rate stability. The adverse effects became more pronounced during the 2007/2008 global financial crises when the country, like many other developing countries, struggled to minimise the negative impacts of volatile capital flows, as portfolio investors began to repatriate capital back to safer countries. The CBN, in response to emerging challenges, have continued to fix the monetary policy rate (MPR) based on prevailing monetary conditions, to anchor other rates in the market and enhance competition among the deposit money banks (DMBs) towards enthroning a free market system for loanable funds in Nigeria.

It was in line with this statutory responsibility that the Bank chose to maintain the MPR at 14 percent during the recent economic recession, despite public outcry in favour of a lower interest rate regime to propel the economy out of recession. The bank retained the rate, on the conviction that high interest rates are paramount for attracting foreign portfolio investments and there was need to prioritise foreign portfolio investments given the foreign exchange difficulties and considerable distortions that confronted the economy during the period of recession. In particular, low levels of private investment was blamed on the difficulties in accessing foreign capital for procuring manufacturing spare-parts and imported machinery needed in production process, with adverse implications for long-term

economic growth and development.

It is against this backdrop that we undertake in this study to investigate whether or not the key monetary policy instrument of the CBN, the monetary policy rate (MPR), provides any signal to foreign portfolio investors in Nigeria, using monthly data spanning January 2007 to September 2018. Specifically, the study employed the structural vector autoregression (SVAR) framework to know whether or not foreign portfolio investors pay any significant attention to the MPR in their investment decisions in Nigeria. The significance of the study is underscored by the need to provide a clearer understanding of the nature and specific attributes of portfolio investment and its interaction with the key monetary policy instrument (the MPR) in Nigeria.

The paper is structured into six sections with the introduction in Section 1. Section 2 provides the theoretical and empirical literature, while the stylised facts on interest rate and foreign portfolio investment in Nigeria are contained in Section 3. The methodology, encapsulating the data and model specifications, are provided in Section 4, while the estimations and empirical results are presented and analysed in Section 5. Section 6 provides the concluding remarks and policy recommendations.

II. Review of Relevant Literature

II.1 Drivers of Foreign Investments in Developing Countries

Broadly, foreign investments are categorised into four. Commercial loans, official flows, foreign direct investment (FDI) and foreign portfolio investment (FPI). Commercial loans, are loans that take the form of bank loans issued to foreign businesses or governments, while official flows refer, generally, to the forms of development assistance that developed nations give to developing ones.

Foreign direct investment (FDI), on the other hand, pertains to international investment in which the investor obtains a lasting interest in an enterprise in another country. FDI is calculated to include all kinds of capital contributions, such as the purchases of stocks, as well as, the reinvestment of earnings by a wholly owned company incorporated abroad (subsidiary), and the lending of funds to a foreign subsidiary or branch. The reinvestment of earnings and transfer of assets between a parent company and its subsidiary often constitutes a significant part of FDI. Foreign portfolio investment (FPI), on the other hand, is a category of investment instruments that is more easily traded and do not represent a controlling stake in an enterprise. These include investments via equity instruments (stocks) or debt (bonds) of a foreign enterprise that does not necessarily represent a long-term interest.

Various factors are responsible for driving investments in developing countries. Decisions on countries to receive FDI are carried out by multinational companies who seek to combine firm and country-specific advantages to their benefit. These decisions are influenced by three broad drivers, namely; the policies of host countries, the proactive measures countries adopt to promote and facilitate investment, and the characteristics of their economies (United Nations Conference on Trade and Development, 1999).

The influence of policies in attracting FDI has declined, overtime, due to: the influence of liberalisation and globalisation on national borders; host country policies, such as trade and privatisation policies, including rules and regulations governing entry and operations of foreign investors; standards of treatment of foreign affiliates; and the operation of markets. In addition to policies, business facilitation measures, such as investment promotion, incentives, after-investment services, improvements in amenities and measures that reduce the costs of doing business, have become increasingly important in facilitating FDI inflow.

Beyond host country policies, economic incentives, such as access to large market and availability of natural resources have greatly influenced the location of FDI. It must be stated, however, that despite the presence of natural resources, multinational companies participate in the extraction of natural resources through non-equity arrangements other than FDI, especially in recent times. Similarly, the influence of demographic characteristics of the population of a country, in addition to the abundance of skilled and unskilled workforce and presence of adequate physical infrastructure influence inflow of market-targeting FDI and companies that target export markets who seek cost reduction strategies. Similarly, improved access to technology and innovative capacity within host countries also influence FDI inflows.

In terms of foreign portfolio investments (FPI), the decision to invest in a country is driven, largely, by the drive for higher returns and to achieve portfolio diversification. In general, there are economic and policy/ regulatory requirements that influence the inflow of FPI into a country. Although the economic determinants are not necessarily targeted at influencing FPI inflow, they are prerequisites for attracting FPI. These include high economic growth rate; exchange rate stability; macroeconomic stability; high level of foreign exchange reserves, a healthy domestic banking system; stock and bond market liquidity; and level of real interest rates. The extent to which these factors influence decisions of investors depends on the extent of risk aversion and the desire of investor(s) to operate in the fixed income or equity segment of the market.

Similarly, macroeconomic policies and regulatory frameworks of host countries,

that are prime determinants of portfolio investors include: ease of dividends and capital repatriation; presence and level of domestic capital gains tax; stock and bond market regulation; quality of domestic accounting and disclosure standards, speed and reliability of the settlement system; availability of domestic custodians and brokers; and, the degree of investor rights protection.

II.2 Interest Rate – Foreign Portfolio Nexus

Beyond the above drivers, portfolio investments respond strongly to the direction and magnitude of interest rates. According to JP Morgan (2015), interest rates are major drivers of bond prices and are, in turn, influenced by them, since a rise in interest rates will reduce the value of bond, and vice versa. Practically, the value and structure of a portfolio is influenced by interest rates, which determine the value of the portfolio. Changes in interest rate may trigger changes in the prices of securities both in the money and capital markets, and as such, there will be adjustment in the mix of portfolio by investors in a bid to hedge the interest rate risk (Ayodele, Afolabi, & Olaoye, 2017). Portfolios are sensitive to interest rate movements based on duration, credit quality, and type of security. Foreign portfolio holdings, with the official formal sector are still affected by monetary policy shocks, especially when a fixed bilateral exchange rate is desired. This way, monetary policy shocks that negatively affect both interest rates and the exchange rate of the bond-issuing country may trigger bond purchases by the authorities of the pegging country in order to stem the pressure of appreciation of the bilateral exchange rate vis-`a-vis the bond-issuing country (Carvalho & Fidora, 2015).

Theoretically, the relationship between portfolio demand and interest rates emphasises the role of risk premia which is the excess return over the expected future short-term interest rates that investors demand to hold an asset with a fixed long term yield. According to Carvalho and Fidora (2015), two main models explain how demand effects can have an impact on long-term interest rates.

Firstly, the Portfolio Balance theories aver that by reducing the amount of a given maturity and, consequently, the duration risk available in the market, purchases of long-term securities reduce the premium that investors demand for that specific duration risk. This can be the case either because the marginal buyer of this specific duration risk is willing to pay a higher price for it, or alternatively because the average buyer decrease exposure to the specific duration risk and therefore demands a lower compensation to hold the security whose effect may spill over to demand for other assets.

An alternative set of theories is the preferred habitat models, which focus on heterogeneous investor preferences and imperfect substitutability between maturities and asset classes (Vayanos & Vila, 2005). These models explain the role of

two kinds of investors, based on preferences for specific maturities and risk-averse arbitrageurs. Arbitrageurs move along the yield curve based on the direction of shocks in a given maturity that decrease yield.

Faced with a demand shock in a given maturity that decreases yields, arbitrageurs will move along the yield curve looking for alternative higher yielding investment opportunities, while other investors, with a preference for that specific maturity, remain. The response of arbitrageurs based on specific shocks explains the channel through which shocks are propagated to a specific maturity along the yield curve, which, in turn, depends on how risk averse they are. When arbitrageurs are highly risk averse, they will be less-willing to invest in other maturities and, hence, propagation will be low and demand shocks at longer maturities will produce larger impact at the long end of the curve.

II.3 Management of Capital Flows by the Central Bank

Inflow from abroad is major a driver of economic activity, since financial intermediation between lenders and borrowers improves the efficiency of resource allocation and growth. One important benefit of investing abroad is that investors could earn a higher economic return than the cost they incurred in investing the funds. Problem of foreign inflow for governments may arise if the absorptive capacity of the recipient country does not keep pace with the growth in capital flows, leading to distortions in the domestic economy (Tule, 2013). This may induce volatility in domestic liquidity and complicate exchange rate management, in affected countries, especially in developing countries, with weak financial sector regulations. Capital inflow increases domestic liquidity by increasing foreign assets of the banking system, thereby exerting upward pressure on domestic prices. Specifically, as more capital inflow are attracted into a developing economy, the currency continues to appreciate, such that domestic goods become less-competitive and with imports becoming cheaper, thereby negatively affecting external reserves (Alade, 2015).

This has made the management of capital flows an issue of critical importance to the monetary authorities, as poorly managed capital inflows could lead to rapid deterioration in monetary and financial conditions thereby making the task of ensuring price stability harder. In managing this, central banks rely on a combination of monetary policy instruments and announcement effects to ensure price stability. Generally, policy actions such as the adjustments in policy rate get transmitted to the real economy through different channels, one of which is the interest rate channel. Thus, an increase in MPR, being an anchor to other rates in the money market, signifies the desire of the central bank to pursue a contractionary (or restrictive) monetary policy, while a decrease implies an expansionary (a more

accommodating or loose) monetary policy (Alade, 2015).

Administration of the policy rate in Nigeria involves averaging of reserve requirement over a maintenance period and the use of Standing Facilities (Lending and Deposit) to define an interest rate corridor which drives interest rates in the money market. Conceptually, banks are expected to quote their overnight interest rates in relation to, or as a ratio of the MPR (Alade, 2015). In addition to signaling the direction of policy (using the MPR) to rein in inflation expectations, the CBN uses reserve requirements, and conducts regular Open Market Operations (OMO) to ensure optimal liquidity at all times (Okpanachi, 2012). The Bank also relies on announcement effect through forward guidance activities to guide liquidity management.

When the central bank tightens money supply by raising the policy rate, borrowing costs are expected to increase, thereby lowering aggregate consumption as investors reduce new investment activities because of the reduction in net worth. Such increase in policy rate would, on the other hand, lead to increase in capital inflow as investors seek additional arbitrage opportunities. It is, therefore, not misplaced to argue that the liquidity management operations of the central bank, especially the mop-up operations has largely been in response to volatility in capital flows. The central bank would therefore need to find an optimal level of interest rates that does not compromise the price stability objective of the country.

II.4 Empirical Literature

Ayodele, et al (2017) in their study of the impact of interest rate on portfolio investments in Nigeria revealed that interest rate, specifically, prime lending rate, significantly influenced portfolio investment, adding that total savings exerted significant positive impact on portfolio investment in both the long and short-run. Using simple analytical framework to estimate the intensity (and effectiveness) of monetary sterilisation by the Central Bank of Nigeria (CBN), Okpanachi (2012) found evidence of less-than-full, but significantly high sterilisation intensity, albeit no indication of sterilisation smoothening by the Bank.

Combining both time series and cross sectional data techniques, Conover, *et.al* (2005) provided a rigorous evaluation of the relationship between US monetary policy and global security returns and found that US monetary policy had a strong relationship with security returns. US stock returns were found to be consistently higher and less-volatile when the Federal Reserve followed an expansionary monetary policy.

Siddiqui and Aumeboonsuke (2014) analysed the relationship between FDI and

interest rates within 5 Asian countries, using the VAR technique. They found that interest rates of Thailand, Indonesia and Malaysia had negative relationship with foreign direct investments in those countries.

Waqasa, *et.al* (2015) investigated the relationship between macroeconomic factors and foreign portfolio investment volatility in four Asian countries (China, India, Pakistan and Sri Lanka), using monthly data, spanning 2000 to 2012. The results revealed that there existed significant relationship between macroeconomic factors and foreign portfolio investment volatility. Variables, such high interest rate, currency depreciation, foreign direct investment, lower inflation were associated with less volatility in international portfolio flows.

Kamar (2013), used panel estimation techniques to study the impact of capital flows on economic growth an d competitiveness. He found that capital flows contributed positively to economic growth through the competitiveness channel. Fratzscher, *et.al* (2009) investigated the impact of monetray policy shocks on portfolio choice of investors in the United States of America, and found that shocks to monetary policy exerted a substantial effect on the size and composition of capital flows and the trade balance of the United States. A 100 basis point reduction in Fed rate, raised net capital inflows and lowered the trade balance by 1 per cent of GDP.

In his study, Tule (2013) investigated the implications of domestic credit growth and international capital flows for monetary policy management in Nigeria over the period 2006-2012. The study revealed that the current account balance is not significant in understanding the interactions among foreign capital inflow, domestic credit growth, and monetary policy actions in Nigeria, in view of the strong asymmetry between net debt flows and net equity flows.

