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Abstract

This study estimated the interest rate elasticity of private sector credit in Nigeria using the Vector Error Correction mechanism. The variables specified included real private sector credit, real GDP, prime and maximum lending rates, exchange rate, 91-day Treasury bill rate, inflation rate and all share index of the Nigerian Stock Exchange. The data utilised covered the period: 1998Q1 to 2013Q4. Granger causality tests were performed, and the co-integration analysis of the Johansen system-wide procedure was employed. The results indicated that private sector credit was fairly interest inelastic in terms of both maximum and prime lending rates. The estimated interest rate elasticity for prime borrowers was -0.27 per cent implying that a one per cent increase in the prime lending rate would lead to a 0.27 per cent drop in private sector credit growth. The short-run vector error correction model estimates shows that approximately 1.8 per cent of disequilibrium is corrected each quarter by changes in the private sector credit. Given the inelastic nature of private sector credit with respect to all measures of interest rate, but high elasticities with respect to income and inflation indices, the efforts of monetary authorities should be directed at ensuring the availability of credit, maintaining price stability and de-risking the business environment in collaboration with the fiscal authority.

I.   Introduction

Credit plays a crucial role in the economy through its stimulation of investments and output growth. It helps to provide resources for investment projects that would otherwise not receive funding if the promoters were to rely entirely on own-generated funds. Thus, the availability of credit raises productivity, employment and aggregate output. Early studies on credit, as popularised by the finance-growth literature, focused on its exact role in the growth process, especially in terms of whether growth stimulates the provision of credit, or credit leads growth. Thus, the contentious debate of the relationship between finance and growth was essentially in terms of which comes first: finance or growth? The standard argument is that a relatively developed credit market contributes to higher economic growth by improving the efficiency of resource allocation. On the flip side, any growth push or impetus requires financing, thus, stimulating financial development by increasing the value of credit markets and strengthening the initial growth impulses (Das and Pradhan, 2009).

The finance-growth literature supports the notion that while inefficient credit system bear the risk of instability and bank failure, economies with better and more efficient credit system grow faster (Kasekende, 2008). With this realisation, the research on credit has, over the years, shifted to issues relating to its supply, availability, delivery mechanisms and price. This, thereby, highlights the central

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role of financial institutions, which intermediate between the deficit and surplus spending units of an economy. Therefore, as averred by Mishkin (2007), a better functioning credit system alleviates the external financing constraints that impede credit expansion, and the expansion of firms and industries. The financial institutions play a significant role in determining the nature of investment activities, level of employment generation, and income distribution through funds allocation (Gross, 2002). Credit availability is a crucial aspect of the funding problems of entrepreneurs, especially in developing countries where infrastructural constraints including security challenges, could impede the expansion of institutions and outlets. These are often reflected in high transaction and intermediation costs, which result in high borrowing and lending rates, thereby impeding financial market efficiency (CBN, 2008).

Aggregate credit is part of the total money supply in an economy; and credit creation is an important role of deposit money banks (DMBs) in the process of financial intermediation. Credit to the economy is typically shared between the needs of the government/public sector and credit that goes to the private sector. Credit to the government is typically used to cover budget deficits and extra-budgetary spending of government for the provision of public goods and services including infrastructure. Because this type of credit is backed by the "full faith and credit" based on the taxing powers of government, it is often seen as riskless by investors, and therefore often crowds out credit to the private sector. Private sector credit, on the other hand, usually funds the provision of private sector requirements of goods, services, and technological innovations. However, the demand for credit would necessarily be sensitive to certain factors including the rate of interest, inflation rate, risk and returns, within the economy, as well as the associated investment climate in the economy. It is within this context that the need to understand the interest elasticity of credit becomes important. Central banks, deposit taking institutions, and policy makers in general are interested in knowing how responsive the demand for credit is to the factors driving it, particularly interest rate, in order to determine the net effect of any policy that influences the lending rate. It is for this reason that this study focuses on the effects of cost of credit or interest rate on private sector credit in Nigeria.

Traditionally, monetary policy can influence private sector investment in five ways namely: the demand for money channel, the credit channel, the interest rate channel, the foreign exchange channel and the asset prices channel. According to Tobias and Chiluwe (2012), less developed countries have weak interest rate responsiveness and underdeveloped financial systems, which due to limited applicability constrain the use of the demand for money and interest rate channels. They argue that monetary policy tends to have greater impact on the asset side of firms's balance sheet (the credit channel view). Kahn (2010) indicated that monetary policy can influence the overall stock of money in an economy, through the injection and absorption of liquidity or by affecting the level of reserve money and the money multiplier, thereby affecting the real sector. Private sector firms can feel the effects of monetary policy actions through

their cost of capital, balance sheet, internal rate of return and investment decisions. Thus, tight monetary policy that restricts credit to businesses may constrain private sector growth whilst monetary policy that facilitates credit to the private sector encourages the growth of private investment.

The balance sheet channel shows how monetary policy affects the credit portfolio of financial intermediaries, which affects the private sector. For instance, a contractionary monetary policy such as sale of treasury instruments would reduce banks' assets thereby affecting banks' ability to grant loans, leading to credit rationing. This has implications for credit availability to borrowers, particularly credit to the private sector.

The credit channel of monetary policy creates direct impact on aggregate demand and output as bank loans represent an important source of funds for business activity and the private sector. As such, the central bank using appropriate monetary policy instruments is in a position to enhance or constrain bank's ability to lend. These would depend on the effectiveness of the underlying monetary policy transmission mechanism of the economy.

The overall objective of the study is to determine the interest rate elasticity of private sector credit in Nigeria. In particular the study would seek to:

 (a) Identify correlations and causality among private sector credit and some specified variables
 (b) Estimate the short and long-run relationships between private sector credit and its determinants;
 (c) Estimate the short and long-run interest rate elasticities of private sector credit in Nigeria.

The paper is structured into four sections. Following the introduction in section one, is section two which presents the literature review. The data and methodology are discussed in section three, while section four contains the results and discussions. Section five concludes with the findings and recommendations.

II. Literature Review and Theoretical Framework

II.1 Theoretical Review

Most studies on demand for credit include financing costs (interest rates or bank lending rates), an economic activity variable (like real GDP or industrial production) and asset prices as the main determining factors.

Economic activity was strongly canvassed as a key determinant of credit to the private sector. Several empirical results indicate a positive correlation between these variables on theoretical grounds implying that robust output growth would likely exert positive impact on expected income and profits, thereby creating a momentum for expansion in investment and consumption. These would require increased financing. This argument implies that strong output growth enables

private agents to support increased consumption and investments through higher levels of indebtedness financed by credit (Kashyap et. al., 1993). There is, however, the counter argument that economic activity and productivity may in fact be negatively related. As Bernanke and Gertler (1995) and Friedman and Kuttner (1993) argued, a rise in current productivity (in contrast to expected productivity) would lead to an expansion in output and profits; and during this expansionary phase, firms may reduce the proportion of external financing in the form of loans and issuance of capital market instruments and rely more on internal sources of finance. Also, households usually take advantage of rising incomes during expansionary phases to lower their debt profile. On the other hand, during the recessionary phase, when household disposable income and corporate profitability are on the decline, the demand for credits by economic agents may increase in order to counteract the effect of lower incomes and profits. This argument reflects a short-run view of the expansionary phase, particularly if it is not expected to last long, in addition to the impact of uncertainty on decision outcomes. It may also reflect the behaviour of economic agents to idiosyncratic shocks.

II.2   Empirical Literature

Leonardo (2002) used a multivariate co-integration analysis with monthly time series for the period January 1986 to December 2000 to estimate a function of credit demand in Venezuela and identified four categories of empirical studies on the determinants of credit, including studies that estimate credit demand as a system due to the endogeneity of interest rate. This resulted in the estimation of a system using two reduced form equations, i.e. one for the interest rate and the other for credit demand. The co-integration tests indicated the existence of one stationary long-run relationship among the interest rate on loans, an index of real sales, the real exchange rate, and the real stock of loans. The short-run dynamics of the demand for credit was then modeled by means of a Vector Error Correction Model. The results were in line with the notion that the quantity of bank borrowing was essentially demand driven and that the interest rates exogenous. The estimated coefficient of elasticity for interest rate was 0.60 and 0.47 for the long-run and short-run models, respectively. Following this, Gumata and Nhlapo (2011) in their study used a co-integrated VAR approach in estimating the responsiveness of credit to real interest rates.

There is a consensus in the literature that bank lending rates have a negative relationship with the demand for private sector credit (Calza et. al., 2003). The cost of loans or interest rates was included as an explanatory variable in modelling the determinants of private sector demand for loans in the Euro Area (Calza et. al., 2003), by specifying private sector loan demand (LOANS) as a function of the gross domestic product (GDP), short-term interest rate (ST), long-term interest rate (LT), and a random shock (ε):

The model was specified in semi-log linear form. The inclusion of both short and long-term interest rates was informed by the lack of sufficiently long time series on euro area retail interest rates. In the study, it was assumed that the interest rate can be approximated by the short-term money market rates and the long-term bond yield. The short-term interest rate was the weighted average of three-month interbank rates or the three months EURIBOR interest rate, while the nominal long-term interest rate was the GDP weighted average yields on national ten-year government bonds.

Nag et. al., (2007) empirically examined the relationship between interest rate and commercial bank credit in India and the underlying geographical distribution pattern of credit in the country. The methodology employed for the study was the Fractile Graphical Analysis, which is one of the first non-parametric regression methods developed particularly to compare two regression functions for two bivariate populations (X, Y) where the co-variate (X) for the two populations are not essentially on comparable scales. The technique, originally proposed by Mahalanobis (1960) was discovered to be suitable in comparing two regression curves, when the independent variable is susceptible to location shift. The study indicated that interest on term loan had a negative relationship with the size of credit in the Indian economy, with estimated coefficients of -0.3, -0.2, -0.4 and 0.0 for Delhi, Maharashtra, Tamil Nadu and West Bengal, respectively.

Sophocles et. al., (2012) used multivariate co-integration methodology to estimate a vector error correction model (VECM) and identify different demand and supply relationships for consumer loans. Using a sample of quarterly data for the period 1990Q1 to 2008Q4, they introduced demand and supply-related shifts in parameters via the inclusion of suitable dummy variables and trends in the long-run relationships. The study deviated partially from the typical Johansen procedure and estimated the model in two steps and found that the coefficient size restrictions on the demand and supply co-integrating vectors and theoretical exclusion were valid. The study found that the supply side was mostly responsible for the rise in consumer loan expansion after credit liberalisation in Greece with an interest rate coefficient of credit elasticity of 0.039 and 0.044, respectively, for the demand and supply equations. The interest rate semi-elasticity in the long-run demand equation seems to fall, suggesting possibly that the crisis-related pressure lowers the readiness of borrowers to take up more loan. The liberalisation effects was well captured by the variables modelling structural changes, however, the crisis effect was not sufficiently captured.

Hassan et. al., (2012) studied the elasticity of credit demand in the agricultural sector in Pakistan, based on administration of questionnaires. The research sample comprised residential farmers in Pakistan. To verify the scale, validity and reliability of the responses, reliability tests and statistical analysis were conducted. They found that the factors driving agricultural sector credit demand were interest rate,

climate change, credit worthiness and investment in micro irrigation system. Because the credit model was not estimated for Pakistan, the elasticity of credit to the identified variables were not determined which was a limitation of the study.

Gattin-Turkalj et. al., (2007) used Ordinary Least Squares (OLS) method to estimate the demand for total loans in Croatia. The findings showed that the dynamics of loans demand was explained largely by the real GDP and real interest rates. The study noted that despite the simple specification of the model, GDP captured the most significant factors determining loan demand. Other variables were included to test for the robustness of the baseline specification, but the results showed their limited significance as additional variables in explaining loan growth. The variables were trend variables (to reflect supply side-effect), inflation and nominal exchange rate (USD and EUR). Quarterly data from 1997:Q1 to 2007:Q1 were used for the estimation with the estimated interest rate elasticity of credit at 0.87 and 0.46 for loan to private sector and loan to household, respectively. The study was well focused, however, it relies on a strong assumption that supply side effects did not play a significant role in credit determination, which requires, as a remedy, the simultaneous modeling of credit demand and supply.

Imran and Nishat (2012) investigated bank credit in Pakistan. The dependent variable was growth in bank credit, while the explanatory variables were liabilities from abroad growth, domestic deposits growth, M_2 as a percentage of GDP, money market rate, real output growth, inflation and the exchange rate. The authors focused on the supply side and employed the autoregressive distributed lag (ARDL) econometric method using annual Pakistani data from 1971 to 2008.

Results from the model estimation showed that the variables that significantly affected banks credit to the private sector in the long-run were domestic deposits, economic growth, foreign liabilities, exchange rate, and the monetary conditions of the country, while inflation and money market rate did not influence private sector credit.

Sharma and Gounder (2012) used cross–country panel data of bank credit to private sector among six different South Pacific economies, between 1982 – 2009. The variables included were: Bank private sector credit (BPRVY), Average lending rate (ALR), Inflation rate (INF), Bank deposit to GDP (BDY), Bank assets to GDP (BANKY), Stock market (SM), Gross domestic product (GDP). To empirically estimate the influence of the specified variables on bank credit to private sector in the South Pacific, the reduced form linear model was specified. Results showed that increasing lending rates and inflation may be unfavourable for credit growth, deposit and asset size are positively related, and thus economic growth leads to credit growth.

Hofmann (2001) analysed the determinants of credit to the private non-bank sector using a co-integrating VAR in 16 industrialised countries between 1980:Q1 to 1998:Q4. The co-integration tests suggested that standard credit demand factors were unable to explain the long-run development of credit. On the other

hand, long-run relationships linking real credit positively to real GDP and real property prices and negatively to the real interest rate will be identified, if real property prices are measured as a weighted average of real residential and real commercial property prices and added to the system. The long-run relationship, identified by the author was interpreted as long-run extended credit demand relationships, but could also capture effects on credit supply. The study also conducted impulse response analysis based on a standard Cholesky decomposition, which revealed a significant bi-directional dynamic interaction between bank credit and property prices.

The study also analysed the relationship among real interest rate, real GDP, real property prices and real lending, based on the multivariate approach to co-integration analysis proposed by Johansen. The study used the Johansen approach to alternative single equation estimation because of possible existence of multiple long-run relationships or presence of weakly exogenous variables.

In order to assess whether property prices play a role in explaining the development of credit the study estimated two econometric models, a minimal system consisting of only the log of real credit, the log of real GDP and the real interest rate, and an extended system also comprising the log of real property prices. The study found that innovations to the short-term real interest rate had a strong and significant negative effect on bank credit, GDP and property prices.

Stepanyan and Guo (2011) examined changes in bank credit in a selection of emerging market economies. Their analysis used quarterly data series on: banking sector private credit (dependent variable), banking sector foreign liabilities, banking sector domestic deposits, real GDP, inflation, deposit rate (as a substitute for the monetary condition), exchange rate, US federal funds rate, US M_2 and non-performing loan ratio. Their results showed that domestic and foreign funding contributed positively and significantly to credit growth. The results also indicated that stronger economic growth leads to higher credit growth, and high inflation, while increasing nominal credit, is detrimental to real credit growth. It also found that loose monetary conditions, either domestic or global, resulted in more credit growth with implications for the health of the banking sector.

In Nigeria, empirical studies had been carried out to assess the relationship between interest rate and private sector credit. Aniekan and Sikiru (2011) examined the relationship between banking sector credit and economic growth in Nigeria over the period 1970-2008, and established causality between the pairs of variables of interest using Granger causality test with a Two-Stage Least Squares (TSLS) estimation technique. The results of Granger causality test showed evidence of unidirectional causal relationship from industrial production index to GDP and from GDP to private sector credit (PSC). The models indicated that lending (interest) rate impedes economic growth through credit. This led the paper to

recommend the necessity for financial market developments that encourage credit to the real sector with low cost of funds in order to stimulate output growth.

Olokoyo (2011) tested the determinants of commercial bank lending and its impact on lending behaviour in Nigeria using VECM. Variables used in the study were: liquidity ratio, stipulated cash reserve requirements ratio, lending rate, volume of deposits, investment portfolio and commercial banks loan advance from 1980 – 2005. The co-integration test showed the presence of a single long-run relationship between the banks' lending and liquidity ratio, minimum cash requirement ratio, interest rate, investment portfolio, volume of deposit, economic output and foreign exchange.

An important lesson from the credit functions in the surveyed literature is the bi-directional relationships among credit, interest rates and economic activity as well as the existence of both short-run and long-run relationships, which form the basis of estimating the interest rate elasticity of private sector credit models by means of a VECM technique (Sophocles et al, 2012; Leonardo, 2002). Also, this technique took into account the established long-run relationship among the variables in the models including some exogenous variables. Apart from a generally scanty literature on interest rate elasticity of credit, especially in Nigeria, the empirical literature is limited by not covering the episode of recent global economic instability. This paper is an attempt to fill such gaps as well as provide a tool for policy design by the Monetary Policy Committee of the Central Bank of Nigeria.

II.3   Credit Channel of Monetary Policy Transmission

Current literature has focused on two issues concerning credit channels of monetary policy transmission mechanism. Studies on the interactions between output growth and monetary policy indicate a key role played by credit and the credit delivery system. Kahn (2010) noted that the cost of funds and rate of fixed investment, (housing expenditures, inventories) could be affected by short-term interest rates changes by the central bank, using open-market operations. Thus, output fluctuates as a result of changes in aggregate demand. Kahn (2010) further observed that the research findings supporting the traditional conception of the weak effects of monetary policy measures on output growth led to the credit channel theory, whose development was anchored on the standard premise that frictions in the market usually results in a spread between the external and internal sources of financing for firms. The author noted that changes in "external finance premium" as postulated by Bernanke and Gertler (1995) provide a more convincing explanation of movements in overall output and investment, than changes in short-term interest rates.

Kahn (2010)'s view was that monetary policy influences the external finance premium or relative pricing and supply of loans by commercial banks in the context of credit transmission channel. When restrictive monetary policy forces deposit money banks to forego the utilisation of funds that are sourced through the market and cannot be replace through other sources (such as CDs or

equity), then the relative cost of funds will rise, reducing the availability of loans to borrowers who are largely bank-dependent customers, and consequently rationing them out by a rise in the external finance premium. Firms and businesses, in the financial markets of advanced economies, generally have access to alternative funding channels. In Sub-Saharan Africa, characterised by shallow and weakly developed financial markets, only large firms and corporations can borrow from external financial markets while the smaller businesses and firms have recourse to mainly internally generated resources and funds as well as borrowing from the domestic banking system. Under such circumstances, investment decision making relies more on the internal rate of return than the rate of interest.

III.   Stylised Facts on Private Sector Credit and Interest Rate Developments in Nigeria

In Nigeria, recent developments in the financial sector require a re-examination of the relationship between deployment of monetary policy tools and private sector credit, in order to enhance the conduct of monetary policy. These developments include the deregulation of the financial sector in 1993, leading to the introduction of indirect monetary policy instruments; banking sector consolidation in 2004 and 2006 leading to rapid growth in private sector credit; continuing under-performance of monetary aggregates against the backdrop of robust GDP growth rates since the mid-1990s, and liquidity surfeit in the banking system. A notable observation is the sluggish growth in private sector credit before 2003, owing largely to the shallowness of the financial market and the low capital base of financial institutions (Figure 1).

Following the banking sector consolidation program in 2004, which led to an increase in the capital base of banks from ₦2.0 billion to ₦25.0 billion, and a reduction in the number of banks from 89 fragile institutions to 25 strong banks, the growth in private sector credit accelerated from ₦1.642 billion in the fourth quarter of 2004 to ₦9.895 billion in the fourth quarter of 2009. The onset of the global economic crisis in 2007/8 and the attendant liquidity crisis in the Nigerian banking system, leading to the build-up of non-performing facilities and the consequent increase in the cost of funds, affected the flow of banking system credit to the private sector. Thus, in 2010, private sector credit actually declined marginally from ₦9.715 billion in the first quarter to ₦9.460 billion in the fourth quarter. Following the conclusion of the banking sector reform programme which led to the setting up of the Asset Management Corporation of Nigeria (AMCON) to acquire toxic assets of banks, and the setting up of bridge banks, commercial banks became healthier to extend credit to the private sector.

Consequently, private sector credit rose from ₦9.446 billion in the first quarter of 2011 to ₦14.693 billion in the second quarter of 2012. From the finance-growth point of view, this expansion of credit can only raise overall output growth if it was channeled to the private sector. This, therefore, calls to question the nature of the responsiveness of private sector credit to any monetary and banking sector

stimulus in Nigeria. Accordingly, this study seeks to determine the interest rate elasticity of private sector credit in Nigeria.
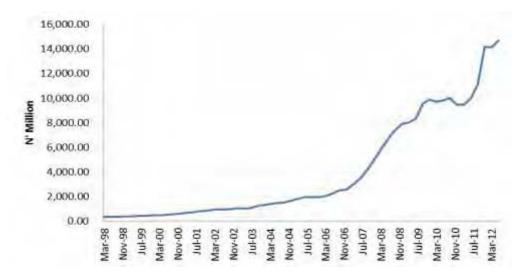
Figure 1: Private Sector Credit (Cp) in Nigeria

IV.   Methodology

In the literature, the analysis of determinants of the private sector credit is limited to a relatively small set of variables relating to the cost of loans and general economic activity. Following Plamen et. al., (2008) and Hofmann (2001), the variables that were used for the model included: real credit to the private sector (RCPS), real gross domestic product (RGDP), prime lending rate (PLR), maximum lending rate (MLR), treasury bills rate (TBR), nominal exchange rate of the naira (EXR), consumer price index for headline inflation (CPIH), and the all-share index (ASI). Quarterly data spanning 1998Q1 to 2013Q4 were utilised for the study. The choice of the data period was informed by the consideration of the period of financial market liberalisation. The Nigerian financial market was fully liberalised following the introduction of open market operations in 1993, and the interbank foreign exchange market in 1999, and as such data relating to earlier periods would indicate financial repression. The dependent variable in the credit function was credit to the private sector. Logarithmic transformations were applied to the non-rate variables to facilitate direct interpretation of computed regression coefficients as elasticities. In the tradition of Krautmann (2006) the interpretation of the regression coefficients in a semi-logarithmic function is extremely close to the theoretical value of a proportional change. This applies to the interest rate variables, which were in percentages or relative numbers. Thus, the coefficients for the interest rates were directly interpretable as elasticity since the dependent variable was in natural logarithms. The implicit model is specified as follows:

$$LNRCPS = f(LNRGDP, LNCPIH, LNASI, PLR, EXR, TBR, MLR) \qquad (2)$$

The variables and their definitions are contained in table 1.

A co-integration test based on Johansen and Juselius (1990) was applied to determine the long-run relationships among the variables. The test followed the Vector Error Correction Model (VECM). A VECM is a restricted form of the Vector Autoregressive (VAR) model. Given a standard VAR (p) representation:

$$y_t = c + A_1 \, y_{t-1} + A_2 \, y_{t-2} + \cdots A_p \, y_{t-p} + e_t \qquad (3)$$

Where:

y_t = k x 1 vector of endogenous variables that are integrated of order I(1); c = k x 1 vector of constants; A_i = k x k matrix of coefficients; e_t= k x 1 vector of innovations or error terms. The VEC model was employed to determine the short and long-run coefficients.

Then the Vector Error Correction representation of the model is:

$$\Delta y_t = \mu_t + \prod y_{t-1} + \sum_{i=1}^{p-1} \Gamma i \, \Delta y_{t=i} + \varepsilon_t \qquad (4)$$

Where:

$$\prod = \sum_{j=1}^{p} A_{i-1} \quad \text{and} \quad \Gamma i = -\sum_{j=i+1}^{p} Aj$$

The test criteria is that if the matrix$\prod$ has a reduced rank, r<n, then there exists nxr matrices $\boldsymbol{a}$ and $\boldsymbol{\beta}$ with rank r such that $\prod = \boldsymbol{a\beta}$ and $\boldsymbol{\beta'Y_t}$ is stationery; r is the number of co-integrating equations, and the elements of $\boldsymbol{a}$ become the adjustment parameters in the vector error correction model (Hjalmarsson and Osterholm, 2007). Then each column vector of $\boldsymbol{\beta}$ becomes a co-integrating vector.