Fanelli (2017) studied the relationships among monetary policy, capital controls and international portfolios and found that as insurance considerations gained more prominence, home-currency positions become larger, and the excess-return volatility of home-currency assets actually decrease, rather than increase in line with expectations about fixed ad hoc portfolios. Carvalho and Fidora (2015), also found that the increase in foreign holdings of euro area bonds in the mid 2000s was associated with a reduction of euro area long-term interest rates by about 1.55 percentage points.

Ammera, et al (2018) examined the impact of interest rates on cross-border portfolio investments using data on U.S. bond holdings by foreign investors from 31 countries for the period 2003 – 2016 and found that low(er) interest rates, now prevailing in many advanced countries, led to greater investment in the United

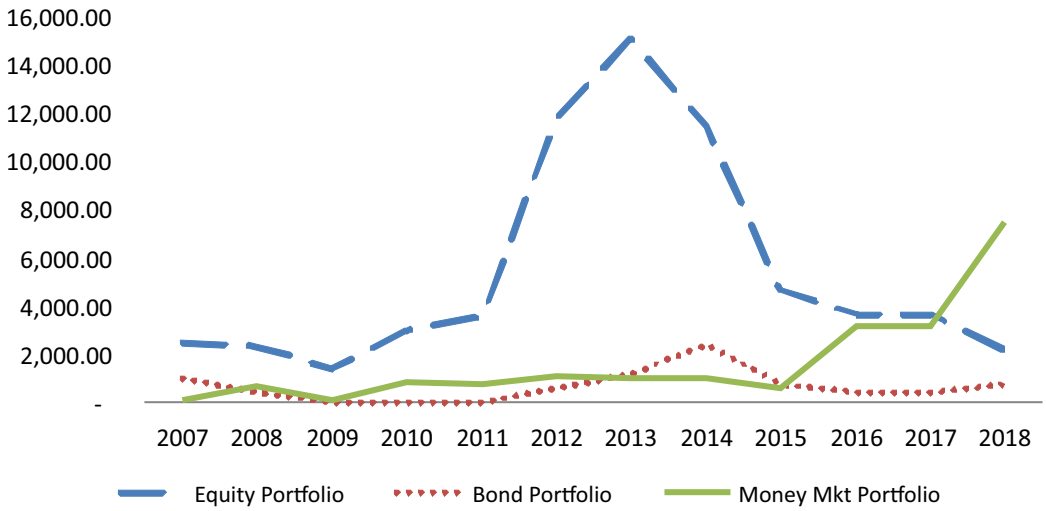
States, with the effects generally driven by investment in (high yield) corporate bonds, rather than in Treasury bonds.

II.5 Interest Rate and Portfolio Inflows in Nigeria: Stylised Facts

Since the 2000s, Nigeria has experienced a phenomenal increase in capital inflows driven by reforms which led to liberalisation and strengthening of the financial system and better macroeconomic environment. Globally, financial developments at the world stage might also have played quite an important role. Investors took advantage of the less integrated nature of developing countries' financial markets which offered higher returns and temporal safe haven opportunities for capital inflows (Okpanachi, 2012).

Until the 2000s, foreign direct investments (FDIs) and debt were the major kinds of inflows to Nigeria. However, as the capital market opened up, the country started to receive substantial inflows in the form of portfolio investment especially from 2004. From 2007 equity portfolio dominated total foreign portfolio investments into the country folowed by capital inflows directed at money market instruments. Portfolio investmets related to bonds were the least dominant (Figure 1).

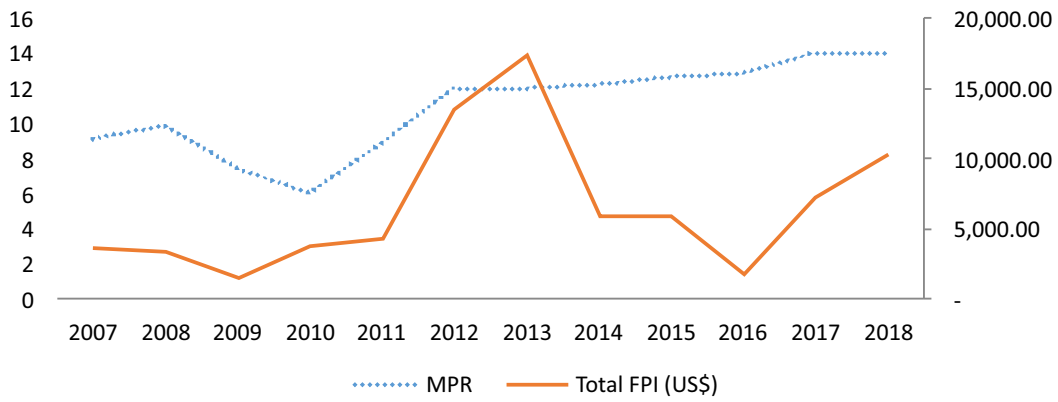
Figure 1: Total Foreign Portfolio Inflows into Nigeria (US$ billion)



Source: Central Bank of Nigeria

Inflow of equity portfolio into the economy dipped in response to the 2008 global financial crisis, as equity inflows declined to US$1.4 bn in 2009 from US$2.5bn in 2007 but had a quick rebound afterwards. Capital inflows increased persistently afterwards peaking at US$15.1bn in 2013 before declining consistently afterwards in response to monetray policy normalisation of the US Federal Reserve, and the domestic risks accompanying the Nigerian elections in 2015, as well as, the macroeceonomic contraction that preceded the 2016 economic recession in the country. However, capital inflow into money market instruments remained stable for most of the time, but recorded consistent increase from 2015. The use of the MPR by the CBN in managing foreign portfolio inflow into the country remained effective from 2007 as the FPI followed closely the direction of the MPR until 2014. The direction of inflow after this period showed that despite the high rates of the MPR, inflow declined between 2014 and 2016 due, mainly, to the reasons earlier given for its trend during the period) before returing to its earlier trend from 2017.

Figure 2: Monetary Policy Rate and Total Foreign Portfolio Investments



Source: Central Bank of Nigeria

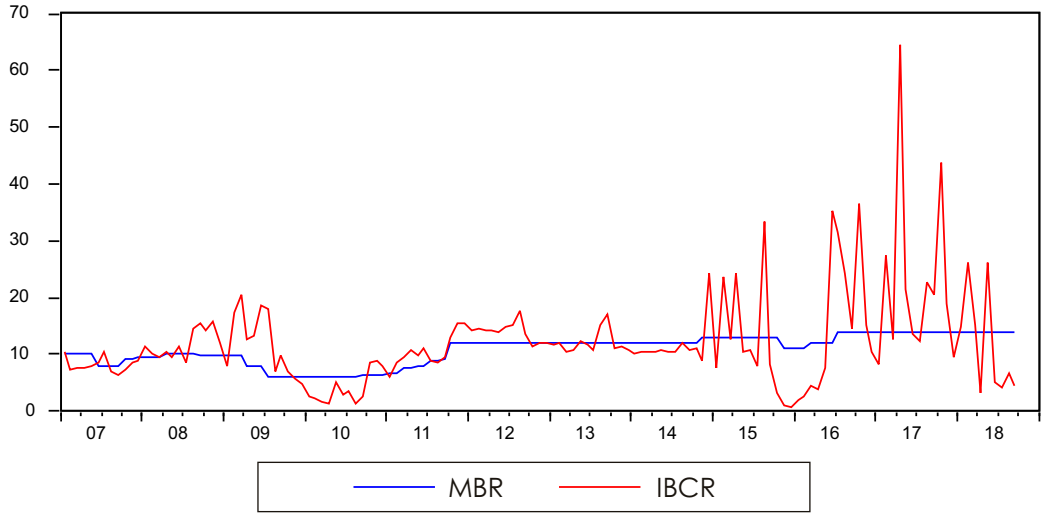
II.5.1 Monetary Policy Rate and Interbank Call Rate

The relationship between the policy rate and interbank call rate is expected to be positive, as increase in monetary policy rate will result to increase in the interbank call rate and vice-versa, ceteris-paribus. The MPR in Nigeria has, on the average, maintained a smooth and stable trend throughout the observed period. This trend is expected because of the lumpy nature of the policy rate, as its variation is not regular, and even when changes occur, it is usually with a small margin.

As shown in Figure 1, the MPR was 10 per cent on average from January 2007 to March 2009, it declined to 8.0 per cent in April 2009 and maintained the declining trend until December 2011 when it peaked at 12 per cent. This trajectory continued

until June 2016. It further rose to 14 per cent in July 2016 and maintained this rate up to September 2018. The movement in the interbank rate was, however, not too smooth, as observed in figure 1. Its trend was volatile, it was also 10 per cent in January 2007, but rose to 21 per cent by March 2009 before declining to as low as 1 per cent in August 2010. It, however, rose to 33 per cent in August 2015, and in December of same year, it was 1 per cent. It peaked as high as 65 per cent in April 2017 and by June 2017 it dropped to 13 per cent. The fluctuations continued throughout the observed period, closing at 5 per cent in September 2018.

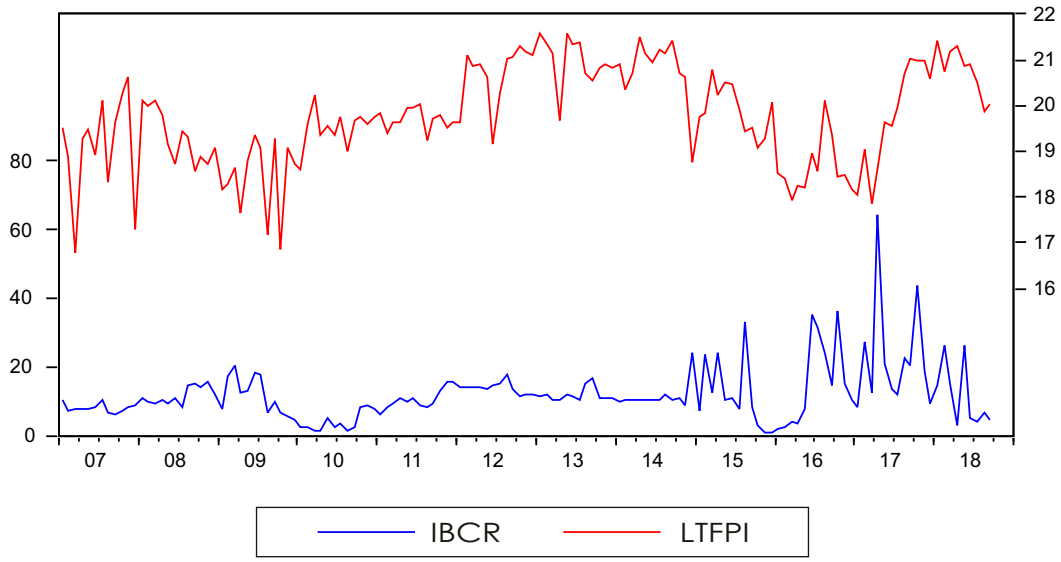
Figure 3: Monetary Policy Rate and Interbank Call Rate



II.5.2 Interbank Call Rate and Foreign Portfolio Investment

Foreign portfolio flows to developing economies in general are exceedingly sensitive to interest rate disparities. Fund tends to flow to economies with high interest rates because of the differences between the current interest rates in the international markets. In Nigeria, one of the reasons given for keeping real interest rates at high level is to attract more foreign capital. The graphical examination of the two series in question did not seem to validate this assertion in all cases, as in some periods, high interest rates were accompanied by lower portfolio flows. This is one of the reasons why the relationship between the interbank call rate and foreign portfolio investment should be subjected to further empirical verification.

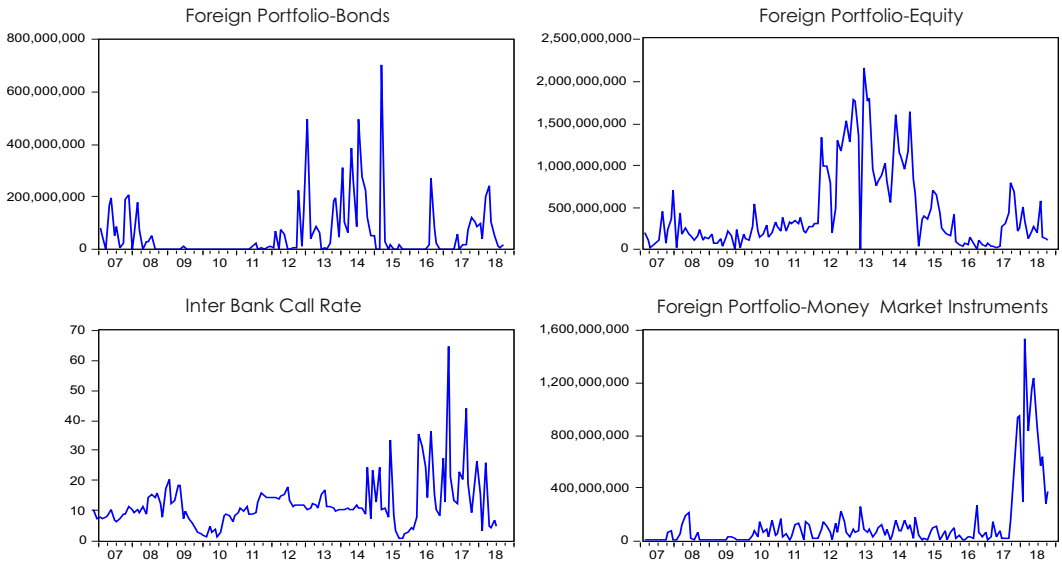
Figure 4: Interbank Call Rate and Foreign Portfolio Investment



II.5.3 Interbank Call Rate and the Components of Foreign Portfolio Investment in Nigeria

Figure 5 shows how the behaviour of the interbank call rate mimics the movements in the components of portfolio investments. All the variables were observed to be volatile with equity portfolio flows being the most volatile, followed by the bonds portfolio and then the money market investments.

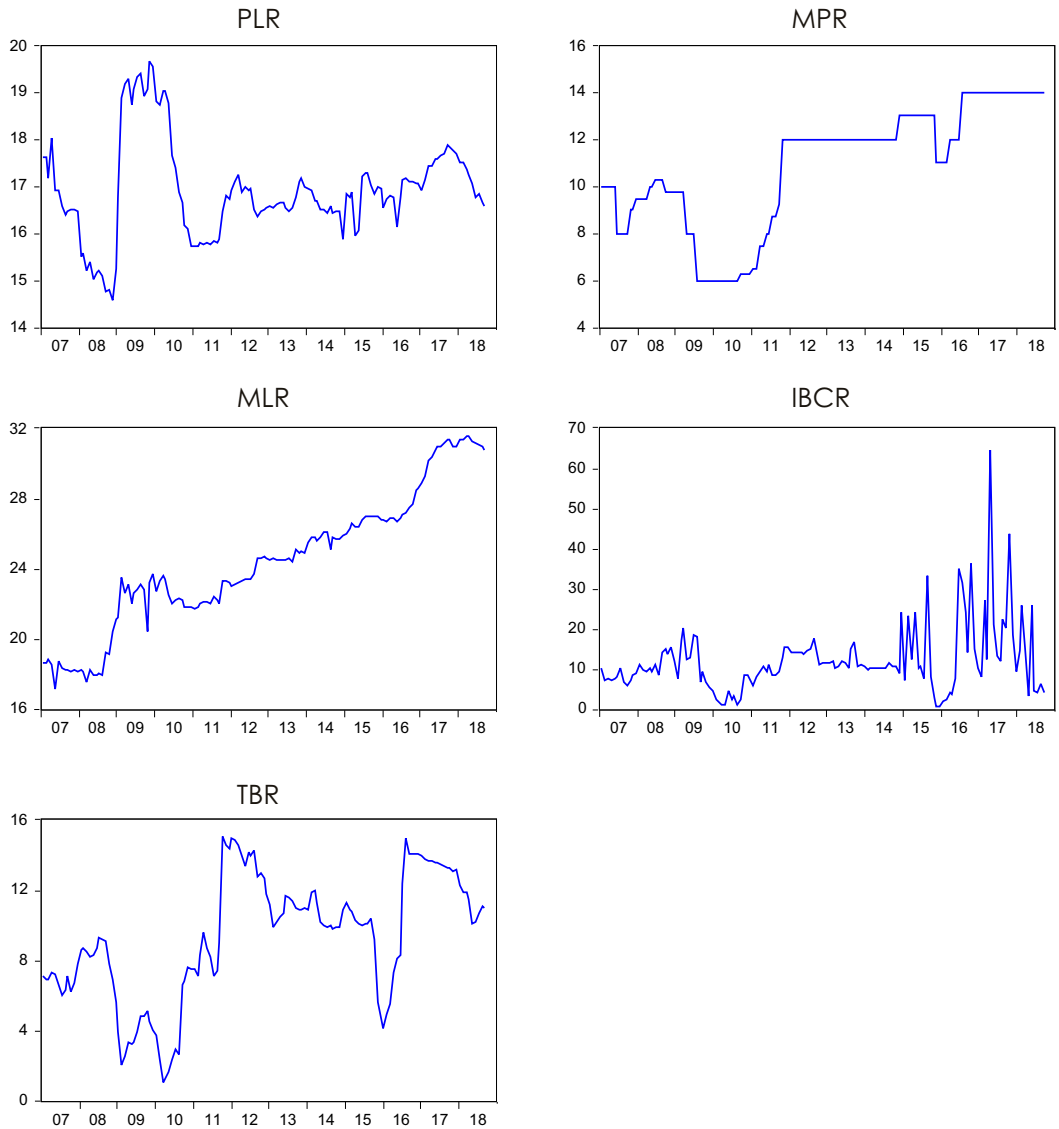
Figure 5: Trends in Inter-bank Call Rate and the Components of FPI.



II.5.4 Monetary Policy Rate and other Short-term Interest Rates

The graphical representation of the policy rate with other short-term interest rates revealed that all the rates trended the same direction, on the average. However, the volatility in the trends differed among these rates. The interbank call rate appeared to be the most volatile of all the rates, followed by the prime lending rates, Treasury bill rates, maximum lending rates and the monetary policy rate in that order (Figure 6).

Figure 6: Trends in the Monetary Policy Rate and the Other Short-term Interest Rates



III. Methodology

III.1 Data

The study employed monthly data spanning January 2007 to September 2018. The variables of interest include the foreign portfolio investment (FPI), monetary policy rate (MPR, external reserve (RESV) and oil price (OP). The data were sourced from various issues of the CBN Statistical Bulletin. The FPI and MPR are the key variables since the focus of the study is to examine whether the monetary policy rate is a signaling instrument for portfolio investors. In other words, do foreign portfolio investors take into account the MPR when taking decisions on whether to invest or not? The MPR is not only an anchor rate, but a base for the operating range or band of the overnight interest rates in the money market. The oil price was employed to capture the dynamics of the Nigerian economy and assumed to be the most exogenous variable in the model. The Nigerian external reserve (RESV) was used to gauge the risk appetite of investors since most of them watch out for reserve levels to guarantee capital reversal.

III.2 Descriptive Statistics

Table 1 was based on 141 observations (after adjustment), hence providing a more precise estimate of the parameters. The variables presented a positive mean for all series with OP having a mean of $81.98 per barrel while MPR has a mean of 10.86 per cent and standard deviation of 2.63 per cent. The RESV showed a mean value of N39.3 billion and a standard deviation of 8.9, while the FPI showed a mean of N6.26 billion and a standard deviation of 5.7. The Jarque-Bera statistics indicated that the null hypothesis of the variables should be rejected and that the variables are normally-distributed. All the variables, but MPR had positive skewness value with TPFI having the highest positive of 1.14 while oil price had the lowest positive of 0.08. In terms of the Kurtosis statistics, all the variables showed positive values with the highest and lowest value of 3.3 and 1.8 for TFPI and OP, respectively.

Table 1: Descriptive Statistics

	OP	MPR	RESV	TFPI
Mean	81.98	10.86	39305.98	62600.00
Median	77.64	12.00	38705.71	376000.00
Maximum	138.74	14.00	62081.86	238000.00
Minimum	30.67	6.00	23689.87	1938.00
Std. Dev.	27.32	2.63	8991.36	57700.00
Skewness	0.08	-0.59	0.52	1.14
Kurtosis	1.75	2.15	2.76	3.33
Jarque-Bera	9.37	12.37	6.64	31.15
Probability	0.01	0.00	0.04	0.00
Sum	11558.65	1530.75	5542144.00	883000.00
Sum Sq. Dev.	104476.60	965.15	113000.00	4660000.00
Observations	141.00	141.00	141.00	141.00

III.3 Preliminary Causality

A preliminary analysis was carried out to examine whether the CBN policy rate was anchoring other rates in the money market. The causality test was performed on a selected number of interest rates against the monetary policy rate. The selected rates included the interbank call rate, the prime lending rate, the maximum lending rate, and the Treasury bill rate. The results of the causality test indicated a unidirectional relationship running from MPR to IBCR. These findings are consistent with the *apriori* expectation, which holds that the monetary policy rate had direct positive influence on the interbank call rate. To this end, we could justifiably say that the MPR anchors the short-term interbank call rate.

The causality test also indicated a unidirectional causality running from prime lending rate to the monetary policy rate, prime lending rate to maximum lending rate and Treasury bill rate to maximum lending rate. Moreover, a bi-directional casualty was found between the interbank call rate and the maximum lending rate, the Treasury bill rate to interbank call rate. In summary, the preliminary findings revealed that the interbank call rate influenced, largely, the behaviour of other rates; and that, though it expectedly drives the other rates more, it is being driven by the policy rate too.

Table 2: Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
MLR does not Granger Cause MPR	139	0.65305	0.5221
MPR does not Granger Cause MLR		2.65038	0.0743
PLR does not Granger Cause MPR	139	6.50879	0.0020
MPR does not Granger Cause PLR		0.12296	0.8844
IBCR does not Granger Cause MPR	139	0.38627	0.6803
MPR does not Granger Cause IBCR		5.56404	0.0048
TBR does not Granger Cause MPR	139	2.24514	0.1099
MPR does not Granger Cause TBR		1.40430	0.2491
PLR does not Granger Cause MLR	139	3.83428	0.0240
MLR does not Granger Cause PLR		0.33464	0.7162
IBCR does not Granger Cause MLR	139	2.53791	0.0828
MLR does not Granger Cause IBCR		2.90665	0.0581
TBR does not Granger Cause MLR	139	2.59644	0.0783
MLR does not Granger Cause TBR		0.43919	0.6455
IBCR does not Granger Cause PLR	139	1.03701	0.3573
PLR does not Granger Cause IBCR		2.22566	0.1120
TBR does not Granger Cause PLR	139	1.40128	0.2499
PLR does not Granger Cause TBR		0.32716	0.7215
TBR does not Granger Cause IBCR	139	4.98169	0.0082
IBCR does not Granger Cause TBR		2.54991	0.0819

III.4 Unit Root Test and Other Pre-Estimation Tests

In examining the statistical properties of the data, unit root tests were conducted on all series and the results indicated that all the variables but FPI were stationary at first difference (Appendix 1). A prerequisite for the estimation of a VAR model is the choice of an appropriate lag length. The FPE, SC and HQ criteria selected an

optimal lag length of order 2, which was employed in the study (Appendix 2). As part of the diagnostic tests, a stability test was undertaken to ascertain the reliability of the VAR model using the autoregressive (AR) root stability test. The estimated VARs proved to be stable since all roots indicated a modulus of less than one and lie inside the circle. Furthermore, a co-integration test was conducted, in which both the trace and Eigen test statistics indicated the presence of least 2 integrating equation.

IV. Analytical Framework

The study employed the structural vector autoregression (SVAR) methodology to estimate and analyse the response of FPI to monetary policy shocks. Despite the recent improvements in the VAR methodology, the choice of SVAR in analysing the impact of monetary policy shocks has proved to produce relatively better and robust results. In addition, the SVAR is theoretically suitable and allows for the identification and imposition of restrictions on the structural relationships among the variables. Since the focus of the study is on the policy implications, the SVARs were estimated in levels to avoid losing the relevant economic information embedded in the data, in line with common practice in monetary literature (CBN, 2014; Berkelmans 2005; Lawson and Rees, 2008; Vinayagathasan 2013; and Claudes 2007). Furthermore, level form estimations are conceptually done under the implicit assumption of the existence of co-integration, among the variables.

Assume the economy is represented by the following structural form:

$$Ax_t = \alpha_0 + C(L)x_{t-i} + B\varepsilon_t \quad (1)$$

Where x_t is a vector of endogenous macroeconomic variables, x_{t-i} is a vector of the lagged values of endogenous variables, ε_t is a vector of random error of disturbance terms for every variable that captures exogenous factors in the model, $C(L)$ is a matrix polynomial in the lag operator L of length p, A a matrix of $n \times n$ dimension, n is the number of variables, and B is a column vector of dimension $n \times 1$, which contains the contemporaneous response of the variables to the innovations or disturbances.

There are three steps involved when estimating an SVAR. The first step is to estimate the VAR in its reduced form because the coefficients in the matrices of (1) are unknown, the variables have temporary effects on each other and the model in its current form cannot be identified. To transform (1) into reduced form, we multiply both sides of Equation (1) by the inverse of matrix A, translating it into a standard VAR representation as follows:

$$x_t=A^{-i}\alpha_0+A^{-i}C(L)x_{t-i}+A^{-i}B\varepsilon_t \quad (2)$$

Further transformation of Equation (2) gives:

$$xt=\gamma_0+D(L)x_{t-i}+e_t \quad (3)$$

Where $\gamma_0=A^{-1}\alpha_0$, $D(L)=A^{-1}\,C(L)$ and $e_t=A^{-1}B\varepsilon_t$. The focal issue here is to recover the underlying structural disturbances from the estimated VAR. Hence, we can estimate the random stochastic residual $A^{-1}B\varepsilon_t$ from the residual ε_t of the estimated unrestricted VAR:

$$A^{-1}B\varepsilon_t=e_t \quad (4)$$

Reformulating (4), we have $A^{-1}B\varepsilon_t\varepsilon'_tB'A'^{-1}=e_te_t'$ and since $\varepsilon_t\varepsilon'_t=I$ we have:

$$A^{-1}\,BB'A'^{-1}=et\;et' \quad (5)$$

In the second step, we identified the structural model from an estimated VAR. As such, it is necessary to impose restrictions on the structural model. Here, we utilised the recursive method of imposing restrictions in SVARs for the aggregate and sectoral output components, using economic theory as the basic foundation. If there are *n* variables, Equation (3) requires the imposition of $n(n+1)/2$ restrictions on the $2n^2$ unknown elements in *A* and *B*. Therefore, additional $n(3n-1)/2$ restrictions are required to be imposed.

$$Ae_t=B\varepsilon_t \quad (6)$$

From Equation (6), it shows that the disturbances or innovations in the reduced form e_t, are complicated mixtures of the underlying structural shocks, which are not easily interpretable except it is directly linked to the structural shocks. The e_t is the source of variation in the VAR analysis.