In order to determine the order of integration, unit root tests for stationarity were applied to the time series. The Augmented Dickey fuller (ADF) test was applied to check for unit roots in the data. Following Gujarati (2003), the ADF unit root equation was:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta Y_{t-i} + \varepsilon_i \qquad (3)$$

Where:
Y_t the relevant time series data;
Δ= first difference operator;
t= the linear time trend;
ε_i= white noise error term;

The null hypothesis for the existence of unit roots is Ho:= 0, against the alternative that Ho: $\delta < 0$. Rejection of the null hypothesis means that the time series is stationary, while failure to reject led to further differencing until stationarity was achieved.
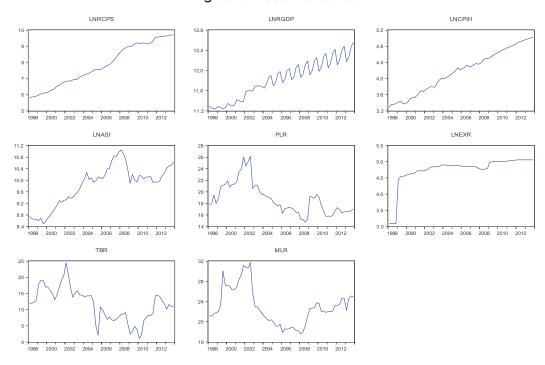
V.   Presentation and Discussion of Results
V.1   Descriptive Analysis

Figure 2 shows the behaviour of the variables over the study period. Some of the variables like LNRCPS, LNRGDP, LNASI, LNCPIH and LNEXR showed an increasing trend with time, while others displayed various forms of fluctuations. The ASI initially increased steadily, peaked in 2007, and fell dramatically thereafter.   All the variables had positive intercept. The interest rate variables did not appear to display any trend with time. These features of the behaviour of the variables were exploited in conducting the unit root tests.

The descriptive statistics (Table 2) indicate that most of the variables had low standard deviations perhaps due to the scaling effect of the logarithmic transformations of some variables.

An examination of the inter-correlation matrix showed that all the included variables, except maximum lending rate (MLR), were highly and significantly correlated with credit to the private sector and with the right signs, suggesting that the selection of the variables were informed by theory (table 3). The interest rate variable MLR seemed to exhibit weaker correlation with private sector credit, although it had the right sign. As expected, LNRGDP displayed a strong and positive correlation with private sector credit. The consumer price index (LNCPIH) showed the strongest correlation with real private sector credit.

Figure 2: Model Variables

V.2   Unit Root Tests

The unit root tests included intercept and trend for tests at level for trended series, and only intercept for test at first differences. Since the data is quarterly, we included up to four lags to correct for auto correlation.

All the variables failed unit root tests at level indicating that they were not stationary. However, the variables became stationary at first difference indicating that they were I(1) variables as shown by the Augmented Dickey-Fuller (ADF) unit root tests in table 4. The stationarity of the variables at I(1) indicates that they can only be used in regression analysis after first differencing.

V.3   Granger Causality Test Results

The result of the pair-wise granger causality test indicated that causality among the included variables gravitated between bi-directional and unidirectional causality depending on the lag length allowed. The outcome with respect to 4 lag lengths is presented in appendix table 8. The results showed that at the 10 per cent level of significance PLR granger cause CPS. However, CPS granger causes EXR. There was bidirectional causality among the following pairs of variables: EXR and GDP; PLR and GDP; EXR and ASI; and EXR and CPIH. Other results were that MLR granger causes GDP and CPIH. The CPIH granger causes PLR, while TBR granger causes MLR and PLR. Similarly, the EXR granger causes MLR. It is important

to indicate that granger causality measures order of precedence and information content among variables in a series. This pattern of causality seems to suggest that causality between CPS and other variables in our model could be indirect or through other variables.

V.4   Co-integration Test Results

Co-integration regression measures the long-run relationship between variables whose existence guarantees that the variables demonstrate no inherent tendency to drift apart. A vector of variables integrated of order one is said to be co-integrated if there exist a linear combination of the variables that is stationary. Following the approach popularised by Johansen and Juselius (1990), the likelihood ratio test statistics, the maximum eigenvalue and the trace statistics were utilised in determining the number of co-integrating vectors. The co-integration tests performed, allowed for the presence of linear deterministic trends. The results of the test are presented in table 5. The likelihood ratio test indicated a lag length of 4 as the appropriate lag structure for the test, while the Schwarz Information Criterion (SIC) gave lag lengths of 2.

The Trace statistics, Maximum eigenvalue, and MacKinnon et al. (1999) p-values show that the null hypothesis of no co-integration was rejected in favour of the alternative hypothesis at the 5.0 per cent level. The analysis further showed that both tests detected the presence of 3 co-integrating equations in the long-run. Thus, both tests imply the existence of long-run relationship among the variables.

Following the identification of long-run relationships among the variables, the primary long-run co-integrating equation was determined by the equation in which only one of the co-integrating variables was normalised to one (1) and had the highest likelihood ratio, in absolute terms. This is presented in Table 6. The co-integrating, long-run equilibrium equation is as follows:

$$
\begin{aligned}
LNRCPS = & \underset{(1.6706)***}{23.6882LNRGDP} - \underset{(1.1981)***}{14.6805LNCPIH} - \underset{(0.2093)}{0.2356LNASI} - \underset{(0.0647)***}{0.2742PLR} \\
& + \underset{(0.2119)***}{0.7540LNEXR} - \underset{(0.0169)***}{0.0855TBR} + \underset{(0.0454)***}{0.2701MLR}
\end{aligned} \tag{6}
$$

The result of the co -integration analysis indicates that in the long-run, all the included variables, significantly explained the growth in real private sector credit. The growth rate of income (LNGDP) has a positive and significant relationship with real private sector credit growth (LNRCPS) as expected. This relationship is theoretically consistent given the argument that output growth has to be financed, implying that an increase in income has to be supported by increases in credit availability. However, with the shallow financial market, governments' efforts to grow the economy ends up relying heavily on the banking system, thereby crowding out credit to the private sector. In recent times, however, there has been the observation that much of the growth in output were not driven by commensurate growth in credit availability to the private sector, further raising the issue of crowding out of private sector credit by the government. Also, the credit extended to the agricultural sector, which constitutes about 21.0 per cent of the

GDP, has been less than 4.0 per cent of total credit. The key message here is for policies to make credit more available to growth-driving sectors of the economy particularly agriculture, manufacturing, and services. Also, government should be encouraged to reduce its reliance on the banking system for credit while intensifying efforts to deepen the financial markets.

The analysis also showed that increase in the inflation rate (LNCPIH) was negatively and significantly associated with private sector credit growth. This result is consistent with reality as inflation erodes the real value of current investments and as such private sector operators are less likely to borrow and invest in an inflationary environment. The central bank should intensify efforts to bring down the rate of inflation and sustain price stability in order to boost investor's confidence, cage inflation expectations and motivate investments and credit growth in the long-run.

The two lending rates - maximum lending and prime lending rates, significantly influenced private sector credit growth at equilibrium. However, while the prime lending rate, as expected, was negatively related to private sector credit, the maximum lending rate has positive relationship with private sector credit. The behaviour of prime lending rate which is the rate for high networth borrowers is consistent with theory. The prime rate is also subject to negotiation between such borrowers and the lenders, and these negotiations are price sensitive, as most of the loan facilities in the formal banking system are extended to the prime borrowers. Consequently a one per cent increase in the prime lending rate would lead to a 0.27 per cent drop in private sector credit.

However, the maximum lending rate at which ordinary firms or marginal operators borrow, carries higher lending risks. The positive relationship between maximum lending rate and private sector credit, implies that ordinary borrowers are price takers who see an increase in lending rate as further indication of their being rationed out of the credit market by the combined effects of the squeeze by prime borrowers and government that have better credit records. They may, therefore, act to sustain their credit demand to avoid the prospect of starving their firms of funds with the implications of shut-downs and lay-offs. Marginal borrowers are also more likely to present riskier projects for funding, at higher interest rates given the adverse selection problem in credit markets. In terms of interest elasticity, the analysis shows that a 1.0 per cent increase in the maximum lending rate would lead to 0.27 per cent growth in private sector credit. Private sector credit has been found, in this study, to be significant but fairly interest inelastic in terms of both maximum and prime lending rates. This finding is consistent with the long standing belief that the issue in credit analysis in Nigeria is not necessarily price but availability. Thus, policy makers and operators should refocus their efforts at improving the availability and flow of credit to the real economy.

Treasury bill rate is the interest rate at which the government borrows to fund short-term revenue short-falls. The Treasury bill rate was observed to negatively and significantly influence credit to the private sector. At each point in time, there is a limited amount of credit available to the economy, such that an increase in the Treasury bill rate would discourage or reduce private sector credit and thus serve to increase the flow of credit to government thereby crowding out private sector credit. The elasticity of treasury bill rate was 0.08, implying that a 1.0 per cent increase in the 91-day treasury bills rate would lead to 0.08 per cent fall in private sector credit.

The short-run vector error correction model estimates shows that about 0.01 per cent of disequilibrium is corrected each quarter by changes in the private sector credit (Table 10). This indicates that the estimated elasticity coefficients are stable in the short-run and adjust slowly to equilibrium. Similarly about 9.3 per cent of the disequilibrium in the short-run model is corrected by changes in real output. In the short-run, only the lagged value of real private sector credit and prime lending rate were significant in explaining real private sector credit. The prime lending is significant in explaining changes in real private sector credit, with short-run elasticity coefficient of 0.029. This indicates that in the short-run, a 1.0 per cent increase in PLR would lead to 0.029 per cent change in real private sector credit after two quarters. The non-significance of other interest rate variables in the short-run indicates that private sector credit is largely interest inelastic in the short-run.

The result of the estimated model also indicated that the depreciation of the local currency will significantly lead to an increase in credit to the private sector. This follows the expectation that a loss in the value of domestic credit can lead to an increase in the size of the loan demanded in order to maintain the real value of investment projects.

VI.   Conclusion

The following are the key findings of this study:

1. All the included variables, except all share index, significantly explained the growth in real private sector credit in the long-run;

2. The growth rate of income (LNGDP) as expected had a positive and significant relationship with real private sector credit growth (LNRCPS), indicating that increasing level of income positively influences private sector credit growth supported by credit availability;

3. Increase in the inflation rate (LNCPIH) was significant but negatively associated with private sector credit growth, which is consistent with economic theory as inflation erodes the real value of current investments;

4. Both the maximum and prime lending rates significantly influenced private sector credit growth at equilibrium in the long-run. However, while the prime lending rate as expected, negatively explained private sector credit growth, the maximum lending rate, contrary to theory, was positively related to private sector credit. The bulk of the credit goes to prime borrowers, who constitute a small proportion of the borrowers. This may

suggest that marginal borrowers to whom maximum lending rate applies are price takers with no collateral or influence over lenders in the Nigerian credit environment. The estimated interest rate elasticity for prime borrowers was 0.27, implying that 1.0 per cent increase in the prime lending rate would lead to a 0.27 per cent drop in private sector credit growth. In the marginal borrowers/customers segment, in terms of interest rate elasticity, the analysis shows that 1.0 per cent increase in the maximum lending rate would lead to 0.27 per cent growth in private sector credit;

5. Private sector credit is, thus, fairly interest inelastic in terms of both marginal and prime lending rates. This finding is consistent with the long standing belief that the issue in credit analysis in Nigeria is not necessarily price but availability. This is more so the case given the dearth of publicly sourced infrastructure such as energy, roads and water supply, which entrepreneurs and firms have to provide through self-efforts;

6. The Treasury bill rate negatively and significantly influenced credit to the private sector with an elasticity coefficient of 0.08 per cent;

7. The short-run vector error correction model estimates shows that about 0.01 per cent of disequilibrium is corrected each quarter by changes in the private sector credit; and

8. In the short-run, only the lagged values of real private sector credit and prime lending rate were significant in explaining growth in real private sector credit. The non-significance of other interest rate variables indicates that private sector credit is largely interest inelastic in the short-run.

These findings have important implications for policy and research. The maximum and prime lending rates significantly influenced private sector credit growth at equilibrium with elasticity of 0.27 and -0.27 per cent, respectively. The estimated elasticity coefficients are almost zero in the short-run and adjust slowly to the equilibrium. The low interest rate elasticity of credit implies that credit growth would be stimulated by policies directed at improving non-price factors, including providing more favourable business environment for borrowers, such as infrastructure, efficient banking system, and appropriate regulatory regime.

The positive and significant relationship of real income with private sector credit growth implies that policies to make credit more available to growth-driving sectors of the economy particularly agriculture, manufacturing, and services should be implemented. Also, government should be encouraged to reduce its reliance on the banking system for credit while intensifying efforts to deepen the financial markets, particularly the Nigerian capital market. The central bank should sustain efforts to bring down the rate of inflation and maintain price stability in order to boost investor's confidence, promote investments and output growth.

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Appendix

Table 1: Variables, their Definition and Measurement

Variables	Definition	Measurement
LNRCPS	Private Sector Credit (in Logarithms)	Values in Naira (₦)
LNRGDP	Real Gross Domestic Product (in Logarithms)	Values in Naira (₦)
LNCPIH	Consumer Price index (2009=100) (in logarithms)	Index
LNASI	All share index of the Nigerian stock market (in logarithms)	index
PLR	Prime lending rate of banks in Nigeria	Per cent
LNEXR	Index of nominal exchange rate (in logarithms)	index
TBR	Treasury bills rate	Per cent
MLR	Maximum lending rate of banks in Nigeria	Per cent

Table 2: Descriptive Statistics

	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Prob.	Obs.
LNRCPS	7.83	7.60	9.70	5.78	1.29	0.01	1.58	5.35	0.07	64
LNRGDP	11.83	11.87	12.56	11.24	0.38	(0.03)	1.92	3.12	0.21	64
LNCPIH	4.18	4.26	5.03	3.29	0.53	(0.09)	1.76	4.17	0.12	64
LNASI	9.82	9.99	11.05	8.50	0.69	(0.39)	2.24	3.18	0.20	64
PLR	18.77	17.97	26.16	14.77	2.73	0.93	3.35	9.62	0.01	64
LNEXR	4.75	4.85	5.06	3.09	0.46	(2.98)	11.23	275.87	-	64
TBR	11.54	12.00	24.50	1.04	5.11	0.01	2.56	0.53	0.77	64
MLR	22.93	22.26	31.77	17.58	3.61	0.71	2.86	5.39	0.07	64

Table 3: Correlation Matrix of the Variables

Covariance Analysis: Ordinary

Correlation t-Statistic Probability	LNRCPS	LNRGDP	LNCPIH	LNASI	PLR	LNEXR	TBR	MLR
LNRCPS	1.000000							

LNRGDP	0.951584	1.000000						
	24.37552	-----						
	0.0000	-----						
LNCPIH	0.987525	0.964973	1.000000					
	49.38250	28.96215	-----					
	0.0000	0.0000	-----					
LNASI	0.786528	0.801160	0.807598	1.000000				
	10.02846	10.54112	10.78291	-----				
	0.0000	0.0000	0.0000	-----				
PLR	-0.644370	-0.651267	-0.663025	-0.639635	1.000000			
	-6.634862	-6.757718	-6.973938	-6.552133	-----			
	0.0000	0.0000	0.0000	0.0000	-----			
LNEXR	0.636274	0.629117	0.654883	0.598130	-0.126230	1.000000		
	6.494190	6.372842	6.823274	5.876830	-1.001954	-----		
	0.0000	0.0000	0.0000	0.0000	0.3203	-----		
TBR	-0.596516	-0.560049	-0.591406	-0.610981	0.665202	-0.213297	1.000000	
	-5.852188	-5.322931	-5.774907	-6.077046	7.014952	-1.719063	-----	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0906	-----	
MLR	-0.289805	-0.338054	-0.334842	-0.582778	0.794313	0.008550	0.643722	1.000000
	-2.384245	-2.828356	-2.798069	-5.646841	10.29521	0.067326	6.623472	-----
	0.0202	0.0063	0.0068	0.0000	0.0000	0.9465	0.0000	-----

Table 4: Augmented Dickey-Fuller (ADF) unit root test statistics (t-values) for the Variables

Variables	At Level	First Difference	Order of Integration
LNRCPS	-1.821974 (0.6817)	-5.484022*** (0.0001)	I(1)
LNRGDP	-1.918599 (0.6319)	-4.280235*** (0.0012)	I(1)
LNCPIH	-2.935596 (0.1590)	-4.567378*** (0.0029)	I(1)
LNASI	-1.292554 (0.8805)	-6.654805*** (0.0000)	I(1)
LNDDL	-1.366627 (0.5927)	-11.78268 (0.0000)***	I(1)
LNEXR	-3.245823* (0.0854)	-7.382499*** (0.0000)	I(1)
MLR	-1.705352 (0.4235)	-7.043261*** (0.0000)	I(1)
PLR	-1.575835 (0.4887)	-8.394733*** (0.0000)	I(1)
TBR_91	-2.354351 (0.1589)	-8.376218*** (0.0000)	I(1)
IBR	-2.473889 (0.1268)	-8.559595*** (0.0000)	I(1)

Note: Values in parenthesis are prob-values; *Significant at 10 per cent; **Significant at 5 per cent; ***Significant at 1 per cent.

Table 5: Co-integration Test Result

Unrestricted Co-integration Rank Test (Trace)				
Hypothesised No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.830927	260.1142	159.5297	0.0000
At most 1 *	0.545592	151.6914	125.6154	0.0005
At most 2 *	0.531137	103.5770	95.75366	0.0130
At most 3	0.305113	57.37293	69.81889	0.3248
At most 4	0.192938	35.16857	47.85613	0.4392
At most 5	0.173950	22.09293	29.79707	0.2934
At most 6	0.115802	10.43580	15.49471	0.2487
At most 7	0.046870	2.928249	3.841466	0.0870

Trace test indicates 3 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

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)				
Hypothesised No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.830927	108.4228	52.36261	0.0000
At most 1 *	0.545592	48.11441	46.23142	0.0311
At most 2 *	0.531137	46.20411	40.07757	0.0091
At most 3	0.305113	22.20436	33.87687	0.5918
At most 4	0.192938	13.07564	27.58434	0.8807
At most 5	0.173950	11.65713	21.13162	0.5817
At most 6	0.115802	7.507549	14.26460	0.4310
At most 7	0.046870	2.928249	3.841466	0.0870

Max-eigenvalue test indicates 3 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

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

Table 6: Normalised Co-integrating Equation

1 Co-integrating Equation(s):		Log likelihood	164.1299				
Normalised co-integrating coefficients (standard error in parentheses)							
LNRCPS	LNRGDP	LNCPIH	LNASI	PLR	LNEXR	TBR	MLR
1.000000	-23.68816	14.68053	0.235618	0.274179	-0.754048	0.085555	-0.270155
	(1.67061)	(1.19811)	(0.20935)	(0.06467)	(0.21188)	(0.01690)	(0.04537)
Adjustment coefficients (standard error in parentheses)							
D(LNRCPS)	-0.010853						
	(0.01103)						
D(LNRGDP)	0.093109						
	(0.01211)						
D(LNCPIH)	-0.008685						
	(0.00542)						
D(LNASI)	-0.017995						
	(0.03114)						
D(PLR)	0.394162						
	(0.23070)						
D(LNEXR)	0.057225						
	(0.03982)						
D(TBR)	1.330235						
	(0.48665)						
D(MLR)	0.884955						
	(0.21936)						

Table 7: Short-run Vector Error Correction Model Estimates

Error Correction:	D(LNRCPS)		
Variable	**Coefficient**	**Standard Error**	**T-value**
CointEq1	-0.010853	(0.01103)	[-0.98366]
D(LNRCPS(-1))	0.416308	(0.13975)	[2.97896]
D(LNRCPS(-2))	0.102780	(0.14840)	[0.69258]
D(LNRGDP(-1))	-0.143584	(0.15100)	[-0.95089]
D(LNRGDP(-2))	-0.153612	(0.13844)	[-1.10963]
D(LNCPIH(-1))	-0.202589	(0.27733)	[-0.73051]
D(LNCPIH(-2))	-0.118816	(0.24374)	[-0.48747]
D(LNASI(-1))	-0.013293	(0.05307)	[-0.25050]
D(LNASI(-2))	0.099454	(0.05487)	[1.81243]
D(PLR(-1))	0.015645	(0.00930)	[1.68227]
D(PLR(-2))	0.029310	(0.00964)	[3.04065]
D(LNEXR(-1))	0.033180	(0.04376)	[0.75820]
D(LNEXR(-2))	-0.052551	(0.04444)	[-1.18248]
D(TBR(-1))	-0.001448	(0.00352)	[-0.41130]
D(TBR(-2))	0.003179	(0.00366)	[0.86927]
D(MLR(-1))	-0.012234	(0.00728)	[-1.67932]
D(MLR(-2))	-0.012423	(0.00675)	[-1.84074]
C	0.044500	(0.01459)	[3.05092]

R-squared	0.384750		
Adj. R-squared	0.141512		
Sum sq. resids	0.124321		
S.E. equation	0.053770		
F-statistic	1.581781		
Log likelihood	102.4155		
Akaike AIC	-2.767723		
Schwarz SC	-2.144842		
Mean dependent	0.062602		
S.D. dependent	0.058032		

Determinant resid covariance (dof adj.)	1.04E-11
Determinant resid covariance	6.36E-13
Log likelihood	164.1299
Akaike information criterion	-0.397701
Schwarz criterion	4.862182
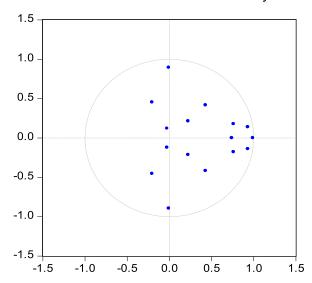
Table 8: Pairwise Granger Causality Tests

Lags: 4			
Null Hypothesis:	Obs	F-Statistic	Prob.
PLR on LNRCPS	58	3.89256	0.0080
LNRCPS on PLR		1.42989	0.2382
EXR on LNRCPS	58	0.59087	0.6708
LNRCPS on EXR		15.4360	3.E-08
MLR on LNRGDP	58	3.76610	0.0095
LNRGDP on MLR		0.99184	0.4209
PLR on LNRGDP	58	9.60907	8.E-06
LNRGDP on PLR		3.36694	0.0164
EXR on LNRGDP	58	4.16934	0.0055
LNRGDP on EXR		6.60225	0.0002
MLR on LNCPIH	58	2.75745	0.0380
LNCPIH on MLR		1.43372	0.2369
PLR on LNCPIH	58	1.73651	0.1570
LNCPIH on PLR		3.45916	0.0144
EXR on LNCPIH	58	3.40564	0.0155
LNCPIH on EXR		8.47535	3.E-05
EXR on LNASI	58	2.86697	0.0327
LNASI on EXR		4.14684	0.0057
EXR on MLR	58	6.47586	0.0003
MLR on EXR		0.41306	0.7984
TBR_91 on MLR	58	3.18238	0.0211
MLR on TBR_91		1.22199	0.3136
TBR_91 on PLR	58	2.45500	0.0580
PLR on TBR_91		0.61549	0.6535

Table 9: Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-270.8863	NA	1.76e-06	9.453773	9.735473	9.563737
1	174.6926	755.2185	4.33e-12	-3.481107	-0.945807*	-2.491428
2	258.0336	118.6549	2.52e-12	-4.136731	0.652169	-2.267339
3	348.1102	103.8171	1.44e-12	-5.020684	2.021815	-2.271578
4	479.9876	116.2310*	2.91e-13	-7.321615	1.974485	-3.692794
5	589.6827	66.93260	2.61e-13*	-8.870601*	2.679098	-4.362066*