The third step of the SVAR analysis is to use innovation to access the pass-through from the monetary policy variables to aggregate output and sectoral output. It uses the forecast error e_t from the estimated reduced form VAR to obtain the impulse response functions (IRF) and forecast error variance decomposition (FEVD), to examine the foreign portfolio effects of monetary policy shocks. The IRFs show the response of each variable in the system to shocks to the system variables. A unit shock is applied to the error term of each variable from each equation, separately, and the effects upon the VAR system are traced over time. The FEVD tells us the proportion of movements in a sequence due to its own shocks, and shocks to the other variables. In other words, it shows the proportion of the forecast error variance

in a variable that is explained by innovations to itself and other variables. Therefore, FEVD provides information about the relative importance of each random innovation in affecting the variables in the VAR (Enders, 2010).

IV.1 Models Specification

The model was estimated using a five variable SVAR. All the variables enter the model in log-levels. Following from the above general analytical framework for SVAR, the specific model specification for the study in line with our chosen lag length 2 stated as:

$$OP_t = +\alpha_1 + \beta^1_{11} OP_{t-1} + \beta^2_{11} OP_{t-2} + \beta^1_{12} MPR_{t-1} + \beta^2_{12} MPR_{t-2} + \beta^1_{13} RESV_{t-1} + \beta^2_{13} RESV_{t-2} + \beta^1_{14} FPI_{t-1} + \beta^2_{14} FPI_{t-2} + \varepsilon_{t1} \quad (7)$$

$$MPR_t = \alpha_2 + \beta^1_{21} OP_{t-1} + \beta^2_{21} OP_{t-2} + \beta^1_{22} MPR_{t-1} + \beta^2_{22} MPR_{t-2} + \beta^1_{23} RESV_{t-1} + \beta^2_{23} RESV_{t-2} + \beta^1_{24} FPI_{t-1} + \beta^2_{24} FPI_{t-2} + \beta^0_{1} OP_t + \varepsilon_{t2} \quad (8)$$

$$RESV_t = \alpha_3 + \beta^1_{31} OP_{t-1} + \beta^2_{31} OP^{t-2} + \beta^1_{32} MPR_{t-1} + \beta^2_{32} MPR_{t-2} + \beta^1_{33} RESV_{t-1} + \beta^2_{33} RESV_{t-2} + \beta^1_{34} FPI_{t-1} + + \beta^2_{34} FPI_{t-2} + \beta^0_{1} OP_t + \beta^0_{2} MPR_t + \varepsilon_{t3} \quad (9)$$

$$FPI_t = \alpha_4 + \beta^1_{41} OP_{t-1} + \beta^2_{41} OP_{t-2} + \beta^1_{42} MPR_{t-1} + \beta 2_{42} MPR_{t-2} + \beta 1_{43} RESV_{t-1} + \beta^2_{43} RESV_{t-2} + \beta^1_{44} FPI_{t-1} + \beta^2_{44} FPI_{t-2} + \beta^0_{1} OP_t + \beta^0_{2} MPR_t + \beta^0_{3} RESV_t + \varepsilon_{t4} \quad (10)$$

IV.2 Identification Scheme

Although there is still no consensus in the literature on how to identify the monetary policy reaction function correctly, two popular approaches include: following a policy rule, such as the 'Taylor Rule' (Taylor, 1993) or allowing the monetary authority to contemporaneously respond to as many variables as possible. In evaluating the response of foreign portfolio inflows to monetary policy shocks in this study, the former approach was chosen and the cholesky decomposition recursive ordering was employed as represented by the matrix below. The OP was assumed to be exogenously determined contemporaneously, hence represented the first equation in the model. This implies that no variable in the system is expected to influence it contemporaneously.

The MPR represents the second equation and the official monetary policy stance of the CBN and is assumed to be influenced only the oil price. It also served as the key element of propagation of shocks when examining the effect of monetary policy on the economy. The third row which is the external reserve equation which assumes that there is contemporaneous interaction between OP and FPI. In other

words, the RESV is affected contemporaneously by only the innovations from OP, FPI and itself. The fourth equation which represent the variable of interest-foreign portfolio investment is assumed to respond contemporaneously to all the variables in the model.

$$BX_t \begin{bmatrix} 1 & 0 & 0 & 0 \\ b21 & 1 & 0 & 0 \\ b31 & 0 & 0 & b33 \\ b41 & b42 & b43 & 1 \end{bmatrix} \begin{bmatrix} op_t \\ mpr_t \\ resv_t \\ fpi_t \end{bmatrix} \quad (11)$$

V. Analysis of Results

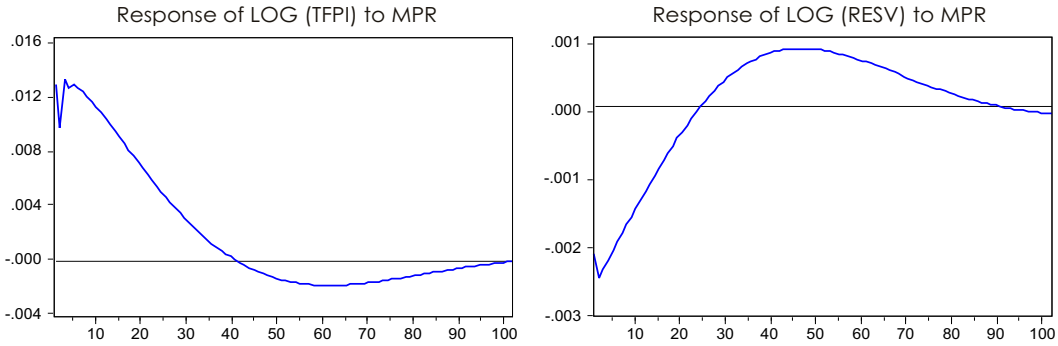
V.1 Impulse Response Analysis

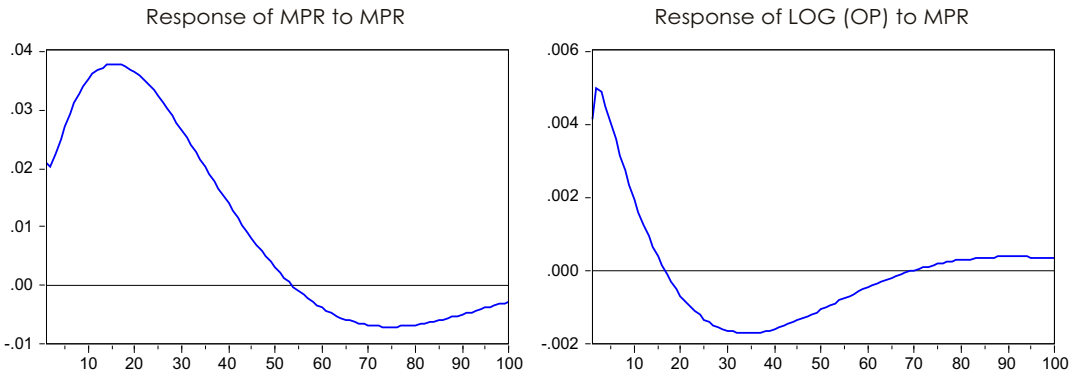
Impulse response functions (IRF) are structured in such a way as to trace the effects of any shock, represented by the error term of the relevant equation, on the future values of the dependent variable in the specified equation and those in the other equations (Adamu, 2017). In this study, the structural impulse response functions were used to verify whether or not the monetary policy rate is a signalling instrument for portfolio investors in Nigeria. From the results shown in Figure 7, the IRFs revealed a positive relationship between TFPI and the MPR. The results indicate that a one standard deviation positive shock in the MPR would lead to a 0.21 percent increase in TFPI. This implies that an increase in short-term interest rates (via the instrumentality of the MPR) relative to the rates prevailing in the rest of the world would enhance TFPI inflow to Nigeria. Moreover, the positive response of TFPI to one standard deviation innovation in the MPR seemed to persist over a fairly long period, suggesting that the response of foreign portfolio investors to upward adjustments in the MPR is not short-lived.

Further analysis revealed that the response of TFPI to one standard deviation

Figure 7: Impulse Response Functions (IRFs)

Response to Structural One S.D. Innovations





innovation in the MPR was contemporaneous as the MPR influenced the outcome of investors' decision within the first month. This implies that the investment decision by portfolio investors based on monetary policy signals is swift.

The response of total external reserves (RESV) to one standard deviation shock in the MPR is, however, not in line with apriori expectations. This is, nonetheless, not entirely surprising considering the persistent active but necessary intervention by the CBN in the foreign exchange market during the study period to defend the international value of the naira, specifically during the global financial crisis and the recent economic recession, which resulted in the gradual depletion of reserves. This necessitated the Bank to implement new measures to conserve foreign exchange, including the banning of 41 items from accessing foreign exchange through the official window.

In summary, the results suggest that, increase in the MPR (and hence short-term interest rates) has the potential to attract more foreign portfolio investment into Nigeria. This also implies that the monetary authority can tighten monetary policy by increasing short-term interest rates to attract higher foreign portfolio investments. This further implies that the MPR (being the anchor rate to other short-term interest rates in the market) is a signalling instrument to foreign portfolio investors in Nigeria.

V.2 Variance Decomposition Analysis

The VAR system was estimated to isolate the variation of each endogenous variable that was due to shocks in each component. In doing this, the significance of each random shocks, relative to the others, was ascertained. The forecast error variance decomposition (FEVD) analysis (Table 3) revealed that shocks to foreign portfolio investment accounted for 63.9 per cent of the variations in itself in the first period and settles at 62.0 per cent by the end of the tenth month.

Table 3: Forecast Error Variance Decomposition of Foreign Portfolio Investment

Period	S.E.	Oil Price shocks	Monetary Policy shocks	External Reserves Shocks	FPI Shocks
1	0.653557	1.840738	0.037991	34.16454	63.95674
2	0.683836	3.206088	0.054622	33.78270	62.95659
3	0.722752	4.490395	0.081506	31.53452	63.89358
4	0.737355	5.650983	0.106890	30.33452	63.90761
5	0.749120	6.625559	0.132668	29.39907	63.84270
6	0.757263	7.431011	0.156965	28.89334	63.51869
7	0.763800	8.087997	0.179985	28.59645	63.13556
8	0.768972	8.621481	0.201473	28.44591	62.73113
9	0.773100	9.054447	0.221519	28.36530	62.35874
10	0.776340	9.405776	0.240154	28.31878	62.03529
11	0.778839	9.690754	0.257447	28.28323	61.76857
12	0.780722	9.921375	0.273450	28.24868	61.55650

In the first month, the variation of foreign portfolio investment was explained by 0.03 per cent variation in MPR, it continued on that positive impact throughout the forecast horizon and settled at 0.24 per cent by the tenth month. This position validates our findings from the impulse response functions, that the policy rate is indeed a signalling instrument for portfolio investors in Nigeria. The above results are in line with apriori expectation, as higher interest rates are expected to attract more foreign investment.

VI. Policy Implications and Conclusion

VI.1 Policy Implications

The results of the empirical finding suggest that the monetary policy rate is a signalling instrument for portfolio investors in Nigeria. The results further suggest that increase in the MPR and the short-term interest rates have the potential to attract more foreign portfolio investment into Nigeria. Specifically, the structural coefficient indicated that a 1 per cent increase in MPR resulted to 0.21 per cent increase in portfolio investment. This implies that interest rates in Nigeria matters to foreign portfolio investors in their decision to invest in the country. This also means that the volume of portfolio inflows Nigeria enjoys presently despite some perceived risks may be due largely to higher interest rates. It is, therefore, our conviction that the monetary authority, through the instrumentality of the MPR, can attract higher

foreign portfolio investments, if it so desires by providing the right signals to foreign portfolio investors. Moreover, the finding that higher MPR attracts lower external reserves seems to suggest that the CBN needs to strengthen its foreign exchange policy to eliminate speculative demand and reduce intervention in the foreign exchange market. This also requires the CBN to continue striving towards achieving higher reserve position by expanding the current level of foreign portfolio investment.