Inverse Roots of AR Characteristic Polynomial

Table 10: Vector Error Correction Model

Vector Error Correction Estimates

Sample (adjusted): 12/01/1998 12/01/2013
Included observations: 61 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Co-integrating Eq:	CointEq1
LNRCPS(-1)	1.000000
LNRGDP(-1)	-23.68816
	(1.67061)
	[-14.1794]
LNCPIH(-1)	14.68053
	(1.19811)
	[12.2531]
LNASI(-1)	0.235618
	(0.20935)
	[1.12549]
PLR(-1)	0.274179
	(0.06467)
	[4.23946]
LNEXR(-1)	-0.754048
	(0.21188)
	[-3.55880]
TBR(-1)	0.085555
	(0.01690)

	[5.06324]
MLR(-1)	-0.270155
	(0.04537)
	[-5.95484]
C	212.1618

Error Correction:	D(LNRCPS)	D(LNRGDP)	D(LNCPIH)	D(LNASI)	D(PLR)	D(LNEXR)	D(TBR)	D(MLR)
CointEq1	-0.010853	0.093109	-0.008685	-0.017995	0.394162	0.057225	1.330235	0.884955
	(0.01103)	(0.01211)	(0.00542)	(0.03114)	(0.23070)	(0.03982)	(0.48665)	(0.21936)
	[-0.98366]	[7.68912]	[-1.60286]	[-0.57792]	[1.70855]	[1.43711]	[2.73348]	[4.03417]
D(LNRCPS(-1))	0.416308	-0.124701	0.037188	0.188551	4.914528	-0.055237	-1.244253	3.419188
	(0.13975)	(0.15338)	(0.06863)	(0.39438)	(2.92209)	(0.50436)	(6.16396)	(2.77852)
	[2.97896]	[-0.81303]	[0.54188]	[0.47809]	[1.68185]	[-0.10952]	[-0.20186]	[1.23058]
D(LNRCPS(-2))	0.102780	-0.188194	0.018905	-0.368187	-1.702505	-0.336524	-3.611073	-0.985395
	(0.14840)	(0.16287)	(0.07288)	(0.41880)	(3.10297)	(0.53559)	(6.54552)	(2.95052)
	[0.69258]	[-1.15547]	[0.25941]	[-0.87916]	[-0.54867]	[-0.62833]	[-0.55169]	[-0.33397]
D(LNRGDP(-1))	-0.143584	1.090814	-0.123678	-0.275378	6.070793	0.728108	17.66862	12.25765
	(0.15100)	(0.16572)	(0.07415)	(0.42613)	(3.15733)	(0.54497)	(6.66018)	(3.00220)
	[-0.95089]	[6.58208]	[-1.66789]	[-0.64623]	[1.92276]	[1.33606]	[2.65288]	[4.08289]
D(LNRGDP(-2))	-0.153612	0.284549	-0.127095	-0.062491	4.986946	0.690878	14.11959	8.480127
	(0.13844)	(0.15193)	(0.06798)	(0.39067)	(2.89460)	(0.49962)	(6.10598)	(2.75238)
	[-1.10963]	[1.87284]	[-1.86954]	[-0.15996]	[1.72284]	[1.38281]	[2.31242]	[3.08101]
D(LNCPIH(-1))	-0.202589	-0.592857	-0.038515	-0.674723	-1.662210	-0.767993	-7.948529	-1.528405
	(0.27733)	(0.30437)	(0.13619)	(0.78263)	(5.79874)	(1.00089)	(12.2321)	(5.51384)
	[-0.73051]	[-1.94782]	[-0.28281]	[-0.86212]	[-0.28665]	[-0.76731]	[-0.64981]	[-0.27719]
D(LNCPIH(-2))	-0.118816	-0.876817	-0.190855	-0.094160	-4.196771	-0.700566	-12.13364	-2.162073
	(0.24374)	(0.26751)	(0.11969)	(0.68785)	(5.09643)	(0.87967)	(10.7506)	(4.84603)
	[-0.48747]	[-3.27774]	[-1.59453]	[-0.13689]	[-0.82347]	[-0.79640]	[-1.12865]	[-0.44615]
D(LNASI(-1))	-0.013293	-0.099025	0.002419	0.126089	-1.187740	-0.117964	1.129687	-1.196138
	(0.05307)	(0.05824)	(0.02606)	(0.14976)	(1.10958)	(0.19152)	(2.34060)	(1.05507)
	[-0.25050]	[-1.70026]	[0.09281]	[0.84196]	[-1.07044]	[-0.61594]	[0.48265]	[-1.13371]
D(LNASI(-2))	0.099454	0.027538	-0.028172	0.271003	-1.055759	-0.215367	-1.093930	-1.649883
	(0.05487)	(0.06022)	(0.02695)	(0.15486)	(1.14737)	(0.19804)	(2.42030)	(1.09100)
	[1.81243]	[0.45726]	[-1.04548]	[1.75003]	[-0.92016]	[-1.08749]	[-0.45198]	[-1.51227]
D(PLR(-1))	0.015645	-0.012589	0.008679	0.044668	-0.304402	-0.047050	0.010829	0.139519
	(0.00930)	(0.01021)	(0.00457)	(0.02624)	(0.19446)	(0.03356)	(0.41019)	(0.18490)
	[1.68227]	[-1.23342]	[1.90046]	[1.70195]	[-1.56541]	[-1.40181]	[0.02640]	[0.75456]
D(PLR(-2))	0.029310	-0.001712	0.002164	0.025912	-0.229175	0.017914	0.038843	-0.184226
	(0.00964)	(0.01058)	(0.00473)	(0.02720)	(0.20155)	(0.03479)	(0.42517)	(0.19165)
	[3.04065]	[-0.16186]	[0.45706]	[0.95254]	[-1.13704]	[0.51493]	[0.09136]	[-0.96125]
D(LNEXR(-1))	0.033180	-0.020250	-0.011691	0.119734	1.281962	0.065873	-0.317558	0.062512
	(0.04376)	(0.04803)	(0.02149)	(0.12350)	(0.91502)	(0.15794)	(1.93018)	(0.87007)

	[0.75820]	[-0.42162]	[-0.54403]	[0.96952]	[1.40101]	[0.41708]	[-0.16452]	[0.07185]
D(LNEXR(-2))	-0.052551	-0.029942	-0.075026	-0.218492	0.343657	-0.032211	0.373272	3.711137
	(0.04444)	(0.04877)	(0.02182)	(0.12542)	(0.92924)	(0.16039)	(1.96018)	(0.88359)
	[-1.18248]	[-0.61388]	[-3.43781]	[-1.74214]	[0.36983]	[-0.20083]	[0.19043]	[4.20009]
D(TBR(-1))	-0.001448	-0.011573	0.001577	-0.011154	-0.030281	-0.003827	0.185459	0.031263
	(0.00352)	(0.00386)	(0.00173)	(0.00993)	(0.07359)	(0.01270)	(0.15524)	(0.06998)
	[-0.41130]	[-2.99616]	[0.91231]	[-1.12301]	[-0.41147]	[-0.30127]	[1.19469]	[0.44677]
D(TBR(-2))	0.003179	-0.005987	0.002756	0.004034	0.044810	-0.003309	-0.433918	0.110894
	(0.00366)	(0.00401)	(0.00180)	(0.01032)	(0.07647)	(0.01320)	(0.16131)	(0.07272)
	[0.86927]	[-1.49165]	[1.53428]	[0.39086]	[0.58596]	[-0.25071]	[-2.68990]	[1.52504]
D(MLR(-1))	-0.012234	-0.004018	-0.004160	-0.028923	0.100612	0.017965	-0.183142	-0.178463
	(0.00728)	(0.00800)	(0.00358)	(0.02056)	(0.15232)	(0.02629)	(0.32132)	(0.14484)
	[-1.67932]	[-0.50251]	[-1.16284]	[-1.40684]	[0.66051]	[0.68331]	[-0.56997]	[-1.23214]
D(MLR(-2))	-0.012423	-0.009109	-0.008198	-0.006683	0.136381	-0.017815	-0.066522	-0.112539
	(0.00675)	(0.00741)	(0.00331)	(0.01905)	(0.14111)	(0.02436)	(0.29767)	(0.13418)
	[-1.84074]	[-1.22978]	[-2.47363]	[-0.35088]	[0.96646]	[-0.73144]	[-0.22348]	[-0.83871]
C	0.044500	0.059676	0.039085	0.066414	-0.290864	0.079622	0.276208	-0.395446
	(0.01459)	(0.01601)	(0.00716)	(0.04116)	(0.30498)	(0.05264)	(0.64333)	(0.29000)
	[3.05092]	[3.72786]	[5.45682]	[1.61349]	[-0.95372]	[1.51256]	[0.42934]	[-1.36363]
R-squared	0.384750	0.865599	0.473038	0.229328	0.325348	0.134411	0.318003	0.645143
Adj. R-squared	0.141512	0.812464	0.264704	-0.075356	0.058625	-0.207799	0.048376	0.504851
Sum sq. resids	0.124321	0.149750	0.029980	0.990100	54.35371	1.619317	241.8658	49.14391
S.E. equation	0.053770	0.059013	0.026405	0.151742	1.124295	0.194058	2.371629	1.069056
F-statistic	1.581781	16.29051	2.270577	0.752675	1.219796	0.392773	1.179418	4.598571
Log likelihood	102.4155	96.73949	145.7963	39.12984	-83.03674	24.12527	-128.5684	-79.96356
Akaike AIC	-2.767723	-2.581623	-4.190043	-0.692782	3.312680	-0.200829	4.805521	3.211920
Schwarz SC	-2.144842	-1.958742	-3.567162	-0.069901	3.935561	0.422052	5.428402	3.834801
Mean dependent	0.062602	0.021616	0.027281	0.032484	-0.040164	0.032245	-0.020984	0.054098
S.D. dependent	0.058032	0.136272	0.030793	0.146329	1.158774	0.176577	2.431163	1.519262

Determinant resid covariance (dof adj.)	1.04E-11
Determinant resid covariance	6.36E-13
Log likelihood	164.1299
Akaike information criterion	-0.397701
Schwarz criterion	4.862182

Measuring the Depth of Liquidity and Efficiency of the Nigerian Capital Market

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Abstract

The study developeda spectrum of indicative measures of capital market liquidity using Nigerian monthly stock market indices for the period January 2000 – June 2014. It identified four broad measures of liquidity common in the literature,transaction cost, volume,price and market impact measures. Based on these, three sub-measures of market efficiency coefficient, variance ratio, turnover ratio and illiquidity index were developed based on data availability and other market factors specific to the Nigerian environment. The study examined the impact of capital market liquidity on asset price returns, using a vector auto regression (VAR) model which showed that the Nigerian capital market was illiquid during the review period. While the result indicated the existence of a long-run relationship between stock market returns and liquidity, evidence from both the short-run and long-run causality indicated unidirectional relationship between stock market returns and turnover ratio, with no feedback effect. The generalised impulse response function indicated that response of market liquidity to asset price returns is stronger than the response of asset price returns to market liquidity. The result is consistent with the behaviour of an illiquid market.

Keywords: Market liquidity, capital market, efficiency, market performance
JEL Classification: G14, L1

I.   Introduction

The role of capital market as a leading indicator of economic activity reemerged in the aftermath of the 2007/2008 global financial crisis. Economic growth theory is replete with evidence of the importance of the capital market. The capital market is key in the promotion of good corporate governance, effective allocation of resources, monitoring of corporate performance and providing ex ante information about possible investments. The capital market is essential to monitor investments, diversify and manage risk; mobilise and pool savings; and facilitate trade in goods and services. The performance of the capital market indicators such as the yield curve and equity prices also reflect the expectation and confidence of economic agents in the economy. The efficiency of the capital market in discharging these functions largely depends on numerous factors such as market size, liquidity, turnover, integration with other capital markets, concentration, market volatility, asset pricing; and quality of regulation and enforcement (Demirguc-Kunt and Levine, 1996a, 1996b; Levine and Zervos, 1996, 1998; Levine, 1991, 1997; Argarwal, 2000; Arestis, Demetriades and Luintel, 2001, Yartey and Adjasi, 2007; Yartey, 2008; and Rousseau and Wachtel, 1998).

One major lesson from the financial crisis is the imperative of a liquid capital market in stabilising financial system liquidity. Given the general perception that liquid capital markets are desirable, central banks have adopted various forms of monetary accommodation to ensure that the markets are liquid. Although, what

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constitute adequate liquidity remains largely elastic. Liquidity as a major indicator of market soundness has evinced interest among scholars and market players. For instance, Polimenis (2005) defined it as the expected rate of order of execution in – ability to easily buy and sell - shares per minute. Sarr and Lybek (2002) and Minovic (2012) defined liquidity as the ability to trade large quantities quickly, at a low cost, and without moving price. Gabrielson, Marzo and Zagaglia (2011) defined liquidity as a structured transaction that provides a prompt and secure interaction between the demand and supply of assets, which ultimately lowers transaction costs. The controversy on the definition of liquidity is generally fuelled by the postulation that an exhaustive and acceptable definition must be anchored on two important pillars; the transaction time, i.e. speed of execution; and price paid for liquidity services.

Sarr and Lybek (2002) identified the benefits of liquidity to include; allowing a central bank to use indirect monetary instruments which generally contributes to the stability of the monetary transmission mechanism. Secondly, it permits financial institutions to accept larger asset-liability mismatches, both regarding maturity and currency, thus, fostering more efficient crisis management by individual institutions, and reducing the risk of central banks having to act as lender of last resort for solvent but illiquid credit institutions; and thirdly, delivering more attractive financial assets to investors, who can transact in them easily. Gabrielson, Marzo and Zagaglia (2011) documented the importance of liquidity on asset prices by arguing that the market will experience lower asset prices and higher rates of return in the presence of higher transaction costs. The benefits of liquidity, is that, it gives investor the latitude to quickly and cheaply alter their portfolios, which make investments less risky, facilitate longer-term and profitable investment.

The above benefits of liquidity have brought to fore, the importance of measuring capital market liquidity with precision. Scholars, policy makers and investors have developed different measures of liquidity. Common measures in the extant literature include; value of shares traded; conventional liquidity ratio; the Index of Martin (1975); turnover ratio; Hui and Heubel (1984) liquidity ratio; market adjusted liquidity index; explicit illiquidity measure. Others include: Marsh and Rock (1986) liquidity ratio; variance ratio; market capitalisation ratio; bid-ask spread, measure of implied spread; Amivest's measure; Amihud's measure; Amihud's Based measure; zero-return measure; and price pressure measure, among others.

These are broadly classified into; one-dimensional, multi-dimensional measures; and volume-based liquidity measures and price variability indices. There are several criticisms of the usefulness and effectiveness of each of these measures. For instance, the volume-based measure has been criticised for failing to differentiate between permanent and temporary price effect of swings in traded volume; and do not show how a sudden order arrival (order-induced effect) can affect prices (Gabrielson, Marzo and Zagaglia, 2011). Marsh and Mock (1986), also argued that volume-based liquidity overestimates the effect of price variability on large transaction. Similarly, the criticism of the price variability indices was its

insensitivity to the time interval chosen for its calculation, and the problems associated with the notion of unobservable equilibrium prices. Methodologies used in extant literature include event studies (Brown and Warner, 1980, 1985), vector autoregression (VAR) (Hasbrouck, 1988, 1991, 1993 and 2002), co-integration in market microstructure (McInish and Wood, 2000), among others.

The argument on the best measure of liquidity is still on going with improved econometric methodology. There is a consensus among scholars and market players that a robust measure of liquidity must incorporate market efficiency coefficients, speed of transaction (turnover ratio), impact of illiquidity and the relationship between liquidity market and stock returns. Despite the plethora of theoretical and empirical literature on robust measures of capital market liquidity across jurisdictions, studies in Africa, and specifically, Nigeria still concentrate so much on market capitalisation (MC), value of shares traded and all share index (ASI). For instance, Adjasi and Biekpe (2009) examined the effect of stock market prices on investment growth in selected African countries, using stock market measures such as stock prices, market capitalisation ratio, and value of shares traded ratio. Iyoboyi (2013) examined the impact of financial deepening on the growth of the Nigerian economy using total market capitalisation ratio to GDP to proxy market deepening. The study by Adelegan (2009) used value of shares traded and market capitalisation as measures of capital market development to examine whether financial integration and capital market development have improved the efficiency with which investment funds are allocated to competing uses in Nigeria. Against this backdrop is the need to evaluate the Capital Market as a viable alternative to the Money market for corporate financing. This has long-term implications for bringing down interest rates in the money market.

Studies that clarify our understanding of liquidity measures using market efficiency coefficients, speed of transaction (turnover ratio), impact of illiquidity and the relationship between liquidity market and stock returns in Africa and Nigeria are lacking. This study fills this important research gap by using Nigerian data to measure the depth of liquidity and efficiency of the Nigerian capital market along these four measures.

The major problem addressed by this study is in terms of the depth of liquidity and efficiency of the Nigerian capital market. Given the heated debate on the relationship between market liquidity, efficiency and earnings, knowledge of liquidity of the capital market would be critical to the monetary authorities for ensuring price stability.

Currently, there is limited security and product offering in Nigerian capital market, which contrast sharply with most emerging economies. Specifically, equities and government bonds are the major instruments tradable in the Nigerian Stock Exchange. For instance, the NSE is composed of three (3) tiers, while active trading only occurs in the first tier. Of the 213 listed companies as at 2014, only 25 companies dominated the market and banking sector constituted about 70.0 per cent of active trading activities on the Exchange.

In view of the foregoing, the study developed three measures of capital market liquidity and efficiency that should guide policy. In addition, a robustness test was carried out to assess the impact of market liquidity on stock market returns using Nigerian monthly data (January 2000 - June 2014) on stock market equities to develop a spectra of indicative measures for gauging the liquidity of the market.

Following this introduction, Section 2 provides a review of related empirical and theoretical literature, while Section 3 reviews stylised facts of the Nigerian capital market before, during and after the global financial crisis. Section 4 discusses the methodological framework adopted for the study, while Section 5 gives the empirical presentation and analysis. Section 6 concludes the study.

II.   Literature Review

There has been extensive research on the link between economic growth and capital markets. Levine (1991) suggested that stock markets help economic agents manage liquidity and productivity risk by providing a diverse portfolio of investment opportunities. Such inflow directly enhance the productivity of firms and feed through to economic growth. Similarly, King and Levine (1993) and Bensivenga et. al., (1996) provided further evidence to support a positive relationship between financial markets and economic growth. The relevance of a deep financial market is in its ability to absorb capital flows and apply them in an efficient and non-distortionary manner. This is observed in well-developed capital markets where liquidity inflow are efficiently dispersed across the financial system. In addition, a developed financial market gives the central bank a broader range of tools for monetary policy. Rojas-Suarez (2011) furthermore identified four connected and complementary pillars as the prerequisites for capital market efficiency in illiquid and under developed emerging market economies. He evinced that failure in not strengthening any of the pillars would weaken the others.

Capital market liquidity is a complex concept and measuring it is even more multifaceted. According to Ivanovic (1997), capital market liquidity can be defined as the ability of the market to continuously transform one asset into another. Bogdan et. al., (2012) suggested that capital market liquidity is the ability to convert stocks into cash and vice versa without affecting the price or with minimal impact on price. Amihud et. al., (2005) on the other hand defined it as the ease of trading a security that just makes it one of the key elements on which the investor will decide whether or not to invest. Another important concept associated with liquidity is the quick execution of orders and ability to convert assets to cash at the lowest cost. Selling an illiquid stock quickly can be difficult or even impossible without accepting the lower price.

II.1   Measuring Liquidity of the Capital Market

Sarr and Lybek (2002) classified the measures of liquidity into four categories: transaction cost measures which involve costs associated with trading financial

assets as well as secondary markets trading frictions; high transaction costs reduce the demand for trade and therefore, the number of potentially active participants in a market. On the contrary, when transaction costs are low, a phenomenon usually associated with more liquid markets, transactions are more likely to take place around the equilibrium price of an asset leading to a more unified and deep market. The bid-ask spread is sometimes calculated using weighted averages of actually executed trades over time. In addition, the trade size at which a dealer is committed to trade at quoted prices is also a useful indicator. Per volume-based, measures that distinguish liquid markets by the volume of transactions compared with the price variability, primarily to measure breadth and depth: Markets considered deep also incorporate breadth due to the fact that large orders can be broken into small orders to lessen the effect on transaction prices.

Traditionally, trading volume is used to capture the presence of market transactions and participants. The trading volume metric is made more meaningful by relating it to the outstanding volume of the asset being considered. The turnover rate is used to give an indication of the number of times the outstanding volume of the asset changes hands. Per equilibrium price based, measures to mainly measure resilience by capturing orderly movements toward the equilibrium price. For example, the Market-Efficiency Coefficient (MEC) makes use of the fact that in liquid markets, price movements are fluid even when new information influences equilibrium prices. In addition to the MEC, vector auto regression econometric techniques like impulse response functions are also used to uncover the fact that the price discovery process is timelier and complete in liquid markets. Per Market-impact, measures which examine liquidity from other factors to explain price movements. A distinction is made in the equity markets between systematic and unsystematic risk based on the Capital Asset Pricing Model (CAPM) which provides a platform for extracting market information. It is worth mentioning that no solitary metric measures market tightness, immediacy, depth, breadth and resiliency. Consequently, their measurements require the adoption of different measures.

II.2   Empirical Literature

Engle and Lange (1997) examined a novel measure, VNET for measuring financial market depth. The measure estimated the excess volume of initiated transactions, buys or sells, associated with a price movement. It defined an illiquid market as one in which an increase in price was accompanied by a negligible excess of buyers, while a market with depth was one where given the same price change, would precipitate a large excess of buyers. Using TORQ data, they found that the relationship between market depth and past volumes was positive but less than proportionate and that a negative relationship existed between depth and number of transactions. The findings suggested that in the long-run, high volumes are associated with reduced market liquidity and an inflow of well- informed market participants.

Sarr and Lybek (2002) provided a survey of indicators for estimating liquidity conditions in financial markets. Their findings suggested that in the absence of a

generally accepted measure of market liquidity, a number of measures must be employed. This is to take into consideration, market-specific factors and idiosyncrasies.

Gabrielson, Marzo and Zagaglia (2011) examined definitions of market liquidity that highlighted the importance of the bid-ask spread as well as estimates of its components. Their findings highlighted the importance of intra-daily measures of liquidity in capturing a market's core features including the arrival of new information to trading parties. Hearn (2009) used different liquidity measures and firm-level bid-ask quoted prices for six-African markets and two European markets, to estimate liquidity in major African equity markets. His evidence suggested that using either the per centage zero daily returns or the Liu (2006) volume-based construct would help investors to model market liquidity and premiums as well as exploit opportunities in Africa's diverse emerging markets.

Batten and Vinh (2010) investigated the nexus between stock returns and liquidity in the Vietnam stock market with the use of firm-level data. The study employed a data set obtained from listed firms in the Ho Chi Minh City Stock Exchange. The result showed that liquidity positively affected stock returns, unlike the previous studies which indicated that liquidity had a negative relationship with stock returns because in that case, investors would normally require a premium as a tradeoff or compensation for illiquid stocks in developed markets. Baker and Stein (2004) adopted a model to clarify why increases in market liquidity would forecast a lower successive return in both the aggregate and firm-level data. The authors concluded that share turnover and aggregate measures of equity issuance were closely related, but in multiple regression, both of them have the power to incrementally explained or forecast future equal-weighted market returns.

Amihud and Mendelson (1991) in their study of the relationship between liquidity and asset price, found that liquidity was a very important factor in determining asset pricing. They further explained that for equities and bonds, the lower the liquidity of an asset, the higher the returns. This did not indicate that investors were more comfortable holding assets with lowered liquidity level, the higher cost of transaction may translate to a very low return gains. Only those investors holding assets on a very long-term basis would benefit from holding low-liquidity assets.

Datar (2000) studied the measurement of stock market liquidity stating the relative merit of different measures of market liquidity while proposing the elasticity of trading as an alternate measure which he believed was easy to compute and possess superior information content. The elasticity of trading measures the volume of trading in relation to changes in prices. He estimated the coefficient of elasticity of trading to analyse the liquidity of equity trading at India's National Stock Exchange.

Chordia et. al., (2003) explored the movement of liquidity in both equities and bond market for 1800 trading days. Their results revealed that liquidity was highly driven by volatility of the returns, since innovation experienced in bond and

equities market liquidity and volatilities had proven to be very significantly correlated. Their results also showed that an expansionary monetary policy will increase the equities' market liquidity, especially during the period of financial crisis. However, an unexpected increase or decrease in the federal funds rate will translate to a decrease or increase in liquidity and increase (decrease) in equities and bond volatility.

Muranaga and Ohsawa (1997) in studying the dynamics of market liquidity in Tokyo Stock Exchange (TSE) used the tick-by-tick data of individual stock listed on the stock market. They examined the three indicators of market liquidity using the three Kyle's concepts of market liquidity, which are depth, tightness and resilience. They further examined the relationship between each of the three indicators of market liquidity, using a cross sectional data. Their findings revealed that three indicators and trade frequency were positively correlated.
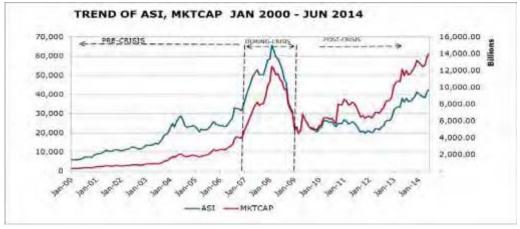
III.   Stylised facts of the Nigerian Capital Market

This section presents stylised facts depicting developments in the Nigerian capital market before, during and after the 2007 global financial crisis (Figures 3.1 and 3.2). The Nigeria capital market has enjoyed a decade of unprecedented growth. Total market capitalisation grew by over 90.0 per cent in the last decade. However, from its high in March 2008, market capitalisation went into a spiraling fall, decreasing by 45.8 per cent at end-2008.

III.1   Developments Prior to the Global Financial Crises
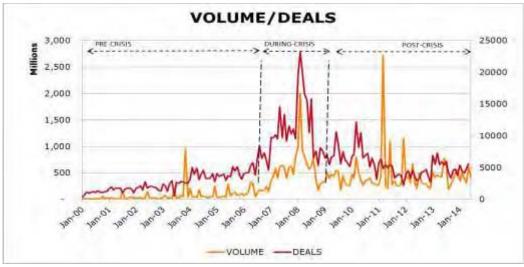
The Nigerian capital market has been largely equity-driven. The financial reforms in Nigeria, especially in the banking sector deepened the financial system and created public awareness, leading to significantly greater involvement in the activities of the capital market. Before 2008, the market grew unprecedentedly for about a decade. MC rose by 318.3 per cent and the ASI increased by 161.6 per cent, to 63,016.6 in March 2008 from 24,085.8 in December 2005 (NSE 2008). Stock prices appreciated although independently to market fundamentals. The boom led to a rush on investment by all categories of investors. Commercial banks extended loans to customers to invest in stocks.

Figure 3.1: Trend in All Share Index and Market Capitalisation

Source: Nigerian Stock Exchange

Figure 3.2: Trend in Volume Traded and Number of Deals

Source: Nigerian Stock Exchange

III.2   Developments during the Crisis

From its foundation in the banking sector, the financial crisis that commenced in the United States in mid-2007, spread to other countries and sectors of the financial system. It quickly spread to Europe and Asia. The emerging and developing economies were not spared. The stock market was the transmission of the 2007/2008 global financial crisis (Sere-Ejembi, 2008). However, the impact of the crisis manifested in Nigeria towards 2008 as market indicators witnessed spiral negative performance.

Adamu (2009) identified the causes of the crisis as the boom and bust of the US subprime mortgage, lagging supervision, increasing unregulated financial products, new financial architecture, unsupervised and highly risky loans, activities of credit rating agencies, lapses in credit rating and poor government policies. Though, there are debates that the crisis was not devoid of warnings, given the abnormal trend of the United States mortgage boom and speed of financial engineering that created unregulated products. The practice was allowed to flourish because of the thinking of neo-liberal economists, that any form of tough guidelines by the Government might constrain innovations and growth of small businesses in the US and Europe. This influenced the creation of products that triggered the crisis like collateralised debt obligation, credit default swaps and asset securitisation.

The crisis resulted in the failure of globally systemic important financial institutions and small and medium enterprises. To protect the global financial system from the effects of the crisis, governments across different counties, irrespective of their economic ideology had to bailout the financial system, in the form of tier one and/or tier two capitals.

Despite the general perception that the Nigerian financial system was insulated from crisis because of its resilient informal sector and less integration to the global financial crisis, the visible signs of the crisis in Nigeria manifested in the capital market (CBN, 2009). For instance, market capitalisation witnessed steady downward trend and the prices of equities crumbled by 50 per cent, as foreign investors exited the market to service their obligations in their home countries. The huge capital reversal and liquidation of portfolio investment also affected the Nigerian foreign exchange market. This led to increased demand pressure for foreign exchange, consequently leading to a drastic reduction in Nigerian foreign reserve. The impact of the crisis spread across various sectors of the Nigerian economy. First, the major stock market indicators such as market capitalisation, all share index and volume of transaction experienced a continuous slide. Second, there was liquidity and capital adequacy crisis in the banking system due to excessive exposure to the capital and oil markets. This resulted in credit tightening as foreign banks lowered credit lines to Nigerian banks, which led to the erosion of bank profitability. Third, is the continuous decline in government revenue because of slide in crude oil prices as a result of slow-down in economic activities. The contraction experienced in the fiscal sector worsened the crowding-out effect of the real sector.

III.3   Developments in the Post Crisis

Aside the global financial crisis, one other major factor that led to the capital market burst is the astronomical level of unethical practices in the market. Eboh and Ogbu (2010) captured it thus "buffeted by share price manipulations, insider dealings, and other unethical conduct and leadership crisis at the council level" and that "the market witnessed one of the worst bearish runs in its history" when "stock prices plummeted to an all-time low - from ₦12 trillion in 2009, to ₦5.5 trillion in 2010".

These unethical practices are broadly classified into two. First is malpractice by market operators. This takes the forms of: failure of receiving bankers to pay proceeds of offer to company issuers; failure of receiving agents to submit subscriber application forms and money to the registrar; issuing house and receiving banker placing proceeds of offer on call to make financial gains, colluding to falsify company issuer financial statement; trading with clients' funds; non-delivery of proceeds of sale to transferor; excessive charges of fees or commission, off the Exchange floor trading; insider trading abuse; utilisation of unit trust fund for promoters' operations, among others. Second is malpractice by company issuers. This takes the forms of non-issuance of certificate to investors when applicable; non-payment of declared dividends; price manipulation through indirect trading in its own securities (i.e. buying and selling) and causing changes in price; failure to redeem a debt security; restriction on the transfer of shares of a public listed company; insider trading abuses by control persons in the companies; falsification of company's issuers' financial statement; on-payment of parties to its offer, among others.

Thus, most post crisis developments were targeted at promoting market transparency and restoration of investor confidence. First, the Securities and Exchange Commission (SEC) in a bid to revamp the capital market set-up a committee to revise the 2011 Code of Best Practices for Quoted Companies in Nigeria. Over the next five years, SEC proposed to develop a credible market with five different products including: fixed income; equities; exchange traded funds (ETFs); options; and financial futures. The products are expected to deepen the liquidity of the Nigerian capital market, by increasing market capitalisation to US$1trillion by 2016. There was also a proposal to use explicit and/or implicit regulation to encourage multinationals such as firms in the communication and oil sectors of the economy to get listed on the Stock Exchange.

In an effort to restore investor confidence, about 260 operators in the capital market were charged to Investments and Securities Tribunal (IST) by the Security and Exchange Commission for allegedly violating the ethics and guidelines. SEC accused the market operators of allegedly violating the Investments and Securities Act (ISA), 2007 by engaging in insider dealing, using unpublished price for securities transactions. Consequently, SEC stated that the prosecution of those market operators was to restore the Nigerian capital market integrity as well as investor confidence. It further argued that the suit was initiated against market operators who had engaged in insider trading by using unpublished price in the purchase or sale of securities. Similarly, SEC and the NSE leadership were restructured. For instance, the Director General of both institutions and the President of the Nigerian Stock Exchange were changed.

In the same vein, the Investor Protection Fund scheme was revisited. It would be recalled that the Investor Protection Fund was guaranteed by the World Bank to stimulate investor confidence in the stock market.

IV.   Methodology

Following the study by Sarr and Lybek (2002) and Amihud (2002), we tested for market liquidity using some key traditional measures. The methodology relied on the use of non-Econometric measures of liquidity. Three of these common measures computed were the turnover ratio, variance ratio (Market efficiency coefficient) and illiquidity index. Although, the study advanced other common measures in the empirical literature, data challenges, forced us to rely on these measures. In addition, a robustness test was carried out to assess the impact of market liquidity on stock market returns using econometric methods, specifically, Vector Autoregression. The purpose is to show the effect of liquidity on stock market returns.

IV.1   Data

The estimation used monthly data sourced from the Central Bank of Nigeria and Nigeria Stock Market, respectively. The period spanned from 2000:M1 to 2014:M6. The trend showed a rising ASI and market capitalisation from 2000 to 2008, but declined due to the global financial crisis and remained low from 2009 to 2010. Both variables began to rebound beginning from 2010, a trend that has continued until June 2014. The turnover ratio and value traded on the other hand remained within normal limits as they showed less volatility.
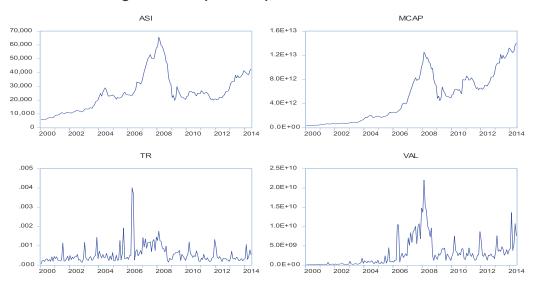
Figure 4.1: Graphical Representation of the Data.

The All share index recorded mild swings in 2007 and larger swings from 2007 to 2009. The swings had calmer since 2010 due to domestic efforts to cushion the impact of the crisis on the economy. As can be observed, the swings observed during the crisis period, began to fizzle out from 2011 to June 2014. The trends and summary statistics for the ALSI, ASI returns, turnover ratio and value traded are presented below.

Table 4.1: Descriptive Statistics

	ASI	MCAP	TR	VAL
Mean	25537.19	4.98E+12	0.000553	3.01E+09
Median	23528.29	4.90E+12	0.000398	1.98E+09
Maximum	65652.38	1.40E+13	0.004010	2.20E+10
Minimum	5752.900	3.21E+11	5.40E-05	17219533
Std. Dev.	13253.98	3.99E+12	0.000499	3.64E+09
Skewness	0.852253	0.484029	3.831886	2.097669
Kurtosis	3.429337	2.026831	23.77593	8.187736
Jarque-Bera	22.40013	13.66041	3555.201	322.7227
Probability	0.000014	0.001081	0.000000	0.000000
Sum	4443472.	8.67E+14	0.096261	5.23E+11
Sum Sq. Dev.	3.04E+10	2.75E+27	4.31E-05	2.29E+21
Observations	174	174	174	174

Despite the seeming challenges during this period, the Nigerian stock exchange All Share Index and market capitalisation, which reached a height of 63,016.56 and 12,503.19 points, respectively, in 2008, are yet to attain the pre-crisis levels. The mean for the ASI at 25,537.19 was less than the psychological threshold of 40,000 points. The high standard deviation of ASI at 13,253.98 suggested the presence of high volatility. The Jarque-Bera statistics suggested the rejection of the normality assumption, which was consistent with the characteristics of a financial time series.

IV.2   Measures of Capital Market Liquidity and Efficiency

Among the various measures of liquidity in the literature, the study considered three of these, which were suitable in the Nigerian context. For example the variance ratio (marginal efficiency coefficient) provided by Gabrielsen, Marzo and Zagaglia (2007), the turnover ratio (ratio of volume of share traded to market capitalisation) suggested by Demirguc-Kunt and Levine (1996) and King and Levine (1993) as well as the explicit illiquidity measure suggested by Amihud (2002) were used in the study.

IV.2.1 The Variance Ratio

The variance ratio also known as the Market Efficiency Coefficiency (MEC), measures the degree of execution cost on price volatility over short horizons. It compared the long-term variance with the short-term variance

$$VR = \frac{var\ (ASIr^L)}{T*var\ (ASIr^S)} \tag{1}$$

Where VR is the variance ratio, var(ASIrL) define the long-term variance, while var(ASIrS) is the short-term variance of asset return, and T indicates the sub-periods within the long period. V Ri < 1, suggests illiquid/inefficient markets. This implies the existence of a discrepancy between the short and long-term equilibrium returns.

There are strong arguments in the literature that variance ratio can be computed over arbitrary time intervals in view of the fact that there are different informational content in the analysis of short-term and long-term variance. Gabrielson et. al., (2011) argued "that a series of short-term transactions tend to impact on the market price in such manner that is more significant than a set of transactions measured over a longer period". Thus, even though it is pertinent that this index cannot fully describe all the causes of liquidity cost, some of its identified shortcomings include its sensitivity to the time interval chosen for its calculation as it could generate contrasting results when different periods are chosen. A second shortcoming of this method is its assumption of equilibrium prices that are non-evident.

IV.2.2 Turnover Ratio

Demirguc-Kunt and Levine (1996) and King and Levine (1993) used the turnover ratio to measure the liquidity of the stock market in term of market efficiency. Specifically, the measure estimated the relationship between values of shares traded and total market capitalisation. A market is liquid if the cumulative value of the turnover ratio is 1 or close to the value of 1.

$$TR = \frac{VALTrd}{MAKCAP} \tag{2}$$

Where TR is turnover ratio, VALTrd is the value of share traded and MAKCAP is market capitalisation. This measures the percentage of total active shares.

IV.2.3 Illiquidity Measure

This is a measure of the average of daily impact over a given period of time. In the manner of Amihud (2002), the study adopted the method to provide a rough measure of the price impact on market liquidity. A significant aspect of this measure is the fact that, the volume of shares traded is central in the analysis. The illiquidity measure is derived thus:

$$ILLIQ^T = \frac{1}{DT}\Sigma\frac{ASI}{VT} \tag{3}$$

Where ILLIQ^t is the measure of market illiquidity, D $_t$ represents the number of days in the sample period, ASI$_t$ represents the return on day t of year t and V$_t$ denotes the daily volume. Thus, we adopt this measure using monthly data. The main benefit of this index is its reliability on generally available data. It is thus, suitable for computation in those markets where sophisticated measures like the bid-ask

spreads are not reported. Similar to the other two measures discussed above, ratios less than 1 indicated that the market is illiquid.

IV.3   Econometric Estimation

The aim of the econometric estimation is in three folds: first, evaluate the long-run relationship between stock market return and liquidity while controlling for real exchange rate. Second, examine the dynamic causal relationship between stock market returns and liquidity and third, computed the generalised impulse response function and variance decomposition to examine how these variables respond to shocks by other variables in the VAR framework.

This paper adopted the vector autoregression (VAR) framework of Johansen (1988, 1992), using the maximum likelihood procedure. The framework consists of four variables: All share index (ASIr) and turnover ratio (TR); we, however, control for global financial crisis using a dummy variable and real exchange rates. The decision to control for real exchange rate is because of the high degree of openness in the Nigerian capital market.

On the causality tests, the study applied two types of tests: the Granger non-causality test and the long-run causality test. The study carried out a Wald test to evaluate the short-run dynamics, while long-run causality between stock returns and liquidity was examined using the weak exogeneity test of the likelihood ratio test with χ^2 distribution. Apart from using VAR to test for the long-run relationship through theco -integration test. It has also been found to be very effective in forecasting, especially using the impulse response function and variance decomposition of forecast-error.

V.   Discussion of Results
V.1   Computation of Measures of Liquidity

The result in Table 5.1 indicated that all the measures of liquidity that were computed for the Nigerian capital market showed that the market is illiquid. The implications of the results are three folds depending on which measure we are looking at. For the variance ratio, both the composite and the disaggregated ratios imply that short-term returns are higher than long-term returns. Similarly, the results from the explicit illiquidity ratio and the turnover ratio suggest a weak link between volume and price and that less than oneper cent of the total shares in the market are actively, being traded, respectively.

Table 5.1   Market Liquidity Coefficient

Measure	Formula	Results				Market Condition	Remark
		Pre-Crisis	During Crisis	Post-Crisis	Composite		
Variance ratio (MEC)	$VR = \dfrac{var\left(ASIr^{L}\right)}{T*var\left(ASIr^{S}\right)}$	0.0168	0.0570	0.0290	0.0205	Illiquid	Short-term return > long-term return
Illiquidity ratio	$ILLIQ^{T} = \dfrac{1}{DT}\sum^{L}\dfrac{ASI}{VT}$	0.0004	0.0001	0.0001	0.0002	Illiquid	Weak link between volume and price
Turnover ratio	$TR = \dfrac{VALTrd}{MAKCAP}$	0.0005	0.0008	0.0004	0.0006	Illiquid	< 1 per cent total shares are active

Source: Authors' Computation

V.2   Analysis of the Robustness of the Liquidity Measures

We began the analysis using the traditional unit root test. This was followed by a test of long-run relationship, using vector autoregression technique of Johansen (1988) and Johansen and Juselius (1992). The Granger non-causality and the weak (long-run) exogeniety tests were also performed. A diagnostic test to ascertain the stability of the VAR model was conducted using the inverse root of AR characteristic polynomial. Finally, impulse response function and variance decomposition were estimated.

V.2.1   Unit root test

To determine the order of integration and ensure the stationarity of the variables used, the paper performed two shades of the unit root test: the Augmented Dickey-Fuller (ADF) and the Phillip-Peron (PP). Evidence from Table 5.2 indicated that all the series (TR, ASIR LVAL, LMCAP and LEXCH) were non-stationary at level. However, they became stationary at the first difference.

Table 5.2: Unit Root Test

VARIABLE	LEVEL ADF	First Difference	LEVEL PP	First Difference	Integration
TR	0.728	-10.29***	1.401	-30.11***	I(1)
ASIR	-1.867	-12.48***	-1.934	-12.47***	I(1)
LVAL	-2.122	-15.01***	-1.582	-26.25***	I(1)
LMCAP	-1.657	-11.11***	-1.555	-11.11***	I(1)
LEXCH	-1.855	-8.829***	-1.902	-8.694***	I(1)

Source: Authors' Computation
*** implies 1 per cent level of significance. Critical value at 1 per cent level of significance was -3.468.

V.2.2   Johansen co-integration test

The results for the co-integration are presented in Table 5.3 and evidence from the result suggested the presence of two co-integrating vectors both from the trace and maximum eigenvalue statistics. The lag order selection used for this model included sequential modified test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC). Evidence from these lag selection suggested the lag of order 3. The result of the Lagrange Multiplier (LM) test statistics at lag 3 indicated no serial correlation in residuals, (0.2570).

Table 5.3: VAR= (ASIR, TR, LEXCH) = lag (3)

Null	Alternative	λ Trace	95 per cent critical value	λ max	95 per cent critical value
r = 0	r $\geq$ 1	74.714	29.797***	50.149	21.131***
r $\leq$ 1	r $\geq$ 2	24.566	15.494***	22.956	14.264***
r $\leq$ 2	r $\geq$ 3	1.6095	3.8414	1.6095	3.8414

r indicates the number of co-integrating vector. (***) indicates statistical significance at 1 per cent levels

V.2.3   Causality tests

Engle and Granger (1987) explained that once the variables of the same integration I(1) and a long-run relationship has been established, then it is necessary to add an error correction mechanism to the dynamic model. This easily measures the speed of adjustment or level of deviation from the long-run equilibrium. In addition, the short-run non-causality and the weak exogeneity test were performed.

The result of the short-run causality is presented in Table 5.4 and evidence from the result indicated that exchange rate Granger causes stock market return, while when Turnover ratio (TR) served as dependent variable. There was no feedback effect from stock market return to exchange rate. Also, there was no evidence of causality between turnover ratio and exchange rate when stock return (ASIR) was used as dependent variable. However, when exchange rate was used as dependent variable, evidence suggested that stock market return Granger caused turnover ratio and it was statistically significant at one per cent level.

Evidence from the long-run causality test in Table 5.5, showed a similar result as evidenced in the unidirectional causality from stock market returns and turnover ratio with no feedback effect from the turnover ratio. The result also suggested the existence of unidirectional causality from exchange rate to turnover ratio. Meanwhile, there was a clear evidence of bidirectional causality between exchange rate and stock market returns in the long-run.

Table 5.4:   Granger Non-causality Test

Dependent Variable: TR	Chi square	P Value
ASIR	1.637	0.651
LEXCH	10.900	0.0123**
Dependent Variable: ASIR		
TR	0.3464	0.9511
LEXCH	2.145	0.5427
Dependent Variable: LEXCH		
TR	4.286	0.2322
ASIR	16.883	0.0007***

*** indicate 1 per cent level of significance

Table 5.5: Long-run Causality (Weak Exogeneity) Test

Hypothesis	
TR: (Ho: α_{11} =0)	Chi-square(1): 0.0496 Probability: 0.824
ASIR: (Ho: α_{21} =0)	Chi-square(1): 24.411 Probability: 0.00001***
LEXCH: (Ho: α_{31} =0)	Chi-square(1): 9.3967 Probability: 0.00217**
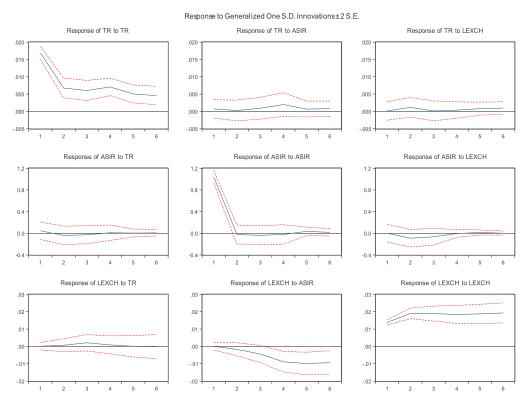
(***) and (**) indicate level of significance at 1 per cent and 5 per cent respectively.

V.2.4   Impulse Response Function and Variance Decomposition

Figure 5.1 presents the generalised impulse response function and evidence from the figure indicated a positive marginal return was observed in the first month following one standard deviation shock from market returns (ASIR) to market liquidity (TR). The shock remained mild during the second and third months and thereafter peaked in the fourth month before the effects declined, but remained positive for the remaining period. On the converse, a positive marginal return was observed in the first month following one standard deviation shock from market liquidity (TR) to market returns (ASIR). It, however, turned negative between the second and fourth month before returning to a steady state for the remaining period. From the above, it can thus, be inferred that the response of market liquidity to market returns is stronger than the response of market returns to market liquidity. The result is consistent with the behaviour of an illiquid market as investors are interested in the equity market when there are opportunities for higher returns.

Figure 5.1: The Impulse Response Function

Response to Generalized One S.D. Innovations ± 2 S.E.