VI.2 Conclusion

The paper examined whether the monetary policy rate (MPR) of the CBN is a signalling instrument for foreign portfolio investors. Using the structural vector autoregression (SVAR) model and MPR as key indicator of monetary policy, the results showed that the changes in the MPR could impact the behaviour of foreign portfolio investors. The study found that the MPR is indeed a signalling instrument for portfolio investors in Nigeria. The response from investors, due to changes in the policy rate does not, however, undermine the role of other factors in the determination of foreign portfolio investment in Nigeria. Specifically, the structural coefficient indicated that a 1 per cent increase in MPR raised the portfolio investment by 0.21 per cent.

Above all, the CBN needs to strengthen its foreign exchange policy to eliminate speculative demand so as to reduce its intervention in the foreign exchange market. The CBN also needs to continue striving towards achieving higher reserve position by expanding the current level of foreign portfolio investment.

It is recommended that the Bank should sustain its forward guidance strategies so as to properly anchor the expectations of portfolio investors on the future path of interest rates, as well as collaborate with other stakeholders to improve the investment climate in the country.

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Appendices

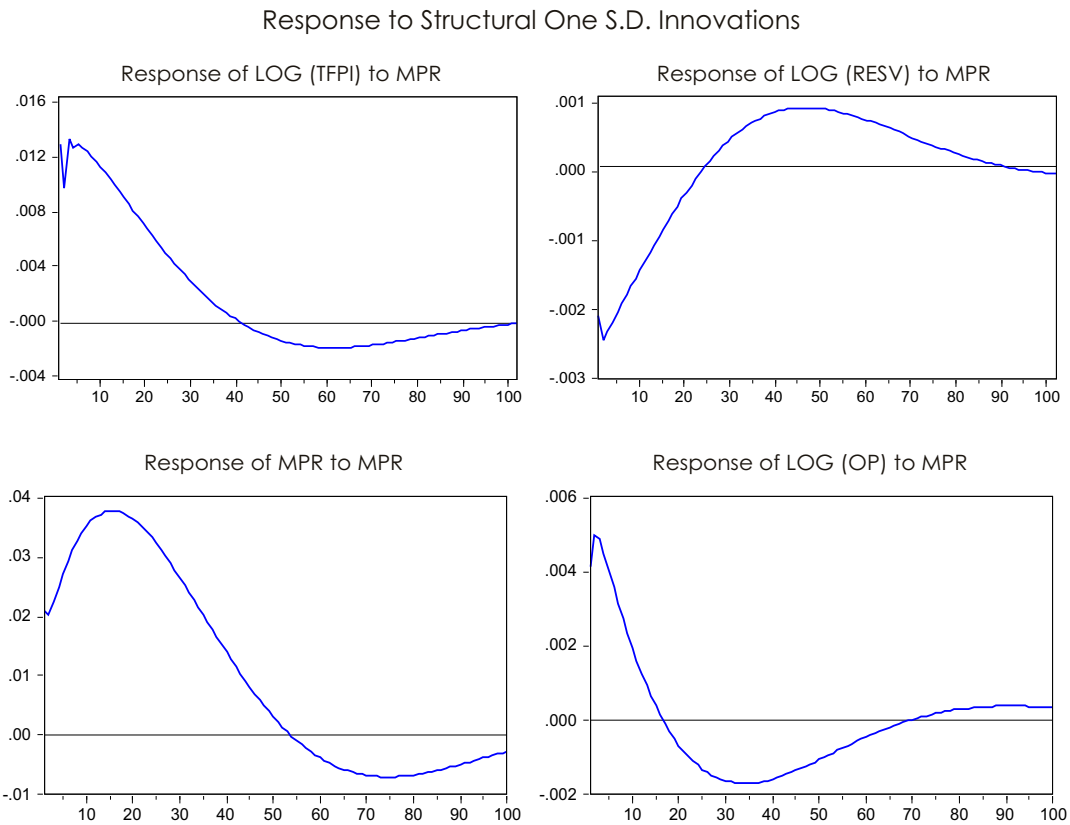
Appendix 1

UNIT ROOT

	Augmented Dicker Fuller (ADF)					Philip Perron (PP)				
	Level T-Statistics	**Prob.**	**1st Diff T-Statistics**	**Prob.**	**Order of Integration**	**Level T-Statistics**	**Prob.**	**1st Diff T-Statistics**	**Prob.**	**Order of Integration**
LOP										
MPR	-2.13	0.53	-11.26	0.0000	I(1)	-2.35576	0.4011	-11.3348	0.0000	I(1)
LRESV	-1.68	0.43	-7.17	0.0000	1(1)	-1.63872	0.4602	-7.5028	0.000	1(1)
LFPI	-3.21	0.09	-16.99	0.0000	I(0)	-4.44914	0.0026	-22.0988	0.0000	I(0)

Notes: ADF 1 and PP 1 represent= Unit root tests with constant, while ADF 2 and PP 2 = Unit root tests with constant and trend. *, ** and *** indicate statistical significance at the 1%, 5% and 10% level respectively. With constant and trend: McKinnon (1991) critical values are -4.0496(1%), -3.4540 (5%) and -3.1527 (10%).

Appendix 2



Structural VAR Estimates

Sample (adjusted): 2007M03 2018M09
Included observations: 139 after adjustments
Estimation method: method of scoring (analytic derivatives)
Convergence achieved after 133 iterations
Structural VAR is over-identified (4 degrees of freedom)

Model: Ae = Bu where E[uu']=I
Restriction Type: long-run pattern matrix
Long-run response pattern:

1	0	0	0
C(1)	1	0	0
C(2)	0	1	C(6)
C(3)	C(4)	C(5)	1

	Coefficient	Std. Error	z-Statistic	Prob.
C(1)	-4.489898	0.084819	-52.93511	0.0000
C(2)	0.621021	0.092975	6.679424	0.0000
C(3)	0.906328	0.152024	5.961741	0.0000
C(4)	0.211193	0.128528	1.643161	0.1003
C(5)	-1.472369	0.127778	-11.52287	0.0000
C(6)	0.448968	0.065525	6.851812	0.0000

Log likelihood	-7196.095		
LR test for over-identification:			
Chi-square(4)	14752.35	Probability	0.0000

Estimated A matrix:

1.000000	0.000000	0.000000	0.000000
0.000000	1.000000	0.000000	0.000000
0.000000	0.000000	1.000000	0.000000
0.000000	0.000000	0.000000	1.000000

Estimated B matrix:

0.033691	0.004116	0.014609	-0.009621
-0.020617	0.020889	0.569841	0.277481
0.008375	-0.002113	0.013276	0.008163
0.088671	0.012739	-0.382007	0.522669

Roots of Characteristic Polynomial
Endogenous variables: LOG(OP) MPR LOG(RESV) LOG(TFPI)
Exogenous variables: C
Lag specification: 1 2

Root	Modulus
0.969320 - 0.048879i	0.970551
0.969320 + 0.048879i	0.970551
0.942966	0.942966
0.689919	0.689919
0.483642	0.483642
-0.375448	0.375448
0.234735	0.234735
-0.005603	0.005603

No root lies outside the unit circle.
VAR satisfies the stability condition.

VAR Lag Order Selection Criteria
Endogenous variables: LOG(OP) MPR LOG(RESV) LOG(TFPI)
Exogenous variables: C
Sample: 2007M01 2018M12
Included observations: 129

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-482.8198	NA	0.022283	7.547594	7.636270	7.583625
1	177.0663	1268.618	1.03e-06	-2.435136	-1.991754*	-2.254981
2	208.3197	58.14593	8.13e-07*	-2.671623*	-1.873536	-2.347344*
3	219.6203	20.32360	8.76e-07	-2.598765	-1.445972	-2.130362
4	229.1089	16.47623	9.73e-07	-2.497812	-0.990314	-1.885285
5	234.7992	9.527941	1.15e-06	-2.337972	-0.475768	-1.581321
6	244.3146	15.34279	1.28e-06	-2.237436	-0.020528	-1.336661
7	254.2524	15.40730	1.42e-06	-2.143447	0.428167	-1.098548
8	270.2064	23.74555	1.44e-06	-2.142735	0.783585	-0.953712
9	291.6326	30.56147	1.35e-06	-2.226863	1.054162	-0.893716
10	308.5454	23.07480	1.37e-06	-2.241014	1.394716	-0.763743
11	323.1261	18.98874	1.44e-06	-2.219009	1.771427	-0.597614
12	344.6608	26.70979*	1.38e-06	-2.304819	2.040322	-0.539300

Inflation, Inflation Expectations and Economic Growth in Nigeria

Musa, A. U., Okafor, I. I. and Idoko, I. A.*

Abstract

This study evaluated the impact of inflation on economic growth in Nigeria under different conditions of inflation expectations (low or high). It relied on a two-state threshold regression model, estimated over the period of 2000Q1-2018Q2. The findings revealed that the impact of inflation on growth is much more pronounced when agents' expectations of future inflation surpasses actual inflation. This may not be surprising, as economic agents are usually compelled to react more rapidly to rising inflation, being an additional cost to consumers and firms, than to falling inflation. In line with this finding, it was recommended that the Central Bank of Nigeria (CBN) should: expand her suite of macroeconomic models for inflation forecasting, to meet cutting-edge standards; commit to consistent periodic production of inflation forecasts; and publish them as regular as possible to the targeted audience. This would encourage economic agents to tie their expectations to those forecasts, while enabling the convergence of expected and actual inflation, and thereby improving policy effectiveness.

Keywords: Inflation, Inflation Expectation, Economic Growth, Threshold Regression
JEL Classification: C24, E31

I. Introduction

All nations desire economic growth. This desire is predicated on the belief that growth expands the choice available to citizens, and thus, leads to development – a term taken to mean improved welfare for the citizens. Is economic growth infinitely good? The answer to this question is not as clear and surefooted as our opening contention. Over the years, countries have found out that an unrestrained pursuit of growth had unintended consequences (leading to some of the supranational organisations such as the World Bank, the IMF, the UN, among others, to revise the growth agenda to a new one called "sustainable growth"). The unintended consequences of a narrowly-focused quest for growth are many. But one that stands out clearly and has proven itself to be inimical to overall welfare, and growth itself, is macroeconomic instability, notably price and exchange rate instability.

For many developing countries in the sub-Saharan Africa (SSA) that depend mostly on the sale of primary commodities, macroeconomic instability can be amplified

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

by external shocks, borne out of primary commodity price volatility, and transmitted via the contraction in their fiscal accounts. Subsequently, the rest of the economy being dependent largely on impulse from the public sector, receive the bulk of the shocks, resulting in a vastly pronounced macroeconomic instability, especially high inflation and depreciation of currency, with capacity to impair or even reverse the gains of growth.

The central banks of most developing countries, including Nigeria, have as one of their primary mandates, the pursuit of price and exchange rate stability. It is believed that stability in these two signals provide agents with a predictable economic horizon with which they can plan their consumption and investment behaviour to maximise their objective functions. In other words, a stable macroeconomic environment helps agents to build into their economic decision and, expectations that are "healthy" for growth.

Therefore, a central bank actively pursues monetary policy with the purpose of stabilising prices in a manner that is good for growth. To do that, however, it must possess a fair knowledge of the relationship between price changes as embodied in the inflation rate, and growth. Researchers and policy makers, had debated, each with their own sets of assumptions. Some worked with the assumption that this relationship was linear and inverse, contending that inflation was bad for growth, while others posited that it was linear and direct, arguing that it was a good signal for producers and, via increased investment. Still, others have contended that the relationship was nonlinear with a turning point at some unknown, but estimable threshold. Beyond that threshold, it starts to hurt growth – a somewhat inverted U relationship.

A large body of empirical analysis has largely 'validated' each of the propositions. A key limitation of most of these econometric models, however, is the assumption that the estimated parameters of the nonlinear relationships are stable and are regime-neutral. This is far from correct as Lucas (1976) demonstrated with his critique of econometric policy evaluation. Lucas argued that the estimated parameters may (and frequently do) depend on the policy regime underpinning the sample period. Thus, there is no guarantee that the parameters, faced with a new policy regime, will not change. In such cases, failing to account for economic agents' expectations of the impact of the new policy can render it ineffective. In fact, Lucas debunked the possibility of having inflation-growth models that assume stable parameters and fail to account for the nature of, and changes in, policy regimes and their impact on the unobserved behaviour of economic agents. For instance, are agents' expectations of future inflation rational or adaptive or some combination of the two? Do they influence their current behaviours, and thus, 'the stable parameters'? Do they also affect growth? if they did, in what direction; and

does the level of the expectations matter for the relationship between inflation and growth? Questions, such as these, are often only partially answered with time-invariant parameter models, and form the crux of the limitations of such types of models.

The objective of this study, therefore, is to attempt to answer these aforementioned questions. The rationale for such an endeavour is the belief that the answers, if obtained, will have far-reaching implications for monetary policy formulation and implementation in Nigeria. The study employed simple bivariate regression and threshold regression analysis, using quarterly sample spanning 2000Q1 to 2018Q2. Evidence suggests that, while inflation expectations seem to matter less for growth, they do influence private consumption and investment, significantly. Furthermore, inflation seems to affect growth "more" negatively when expected inflation surpasses actual than otherwise.

The rest of the paper is organised as follows. Section 2 reviews the literature with the aim of establishing a framework within which inflation affects growth generally and how such relationship fares in Nigeria's context. Section 3 estimates the models and discusses the results, while Section 4 concludes the paper.