The impulse response from one standard deviation from exchange rate (EXR) to market returns (ASIR) was negative up to the forth month after which it returned to the steady state for the remaining period. This means that exchange rate instability could negatively affect the fortunes of the market as available data also indicated that investment in equities constitutes a major chunk of foreign portfolio investments. Also, a shock from market returns to exchange rate was negative for the entire period. This showed that investors, particularly foreign investors are likely to pull out of the market in the face of lower returns in the market thereby putting further pressure on the exchange rate. The result from both estimates are indeed consistent with the outcome our Granger causality test which suggested bi-directional causality. The impulse response from a shock from turnover ratio (TR) to exchange rate (EXR) was zero in the first month, but slightly turned positive from the second month to the fourth month before returning to the steady state for the remaining period. This is consistent with our a priori expectation. On the other hand, a shock form exchange rate (EXR) to market liquidity (TR) was positive and mild in the entire period even though there was an episode in the third period when it reverted to a steady state.

review period. On the assumption that the Nigerian banking system was highly liquid, this finding suggests that, the banking sector and the stock market compete with each other as vehicles for financing investment.

The result of the short-run causality indicated that when Turnover ratio (TR) served as dependent variable, exchange rate Granger causes stock market return. However, there is no feedback effect from stock market return to exchange rate. In addition, there was no evidence of causality between turnover ratio and exchange rate when asset price return (ASIR) was used as dependent variable. However, when exchange rate was used as dependent variable, evidence suggested that stock market return Granger caused turnover ratio and this was statistically significant at 1.0 per cent. The long-run causality showed a similar result as evidenced in the unidirectional causality from stock market returns and turnover ratio with no feedback effect from the turnover ratio. The result also suggested the existence of unidirectional causality from exchange rate to turnover ratio. However, there is a clear evidence of bidirectional causality between exchange rate and stock market returns in the long-run.

The generalised impulse response function deduced from the VAR estimation, indicated that a positive marginal return was observed following a shock from asset price returns (ASIR) to market liquidity (TR). A positive marginal return was also observed in the first month following a shock from market liquidity (TR) to asset price returns (ASIR) which become zero after the first month and turned negative between the second and fourth month. We thus, inferred that response of market liquidity to asset price returns is stronger than the response of asset price returns to market liquidity. The result is consistent with the behaviour of an illiquid market as investors are more interested in the equity market when there are opportunities for higher returns.

The impulse response from a shock from exchange rate (EXR) to asset price returns (ASIR) was negative. This suggested that exchange rate instability could negatively affect the fortunes of the market as available data also indicated that investment in equities constituted a major chunk of foreign portfolio investments. Similarly, a shock from asset price returns to exchange rate was also negative, implying that, investors, particularly foreign investors were likely to pull out of the market in the face of lower returns on their investments, thus, putting further pressure on the exchange rate. This result from both scenarios were indeed consistent with the outcome our Granger causality test which suggested bi-directional causality in the long-run.

The findings also suggested that the dummy variable for the global financial crisis was significant in the model and had effects on asset price returns. For the asset price returns (ASIR), it was found that market liquidity influenced asset price return significantly at lag 3 (after three months). Although, the model had a general goodness of fit, TR and EXR were not statistically significant at their individual probability levels. Only exchange rate policy and the dummy for financial systems stability were found to be significant, or were critical to enhancing asset price

returns. The implication for the Nigerian capital market is that while market liquidity can influence asset prices in the short-run, financial system instability (DSB) could be transmitted to asset prices.

For most policy makers, particularly the Central Bank, the imperative for a well-developed capital market and the associated benefits is never in doubt. The central banks would be able to manage capital flows more efficiently if the financial market is well developed. This will reduce the central bank's intervention in the foreign exchange market and enhance effective monetary policy. It could as well complement the management of monetary policy and capital flows when market fundamentals do not encourage continuous capital flows or forces a reversal or sudden stop.

The capital market provides an avenue of sourcing for fund from different channels. The Market impacts positively on economic development due to its superior capacity of sourcing fund on long-term basis through the domestic and external sources. For Nigeria, financing through long-term basis has remained a major task towards the enhancement of competitiveness of the economy. It is even a more serious issue now in view of the recently rebased gross domestic product (GDP). Already, deposit money banks in Nigeria are unable to fulfill these roles because of prudential requirements like the recent 75 per cent CRR on public sector deposits and other capital requirements. The regulators should therefore, further enhance the capacity of the Nigerian capital market to provide the much needed long--term investment, by pursuing appropriate measures with respect to removing any barriers to market liquidity and ensuring access to capital markets for all the big players in the economy. In addition, developing the banking sector can promote stock market development as demonstrated by the experiences of many East Asian countries (Yartey, 2008). There is also the need to encourage market diversification through the development of new products and in addition, enforcing best standard practice in order to attract the much needed foreign capital flows into the market.

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Capital Flows to Nigeria: A Structural VAR Analysis

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Abstract

One of the utmost desire of every developing economy nurturing the aspiration of joining the league of developed nations is to pursue a course of plan that would makes it realisable. Undeniably, different channels have been identified in the economic literature as possible ways through which growth can be achieved. Attraction of foreign capital inflows has been identified as possible channel through which sustainable growth can be easily achieved. To this end, the paper empirically unravels both the pull and push factors in determining foreign capital flows, with special reference to the Nigerian economy. An empirically tractable structural VAR model is developed, and variance decomposition and impulse response analyses are used to investigate the temporal dynamic effects of shocks to both the pull and push factors on different components of foreign capital flows namely: overseas development assistance (ODA), foreign direct investment (FDI) and remittance (REM) flows. Prominently, the significant roles of shocks to domestic productivity, domestic real interest rate and foreign interest rate with their associated and magnifying impacts consistently featured across the various components as major determining factors. However, on the policy front, the paper emphasises the concomitant need for policy makers to design domestic policy that account for both external and internal shocks to real variables of the economy.

Keywords: Foreign capital flows, Pull and Push factors, Structural Vector Autoregressive Models.

JEL Classification Numbers: E44, F3

I.   Introduction

Anumber of countries across the world have taken steps to encourage cross border[1] investments or foreign capital flows as it were, due largely to the supposed benefits[2] it confers on the recipient countries. It is also perceived as one of the key sources of funds for emerging markets and as such it is considered important to sustained economic development. Thus, it is not surprising that the inflows of foreign capital to developing countries and emerging market economies have surged considerably from the beginning of the 1990s. Developing countries in Asia and Latin America received about USD670 billion of foreign

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[1] Cross-border capital flows have skyrocketed in the last decades (see. Lane and Milesi-Ferretti, 2007).

[2] It brings about increased efficiency in the allocation of global resources, transfer of technology and management skills. Some of the other advantages of foreign investment are: risk sharing with the rest of the world, greater external market discipline on macroeconomic policy, broader access to export markets through foreign partners, training and broader exposure of national staff, greater liquidity to meet domestic financing needs, broadening and deepening of national capital markets, and improvement of financial sector skills (see World Bank, 1995 for more detailed narratives).

capital in five years from 1990 to 1994, as measured by the total balance on the capital accounts of these countries (Calvo, Leiderman and Reinhart, 1994a). However, Sub-Saharan Africa received a comparatively smaller share of the increased global capital flows. For instance, total foreign private capital inflow and official aid inflow to sub-Saharan Africa amounted to USD126 billion and accounted for merely 2.0 per cent of total global capital inflows in 2007 (Brafu-Insaidoo and Biekpe, 2014). This is surprising as various incentives as well as policy measures that were adopted towards attracting these inflows seem not to be yielding the expected results. Such measures include but not limited to the financial liberalisation policy stance–one of the key components of Structural Adjustment Programmes adopted by countries within the sub-region at different dates in the 1980s, accession to different regional groupings and other physical measures that are aimed at attracting foreign capital flows. In spite of these meagre inflows, policy targets aimed at attracting foreign capital flows continues to gain more currency in the region owing to the low income levels and domestic savings (Asiedu, 2002). The pertinent question is: what are the key factors determining the attraction of foreign capital inflows?.

Specifically, explanations to the above question will be provided within the context of the Nigerian economy. The choice of the country stems from the following reasons: (i) Nigeria, just like every other developing nation, aspires to join the league of high growth achievers thus, it is in dire need of adequate resources to execute this; (ii) in no small measure, the country is blessed with abundant natural and human resources[3] among the countries in the sub-Saharan African (SSA) region. In spite of these enormous endowments, yawning gap still exist to date between the country's developmental needs and the available resources; (iii) all efforts directed at attracting foreign capital flows usually in forms of granting of tax holidays and subsidies, reduction in the rate of taxes, exemptions from import duties, accelerated depreciation allowances as well as deliberate compromise and modification of environmental standards are not producing any appreciable and desired results, and (iv) the country requires foreign capital flows to augment domestic savings in order to spur investment and growth. On the basis of the foregoing, understanding the determinants of foreign capital flows is a key policy concern because it may have crucial impacts on Nigeria's level of economic development.

Furthermore, it is pertinent to mention that enormous research efforts have queried and yet continue to inquire about what constitutes the key determinants of foreign capital flows, mostly from the advanced industrialised economies to emerging and developing countries' counterparts. Unarguably, the pendulum of

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[3] It is the most populous country in the sub-region with an estimated population of over 180 million.

the emerging divergent views, however, has always swung between the push versus pull factors. While the former, relates to economic developments in industrial countries that influence the supply of capital flows to developing countries and are thus exogenous or external in nature, the latter, on the other hand, are country-specific endogenous, or internal, and relate to economic developments in recipient countries that influence the demand for capital flows. What is, however, unsettled is the suggestion of the dominance of either push or pull factors in driving foreign capital flows to developing countries. For quite some time, the central question in the literature has been that of establishing the relative importance of push versus pull factors, that is the extent to which capital flows are a function of the determinants in industrial countries vis-à-vis the country-specific determinants of the developing countries hosting the investment (Chuhan et. al., 1998; Carlson and Hernandez, 2002). For instance Calvo et al. (1992) Harvey (1994) and Fernandez-Arias (1996) were able to establish the important role of push over pull factors in their respective studies. So also were studies by Bohn and Tesar (1996), World Bank (1997) and Hernandez et al. (2001) that argued that the surge in capital inflows is mostly the result of push factors. By and large, the controversies over the supremacy of push over pull factors and vice versa are largely contentious and somewhat unresolved.

In the light of the foregoing, the main objective of the paper is to examine the determinants of capital flows to Nigeria. Thus, the paper contributes to the existing literature in two major ways. First, we test for the determinants of different components of foreign capital flows namely: foreign direct investment, overseas development assistance (ODA) and remittance (REM). The resulting outcome will assist in designing appropriate policy measures that will be targeted at attracting foreign capital flows instead of adopting and applying general policy framework to more specific problems. Second, both the global "push" factors for capital flows and the country-specific "pull" factors are well taken care of in a country-specific case like Nigeria instead of the usual cross-sectional approach of the previous studies. The study will serve as an addition to the stock of country-specific studies on the determinants of foreign capital flows at least for the region.

The remaining sections of the paper are as follows. Section 2 conducts a terse review of previous empirical studies on the determinants of foreign capital flows. Section 3 presents the stylised facts about the various components of foreign capital flows into Nigeria. Section 4 describes the data and empirical methodology. Empirical results are reported in section 5, while Section 6 concludes the paper.

II.   Literature Reveiw

This section undertakes a brief conceptual discussion on what capital flows are as well as what the factors that determines it.

II.1 Conceptual Issues

There is no strict definition of capital flows in the international economics literature. Definition and measurement of capital flows can have slight differences among the records of international institutions, such as the World Bank and the IMF, through time. Calvo et. al., (1994a), defines capital flows as the increase in net international indebtedness of a country at a given period of time. Capital flows are calculated as the surplus in the net capital account item of the balance of payments identity. Balance of payments identity indicates that, if errors and omissions are excluded, the capital flows will be equal to the summation of current account deficit and the increase in the net international reserve holdings of the country. With the existence of minor net errors and omissions, it is rational to expect a strong tie between these three items of the BOP identity. The term "net foreign savings, net external financing'' are used synonymously as capital flows in some studies. There is no consistent calculation of this term in IMF's World Economic Outlook (WEO) publications. In addition, there are differences in the IMF's definitions of capital and financial account.

The determinants of capital flows can be divided into two groups: domestic and external factors. Domestic factors are based on the economic environment of the developing country that receives the flow of foreign capital. These factors are the factors that "pull" capital flows, thus called "pull factors", as well. Pull factors are assumed to be under the control of policy makers. External factors are based on the economic environments of the industrial countries and other developing countries, and are beyond the control of domestic policy makers. If favourable, external factors "push" capital flows to the developing countries, and they are known as "push factors", as well.

II.2 Review of Empirical Studies

This section attempts to give apt rendition of various strands of empirical studies that had been conducted on the determinants of foreign capital flows both in the developed and developing nations. For the sake of space, it is not our intention to conduct any comprehensive literature survey on the aforementioned studies but rather justifying a position for undertaking this research. This is tersely pursued in what follows:

Kim and Choi (2013), in their paper analysed the determinants of international capital flows in Korea during 1980-2010. Specifically, they investigated the role of push (external) and pull (internal) factors in determining the magnitude and directions of overall capital flows and their components using a time-series analysis. The regression results showed that external factors, particularly world interest rate, significantly influence overall capital flows in Korea. Among the internal factors, current account had significant and negative effects on capital flows. The estimated coefficients varied in different sub periods. In particular, the role of internal factors decreased over time. They also found that portfolio investment was more sensitive to internal and external economic environments compared with direct investment.

Ahmed and Zlate (2013) examined the determinants of net private capital inflows to emerging market economies using a panel data methodology. These inflows were computed from quarterly balance-of-payments data from 2002:Q1 to 2012:Q2. The main findings were: first, growth and interest rate differentials between Emerging Market Economies (EMEs) and advanced economies and global risk appetite were statistically and economically important determinants of net private capital inflows. Second, there had been significant changes in the behaviour of net inflows from the period before the recent global financial crisis to the post-crisis period, especially for portfolio inflows, partly explained by the greater sensitivity of such flows to interest rate differentials and risk aversion. Third, capital control measures introduced in recent years did appear to have discouraged both total and portfolio inflows. Fourth, in the pre-crisis period, there were some evidence that greater foreign exchange intervention to curb currency appreciation pressures brought more capital inflows down the line, but they cannot identify such an effect in the post-crisis period. Finally, they did not find statistically significant positive effects of unconventional U.S. monetary expansion on total net EME inflows, although there do seem to be a change in composition toward portfolio flows. Even for portfolio flows, U.S. unconventional policy was only one among several important factors.

Byrne and Fiess (2011) also examined international capital flows to emerging and developing countries. Using both Heterogeneous and Homogeneous Panel Data Models, they were able to assess whether commonalities exist, the permanence of shocks to commonalities and their determinants. Also, they considered individual country coherence with global capital flows and measure the extent of co-movements in the volatility of capital flows. Their results showed that there were commonalities in capital inflows, although aggregate or disaggregate capital flows responded differently to shocks. They found that the US long-run real interest rate was an important determinant of global capital flows, and real commodity

prices were relevant but to a lesser extent. They also found a role for human capital in explaining why some countries can successfully ride the wave of financial globalisation.

Culha (2006) also examines the determinants of capital flows into Turkey in the traditional 'push-pull' factors approach using a structural vector auto regression (SVAR) model. The period of analysis span from 1992:01 to 2005:12. The empirical evidence suggests that the relative roles of some of the factors have changed considerably in the post crisis period and pull factors are in general dominant over push factors in determining capital flows into Turkey.

Brana and Lahet (2008) investigate the impacts of both external factors and domestic fundamentals on the evolution of capital inflows with a panel of four Asian countries over the 1990-2007 period. The objective is to test contagion variables. Tests show that both push and pull factors are significant. Push factors as carry trade strategies, global liquidity and contagion factors; seem to be major determinants of capital inflows into Asia.

Jevcak, et. al., (2010), also looked at the capital flows to the new EU Member States from Central and Eastern Europe (NMS10)[4] during the last decade. Firstly, they analysed the role of various types of foreign capital flows – direct investment, portfolio investment, financial derivatives and other types of flows (mainly bank loans) – over time and across countries. Secondly, they explored the determinants of capital flows to the NMS10, distinguishing between factors relating to the external economic and financial environment ("push factors") and factors specific to the recipient NMS ("pull factors"). Using vector autogressive model (VAR), the analysis showed that external determinants had been important in explaining capital flows to the NMS10. In particular, they found a strong role for euro area interest rates, business cycle, and risk sentiment. At the same time, the ability of the NMS10 to attract foreign capital had also been influenced by domestic economic and financial conditions and policies. Risk sentiment appeared to be a robust driver for both the common component of aggregate capital flows to NMS10 and flows to individual countries.

Boschi (2012), documented the determinants of capital flows to Argentina, Brazil and Mexico, assessing the relative importance of domestic and international factors through the estimation of a long-run structural Global VAR model of the world economy. The results showed that in the long-run international factors prevail on domestic factors as determinants of the equilibrium behaviour of Net

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[4] These are new European Union member states from central and eastern Europe namely Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia.

Foreign Assets (NFA) and also provided overwhelming evidence that domestic shocks were predominantly responsible for their short-run dynamics. One striking result of the paper was that the US variables were by no means the main external factors affecting Latin American NFA.

Brafu-Insaidoo and Biekpe (2014) investigated the major determinants of international capital flows in selected countries in Sub-Saharan Africa. Using a dynamic panel data analysis, they found that liberalisation of the domestic financial system and the domestic equity market had a positive and significant impact on international capital flows. Aggregate capital account liberalisation was not significant, but the elimination of multiple exchange rates significantly affected international capital flows, while other components had a more limited impact: the liberalisation of inward FDI directly increased foreign direct investments, whilst the deregulation of offshore borrowing directly caused an increase in foreign debt inflows. Regionalism caused an increase in foreign direct investment inflows but did not affect other forms of capital inflows.

De Vita and Kyaw (2007), investigated the relative significance of the determinants of disaggregated capital flows (foreign direct investment and portfolio flows) to five developing countries, across different time horizons. An empirically tractable structural VAR model of the determinants of capital flows was developed, and variance decomposition and impulse response analyses were used to investigate the temporal dynamic effects of shocks to push and pull factors on foreign direct investment and portfolio flows. Estimation of the model using quarterly data for the period 1976-2001 provided evidence supporting the hypothesis that shocks to real variables of economic activity such as foreign output and domestic productivity are the most important forces explaining the variations in capital flows to developing countries.

Aside the empirical studies discussed above, many empirical studies on capital flows had been documented for Nigeria as well but those that were similar in focus to this present effort are Ekeocha, 2008; Obida and Abu, 2010; Anyanwu, 2011; Obida and Abu, 2012; Okpara et. al., 2012 and Okafor, 2012. They all attempted at analysing the determinants of capital flows to the Nigerian economy. For instance, Ekeocha (2008) tried to model the long-run determinants of foreign portfolio investment (FPI) in Nigeria over the period of 1986-2006 using time series analysis. The variables used were market capitalisation, sovereign risk premium, real exchange rate, level of institutional quality, investment, real interest rate, level of financial openness and trade openness. The results showed that there was a long-run relationship among some of the variables applied. FPI was found to be co-integrated with real rate of return on investments in the capital

market, real interest rate, and investment implying that these variables have a long-run relationship. The results indicated that FPI was positively related to real rate of return on investments in the capital market, real interest rate, and investment while it was negatively related to real exchange rate, market capitalisation, trade degree of openness and institutional quality in Nigeria.
Obida and Abu (2010) investigated the determinants of foreign direct investment in Nigeria. The error correction technique was employed to analyse the relationship between foreign direct investment and its determinants. The results revealed that the market size of the host country, deregulation, political instability, and exchange rate depreciation are the main determinants of foreign direct investment in Nigeria.

Harrison (2012) investigates the impact of pull factors on capital movement in Nigeria using Ordinary Least Square (OLS) method. He regresses macroeconomic variables like real gross domestic product, inflation rate, interest rate, net export and real exchange rate on foreign direct investment. The result shows that real gross domestic product, interest rate, and real exchange rate are key determinants of foreign direct investment in Nigeria. The result suggests that these domestic macroeconomic variables are critical to FDI inflow.

In light of the above, our study charts a different pathway unlike other studies for Nigeria that merely takes one of the components of capital flow as a focal point of analysis. Thus, the paper's contribution to the existing literature stems from the disaggregation of the capital flows into its components within the structural vector autoregressive (SVAR) framework.

III.   Stylised Facts about Foreign Capital Flows into Nigeria

This section features some salient stylised information about the trends of various components of foreign capital flows into Nigeria. This will enable the appreciation of different behavioural trends emanating from each of the component comprising foreign capital flows.
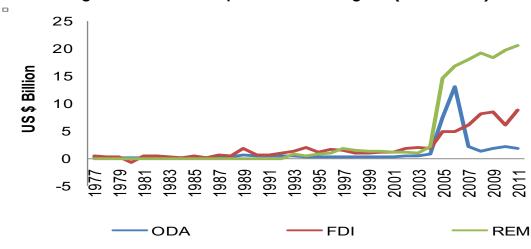
Figure 1: Trends of Capital Flows into Nigeria (1977 – 2011)

Source: World Development Indicator, 2013
Note: ODA stands for overseas development assistance; FDI=foreign direct investment and REM=remittances

Capital flows constitutes the bulk of developmental financing option used by developing nations to finance their growth and development. From figure 1, it can be observed that foreign direct investment remains the leading foreign capital flows from 1977 up to 2004. This further corroborates earlier claim that FDI is the largest component of capital flows into the developing nations. This is not surprising as Nigeria is among five top recipients of FDI in the region. The countries with the largest FDI inward stocks in SSA are: South Africa, Nigeria, Angola, Sudan and the Republic of the Congo. At the end of 2010, these countries accounted for 69.0 per cent of total FDI inward stock in Sub-Saharan Africa (Michalowski, 2012). By implication, Nigeria tends to attract more FDI than ODA as shown in Figure 1. In spite of this, the quantum of the inflows relative to her potentials in terms of size and resource leave much to be desired. It can be argued that the limited attractiveness of Nigeria to the potential foreign investors emanate, to a large extent, from various risk factors including economic and political instability, diseases like HIV-AIDS, tuberculosis, natural disasters, internal and external armed conflicts, etc.

However, the situation later changed in favour of remittances beginning from 2004 up to 2011. The dwindling rate of FDI and ODA flows may be adduced as one of the reasons responsible for the sudden surge of remittances into Nigeria. Remittances are usually sent to relatives and friends to cushion the impacts of shocks to consumption which the family of the remitters may have encountered back home.

In terms of five year annual averages, starting from 1970-1974, ODA plunged from $493 million to an average of US$181 million in 1975-1979. The trend declined further in the next five years ending 1984 with the amount totalling US$104 million. The annual averages during the periods 1985-89, 1990-94, 1995-99, and 2000-2004 are 2.2, 3.86, 2.74 and 4.16 million, respectively. However, ODA during 2005-09 grew by $5.15 (See Table.1 below).

Table. 1: Trend of Annual Averages of Foreign Capital Components for Nigeria (1970-2009)

	ODA (USD)	FDI (USD)	Remittance (USD)	Per capita ODA	FDI as a ratio of GDP	Remittance as a ratio GDP
1970-74	493[a]	285[a]	n/a	0.7451	2.1456	n/a
1975-79	181[a]	354[a]	n/a	0.1458	1.0162	n/a
1980-84	104[a]	158[a]	16.4[a]	0.0900	0.4533	0.0354
1985-89	225[a]	71[a]	5.8[a]	0.5712	2.9103	0.0232
1990-94	386[a]	1.1[b]	295[a]	1.0627	5.3851	1.7056
1995-99	274[a]	1.25[b]	1.3[b]	0.6244	3.7438	3.8668
2000-04	416[a]	1.62[b]	1.42[b]	0.5297	2.6846	2.3693
2005-09	5.15[b]	6.52[b]	17.4[b]	3.5337	4.0780	11.1150

Note: a and b denote million and billion dollars
Source: World Development Indicator, 2013.