II. Review of Literature

II.1 Conceptual Issues

Inflation is commonly referred to as a general increase in the price level, commonly represented by a price index, such as the consumer price index (CPI) or producer price index (PPI) and GDP deflator. Broadly, inflation can be demand-pull or cost-push. Demand-pull inflation arises when aggregate demand exceeds aggregate supply and the resultant supply shortage exerts upward pressure on the prices of goods and services. Cost-push inflation, on the other hand, refers to inflation attributed to rising cost of production, often engendered by structural imbalances, which is transferred to consumers in the form of higher prices.

Economic agents usually face uncertainties about the future path of inflation. This affects their decision-making processes regarding consumption, investment, wage and price setting, among others. Hence, their perception of the possible future outcome of inflation is a very important variable in the determination of actual inflation, as well as, other important macroeconomic variables, such as output, the exchange rate and interest rate. Thus, inflation expectations, a term that refers to agents' estimation of future values of inflation, form the core of the rational expectation revolution.

Economic growth is commonly measured by the increase in a country's total output

or real gross domestic product (GDP). It is the total value of all final goods and services produced within a country over a period of time. It is a very important indicator to measure the general progress a country is making.

The inflation-growth nexus debate has been going on for a while, and its conclusions have been changing with new theories, methodologies and computational power. On theoretical expositions, while the monetarists argue that inflation is harmful to economic growth. The Keynesians, on the other hand, believe whatever effects inflation may have on growth only happens in the long-run. However, how economic agents' expectations of future inflation affect the relationship between inflation and growth is very important to this study.

There are two common strands of thought on inflation expectations – the rational and the adaptive expectations. For rational expectations, economic agents are thought to be rational and would always take decisions that enable them maximise their utility or profit. Thus, they are thought to be forward-looking such that their expectations of future inflation do not vary much from the actual outcome. On the other hand, adaptive expectation assumes that economic agents' inflation expectations are dependent on past actual inflation. Hence, if inflation in the current period increases, agents believe that it is most likely going to be higher in the next period.

II.2 Theoretical Literature

The debate on whether inflation is harmful to economic growth is ongoing, with no discernable general consensus. However, a readily agreed position is that uncertainty around inflation is the most significant cost of inflation. Uncertainty affects output through its influence on the investment decisions by firms and the consumption and savings decisions of individuals. The concept that rising inflation amounts to greater uncertainty about inflation is attributed to the pioneer studies of Okun (1971) and Friedman (1977).

Okun (1971), posits that a steady state with fully anticipated inflation cannot be attained, as economic policy is characterised by imperfection, since only very little is known of the expectation of people, in terms of the variability and uncertainty in future inflation. Hence, the acceptance of the assumption of steady inflation fails to realise the imperfection in public policies and their influence on price expectations. He is of the view however, that it is reasonable to assume that government action about inflation is an important stimulus on inflationary expectations of the private sector and that increasing expectation about inflation is capable of worsening the tradeoff, hence, resulting in higher actual inflation, given any unemployment rate.

Friedman (1977) on the other hand, anchors his argument on inflation uncertainty on two pillars. Firstly, he hypothesises that increasing inflation triggers unpredictable reactions by the monetary authority, which could result in greater uncertainty about future inflation. Secondly, he posits that uncertainty regarding inflation distorts the effectiveness of price mechanism, in terms of efficient resource allocation and could have negative output effects.

Inflation expectation is an important phenomenon in economics with great implications for policies. This is so because the impact or outcome of any policy depends, largely, on the perception of economic agents and how they react in anticipation of certain outcomes. The inflation expectations of economic agents involve a lot of uncertainties, which vary over time, based on information at their disposal. To this end, there are divergent views on the mechanisms behind the formation of inflation expectations and its attendant uncertainty. However, no theory has been able to explain explicitly how the perception of economic agents about uncertainty surrounding inflation expectations is influenced. The views explained in this study center around how inflation expectations are formed.

The concept of expectations in economic theory is not new. Early economists, such as Pigou, Keynes, and Hicks have recognised that people's expectations of the future significantly affect the business cycle. Keynes called it, "waves of optimism and pessimism" that helped determine the level of economic activity. However, the proponents of both adaptive and rational expectations theories have been credited with the mainstreaming of the concept into economic analysis. The rational expectations hypothesis credited to Muth (1961) explains the dependence of the outcome of a given economic phenomenon on the expectations of economic agents. In other words, decisions among economic agents, are based on the best information available to them, as well as the knowledge of past events. The theory assumes that people learn from past mistakes and thus recognises that although economic agents may not always be right in their decisions, they would, on average make the right decisions.

The concept of expectation was further made popular by latter economists notably Lucas (1972) through his works on Expectations and the Neutrality of Money and the Lucas (1976) Critique. On the relationship between inflation and economic growth, several views abound in the literature, such that the adoption of a single theoretical exposition will simply be self-serving. However, the following section will briefly outline the key arguments of the most popular among them – the Keynesian and the monetarist. This is done so that an idea could be formed as to the varied conclusions of scholars on the nature of the relationship. Later on, a summary of the empirical findings of authors, as to the aforementioned relationship in Nigeria, will be presented. This will also be done to situate the current mixed results, which the

debate has thrown up.

The Keynesian theory suggests a positive relationship between inflation and output in the long-run, and is attributable to the fact that at full employment when aggregate demand (AD) and aggregate supply (AS) equates, a continuous increase in AD could result in inflation. The Monetarists whose views were pioneered by Friedman however argued that change in money supply is the most important determinant of economic growth. As such, the behaviour of the business cycle is ultimately linked to money supply. Inflation therefore, occurs if money supply grows more than economic growth rates. More specifically, inflation occurs, if money supply increases faster than national income growth rate. According to them, inflation is a monetary phenomenon and to deal with it, government should use monetary policies that decrease money supply. In addition, decreasing money supply leads to increase in unemployment rate, which leads to decrease in economic growth. Thus, inflation is detrimental to economic growth (Snowdon and Vane, 2005).

II.3 Empirical Literature

There exist divergent views in the literature on the relationship between inflation and economic growth. This leaves the question of whether or not there exists a unifying theory capable of explaining that relationship, largely, unanswered. Khan and Eggoh (2014) rightly submitted that the mixed outcomes seen in most studies emanate from the lack of consensus on whether the inflation–growth relationship is dependent on certain country-specific characteristics. The authors, however, strongly believe that country-specific idiosyncrasies play a greater role on the inter-temporal dynamics of inflation and growth. This belief is influenced by more recent multidisciplinary approach to public policy which have brought to fore the importance of non-economic forces, such as the political system, cultural and other social set-ups and their influence on economic agents' decision-making.

As a consequence, this summary will focus on empirical findings on the relationship between inflation and growth in Nigeria. Nigeria has experimented with different political systems, and it seems to have strong and influential socio-cultural systems and thus, may actually exhibit its own unique characteristics as suggested by Khan and Eggoh (2014). The relationship between inflation and growth is reviewed and summarised in Table 1.

Table 1: Review of Literature on Inflation – Growth Nexus

AUTHOR(S)	SCOPE	TOPIC	METHOD OF ANALYSIS	FINDINGS
Anidiobu et. al. (2018)	**Nigeria** 1986 to 2015	Analysis of Inflation and Its Effect on Economic Growth in Nigeria	Ordinary Least Square (OLS) technique	Inflation has a positive and non - significant effect on economic growth for the study period
Enejoh & Tsauni (2017)	Nigeria 1970 to 2016	An Analytical Study of the Impact of Inflation on Economic Growth in Nigeria	ARDL approach to co-integration and error correction mechanism (ECM)	Inflation has a positive impact on economic growth both in the short and long-run Inflation does not Granger cau se economic growth
Eze & Nweke (2017)	Nigeria 1980 to 2015	Assessment of the Effect of Inflation on Nigeria's Economic Growth: Vector Error Correction Model Approach	Co-integration approach, VECM and Granger causality	Existence of a long-run relationship existed among the variables of interest while the VECM results demonstrated that inflation affects Nigeria's economic growth negatively, though, insignificantly.
Obi et al. (2016)	**Nigeria** 1981 - 2014	Inflation and Growth Nexus In Nigeria: An Investigation Into the Simultaneous Relationship	two stage least square estimation technique	Inflation is beneficial to growth though not significantly, while growth is significantly beneficial to inflation, given the positive relationship between inflation and growth and the negative relationship between growth and inflation.
Anochiwa and Maduka (2015)	Nigeria 1970 to 2012	Inflation and Economic Growth in Nigeria: Empirical Evidence?	Johansen co-integration technique and Granger causality test	A nonlinear relationship between economic growth and inflation, suggesting an inverse relationship and absence of a causality relationship between economic growth and inflation
Olu and Idih (2015)	Nigeria 1980 and 2013	Inflation and economic growth in Nigeria. Journal of Economics and International Business Management, 3(1): 20-30.	the Ordinary Least Square (OLS)	Inflation rate has a positive but non-significant relationship with economic growth rate
Eggoh and Khan (2014)	102 countries from both developed and developing economies 1960–2009	On the nonlinear relationship between inflation and economic growth	PSTR and dynamic GMM techniques	Inflation–growth nonlinearity is sensitive to a country's level of financial develop ment, capital accumulation, trade openness and government expenditures
Inyama (2013)	Nigeria 1979 to 2010	Does Inflation Weaken Economic Growth?	Ordinary Least Squares Approach and Granger Causality	Inflationary rate is negatively related with real gross domestic product. Also, the results revealed the absence of causality between inflationary rate and real gross domestic products at both lag 2 and lag 4

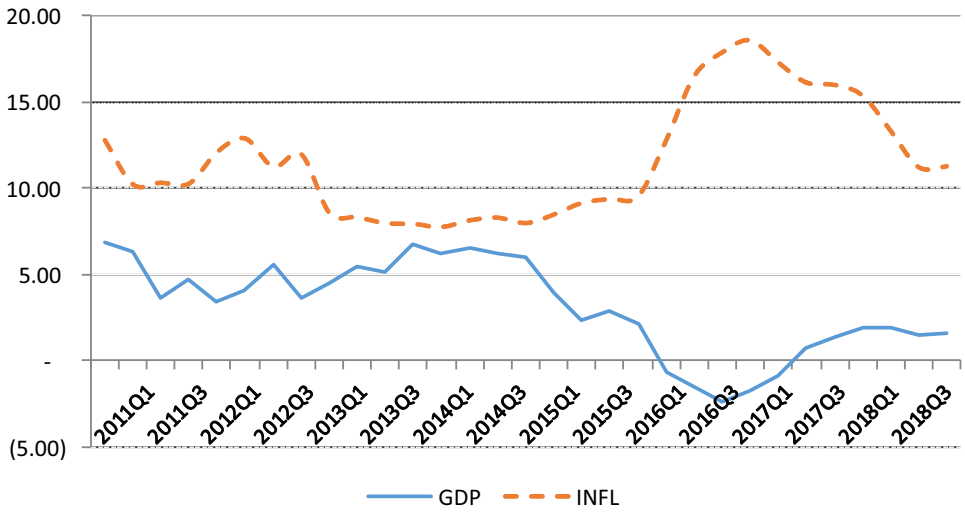
Osuala et al. (2013)	Nigeria 1970-2011	Impact of inflation on economic growth in Nigeria: A causality test	Granger causality test	A positive relationship between inflation and economic growth. However, there was no leading variable in the relation among the variables of interest, hence, a contemporaneous effect
Mamo (2012)	panel data for 13 SSA countries 1969 to 2009	Economic Growth and Inflation: A panel data analysis	Panel Granger causality test	Existence of a negative relationship between economic growth and inflation. This study also examined the causality relationship between economic growth and inflation using panel Granger causality test and portrayed inflation as a probable factor in predicting growth among the countries of interest
Umaru and Zubairu (2012)	Nigeria 1970 to 2010	Effect of Inflation on the Growth and Development of the Nigerian Economy: An Empirical Analysis	Granger causality test	Although GDP Granger-causes inflation, inflation does not Granger-cause GDP
Omoke (2010)	Nigeria 1970 to 2005	Inflation and Economic Growth in Nigeria	Co-integration and Granger causality tests	No long-run relationship between Inflation and economic growth for the review period

II.4 Inflation-Growth Nexus in Nigeria

In Nigeria, the CBN, like other monetary authorities all over the world, has continued to grapple with the vagaries of inflation through the management of monetary variables, particularly money supply. This role is made even more prominent with the Central Bank assuming developmental roles, hence the need to ensure price stability, which is cardinal for the realisation of government's macroeconomic goal of improving the welfare of its citizenry. The CBN ensures that the level of money supply does not have an adverse effect on the economic activities. Therefore, adequate level of money supply is needed to achieve a set growth target. However, amidst the effort of the CBN, antecedents of inflation in Nigeria over the years have shown that the postulation of Friedman in 1956 that inflation is always and everywhere a monetary phenomenon is not entirely applicable in Nigeria. Available evidence has shown that, other than monetary influences, inflation in Nigeria is also affected by structural factors, such as inflation expectation, imports, global oil price, exchange rate, and domestic pump price of petroleum products.