IV. Methodology and Data Source

For the empirical analysis of the determinants of foreign capital flows into Nigeria, the paper utilises SVAR time series approach. This approach will enable the relative impacts of push and pull factors on capital flows into Nigeria to be established. This is carried out via two analyses: (i) impulse-response functions which are produced from the estimated SVAR model, and (ii) variance decomposition analysis. For the empirical model, we assume a small open economy in which two types of shocks, namely external and internal, are given considerations. The former is also referred to as push factors. This includes world supply shocks (proxied by US growth rate of output) and foreign interest rates (proxied by the US interest rates). We thus model foreign capital flows into three main components viz, overseas development assistance (ODA), foreign direct investment (FDI) and remittances (REM) and these are stated as:

$$ODA_t = f_1(u_t^{usgrgdp}, u_t^{u\sin t}, u_t^{grgdp}, u_t^{r\text{int}}, u_t^{exc}, u_t^{oda}, u_t^{fdi}, u_t^{rem}) \tag{1}$$

$$FDI_t = f_2(u_t^{usgrgdp}, u_t^{u\sin t}, u_t^{gdgdp}, u_t^{r\text{int}}, u_t^{exc}, u_t^{oda}, u_t^{fdi}, u_t^{rem}) \tag{2}$$

$$\left\langle REM_t = f_3(u_t^{usgrgdp}, u_t^{u\sin t}, u_t^{gdgdp}, u_t^{r\text{int}}, u_t^{exc}, u_t^{oda}, u_t^{fdi}, u_t^{rem}) \right\rangle \tag{3}$$

Equations 1,2 and 3 which represent foreign capital flows define it as a function of shock on foreign output $u_t^{usgrgdp}$, foreign interest rate, $u_t^{u\sin t}$, domestic productivity, u_t^{grgdp}, domestic interest rate, $u_t^{r\text{int}}$, real exchange rate, u_t^{exc}, as well as shocks on each of the component of foreign capital inflows itself that is u_t^{oda}, u_t^{fdi} and u_t^{remi} respectively.

The structural shocks in Equations 1,2 and 3 are unobservable; for the underlying structural shocks to be uncovered requires identifying additional restrictions. To extract the eight structural shocks, we consider an eight-variable VAR system in which the observable variables are related to the structural shocks. Following Ying and Kim (2001), the VAR model is modelled as a $a_{ij}(L)$ lag polynomial form as follows:

$$Y_t = \sum_{i=0}^{\infty} A_i U_{t-i} - A(L)U_i \tag{4}$$

Where $Y_t = (usgrgdp_t, u\sin t_t, grgdp_t, r\text{int}_t, exc_t, oda_t, fdi_t, rem_t)'$, $U_t = (u^{usgrgdp}, u_t^{u\sin t}, u_t^{grgdp},$

$u_t^{r\text{int}}, u_t^{exc}, u_t^{oda}, u_t^{fdi}, u_t^{rem})$ and $A(L) = \sum_{i=0}^{\infty} A_i L^i$ where L is the lag operator. A_i is the matrix of impulse responses of endogenous variable to structural shocks. The variables are foreign output captured by the US growth rate of output, (usgrgdp), foreign interest rate (usint), domestic productivity (grgdp), domestic interest rate (rint), real exchange rate (exc) and the three components of capital flows. Some assumptions are made with respect to the long-run effects of structural shocks. The matrix oflong -run effects of structural shocks is $\sum_{i=0}^{\infty} A_i = A(I) = \{a_{ij}(1)\}$. The external variables are assumed to be affected in the long-run by foreign shocks only. This assumption is applicable to small emerging economy like Nigeria. Thus, there are two types of external shocks in the model. They are foreign output and foreign

interest rate. The former is assumed to evolve exogenously and this can be depicted as:

$$usgrgdp = a_{11}(L)u_i^{usgrgdp}$$

(5)

While the latter on the other hand is assumed to be affected by shocks to the foreign output (which is in this case represented by the US growth rate of output) as well as shocks to itself. Domestic variables are affected by both the internal and the external shocks respectively. Thus, such assumption that domestic or internal variables do not have any impact on foreign variable counterparts is employed as a means of identification. This also partly reflect the fact that the domestic economy (Nigeria) is small relative to the global economy and can therefore be affected but not able to influence the latter. Thelong -run restrictions can be summarised in matrix form as follows

$$
\begin{bmatrix}
usgrgdp_t \\
usint_t \\
grgdp_t \\
rint_t \\
exc_t \\
oda_t \\
fdi_t \\
rem_t
\end{bmatrix}
=
\begin{bmatrix}
* & * & * & * & * & * & * & * \\
0 & * & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & * & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & * & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & * & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & * & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & * & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & *
\end{bmatrix}
\begin{bmatrix}
u^{usgrgdp_t} \\
u^{usint_t} \\
u^{grgdp_t} \\
u^{rint_t} \\
u^{exc_t} \\
u^{oda_t} \\
u^{fdi_t} \\
u^{rem_t}
\end{bmatrix}
$$

(6)

The imposition of restriction into the impulse response matrix A_t makes it possible to recover the structural shocks from the VAR model. The dataset is sourced mainly from world development indicators (WDI) CR-ROM 2013 for consistency purposes.

VI.   Empirical Analysis of Results

This section presents the results ranging from basic descriptive statistics, stationarity tests and to a more robust analysis of impulse response and variance decomposition.

The Table 1 below presents the descriptive statistics of variables used in the empirical evaluation of the determinants of foreign capital flows in Nigeria. From the table, it can be seen that the mean of ODA for Nigeria between 1977 and 2012 is US$1.08 billion with maximum and minimum values beingUS $13.2 billion (in 2006) and US $71.9 million (in 1979) respectively. FDI as a form of foreign capital flow also hasUS $2.22 billion as its average value during the period with the maximum value of US$8.84 billion (2011) and minimum value being- US$738 million

(in 1980). For remittances, the mean value is US$4.54 billion with maximum and minimum values being US$20.6 billion (2011 and 2012) and US$2million (in 1988). The domestic real rate of interest averaged -0.38 but reached its climax in 1998 with double-digit figure of 25.28 per cent while the minimum rate of -43.57 per cent was recorded in 1995. Also, the mean value of real exchange rate is 55.40 with minimum and maximum being 0.55 and 157.50. The variables of push factors like the US rate of interest averaged 4.8 per cent with minimum and maximum rates being 0.6 per cent (1977) and 8.7 per cent (in 1981) respectively. Similarly, the US growth rate of output also averaged 2.85 with the maximum rate that climaxed at 7.26 per cent in 1984 and the minimum plunging into negative rate of 2.80 per cent in 2009. The downward trend in rate can be attributed largely to the aftermath of the global financial crises of late 2008 occasioned by subprime mortgage lending in the US. Apart from first and second moments statistics, the skewness of the variables depict that the distribution of most of the variables have long right tails except for domestic real interest rate, US interest rate and US growth rate of output with long left tails. In addition, the distribution of variables like grgdp, rint, exc, usgrgdp ,oda and fdi are peaked (leptokurtic) relative to the normal while that of usint and rem are flat (platykurtic) relative to the normal. For the jarque-bera statistics, we cannot reject the normal distribution at 1.0 per cent significant level for virtually all the variables except for both domestic and foreign rates of interest.

Table:1 Descriptive Statistics

	GRGDP	RINT	EXC	USINT	USGRGDP	ODA	FDI	REM
Mean	3.60	-0.38	55.40	4.79	2.85	1.08E+09	2.22E+09	4.54E+09
Median	4.31	-2.08	21.89	5.11	3.26	2.92E+08	1.11E+09	7.99E+08
Maximum	33.74	25.28	157.50	8.72	7.26	1.32E+10	8.84E+09	2.06E+10
Minimum	-13.13	-43.57	0.55	0.58	-2.80	71960000	-7.39E+08	2000000
Std. Dev.	7.77	14.93	61.01	2.20	2.03	2.44E+09	2.67E+09	7.66E+09
Skewness	1.09	-0.59	0.53	-0.22	-0.83	3.98	1.40	1.36
Kurtosis	8.05	3.85	1.47	1.99	4.02	18.89	3.58	2.95
Jarque-Bera	45.32	3.18	5.18	1.83	5.70	473.4	12.23	11.13
Probability	0.00	0.20	0.00	0.40	0.06	0.00	0.00	0.00
Observations	36	36	36	36	36	36	36	36

Source: Computed

The unit root test results are presented in Table 2. The first stage of the empirical analyses involved examination of the statistical properties of all the variables under consideration. The results of both Augmented Dickey Fuller (ADF) and Phillip Perron (PP) unit root tests are summarised in Table 2 below. It suggests that the null hypothesis of the presence of unit root in the variables in levels could not be rejected for ODA, REM, GRGDP, RINT, EXC and USINT, thus, indicating that all the variables are non-stationary in levels. However, after first-difference, the null hypothesis of the unit root in each of the series were rejected at the 5 per cent

level of significance. Whereas, variables like FDI and USGRGDP become stationary at levels. It can therefore be said that mixture of order of integration exists among the variables.

Table 2: Unit Root Tests

Variables	Levels		First Difference	
	ADF	**PP**	**ADF**	**PP**
GRGDP	2.13	-2.10	-6.50	-6.51
RINT	-1.12	-0.95	-3.35	-2.79
EXC	-1.52	-1.79	-4.34	-4.10
USINT	-2,60	-2.38	-4.27	-4.19
USGRGDP	-4.10	-4.05	-	-
ODA	-1.26	-1.14	-6.05	-6.77
FDI	-3.06	-4.95	-	-
REM	-0.86	-0.37	-3.22	-7.17

Critical Values: 1 per cent, 5 per cent and 10 per cent are -3.64, -2.95 and -2.62 respectively.
Note: Bold face denotes variables that are significant at conventional levels

V.1   Analysis of Variance Decomposition (VDCs) Results

Variance decomposition provides evidence on the relative importance of each of the shocks. Table 3 shows the percentage of the forecast error variance due to each shock in the structural VAR model over the ten-year horizon, following the sample period 1977 2012 The percentage contributions of the endogenous variables to ODA were depicted in table 3 below. In the short-term, own shock appears to account largely for Overseas Development Assistance (ODA) flow but decline markedly over the longer haul from 76.88 per cent in the first period to 24.05 per cent in the tenth period. In terms of pull factors, domestic productivity measured by real GDP growth increased substantially from 22.15 per cent in the second period to over 31.72 per cent in the tenth period.

By implication, variations in ODA are largely explained by domestic productivity. The real interest rate also plays an important role as it increases from 11.75 per cent in first period to 16.98 per cent tenth period. In addition, the real exchange rate also increases consistently from period to period from as low as 0.02 per cent in the first period to 13.46 per cent in the last period. For the push factors, the important role of the US interest rate is pronounced but marginal, judging by the movement from a negligible 1.53 per cent in the second period to 2.12 per cent in the last period. Overall, the roles of pull factors appear to explain largely the variations in Overseas Development Assistance into Nigeria.

Like ODA, foreign direct investment appears to contribute largely to variation to itself but get declined in the long-run to less than 40.0 per cent from an all high of 62.23 per cent in the first period. Unlike ODA, foreign interest rate appears to dominate FDI flows as can be seen on the table. Thus, the impact of push factors

far outweighed that of pull factors. As shock to the US interest rate explains 17.79 per cent of the forecast error variance in FDI in the first period, subsequently oscillating between its two digit figures from period to period before its final resting point of 14.70 per cent in the last period. Of the pull factors, real interest rates still appear significant from 9.76 per cent in the first period to 11.42 per cent in the tenth period. The least important factor is that of real exchange rates that permanently remain at single digit figures from 1.13 per cent in the first period to 1.57 per cent in the last period.

A more convincing fact emanates from remittance flows, as the impacts of shocks to both domestic productivity and domestic real rate of interest – pull factors-overshadowed those of the push factors. It is quite insightful, however, to note that shocks to either the US interest rate or real GDP growth could significantly affect the remittances inflow into Nigeria but with dominating influence of the latter over the former. It is also instructive to mention that own shocks, which assumes a substantial dimension in the short-run, reduced drastically to negligible portion in the long-run. This can be observed from its movement from 55.32 per cent in the first period to 7.91 per cent in the tenth period. Importantly, it is worthy to note that the significance of the forecast error variance due to other capital flows like ODA, which also took some substantial per cents in the first period after own shock contribution.

Table 3: Variance Decomposition

Variance Decomposition of ODA								
Period	S.E.	Pull Factors			Push Factors		Capital Flows		
		GRGDP	EXR	RINT	USGRGDP	USINT	FDI	ODA	REM
1	0.51	0.33	0.02	11.75	0.03	2.88	8.09	76.88	0.00
2	0.77	22.15	0.68	13.85	0.05	1.53	9.74	51.99	0.02
3	0.94	34.64	3.22	15.18	0.05	1.55	10.19	35.13	0.05
4	1.02	35.10	6.87	15.45	0.14	1.67	10.32	30.04	0.40
5	1.04	34.30	9.44	14.82	0.15	1.88	10.23	28.67	0.51
6	1.07	33.70	10.44	16.32	0.26	1.81	9.72	27.26	0.48
7	1.10	32.89	11.14	17.25	0.47	1.97	9.59	26.07	0.61
8	1.12	32.21	12.07	17.28	0.58	2.13	9.41	25.36	0.96
9	1.14	31.85	12.91	17.22	0.58	2.06	9.16	24.76	1.46
10	1.16	31.72	13.46	16.98	0.57	2.12	8.97	24.05	2.12
Variance Decomposition of FDI								
Period	S.E	Pull Factors			Push Factors		Capital Flows		
		GRGDP	EXR	RINT	USGRGDP	USINT	FDI	ODA	REM
1	3.37	2.01	1.13	9.76	7.09	17.79	62.23	0.00	0.00

2	3.62	2.17	1.03	11.37	6.71	15.36	54.59	6.69	2.08
3	3.92	3.22	0.88	13.71	9.86	15.68	47.11	5.83	3.71
4	4.17	10.65	1.42	12.34	9.57	14.73	42.45	5.19	3.64
5	4.30	10.29	1.37	11.97	9.01	14.16	41.18	8.32	3.70
6	4.37	10.97	1.45	11.59	8.72	14.35	40.67	8.36	3.90
7	4.40	11.27	1.52	11.42	8.61	14.92	40.07	8.33	3.87
8	4.43	11.45	1.53	11.48	8.75	14.81	39.70	8.28	4.00
9	4.43	11.66	1.57	11.45	8.74	14.76	39.60	8.24	3.99
10	4.44	11.67	1.57	11.42	8.71	14.70	39.45	8.48	4.00

| Variance Decomposition of REM									
Periods	S.E	Pull Factors			Push Factors		Capital Flows		
		GRGDP	EXR	RINT	USGRGDP	USINT	FDI	ODA	REM
1	0.60	0.99	9.70	2.88	5.20	1.28	4.88	22.63	55.32
2	0.96	39.47	8.25	4.91	2.21	2.31	1.96	11.73	29.17
3	1.24	36.10	9.48	11.65	2.70	4.53	2.01	9.94	23.59
4	1.52	34.64	9.61	15.85	2.82	8.59	4.12	7.28	17.09
5	1.72	34.41	10.10	17.14	3.27	10.39	4.58	6.17	14.02
6	1.89	35.66	10.43	17.73	3.22	10.30	5.06	5.59	12.02
7	2.03	36.99	11.19	17.61	2.87	9.68	5.38	5.78	10.50
8	2.16	38.07	12.06	16.90	2.56	9.19	5.67	6.19	9.36
9	2.28	39.34	13.13	15.81	2.31	8.88	5.87	6.18	8.49
10	2.37	40.25	14.41	14.82	2.13	8.58	5.81	6.09	7.91

Source: Computed
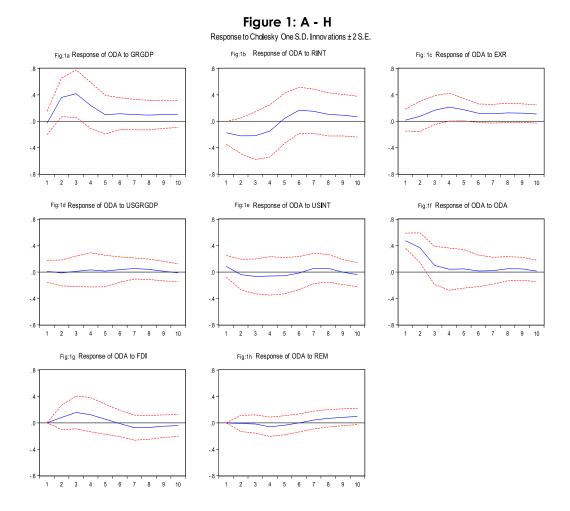
5.2   Impulse Response Function (IRF) Analysis

Further interesting insights into the effects of various shocks on capital flows (like overseas development assistance, (ODA), foreign direct investment, (FDI) and remittances (REM)) into Nigeria can be gauged through an impulse response analysis that allows us to trace the effect of a one-time shock to an innovation on current and future values of the endogenous variable. The results of impulse responses to various shocks are reported. The response of Overseas Development Assistance (ODA) to shock in real GDP growth in Fig.1a is positive and significant from first to tenth periods. This level of significance appears to be more between second and third periods. This tapers out in the subsequent periods. This simply suggests that domestic productivity is a key factor which determines ODA into the country. This finding is in line with Kim and Oh (2012). The real interest rate in Fig.1b is negative for the first five periods but later leaped into positives beginning from sixth up till tenth periods.

The behaviour of the real exchange rate is similar to that of real GDP growth. This means that it is also positive and significant through the periods. Thus, as far as Nigeria is concerned, surges in foreign aid inflows causes depreciation of the naira instead of appreciation. This same result corroborates the findings by Ogun (1995)
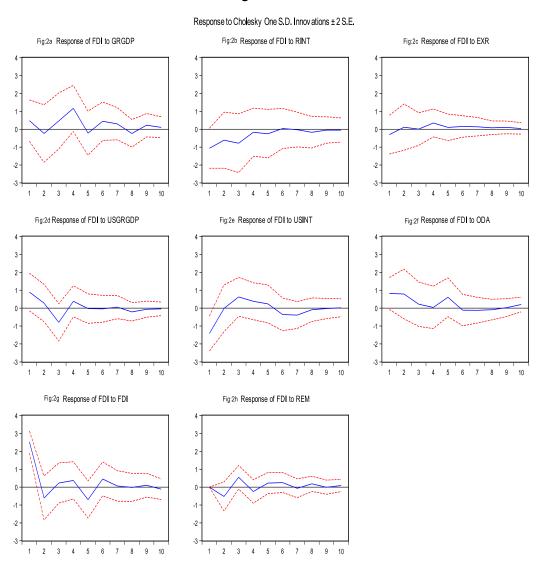
for Nigeria, Nyoni (1998) for Tanzania, Sackey (2001) for Ghana and Ouattara and Issah (2003). This result is contrary to the "Dutch disease" theory of foreign aid which states that an increase in foreign aid tends to cause real appreciation of the local currency. Of the pull factors, the real GDP growth and exchange rate are the most important variables driving ODA into Nigeria. In the case of the push factors, US growth of output in Fig.1d appears to be a key determining factor as it has significant positive influence on the ODA from the first period up to the last period. Similar conclusion cannot be made in the case of foreign interest rate (fig.1e) whose trends became spiral in nature. As can be seen, it plunged back into negatives from positive in the first period. This sustainably lasted for six periods beginning from second up to the seventh periods.

Turning to the impact of shocks of other capital flows on ODA, we observed that remittance (in Fig.1h) does significantly reduce ODA. This appears to be more in the first to five periods. The same narratives are untrue for the foreign direct investment (in fig.1g) whose trends move in the opposite directions.

Figure 1: A - H

Response to Cholesky One S.D. Innovations ± 2 S.E.

In terms of response of foreign direct investment to a one-time shock in pull factor variables, the role of real interest rate appears as the most important. However, it has a negative impact on FDI from first to the last periods. The economic intuition is that a higher real interest rate discourages foreign investors into the country (see Fig.2b). Also, a shock to real exchange rate (Fig.1c) that was initially negative in the first period turned positive from second to the last periods. This result is similar to that of Tripathi (2015). The behaviour of real GDP growth is quite unstable as can be observed in Fig. 2a as it kept oscillating from positives to negatives. By and large, its effects are difficult to discern. For the push factors, the impacts of both US growth of outputs and US interest rates are unpredictable and unstable throughout the periods.

Figure 2: A - H

Response to Cholesky One S.D. Innovations ± 2 S.E.

Fig:2a Response of FDI to GRGDP | Fig:2b Response of FDI to RINT | Fig:2c Response of FDI to EXR

Fig:2d Response of FDI to USGRGDP | Fig:2e Response of FDI to USINT | Fig:2f Response of FDI to ODA

Fig:2g Response of FDI to FDI | Fig:2h Response of FDI to REM

Unlike ODA and FDI, the response of remittances to a one standard deviation innovation in real GDP growth (Fig.3a) and real exchange rates (Fig. 3c) are positive and significant from to first to the tenth periods. The sign of the coefficient of workers' remittances, however, is consistent with the conventional view that a sustained increase in such flows results in an appreciation of the real exchange rate. Hyder and Mahboob (2005), Saadi-Sedik and Petri (2006) find similar results for Pakistan and Jordan. Real interest rates are negative and significant throughout the periods beginning from first to ten. Technically speaking, remittances could be encouraged for two major reasons that bordered on altruistic and investment purposes. Thus, domestic real interest rates have

significant negative relationships with the flow of remittance into Nigeria. Shocks to foreign interest rate and output showed the same patterns (in Fig 3d and 3e). It is intriguing to observe that the situation runs through from the first to the last periods.

Figure 3: A - H

Response to Cholesky One S.D. Innovations ± 2 S.E.

Fig:3a Response of REM to GRGDP
Fig:3b Response of REM to RINT
Fig:3c Response of REM to EXR
Fig:3d Response of REM to USGRGDP
Fig:3e Response of REM to USINT
Fig:3f Response of REM to ODA
Fig:3g Response of REM to FDI
Fig:3h Response of REM to REM

VI.   Conclusion and Recommendations

The need to source for external financing for driving a country to a desirable path of growth and development cannot be overemphasised given the paucity and declining posture of Nigeria's domestic financial resources. To this end, this paper empirically employs a tractable structural vector autoregressive model to unravel the determinants of foreign capital flows into Nigeria. Particularly, both variance

decomposition and impulse response analyses are used to investigate the temporal dynamic effects of shocks to both pull and push factors on different components of foreign capital flows namely: overseas development assistance (ODA), foreign direct investment (FDI) and remittance (REM) flows. Interestingly, insightful outcomes are discernable from each component of the capital flows in Nigeria. Firstly, the domineering role of domestic productivity is well entrenched in the case of ODA. This is directly followed by real interest rate. These outcomes thus, throwupthe dominancy of pull over push factors. Hence, more attent ion should be given to internal over external factors. Similar conclusion could hardly be drawn with respect to FDI in which foreign interest rate appears as the most important factor over other explanatory variables.

Lastly, the role of pull over push factors also appears as the rule rather than exception with respect to remittances. This appears to be true both in the short and long-run. However, on the policy front, the paper emphasises the concomitant need for policy makers to design domestic policy that accounts for both external and internal shocks to real variables of economic activity. With respect to ODA, government should always ensure consistent and sustain increase in the real GDP growth as well as maintaining realistic exchange rates that will not ignite Dutch disease syndrome into the system. For FDI, the real rate of interest should be under close surveillance so as not to deter the entry of new foreign firms or multinational companies as the case may be. Lastly, with respective to REM, domestic productivity should be further enhanced, while at the same time ensures that exchange rates be tailored toward acting as shield against vagaries of the foreign capital and other financial flows.