Nigeria experienced an average double-digit rate of inflation between 2011Q1 and 2012Q4 with the highest rate of 12.89 per cent recorded in 2012Q2. To rein-in inflation, the Central Bank of Nigeria pursued a non-expansionary monetary policy stance, coupled with a buoyant external reserve, made significant progress at containing inflation. The rate reduced to a single digit between 2013Q1 and 2015Q4 with the lowest rate of 7.78 per cent recorded in 2014Q1.

Figure 1: Inflation Dynamics and Economic Growth in Nigeria



Source: Authors' Estimation

However, the rate increased phenomenally from 9.55 per cent in 2015Q4 to 12.77 per cent in 2016Q1. This development was due, largely, to the strong pass-through of the sharp depreciation of naira in response to the rapidly declining international price of crude oil beginning late 2014 (which eventually pushed the economy into a recession). While the recession lasted, inflation remained high, averaging 16.6 per cent. By the second quarter of 2017, the economy pulled out of the recession on account of prudent fiscal and monetary policies, with a slight amelioration in inflation to 17.26 per cent from 18.55 per cent in 2016Q4. Inflation, afterwards, maintained a downward trend, although it is still within the double-digit bracket, as at 2018Q3. This descriptive analysis, as portrayed by the graph in Figure 1 seems to suggest that inflation and growth are inversely related. This, by no means, proves, however, any causative relationship. Furthermore, even if inflation and growth are inversely related, the functional form of such a relationship cannot be ascertained from a mere graph.

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III. Methodology

III.1 Data and Variables

This study utilises the following variables: year-on-year change in real gross domestic product (RGDPG), real personal consumption (RPCG), real investment expenditure (RINVG), and consumer price index, defined as the inflation rate (INF). These series were sourced from the database of the Central Bank of Nigeria spanning first quarters of 2000 to the second quarter of 2018. In addition, the inflation expectation series (INFEXP) was constructed from the inflation series in line with the adaptive expectation hypothesis. Here, it is assumed that, when inflation is rising, people will expect it to continue rising, and when it is falling, they expect it to keep falling. In this connection, inflation expectation was constructed using, the following formula:

$$INFEXP_t = INF_t + (INF_t - INF_{t-1}) = INF_t + \Delta INF_t \quad (1)$$

Furthermore, a second inflation expectation series was constructed using a weighted average of the current inflation and three previous quarters'.

III.2 Techniques of Analysis

III.2.1 Bivariate Regression Models

The analysis begins with two simple bivariate regressions estimated to gauge the impact of expected inflation on both private consumption and gross investment. This was done because the transmission mechanism, that expected inflation might influence output, would be via its impact on the consumption and investment behaviour of both private individuals and firms. Also, a simple regression model showing how output growth relates to inflation was estimated to further examine the nature of the relationship over the scope of the study. In addition, a correlation matrix of all the variables was estimated and evaluated over the full sample of the study.

III.2.2 The Threshold Regression Model

The major technique of analysis is a threshold regression model with two-regimes. In

the traditional specification of a two-state regression model, as presented in Enders (2004), the time path of a series Y_t follows the order:

$$y_t = \begin{cases} a_{10} + a_{11} y_{t\ 1} + e_{1t}\ if\ y_{t\ 1} > \tau \\ a_{20} + a_{21} y_{t\ 1} + e_{2t}\ if\ y_{t\ 1} < \tau \end{cases} \quad (2)$$

Where, τ is the given threshold value for Y_t, e_{1t} and e_{2t} are the error terms in regime one and two, respectively, and a_{10} and a_{20} are the constants in both regimes, respectively. This is a self-exciting threshold autoregressive (TAR) model, as the time-path of Y_t depends on previous values of Y_t, and how the previous values switches across the threshold value. In this case, it is assumed that the variance of the error terms are not equal (that is, $var(e_{1t}) \neq var(e_{2t})$) Where the variance of the error terms in both regimes are the same, that is, $var(e_{1t}) = var(e_{2t})$, the TAR model can be rewritten as;

$$y_t = a_0 + a_1 I_t y_{t-1} + a_2 (1 - I_t) y^{t-1} + e_t \quad (3)$$

I_t is a dummy variable, such that $I_t = 1\ if\ y^{t-1} > \tau = 0$ and $I_t = 0\ if\ y^{t-1} \leq \tau = 0$. From Equation 3, therefore, Y_t is governed by $a_0 + a\ 1_t\ It\ y_{t-1} + e$ whenever $y^{t-1} > 0$, and $a_0 + a_2\ (1 - I_t)\ I_t\ y_{t-1} + e_t$, whenever $y^{t-1} \leq 0$.

More generally, Equations 2 and 3 can be rewritten as Equations 4 and 5, respectively:

$$y_t = \begin{cases} a_{10} + \sum_{i=1}^{p} a_{1i} y_{t-i} + \sum_{i=1}^{p} b_{1i} x_{t-i} + e_{1t}\ if\ z_{t-d} > \tau \\ a_{20} + \sum_{i=1}^{p} a_{2i} y_{t-i} + \sum_{i=1}^{p} b_{2i} y_{t-i} + e_{2t}\ if\ z_{t-d} \leq \tau \end{cases} \quad (4)$$

$$y_t = a_0 + \sum_{i=1}^{p} a_{1i} I_t y_{t-i} + \sum_{i=1}^{p} b_{1i} (1 - I_t) y_{t-i} + \sum_{i=1}^{p} a_{2i} I_t x_{t-i} + \sum_{i=1}^{p} b_{2i} (1 - I_t) x_{t-i} + e_t \quad (5)$$

Where, $I_t = 1,\ if\ z_{t-d} > \tau$ and $I_t = 0, if\ z_{t-d} \leq \tau$. The variables and parameters are as defined in Equation 2 and 3, except for d, z, x and parameter b. The variable b, called the delay parameter, tells the timing of the adjustment process. It is the period upon which the regime switch occurs. The delay parameter d can be 0, 1, 2, 3... The model will be in state 1 if $z_{t-d} > \tau$, and state 2 if $z_{t-d} \leq \tau$. To select the optimal value of d, several y_t model, with different values of d, would be estimated. The optimal d is that which corresponds to the model with the least residual sum of squares (RSS), or the least Akaike Information Criteria (AIC) and Schwarz Information Criteria (SIC). z_t is

the threshold variable. It can be y_t, z_t or even a variable outside the model. x_t represents other explanatory variables. These explanatory variables can also be the threshold variable, upon which the state in the system is dependent, themselves dependent on the states of the system, or non-regime dependent regressors. Finally, P The application of time series in these threshold models also requires that the variables are stationary. For this reason, the unit root properties of the variables in the model were, verified using the framework of the Augmented Dickey-Fuller (ADF, 1979), Phillips-Perron (PP, 1988) and Kwiatkowski, Phillips, Schmidt, and Shin KPSS (KPSS, 1992) tests for unit root. The only non-stationary variable (inflation rate) was then transformed into its first differences, which were found to be stationary, before being incorporated in the model. The threshold model adopted in this study was of the form:

$$RGDPG_t = a_0 + \sum_{i=1}^{p} a_{1i} X_{t-i} + \sum_{i=1}^{p} a_{2i} I_t \Delta INF_{t-i} + \sum_{i=1}^{p} a_{3i}(1 - I_t)\Delta INF_{t-i} + e_t \quad (6)$$

Δ is the first difference of a series, X is vector of non-regime dependent regressors, which also includes an autoregressive term (lagged RGDPG), and $i=0,1,2...$ The estimation procedure for this two-regime model is the application of a simple ordinary least squares (OLS) technique. This is possible after first constructing two new variables, $I_t\ \Delta INF_{t-1}$ and $(1-I_t)\Delta INF_{t-1}$, representing y_{t-1} in state 1 and 2, respectively.

The goal of this study was to determine the impact of INF on RGDPG in two regimes: The first is when inflation is above one period lagged inflation expectation, and the second is when the reverse is the case. This is because the lagged inflation expectation is the expected value of actual expectation at time t. In modelling this relation, the threshold variable was reconstructed to be $Thresh\_Variable_t = INF_t - INFEXP_{t-1}$. The threshold value τ was therefore zero (0). So, the state of the time path of the dependent variable now depends on whether $INFEXP_t^*$ is above or below zero (0). For convenience, we referred to Regime 1, where actual inflation is greater than lagged inflation expectation (where τ is positive) as the "High Inflation Regime", and Regime 2, where τ is negative, as the "Low Inflation Regime". Furthermore, all regressors were assumed to have only one-period lagged impacts on real output. Consequently, i was also assumed to be one (1). The delay parameter d was also assumed to be 1. For this reason, the slope coefficients of inflation in the two regimes measure the impacts of current inflation on future real output growth when current inflation is less or greater than one-period lagged inflation expectations.

III.2.3 Historical Decomposition

The historical decomposition charts the average impulse responses of a given

variable to contemporaneous shocks to all endogenous variables, within a vector autoregressive (VAR) framework. This was constructed for RGDPG to show how it responds to INF, INFEX, RPCG and RINVG, over the scope of the study. The decomposition of the structural errors followed the recursive ordering of Cholesky over a forecast horizon. However, as pre-condition for stability in the estimated VAR model, the optimum lag-length was selected using the Schwarz Information Criteria (SIC), and the characteristic roots of the VAR model all lie within the unit circle.

IV. Empirical Results

IV.1 Data Presentation

In this section, the correlation matrix, and graphical plots of real GDP growth and its key drivers were presented and discussed.

IV.2 Correlation Matrix

The correlation between real GDP growth and the other variables were presented in Table 2. These results showed that, over the scope of the study, the correlation between RGDPG and INF was negative, but very low (-0.05), the correlation between RGDPG and RPCG was positive moderately low at 26 per cent. The correlation between RGDPG and RINV is also positive, with a coefficient of about 33 per cent.

Table 2: Correlation Matrix of RGDP and other Variables.

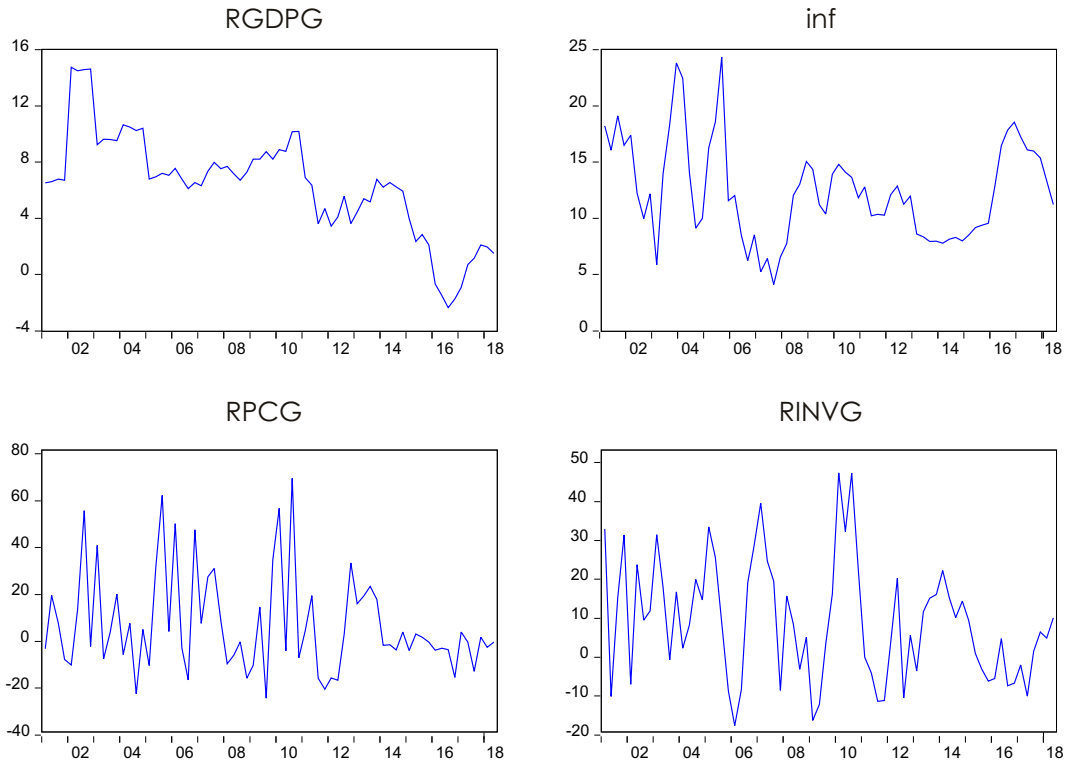
	RGDPG	INF	RPCG	RINVG
RGDPG				
INF	-0.05			
RPCG	0.26	0.00		
RINVG	0.33	-0.09	0.30	

Source: Authors' Estimation

IV.3 Unit Root Tests

The graphical plots of the variables of the study were presented in Figure 2. While RGDPG and INF appeared to marginally trend downwards, RPCG and RINVG appear stationary around a constant mean.

Figure 2: Graphical Plot of RGDPG, INF, RPCG and RINVG.