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Monetary Policy and Asset Prices in Nigeria

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Abstract

This paper attempts to contribute to the debate on the linkages between monetary policy and asset prices in the wake of the recent global financial crisis. The study employs vector error correction (VEC) model on Nigerian weekly data from January 2007 to October 2013. A pair-wise granger causality test indicated a unidirectional causality from asset prices to monetary policy. Exchange rate at lag one was negatively related to the All Share Index, suggesting that exchange rate appreciation is likely to lead to excessive appreciation in asset prices. The results further indicated a positive relationship between financial system stability and asset prices. The variance decomposition indicated that monetary policy rate (MPR) accounted for the largest variation in ASI followed by exchange rate and financial system instability. A key conclusion was that the monetary policy rate had significant impact on asset prices. Notably, the CBN policy rate monetary policy influenced asset prices significantly as from the fourth week for both the All Share Index returns (ASIr) and the NSE 30 return. The results also showed that the predominant sources of asset price volatility were due largely to interest rate shocks, exchange rate shocks and financial system stability. Thus, the authorities should as a matter of priority, continue to provide forward guidance to anchor investors' expectations and the direction of the market as well as put downward pressure and help improve broader financial conditions.

I. Introduction

There is considerable interest in understanding the interaction between asset prices and monetary policy. This is because much of the transmission of monetary policy comes from the influence of short-term interest rates on other asset prices. Movements in other asset prices, including long-term interest rates, bond prices, yields, and stock prices determine private borrowing costs and changes in wealth, which in turn influences real economic activity. Monetary policy has considerable influence on the behaviour of the financial markets. Thus, accurate estimates of the response of asset prices to monetary policy impulses is critical to effective investment decisions and risk management as well as the efficacy of monetary policy.

Earlier studies were slow in recognising that the behaviour of stock prices was linked to monetary policy shocks (Corallo, 2006), but later studies produced evidence of the existence of a strong relationship between monetary policy variables and the stock market (Thorbecke 1995, 1997; Bomfim, 2000; Rigobon and Sack; 2003, 2004). However, difficulties arise in estimating the responsiveness of

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The authors are staff of the Monetary Policy Department, Central Bank of Nigeria. The usual disclaimer applies.

asset prices to monetary policy. First, Rigobon and Sack (2002) observed that short-term interest rates could be simultaneously influenced by the movement in asset prices, resulting in endogeneity problem. Second, variables such as expectations about the economic outlook are likely to impact on both short-term interest rates and asset prices. Indeed, the firm-foundation theory argued that the market price of a share depends mostly on the growth rate of a firm's economic fundamentals such as dividends, earnings, interest rates and risk perception. In a top-down approach, an economy's outlook, future sales and earnings of the industry are considered in estimating firm-specific return on stocks. Expectations of enrichment of economic fundamentals of a firm are reflected through higher price of its stock. These two considerations complicate the identification of the responsiveness of asset prices under previously used models.

This study attempts to contribute to the literature by using Vector Autoregression (VAR) Model to provide a clearer understanding of the relationship in the Nigerian context. This approach allows the examination of the importance of monetary policy on the direction, magnitude and speed of change on asset prices. Apart from the relationship between monetary policy and the stock market, the paper also focuses its analysis on the connection between monetary policy and other asset prices i.e., treasury bills and the exchange rate.

The rest of the paper is organised as follows: Section 2 reviews the theoretical and empirical literature. Section 3 presents some stylised facts outlining the relationship between monetary policy and asset prices, while Section 4 discusses the data and methodology for the study. The results and analysis are contained in Section 5, while Section 6 concludes the paper with reflections on the policy implications.

II.   Theoretical and Empirical Literature
II.1   Theoretical Literature

Monetary policy is transmitted to the real economy through the asset price, interest rate, exchange rate and credit channels (Tobin: 1969 in Ahmed et. al., 2006). Expansionary monetary policy increases money supply and household's spending capacity and when spent on stocks, increases the demand and raises stock prices. Tobin argued that if the market value of a firm's capital exceeds the cost of acquiring it, the firm increases its capital stock. On the other hand, contractionary monetary policy lowers the present value of future earning flows and hence depresses stock prices.

The traditional Keynesian view of the transmission channel is that monetary expansion leads to a fall in real interest rates, lowers firm's cost of capital and

encourages higher investment spending through borrowing. Thus, when interest rates are low, fixed interest securities provide little competition for shares. A tightening of monetary policy reduces liquidity in the banking system and increases short-term interest rates, which lower the present value of future cash flows from stocks as investors tend to adjust their investment portfolio in favour of fixed income securities i.e., bonds. Capital market instruments such as equities experience far wider price fluctuations than money market instruments and are considered to be risky investments (Mishkin, 2004). It is, therefore, argued that if interest rates on bank deposit are relatively high, they can offer a stable, profitable alternative to stock returns. Rational investors would sell some stocks and invest in fixed income securities causing stock prices to fall sharply.

Ahmed et. al., (2006) argued that monetary policy influences the financing cost of a firm and the availability of loans. They noted that, an efficient credit channel for quoted firms would imply that expansionary monetary policy would enable them to take bank loans at easier terms and gain on bank lending rate. This interest gain differential will improve their balance sheets, make them more competitive and induce business expansion. The effect of these activities would result in higher stock prices. In their view, a contractionary monetary policy will, conversely, affect the firms' share price in the opposite direction.

The relationship between inflation and stock prices is not direct and straightforward as empirical evidence remains largely inconclusive and anecdotal. Bordo and Wheellock (2004) argues that asset prices are more likely to be positively impacted in an environment of low and stable inflation. This suggests that monetary policy can encourage asset price booms simply by stabilising the price level. A next generation of models, variants of which are presented in Friedman and Schwartz (1963b), Tobin (1969), and Brunner and Meltzer (1973), introduced a broader range of assets into the traditional Keynesian liquidity framework. They postulated that, central bank operations, which increase liquidity will cause asset price of private sector's portfolio, including equities and real estate to rise and thereby lower their returns. Substitution from more- to less-liquid assets occurs as the returns on the former declines relative to the latter. The impact of expansionary monetary policy will be apparent first in the price of short-term government securities; longer-term securities; and other assets such as stocks, real estate, and commodities such as gold; and finally in the overall price level. Thus, the propositions see rising asset prices as a possible harbinger of future inflation.

II.2   Empirical Literature

A small but growing empirical literature takes a positive view and attempts to estimate the monetary policy response to stock market fluctuations. Early contributions either imposed a zero interest rate response on impact or find evidence of a very small response, always statistically insignificant and sometimes even negative. More recent contributions argued that previous studies found an insignificant interaction between monetary policy and asset prices because they do not properly consider the simultaneous interdependence between interest rates and asset prices. This endogeneity problem was ruled out by assumption in early VAR contributions and was addressed only partially in the estimation of monetary policy rules by using instruments that were likely to be weak. Furlanetto (2011 and 2008) showed that previous estimates of the monetary policy response to stock market fluctuations in the United States were not confirmed when the analysis is applied to other countries and when the sample period for the United States is extended over a longer time period. They estimated a model with data spanning the period 1985-2007 for the EU and six inflation targeting countries i.e., Australia, Canada, New Zealand, Norway, Sweden, and the United Kingdom, and the U.S. They found no positive response in any of the countries except Australia. In the United States in particular, the response declined over time and became statistically insignificant during the housing bubble period (2003–07).

Rigobon and Sack (2002) noted that estimating the response of asset prices to changes in monetary policy was complicated by the endogeneity of policy decisions and the fact that both interest rates and asset prices react to other variables. As a result, they developed a new estimator that was based on the heteroskedasticity that exists in high frequency data. They found that the response of asset prices to changes in monetary policy can be identified based on the increase in the variance of policy shocks that occurs on days of the U.S. Fed's FOMC meetings and of the Chairman's semi-annual monetary policy testimony to Congress. Their results indicated that an increase in short-term interest rates results in a decline in stock prices and in an upward shift in the yield curve that becomes smaller at longer maturities.

Lee et. al., (2006), explored a structural vector autoregression (SVAR) on quarterly data from the first quarter of 1993 to the second quarter of 2010 to determine the impact of monetary policy on asset prices in Taiwan. The variables were the natural logarithm of real GDP, CPI, the Sinyi house price index, the weighted average stock prices and the weighted nominal average lending interest rate. They found that the contemporaneous effect of contractionary monetary policy on house prices exhibits a significant and positive relationship, and the response gradually approaches zero. However, the effect on stock prices was negative and

statistically insignificant. In their view, in the case of monetary contractions, investors may consider depositing money in the bank instead of investing in the stock market. Conversely, when monetary policy is relaxed, investors may procure bank loans at lower cost to invest in the stock market, resulting in a negative relationship between monetary policy and stock prices.

Chuku (2009) also deployed a structural vector autoregression (SVAR) model to trace the effects of monetary policy shocks on output and prices in Nigeria. Making the assumption that the Central Bank cannot observe unexpected changes in output and prices within the same period, which places a recursive restriction on the disturbances of the SVAR. The experiment was conducted using three alternative policy instruments i.e. broad money (M_2), Minimum Rediscount Rate (MRR) and the real effective exchange rate (REER). Overall, they found evidence that monetary policy innovations carried out on the quantity-based nominal anchor (M_2) had modest effects on output and prices with a very fast speed of adjustment, while, innovations on the price-based nominal anchors (MRR and REER) had neutral and fleeting effects on output. The study concluded that the manipulation of the quantity of money (M_2) in the economy was the most influential instrument for monetary policy implementation. It was, therefore, recommended that the central bank should place more emphasis on the use of the quantity-based nominal anchor than the price-based nominal anchors.

Reuter (2010) estimated the interdependencies between monetary policy (money supply and interest rates), asset (house and share prices), consumer prices and GDP, using a vector error correction model for a panel of 18 OECD countries with quarterly data over the period 1980 to 2009. The results suggest that monetary policy, which aims at stabilising share and house prices, might have strong repercussions on GDP, in particular through the interest rate channel and to a less extent on asset markets. Based on this, they argued that since asset prices are guided by economic fundamentals at least in the short-run, only to a limited extent should monetary policy focus on asset prices. This does not imply that excessive price movements in asset markets should be ignored but rather that instruments other than traditional monetary policy such as tighter banking and credit regulations, along with rigorous enforcement, are more suitable to stabilise asset prices.

Yao et. al., (2011) investigated the dynamic and long-run relationships between monetary policy and asset prices in China using monthly data from June 2005 to September 2010. Johansen co-integration approach based on vector autoregression (VAR) and Granger causality test were used to identify the long-run relationships and directions of causality between asset prices and the monetary

variables. Empirical results showed that monetary policies had little immediate effect on asset prices, suggesting that Chinese investors may be irrational and speculative. Instead of running away from the market, investors rush to buy houses or shares when tightening monetary policy. Such seemingly irrational and speculative behaviour can be explained by various social and economic factors, including lack of investment channels, market imperfections, cultural traditions, urbanisation and demographic changes. The study recommended that China's central bank should not use interest rates alone to maintain macro-economic stability and that both monetary and non-monetary policy should be deployed when asset bubbles loom large to avoid devastating consequences when they burst.

Detken and Smets (2004), attempted to derive some stylised facts for financial, real and monetary policy developments during asset price booms, by characterising financial, real and monetary policy developments during asset price booms, aggregating information contained in 38 boom periods since the 1970s for 18 OECD countries. They observed 26 variables in a pre-boom, boom and post-boom phase, as well as observed various macroeconomic variables in a pre-boom, boom and post-boom phase. They analysed the differences between high-cost and low-cost booms (high-cost booms are clearly those in which real estate prices and investment crash in the post-boom periods and follow very rapid growth in the real money and real credit stocks just before the boom and at the early stages of a boom). Their results showed that high-cost booms were associated with significantly looser monetary policy conditions over the boom period, especially towards the late stage of a boom.

Koivu (2010) studied the dynamics of the relationship between monetary policy, asset prices and consumption in China. Employing the structural vector autoregression method with five variables: household income, household consumption, consumer price inflation, an indicator for monetary policy, and asset prices running from late 1998 to the end of 2008, they found that a loosening of China's monetary policy indeed led to higher asset prices, which in turn were linked to household consumption.

West and Agbola (2005) investigated empirically, the causal linkages between asset prices and Australia's cash rate. Quarterly data spanning the period 1980:1 and 2002:4 were employed in the analysis. The Johansen MLE multivariate co-integration procedure revealed that Australia's cash rate and key determinants were co-integrated, and thus, shared a long-run equilibrium relationship. The Stock-Watson dynamic OLS model (DOLS), which is superior to a number of alternative estimators, found empirical evidence of significant long-run relationship

between Australia's cash rate and house prices, stock market prices, inflation rate and Australia's real gross domestic product, and United States cash rate and real gross domestic product. The US cash rate Granger causes Australia's cash rate. Australia's stock market price Granger causes Australia's house prices. The Granger causality test revealed a unidirectional causality from house prices to Australia's cash rate, which is contrary to the conventional wisdom of a bi-directional causality running from the cash rate to house prices.

Following the aftermath of the recent global financial turmoil, and the revival of the debate, on whether central bankers ought to tighten monetary policy preemptively to head-off asset price misalignments before a sudden crash triggers financial instability, Chow and Choy (2009), explored the issue of the appropriate monetary policy response to asset price swings in the small open economy of Singapore. They observed that empirical analysis of monetary policy based on standard VAR models, was often hindered by the use of sparse information sets. To better reflect the extensive information monitored by Singapore's central bank, including global economic indicators, they augmented a monetary VAR model with common factors extracted from a large panel data set spanning 122 economic time series and the period 1980q1 to 2008q2. The resulting factor-augmented vector autoregression (FAVAR) model was used to assess the impact of monetary policy shocks on residential property and stock prices. Impulse response functions and variance decompositions suggested that monetary policy can potentially be used to lean against asset price booms in Singapore.

Assenmacher-Wesche and Gerlach (2008) studied the impact of monetary policy stocks on inflation, output and asset prices, using VARs and panel VARs estimated on quarterly data spanning 1986 to 2006. The analysis suggested several tentative conclusions regarding the ability of using countercyclical monetary policy to rein-in residential property price and stock price booms. First, the panel VAR results showed that monetary policy has large and predictable effects on residential property prices, and that these effects were roughly co-incident with its effect on real economic activity. The results suggested that monetary policy could potentially be used to slow down property price booms, but substantial interest rate increases would be necessary to do so. However, these increase were expected to depress real GDP considerably. Second, the estimates also indicated that monetary policy shocks depressed equity prices by about as much as they reduced residential property prices. However, equity prices decline immediately in this case and returned to their initial levels by the time residential property prices reached their trough. As a consequence of this difference in timing, they concluded that it is not possible to use monetary policy to stabilise both residential property and equity prices. Third, the individual-country VAR estimates were highly

imprecise, thus, reflecting an inherent shortcoming of VAR analysis where a large number of parameters are necessarily subjected to considerable uncertainty. This is where value judgment becomes useful. Thus, a central bank that is persuaded that policy can and should be used to influence asset prices could proceed despite evidence to the contrary. Another interpretation, more plausible to us and compatible with the arguments of Kohn (2007), was that the impact of monetary policy on asset prices was in fact highly uncertain, suggesting that central banks might wish to refrain from attempting to steer asset prices.

Gupta and Kabundi (2009), assessed the impact of monetary policy on real house price growth in South Africa using a factor-augmented vector autoregression (FAVAR), based on a large data set comprising 246 quarterly series over the period 1980:01 to 2006:04. The results, in general, showed that, house price inflation responds negatively to monetary policy shocks, but the responses were heterogeneous across the middle-, luxury- and affordable-segments of the housing market. The luxury-, large-middle- and medium-middle-segments were found to respond much more than the small-middle- and the affordable-segments of the housing market. More importantly, they found no evidence of the home price puzzle, observed previously by other studies that analysed house prices using small-scale models. They attributed this to the benefit gained from using a large information set.

Ahmed et. al., (2006), estimated the effect of contractionary monetary policy shocks on the stock price index in Bangladesh using structural VAR approach. The estimated coefficients of money supply and money demand equations from the structural VAR model were found to be theoretically consistent, suggesting that the short-run identification restrictions were valid. Impulse responses of different variables of interest to contractionary monetary policy shocks, measured by exogenous increases in the short-run policy interest rates, established the theoretical underpinnings of asset price channel to monetary policy shocks. The estimate confirmed that a contractionary monetary policy shock, measured by increase in the short-term policy interest rate has small negative effect on the stock price index and the effect was short lived.

Durham (2003) studied the effect of monetary policy on asset prices. Applying co-integration theory and, relaxing the stringent assumption in the literature that changed in 10-year Treasury yields, stock returns, and changes in the stance of monetary policy were exogenous, a two-stage least squares (2SLS) regressions on quarterly data from 1978:Q4 to 2002:Q3 was fitted. The results suggested that changes in the exogenous component of the U.S. Fed's federal funds rate affected changes in Treasury yields, but not stock returns, *ceteris paribus*.

However, this result was sensitive to alternative proxies for the stance of monetary policy. Also, little evidence suggested that monetary policy responds to the exogenous components of changes in financial asset prices.

Corallo (2006) examined the effects of monetary policy on asset prices in the UK and Germany. They focused the analysis on the relation of monetary policy and other asset prices: the bond price, the bond yield and the exchange rate. Applying the "heteroskedasticity based approach", which allowed to estimate a model in which the variables behave simultaneously and are endogenously defined relying on a new set of assumptions; they found that Germany seemed not to react to policy decisions of its own country: German monetary policy seemed to exert a neutral effect on German stocks. An unexpected increase in the market interest rate depressed equity prices. This negative relation was not significant. This result was in line with some of the traditional literature, which focused on the US economy. In contrast with the German economy, the effect of British monetary policy on stock prices revealed that an increase in interest rates in the UK led to a significant increase of British stock market prices and to a significant appreciation of the currency. These results all together could be a sign of a procyclical policy. They also found that stock prices were negatively linked to interest rate surprises in any significant way. These results suggested that the unexpected component of monetary policy had been neutral on the stock market behaviour.

Duran et. al., (2012) also applied the heteroskedasticity-based technique adopted by Corallo (2006) to estimate the impact of monetary policy on the Turkish bond, currency and stock markets. The empirical results confirmed the findings obtained by event study methods in earlier studies. Firstly, the impact of monetary policy on market interest rates is found to be positive, and diminishes over time for maturities longer than 9 months. Secondly, the results suggested that a rise in the policy rate led to a moderate appreciation of the domestic currency, where the TL/EUR rate was affected more significantly compared with the TL/US dollar rate. Finally, the results showed that an increase in the policy rate led to a decline in stock prices, and monetary policy had the greatest impact on the share prices of financial sector firms.

II.3   Monetary Policy and Asset Prices: Some Stylised Facts
II.3.1   Asset Price and Monetary Policy Rate

We display figures for two stock market variables directly related to asset prices. The All Share Index returns (ASIr) and NSE30 return. The figures were weekly series of each variable across all the episodes of the recent global financial crisis. In figures 3.1 and 3.2, we observed that the All-share Index returns (ASIr) rose to a historic

high in November 2008 when the policy rate was at   10.0 per cent, but thereafter, recorded a dramatic decline in early 2009 due to significant capital outflows arising from the global financial crisis. The ASIr rebounded in 2010 and maintained a steady rise until the adjustments in monetary policy in late 2011 into 2012.

The monetary policy rate, which was about 6.0 per cent from July 2009 to March 2011, was low and seemed insufficient to boost consumer and investor confidence. With low MPR, surplus spending units preferred to save outside the banking system and domestic investors who were motivated with the low MPR, had no loanable funds to access. Foreign investors, who should cash in on the low domestic rates to invest in the country, were still grappling with the impact of the global financial crisis as it lingers. The rate, thereafter, moved to 7.50 per cent in April, 8 per cent in May and 9.25 per cent in September 2011. Increasing the policy rate, which peaked at 12.0 per cent in October 2011, helped the asset prices to gather remarkable momentum from late 2011 to date.
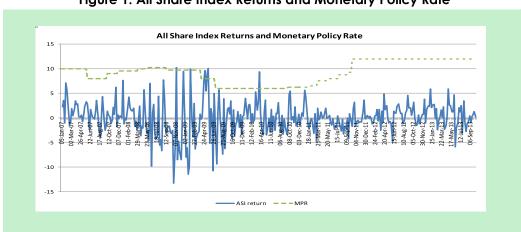
Figure 1: All Share Index Returns and Monetary Policy Rate

Although both the ASIr and NSE30 return experienced episodes of negative and positive fluctuations within a band of +/-6 per cent, their average return was 6 percentage points since October 2011 when the MPR stabilised at 12.0 per cent.

Figure 2: NSE30 Returns and Monetary Policy Rate

II.3.2   Asset Price and Interbank Exchange Rate

Figures 3.3 and 3.4 showed the trend in ASI return and NSE 30 return and the interbank exchange rate. While ASI returns, rose to its peak in the middle of the crisis in November 2008, the NSE30 return peaked June 2010. Recall that the NSE 30 was only introduced in January 2009. The lowest ASI returns also coincided within the same period of November. Although the returns maintained a smooth path through out the remaining period of the analysis, there was however, a distinct effect on the returns from October 2009 as the fluctuations was smaller and smooth from September 2009 when the exchange rate became fairly stable.
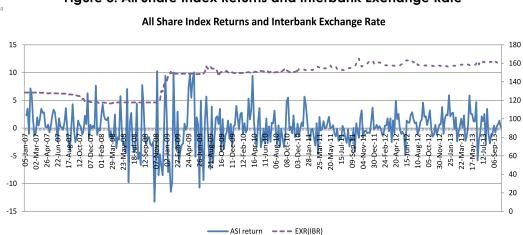
Figure 3: All Share Index Returns and Interbank Exchange Rate

In terms of the relationship between asset prices, with movement in the interbank exchange rate and its effects, we noticed that periods of exchange rate appreciation recorded the highest positive effect on both ASI returns and NSE30

returns, while periods of depreciation have the lowest negative effect. Also, periods that recorded large fluctuations coincided with exchange rate depreciation and vice versa. In terms of the policy dynamics, periods with stable exchange rate performed better as the fluctuations in assets prices were mild and smooth. Again, despite the mixed episodes of negative and positive fluctuations, the average return on both the ASIr and NSE30 was 6 percentage points since November 2011 when the exchange rate steadied within a band of +/- 3 per cent. The Central Bank of Nigeria (CBN) had on 21 November 2011, set the new official exchange rate at ₦155.00 to the US dollar from its previous rate of ₦150 and maintaining the band of +/-3 per cent.
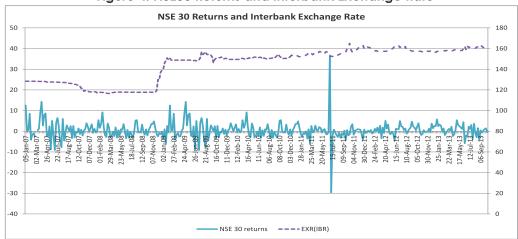
Figure 4: NSE30 Returns and Interbank Exchange Rate

III.   Methodology

III.1   Theoretical Framework

III.1.1 The Capital Asset Pricing Model

The capital asset pricing model (CAPM) developed by Sharpe (1970) is a model that describes the relationship between risk and expected return and is used in the pricing of risky securities.

$$r_\alpha = rf + \beta_\alpha (rm - rf) \qquad\qquad (1)$$

Where:

r_α =Asset price

β_α = Beta of the security

rf = Risk free rate

rm = Expected market return

The logic behind CAPM is the need to compensate investors. This can be done in two ways viz: time value of money and risk. The time value of money is represented by the risk-free (rf) rate in the formula and compensates the investors for placing money in any investment over a period of time. The other half of the formula represents risk and calculates the amount of compensation the investor needs for taking on additional risks. We calculate this by taking a risk measure (beta) that compares the returns of the asset to the market over a period of time and to the market premium $(Rm - rf)$. The CAPM postulates that the expected return of a security or a portfolio equals the rate on a risk-free security plus a risk premium. If this expected return does not meet or exceed the required return, then the investment should not be undertaken.