Source: Authors' Estimation

The results of the ADF, PP and KPSS unit root tests were presented in Table 3. Under the null hypotheses of "unit root" for both the ADF and PP tests, and "stationarity" for the KPSS test, only inflation rate (INF) was found to be integrated of order one (1). The other variables, RGDPG, RPCG and RINVG are all stationary at 5 per cent level of significance. For this reason, inflation rate was transformed into its first difference before being included in the specified threshold model.

Table 3: ADF, PP and KPSS tests

ADF: Null Hypothesis: the variable has a unit root					
		RGDPG	**INF**	**RPCG**	**RINVG**
At Level	t-Statistic	-3.3948	-2.5251	-5.4917	-6.9732
	Prob.	0.0604	0.3155	0.0001	0
		*	n0	***	***
		d(RGDPG)	**d(INF)**	**d(RPCG)**	**d(RINVG)**
At First Difference	t-Statistic	-8.2969	-7.3744	-5.8072	-6.8798
	Prob.	0	0	0.0001	0
		***	***	***	***
PP: Null Hypothesis: the variable has a unit root					
		RGDPG	**INF**	**RPCG**	**RINVG**
At Level	t-Statistic	-3.525	-3.3537	-8.1683	-5.4345
	Prob.	0.0445	0.0664	0	0.0001
		**	*	***	***
		d(RGDPG)	**d(INF)**	**d(RPCG)**	**d(RINVG)**
At First Difference	t-Statistic	-8.298	-9.5028	-17.4758	-11.2734
	Prob.	0	0	0.0001	0
		***	***	***	***
KPSS: Null Hypothesis: the variable is stationary					
	At Level				
		RGDPG	**INF**	**RPCG**	**RINVG**
At Level	t-Statistic	0.0985	0.1212	0.05	0.0295
	Prob.	n0	*	n0	n0
		d(RGDPG)	**d(INF)**	**d(RPCG)**	**d(RINVG)**
At First Difference	t-Statistic	0.0411	0.0805	0.045	0.0211
	Prob.	n0	n0	n0	n0
Notes:					
a: (*)Significant at the 10%; (**)Significant at the 5%; (***) Significant at the 1% and (no) Not Significant					
b: Lag Length based on SIC					

Source: Author's computations

IV.4 Results of the Simple Regression Models

Table 4 presents the results of the simple bivariate relationships. The results confirm a possible negative relationship between inflation and output growth. For the other two bivariate relationships, expected inflation was found to negatively influence both private consumption and investment. This is not surprising. Private individuals would tend to lower their consumption whenever they expect inflation to rise in the next period. Similarly, firms, where they cannot easily transfer increased input costs to consumers, would cut back on investment since their usual margin of profit would become threatened.

Table 4: Results of the Bivariate Regression Models

Inflation-Growth Nexus: ***Dependent variable = Output Growth***		
	Estimated Coefficient	Probability
Constant	16.5376	0.0000
Inflation	-0.0195	0.0277
Expect. Inflation-Private Consumption Nexus: ***Dependent variable = Private Consumption***		
Constant	11.1041	0.0000
Inflation	-0.0266	0.0008
Expect. Inflation-Investment Nexus: ***Dependent variable = Investment Expenditure***		
Constant	14.7856	0.0000
Inflation	-0.0291	0.0044

Source: Author's computations

IV.5 Result of the Estimated Threshold Model

The result of the estimated model, presented in Table 5, revealed the impact of change in inflation on growth of real output across the two regimes. This result showed that changes in inflation had statistically insignificant impact on real GDP growth in the regime of low and high inflation. Although the slope coefficients in the two regimes were insignificant, their negative sign was suggestive of an inverse relationship between change in inflation and growth. However, the degree of impact varied across the two regimes, with that of the high inflation regime being higher than the other.

When actual inflation is higher than the expected inflation to be, increases in

inflation would impede growth in real output more than when actual inflation is lower than expected inflation. Nigeria's inflation is majorly a supply-side and cost-driven in nature. Rising cost of production, including high cost of capital, leads to fall in output. Inflation does not only affect finished goods, it also leads to rise in cost of raw materials and labour. Higher inflation, which rises above expectations, would, therefore, cause growth to fall more rapidly than lower inflation. On the other hand, when actual inflation is lower than what people expected it to be, the negative impact of inflation on growth falls. Low inflation also means low cost of production, and consequently, translate into increase in output.

Table 5: Result of the Estimated Threshold Model.

Dependent Variable: RGDPG	
Low Inflation Regime -- 33 obs	
	Coefficients
D(INF(-1))	-0.02^
C	0.41^
High Inflation Regime -- 31 obs	
D(INF(-1))	-0.06^
C	0.46^
Non-Threshold Variables	
RPCG(-1)	0.01^
INVG(-1)	1.68^
RGDPG(-1)	0.88***
R-squared	0.90
Adjusted R-squared	0.88
F-statistic	80.98***
Durbin-Watson stat	1.95

***Significant at 1%, ^Not significant
Source: Authors' Estimation

Finally, real personal consumption and investment expenditures were found to have positive, but also statistically insignificant impact on real output growth in the study period. Here, the two slope coefficients, which were 0.01 and 1.68, respectively, were properly signed, but statistically insignificant. This is suggestive that both RPCG and RINVG are growth-enhancing.

The estimated model appeared to have a good fit, as the R-square and adjusted R-square are 90 and 88 per cent, respectively. In addition, the F-statistic (80.98), which tested for the joint statistical significance of the estimated parameters, was statistically significant at 1 per cent. Although the Durbin-Watson (D-W) statistic (1.95) was very close to two, suggesting the absence of autocorrelation in the estimated model, the autoregressive nature of the model implied that the D-W was not an appropriate evaluation tool for autocorrelation (see Gujarati, 2004). For this reason, this study applied the Breusch-Godfrey Serial Correlation LM Test for this purpose.

For robustness, therefore, the estimated model was evaluated for the presence or absence of serial correlation and heteroskedasticity within the context of the Breusch-Godfrey Serial Correlation LM test and Breusch-Pagan-Godfrey Heteroskedasticity test, respectively (see Table 6). Both tests were conducted under the null hypotheses of "no serial correlation" and "no heteroscedasticity", respectively. The results indicated the estimated model were free from the two econometric problems, as the F-statistics in both Tests were statistically insignificant (both P-Values were greater than 0.05), leading to a rejection of the null hypotheses in the Tests.

Table 6: Result of Heteroskedasticity and Serial Correlation Tests

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
Null Hypothesis: No Heteroskedasticity			
F-statistic	1.123002	**P-Value**	0.3607
Breusch-Godfrey Serial Correlation LM Test			
Null Hypothesis: No serial Correlation			
F-statistic	0.616905	**P-Value**	0.5433

Source: Authors' Estimation

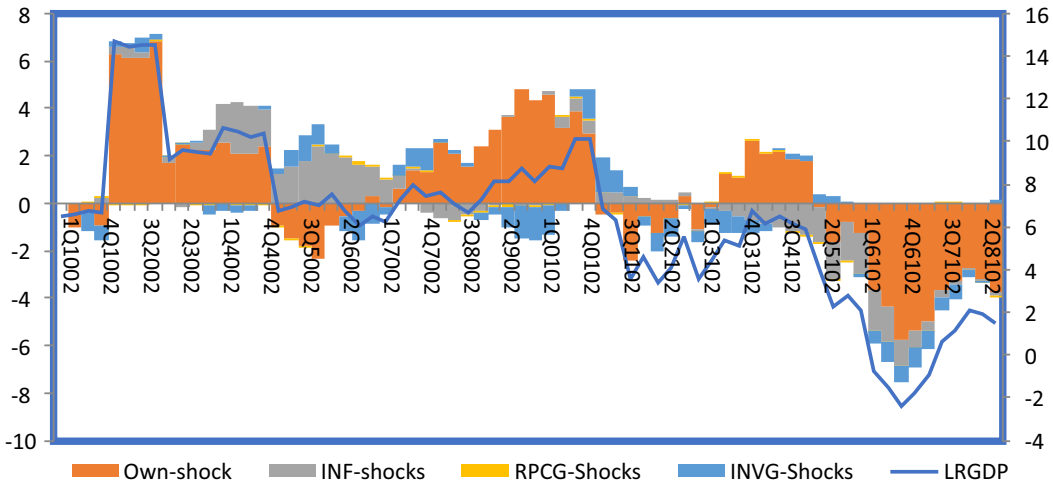
IV.6 Historical Decomposition of RGDP

Figure 3 showed the historical decomposition of RGDPG over the scope of the study. Here, while the responses of RGDPG to shocks to all endogenous variables are charted on the left-hand axis, RGDPG, itself, is charted on the right-hand axis.

This chart revealed the dominant influence of own-shocks in driving real output growth over the period under study. In other words, own-shocks accounted for the most in the behavioural patterns exhibited by RGDPG between 2001 and 2018. In the case of inflation, the responses of RGDPG to inflationary shocks, which were mostly positive between 2001 and 2012, turned negative for the rest of the study period. This shows the mixed reaction of real output growth to inflation in Nigeria.

The responses of real output growth to shocks to real personal consumption (RPCG)and real investment expenditure (RINVG) growths were, however, mixed, oscillating, with varying degrees of magnitudes, over the study period.

Figure 3: Historical Decomposition of LRGDP



Source: Authors' Estimation

V. Conclusion and Policy Implications

This study began with a question that sought to examine the relationship among inflation, inflation expectations and growth. The survey of the literature was shown to have no consensus on the theoretical framework that could provide a testable hypothesis. Nevertheless, prominent schools of thought within the economics profession seem to lean heavily towards the hypothesis that inflation, particularly high episodes, is inimical to growth. A review of several empirical studies confirmed the expected mixed results, borne largely out of the lack of consensus in the theoretical realm as well as the influence of country-specific characteristics. While some confirmed a negative relationship between inflation and growth, others found positive relationships; yet, some still found no relationship.

This study estimated a simple bivariate regression, which established a negative relationship between inflation and growth, within the sample period. Furthermore, two additional bivariate regressions that relate private consumption and investment with expected inflation were estimated. Finally, a threshold regression was estimated to examine whether the relationship between inflation and growth depends on economic agent's perception of what future inflation would be; following adaptive expectation hypothesis.

On the last point, the impact of inflation on economic growth under the condition of varying inflation expectation of the general public was examined. It was assumed that, following the adaptive expectation hypothesis, when the price level rises or falls, Nigerians expect it to keep rising or falling, respectively. However, there was considerable difficulty in estimating a series for inflation expectations that is robust. While the survey-based series by the Statistics Department of the CBN could not be used in a time-series model, every one of the market-based measures had its own drawbacks and appeared significantly different from the others. This is why the study decided to use adaptive expectations.

Inferences were drawn from the estimates of a two-regime threshold autoregressive distributed lag model, which suggests that the inverse relationship between inflation and economic growth in Nigeria is higher when actual inflation rises above inflation expectations, and lower when the reverse is the case.

Inflation affects both consumer goods and intermediate goods (firms' input). The latter is encapsulated in the concept of cost-push inflation, where a rise in cost of raw materials reduces the supply of goods and services, thereby reinforcing the pressure on the general price level. This vicious cycle also comes with other economic problems, like unemployment.

The key findings are summarised as follows. First, inflation has a negative impact on growth. Second, expected inflation has a negative and statistically significant influence on both private consumption and investment, but a negligible impact on growth. This could be due to other drivers of growth not included in the model. Fourth, there is evidence that the impact of inflation on growth is much more pronounced when agents' expectations of future inflation surpasses actual inflation. This may not be surprising since a rising inflation, being an additional cost to consumers and firms, would be viewed and responded to more promptly than a falling one.

In light of these findings, the following implications can be deduced for the purpose of improving the monetary policy process:

First, given the major objective of monetary policy is to stabilise price. This can be achieved by influencing the consumption and investment behaviour of economic agents. Since economic agents react to policy outcome, their expectations of what future inflation will be could undermine the policy effectiveness. Although this study found negligible influence of expected inflation on growth, its impact on agents' economic behaviour (consumption and investment) was significant to warrant more than a cursory attention.

It is therefore recommended that the CBN expand its suite of macroeconomic models for inflation forecasting to meet cutting-edge standards, commit to consistent periodic production of inflation forecasts and publish them as regularly as possible and to the widest possible audience. This would encourage economic agents to tie their expectations to those forecasts, while enabling the convergence of expected and actual inflation, thereby improving policy effectiveness.

Second, given the difficulty of obtaining a consistent proxy for expected inflation because both survey-based and market-based have their drawbacks, it is recommended that the CBN engage in the development of a framework that can estimate a much more robust measure of expected inflation. This measure can be in a form of a composite index that is a weighted average of key survey-based and market-based measures of expected inflation.

Furthermore, having found that expected inflation affects private consumption and investment, the CBN is urged to develop small scale macroeconomic models that characterise, with a higher degree of confidence, the consumption and investment behaviour of economic agents in the Nigerian economy. For instance, while both households and firms are affected by inflation, they, however, form their expectations differently. Knowing, for example, households' marginal propensity to consume and save (MPC, MPS), firms' investment sensitivity to the interest rate, the fiscal multipliers, income distribution of households and their respective weights in the overall MPC, MPS, among others, could significantly improve the effectiveness of the monetary policy process in Nigeria.

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