The CAPM provides guide on an asset's appropriate required return or discount rate—i.e. the rate at which future cash flows produced by the asset should be discounted given that asset's relative riskiness. Betas exceeding one signify more than average "riskiness"; betas below one indicate lower than average. Thus, a more risky stock will have a higher beta and the investor will discount it at a higher rate; while less sensitive stocks will have lower betas and would be discounted at a lower rate.

While some studies raise doubts about CAPM's validity, the model is still widely used in the investment community. Although it is difficult to predict from the beta how individual stocks might react to particular movements, investors can safely deduce that a portfolio of high-beta stocks will move more than the market in either direction, or a portfolio of low-beta stocks will move less than the market. This is important for investors - especially fund managers - because they may be unwilling to or prevented from holding cash if they feel that the market is likely to fall. If so, they can hold low beta stocks instead. Investors can tailor a portfolio to their specific risk-return requirements, aiming to hold securities with betas in excess of 1, while the market is rising, and securities with betas of less than 1 when the market is falling.

Since beta reflects asset-specific sensitivity to non-diversifiable, i.e. market risk, the market as a whole, by definition, has a beta of 1. Stock market indices are frequently used as local proxies for the market—and in that case (by definition) have a beta of 1. An investor in a large, diversified portfolio (such as a mutual), therefore, expects performance in line with the market.

By convention, a central bank has the mandate to deploy its policy rate to influence short-term interest rates, which in turn, affects the returns on investments

(equation 2). On the basis of this, we are able to establish the theoretical linkages of the transmission channels of monetary policy and asset price movement in the capital asset pricing model. In the manner of (Belke and Polliet, 2006 and Okpara, 2010), we assume that, a central bank is able to use monetary policy to influence asset prices through expectations about the future path of money rates.

The capital asset pricing model is by no means a perfect theory (CAPM). But the spirit of CAPM is correct. It provides a usable measure of risk that help investors determine what return they deserve for putting their money at risk.

III.2   Estimation Techniques and Data

As an estimation method, we employed the VAR (vector auto-regression) method that allowed us to derive detailed dynamic statistical evidence of the effects of monetary policy on asset prices. In particular, we examined whether asset price variables responded to unexpected monetary policy shocks and if so, how.

Following Kang et. al.,(2003), the study used the VAR framework of impulse response functions and variance decompositions with weekly data for the period January 2007 to October 2013. The first step in the VAR estimation was the test for the statistical properties of the data. We employed both the (Augmented Dickey-Fuller and Philips-Perron tests) for the stationarity tests to determine the order of integration of the variables. From the analysis, most of the variables were found to be I(1). Based on this, a co-integration test was then conducted to find out whether a long-run relationship existed between those I (1) variables. The analysis found no co-integration between the variables. Based on this, we proceeded to estimate the empirical VAR in the first differences of all the variables. We employed the method of structural factorisation to decompose the empirical shocks from the estimated VAR, from which, impulse response functions were estimated and variance decomposition (VD) analysis conducted.

We used the Impulse Response (IR) from the estimated VAR to calculate the impact of monetary policy on domestic assets and prices. The IR traced out the effect over time on asset variables of a shock to the monetary policy rate. The VD enables us to examine the relative importance of the various shocks for fluctuations in asset prices. The impact elasticities (both static and dynamic) were estimated using the IR functions.

III.2.1 Vector Auto-Regression Model

From the literature, the Vector Error Correction Model (VECM) was more flexible than simply using a VAR on first-differenced data. The VECM was also deployed in this paper because it offered a possibility to apply Vector Autoregressive Model (VAR) to integrated multivariate time series. The greatest interest of a VECM lies in the interpretation of the result, by introducing concepts such as long-term relationship between variables, and the associated concept of error correction, whereas one studies how deviations from the long-run are "corrected".

Thus, because we found a co-integration relationship (which is the long-run relationship) we decided that we might also want to model the short-run relationship between the variables in question, which can be represented by a Vector Error Correction Model, which was pretty much a VAR model in first differences that also included the co-integration vector (or vectors).

III.2.2 Effect on Macroeconomic Variables

We used the expanded VAR model to analyse how monetary policy shocks affected asset price variables. In all, six (6) variables were included in the model. Thus, weekly data were collected from the Central Bank of Nigeria (CBN), the Nigerian Stock Exchange (NSE) and the Financial Markets Dealers Association (FMDA) (now Financial Markets Dealers Quotation, FMDQ) for January 2007 to October 2013. The variables used were data on monetary policy rate (MPR), All Share Index returns (ASI_R), and NSE30 returns (NSE30_R), interbank exchange rate (EXR), and 91-day Treasury bill rate (TB_91Days). We also introduced a dummy for structural break (DSB) to capture the recent global financial crisis. The policy variable of interest is the MPR. The NSE 30 index was introduced in 2009, among other measures taking by the Securities and Exchange Commission (SEC) to make the market to recover. Thus, using the method of backcasting, we have in this study calibrated NSE 30 backwards to 2007 in the case of missing data for the purpose of our analysis. From the literature, (Gourieroux and Monfort, 1997), we know that the methods used for forecasting can be used to compute or reconstruct the past values of a variable as well.

In our model, the data vector is Monetary Policy Rate, All-Share Index returns, NSE 30 returns, interbank exchange Rate and 91 days treasury bills rate (TB_91 Days) in which the contemporaneously exogenous variable comes first in terms of ordering. The real variables are used in the logarithm form, while the price variables are used in the level form. These are the natural log of All-Share Index

returns (ASIr), NSE 30 returns (NSE_30_Index); the natural log of Monetary Policy Rate (MPR), that of Exchange Rate (EXR), and 91-day treasury bill rate.

To examine the relationship between asset prices and monetary policy, the VAR model used excluded the impact of the current values of the independent variables on the dependent variable. Thus, Autoregressive distributed lag (ARDL) model was used when the current values of the independent variables play a significant role in influencing the behaviour of the dependent variable. Both models yield consistent resulted in terms of the impact of the lag values on the dependent variable. The choice of VAR for this paper, however, was to capture the lag impact of the independent variables on the dependent variable to account for policy lag from monetary policy adjustment to asset prices. The VAR model is specified below:

$$ASIr_t = \alpha_0 + \sum_{t=1}^{p} \alpha_i \, ASIr_{t-i} + \sum_{i=0}^{q-1} \beta' \Delta X_{t-i} + DSB_t + \varepsilon_t \tag{2}$$

Where X a vector of MPR, EXR, TBR and DSB is the dummy for structural breaks. α_0 is the intercept, α_i is the coefficient for the lagged ASIr values, β is the coefficients for the lagged independent variables, while ε_t is the disturbance term. Modeling the long response of asset prices to monetary policy adjustment is also important to inform policy makers on the long-run relationship between asset prices and monetary policy.

To measure the response of asset prices to monetary policy shocks, vector error correction model was estimated and the impulse response trend derived. Variance decomposition values were also estimated to decompose how the shocks from the various monetary policy variables influenced asset prices. The vector error correction model is presented below:

$$ASIr_t = \Pi \, ASIr_{t-1} + \sum_{i=1}^{p-1} \phi \, \Delta X_{t-i} + \epsilon \tag{3}$$

Where ϵ_t is the error term, Π and the Φ are functions of the Φs. If $\Pi = 0$, then there is no co-integration. The impulse response function and the variance decomposition would then be extracted from the VEC model. While the impulse response function would present the response of ASI return to one standard innovation shock in monetary policy, the variance decomposition would provide a basis track the set of monetary policy variables that are influence the variation of in asset price response to monetary policy shocks.

IV.   Presentation and Discussion Results

IV.1   Trend and Descriptive Analysis of Monetary Policy and Asset Prices

In this section, we present our results, showing that the monetary policy response to stock prices in the period preceding and in the aftermath of the global financial crisis using weekly data. The variables were tested for stationarity using the Dickey Fuller Generalised Least Square (DF-GLS) and the Ng-Perron test. The choice of this method is in view of the fact that the more popular Phillips-Perron tests suffer from severe size distortions when there are negative moving average-errors (Phillips and Perron, 1988). Although the size of the Augmented Dickey Fuller (ADF) test is more accurate, the problem is not negligible (see Table 1). The summary of the stationarity result is presented below:

Table 1: Dickey Fuller Generalised Least Square (DF-GLS) Unit Root Test Results

Level I(0)		Critical Values		
ADF Stat	Variables	1 %	5%	10 %
-4.6424	ASIr	-2.5717	-1.9417	1.6160
-6.8489	NSE30R			
-0.2455	EXR			
-0.8918	MPR			
-1.2902	TB_91Days			
ADF Stat I(1)	Variables	1 %	5%	10%
-6.3162	EXR	-2.5717	-1.9417	1.6160
-7.9345	MPR			
-7.8814	TB_91Days			

Source: Eviews output

Table 2: Ng-Perron Unit Root Test Results

Level I(0)		Critical Values		
Ng-Perron Stat	Variables	1 %	5 %	10 %
-30.2423	ASIr	-13.8000	-8.1000	-5.7000
-56.2661	NSE30R			
-0.41107	EXR			
-2.0024	MPR			
-3.7751	TB_91Days			
Ng-Perron Stat I(1)	Variables	1 %	5 %	10 %
-51.5820	EXR	-13.8000	-8.1000	-5.7000
-139.684	MPR			
-143.643	TB_91Days			
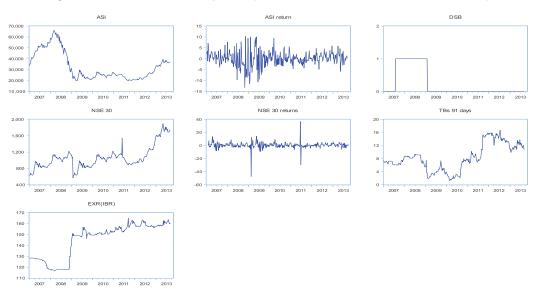
Source: Eviews output

Using both the Dickey Fuller Generalised Least Square (DF-GLS) and the Ng-Perron test with trend, the results showed that the return rate of the All Share Index (ASIr), and the NSE 30 return are I (0) i.e. stationary at levels, while exchange rate (EXR), monetary policy rate (MPR) and 91-day treasury bills (TB_91Days) were stationary at first difference i.e. *I* (I). A plot of the trend on the variables is presented in Figure 5.

The trend showed a rising ASI from 2007 to 2008 that declined due to the global financial crisis and remained low from 2009 to 2011. From 2012, however, the ASI has been rebounding. The All share index returns recorded mild swings in 2007 and larger swings from 2008 to 2009. The swings have been calmer since 2011 due to domestic efforts to cushion the impact of the crisis on the economy. The 2008 financial crisis formed the n-shape in the dummy for structural break (DSB) trend that was used to capture the effect of the financial crisis. The sharp decline in MPR and stepwise increase in MPR from 2007 to 2008 showed the effort by monetary authorities to help stabilise the financial system.

Figure 5: Trend of Monetary Policy Variables and Asset Prices – Weekly

In 2013, however, it rose above 15.0 per cent. This signaled an increase in collaterised inter-bank lending and the need to further strengthen financial system stability. Since global financial crisis could trigger systemic domestic crisis, it is important to continually factor in developments in the global and domestic economy and how they affect macroeconomic indicators in Nigeria when tinkering with MPR. The trends and summary statistics for the NSE30 returns, ASI

returns, dummy for structural break and other monetary aggregates are presented in Table 3.

Table 3: Summary Statistics on Monetary Variables and Asset Prices

Summary Stats	ASIR	NSE30R	DSB	EXR	MPR	TBR91
Mean	0.03	0.39	0.22	145.35	9.25	8.34
Median	0.08	0.36	0.00	151.20	9.75	7.64
Maximum	10.25	36.72	1.00	165.00	12.00	16.75
Minimum	-13.27	-47.47	0.00	116.50	6.00	1.26
Std. Dev.	3.34	4.80	0.42	15.64	2.27	4.08
Observations	345	345	345	345	345	345

Source: Eviews output

The swing observed in the trend of ASI returns from 2008 to 2009 fizzled out from 2011 to 2013. Monetary policy during this period was stable as deviations from the MPR had fluctuated with mild deviations of 2.27 per cent. This is very close to the 200 basis point corridor often set by the Monetary Policy Committee (MPC) for MPR. Exchange rate moved likewise and has been stable. This is shown by the trend and the mean descriptive statistics, which had fluctuated around N145.35 to a dollar by ±N15.64. Despite the performance of monetary policy during this period, the Nigerian Stock Exchange All Share Index, which reached a height of 66,121.93 points in 2008, is yet to attain its pre-crisis performance. After the financial crisis, periods of incremental adjustments in MPR were followed by large swings in the All Share Index. From the end of 2011 to 2013, however, when MPR was kept at 12 per cent, the swing in ASI reduced. Thus, for the MPC knowing when to keep the rates stable, decrease or increase it, remained a peculiar task that needs to be guided by both the empirics of the Nigerian economy and economic theory.

IV.2   Relationship between Asset Prices and Monetary Policy

The pair-wise granger causality test and the Exogeneity Wald tests between monetary policy with ASI returns and NSE30 returns were estimated to determine the direction of influence. The results were consistent when estimated for causality at lag 4. The choice of the lag was informed by the LR lag order selection criteria, which also included significant lag selected by the Akaike and Schwartz information criterion.

IV.2.1 Relationship between Asset Prices (ASI Returns) and Monetary Policy

The estimated VAR model showed that past values of All Share returns had a mixed impact on present returns in the Nigerian stock exchange. Thus, while

previous weeks closing was likely to have a positive influence on asset price returns in the market, it would not be so for asset price returns of up to a month.

Table 4: VAR Lag Order Selection Criteria

Endogenous variables: ASIR EXR MPR TBS91 DSB

Exogenous variables: C

Sample: 1/05/2007 10/11/2013

Included observations: 332

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-4453.195	NA	18682.75	26.86262	26.93139	26.89004
1	-2003.220	4796.638	0.009035	12.32060	12.80197*	12.51257*
2	-1950.637	101.0462	0.008178*	12.22071*	13.11469	12.57723
3	-1923.147	51.83465	0.008612	12.27197	13.57855	12.79303
4	-1880.627	78.63544*	0.008289	12.23270	13.95188	12.91831
5	-1870.332	18.66814	0.009692	12.38754	14.51933	13.23770
6	-1844.822	45.33378	0.010348	12.45074	14.99513	13.46544
7	-1817.515	47.54005	0.010939	12.50311	15.46011	13.68236
8	-1791.463	44.41467	0.011665	12.56303	15.93264	13.90683

Source: Eviews output

* indicates lag order selected by the criterion

Pairwise Granger Causality Tests

Results for the pair-wise granger causality, showed a unidirectional causality from NSE 30 to monetary policy at lags one to three. At lag four, however, a bi-directional causality was found between monetary policy and ASI returns (Table 5): an indication of monetary policy - asset prices interaction. Lag four, which represented four weeks implied that the decision of the MPC influenced asset price behaviour one month before the meeting was held and one month after it was held. The dynamic relationship between asset prices and monetary policy is shown in the estimated VAR model.

Table 5: Pairwise Granger Causality Tests

Sample: 1/05/2007 10/11/2013

Lag: 4

Null Hypothesis:	Obs	F-Statistic	Prob.
MPR does not Granger Cause ASIR	345	2.18457	0.0704
ASIR does not Granger Cause MPR		2.07051	0.0843

Source: Eviews output

**Table 6: VAR Granger Causality/Block Exogeneity Wald
Tests**

Sample: 1/05/2007 10/11/2013
Included observations: 340
Dependent variable: ASIR

Excluded	Chi-sq	df	Prob.
NSE30R	14.43819	4	0.0060***
EXR	6.863155	4	0.1433
MPR	15.68720	4	0.0035***
TBS91	3.194870	4	0.5258
DSB	25.45615	4	0.0000***
All	64.43530	24	0.0000

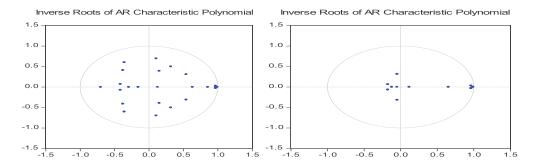*****indicates per cent level of significance*

We employed the block Exogeneity Wald test to complement our Granger casualty test. The Test was to look at whether the lags of the excluded variables granger-cause the endogenous variable in the system. The ALL is a joint test that the lags of all other variables affected the endogenous variables. Thus, from table 6, the first row showed if the lagged coefficients of the variables of DSB, EXR, TBR91 and MPR, were significantly different from zero. The second row (ALL) showed if lagged variables of all variables other than NSE30R were zero. From the results in the table, it was easy for us to accept the null hypothesis in both cases at 5.0 per cent level of significance. Again, the probability of 85.0 per cent supports the acceptance of the null hypothesis. Chi-Sq. @ 5.0 per cent = 16.75.

Inverse Root Stability Test

Results of the inverse root stability test for ASI Returns and the NSE 30 with the restricted VAR process indicated that both models were dynamically stable, as we can see from the following diagram.

Figure 6 Stability test for ASI Returns

Inverse Roots of AR Characteristic Polynomial

Figure 7 Stability test for NSE30 returns

Inverse Roots of AR Characteristic Polynomial

Co-integration Test

The results for the co-integration are presented in Table 7. Both the Trace test from the Johansen co-integration test and the MacKinnon and Maximum Eigenvalue test indicated that there were two co-integrating equations significant at 5 per cent critical value. The number of co-integration was included to estimate the vector error correction model. The choice of the lag was determined by the sequential modified test statistics (LR) lag order selection criteria, which also included significant lag selected by the Schwartz information criterion, Final prediction error (FPE) and Akaike information criterion (AIC). Evidence from the lag selection suggested the lag of order 4. The result of the Lagrange multiplier (LM) test statistics at lag 4 indicated no serial correlation in residuals. The number of co-integration was included to estimate the Vector error correction model (VEC). The normalised co-integrating vector was quite appropriate when we looked at the magnitude, sign and the level of significance. For the co-integration, the lag length was the lag length chosen minus one (since we are running the model in first difference).

Table 7: VAR= (NSE30R DSB EXR MPR TBS91) = lag (3)

Null	Alternative	λ Trace	95 per cent critical value	λ max	95 per cent critical value
r = 0	r≥1	89.978	69.818***	130.327	33.876***
r ≤ 1	r≥2	42.757	47.856	47.220	27.584
r ≤ 2	r≥3	18.514	29.797	24.243	21.131

r indicates the number of co-integrating vector. (***) indicates statistical significance at 1 per cent levels

Table 8: VAR= (ASIR DSB EXR MPR TBS91) = lag (3)

Null	Alternative	λ Trace	95 per cent critical value	λ max	95 per cent critical value
r = 0	r≥1	76.155	69.818***	34.645	33.876***
r ≤ 1	r≥2	41.509	47.856	24.757	27.584
r ≤ 2	r≥3	16.752	29.797	11.125	21.131

r indicates the number of co-integrating vector. (***) indicates statistical significance at 1 per cent levels

IV.3.3 Vector Error Correction Estimate

The result for the vector error correction estimate for NSE 30 returns showed that monetary policy rate and the 91-Day Treasury bill rate were critical to enhancing asset price returns (NSE 30 returns) in the short-run and to stabilise its performance in the long-run. The impact of MPR on asset prices was negative, while TB rate was positive. Of the two co-integrating equations, the first was statistically significant in the VEC context, while the other was not. This suggested that while monetary policy was likely to help correct distortions in the stock market in the long-run, it was not entirely up to monetary authorities. Other factors would as well be responsible for bringing about the long-run equilibrium of the asset price returns. The VEC model showed that monetary policy accounted for 58.1 per cent variation in NSE 30 returns while other factors accounted for 41.9 per cent.

Table 8: VECM Estimate for NSE30

Error Correction:	D(NSE30R)	D(DSB)	D(EXR)	D(MPR)	D(OBB)
CointEq1	-1.285407	0.004659	-0.000635	-0.003563	-0.003490
	(0.10843)	(0.00189)	(0.03253)	(0.00609)	(0.04033)
	[-11.8553]	[2.45984]	[-0.01954]	[-0.58527]	[-0.08653]
CointEq2	0.122461	0.000625	0.043457	0.000281	0.885223
	(0.39919)	(0.00697)	(0.11975)	(0.02242)	(0.14848)
	[0.30678]	[0.08958]	[0.36291]	[0.01252]	[5.96186]
R-squared	0.598054	0.019188	0.084430	0.103423	0.234683
Adj. R-squared	0.580845	-0.022804	0.045231	0.065037	0.201917
F-statistic	34.75303	0.456943	2.153892	2.694310	7.162415

Source: Eviews output

For ASI returns, the result showed that monetary policy rate, exchange rate policy and financial systems stability were critical to enhancing asset price returns in the short-run and to stabilise its performance in the long-run. The impact of MPR on asset prices was negative, while exchange rate was positive. This suggested that

when exchange rate is depreciating, returns on asset prices would be negative. Thus, the policy rate should be increased and financial systems stability sustained to strengthen the performance of the stock market. Of the two co-integrating equation found, the first was statistically significant in the VEC context, while the other was not. This suggested that while monetary policy was likely to help correct distortions in the stock market in the long-run, it was not entirely up to monetary policy to fix distortions in stock prices. Other factors would as well be needed to bring about the long-run equilibrium of the asset price returns. The VEC model showed that monetary policy accounted for 47.05 per cent variation in all share index returns, while other factors accounted for 52.95 per cent.

Table 9: VECM Estimate for All Share Index Returns (ASIr)

Error Correction:	D(ASIR)	D(OBB)	D(MPR)	D(EXR)	D(TBS91)	D(DSB)
CointEq1	-1.060641	-0.097555	-0.002918	-0.060956	-0.006263	0.002266
	(0.12530)	(0.06261)	(0.00996)	(0.05036)	(0.02357)	(0.00309)
	[-8.46485]	[-1.55815]	[-0.29294]	[-1.21046]	[-0.26568]	[0.73290]
CointEq2	-0.076633	-0.173295	0.006049	-0.023257	0.034318	0.006361
	(0.09079)	(0.04537)	(0.00722)	(0.03649)	(0.01708)	(0.00224)
	[-0.84406]	[-3.81993]	[0.83819]	[-0.63738]	[2.00921]	[2.83951]
R-squared	0.511316	0.321942	0.118051	0.193115	0.183597	0.039155
Adj. R-squared	0.470461	0.265255	0.044319	0.125659	0.115345	-0.041172
F-statistic	12.51550	5.679335	1.601079	2.862811	2.689978	0.487446

Source: Eviews output

Impulse Response Function

The impulse response function in figure 8 showed how asset prices respond to shocks from monetary policy. The trend showed that a one standard innovation shock in MPR would be positive and also lag by two weeks before affecting ASI return in the fourth week. There was a highest positive effect on the first week, lowest negative effect on the third week. The ASI returns would, however, quickly recover from any shock in the monetary policy rate by the fourth week. Thus, MPR shock translated to positive returns to ASI early and would resume its steady and smooth path by the start of the fourth week until the end of the period. Exchange rate shock to ASI return was negative in the first week but picked up within the second and third week. Like MPR shocks also, ASI return recovered briefly from the exchange rate shock in the fourth week after which it became negative from the sixth week until the end of the third month.

Shocks from Treasury Bills still translated into positive returns for ASI the next two weeks. The loss to ASI return due to Treasury Bill shock would be mild as the deviation from the zero line was small. The major shock to ASI return was financial

system instability (DSB) as every response of ASI return was negative. The impulse response function showed that while financial system instability (DSB) took time to affect ASI return, it took a while to get out of it and longer to recover fully. Rather than fully recover from the impact of the shock, the impulse response trend of the dummy for financial system stability assumed a steady trend from the sixth period all the way to the twelfth period. A look at the variance decomposition table further shed light on the interaction between monetary policy and asset prices.

Fig. 8: Impulse Response Function

Source: Eviews output

The impulse response function in figure 9 was deduced from the VEC estimation and showed how the variable for asset prices, NSE 30 return respond to shocks from monetary policy. The trend showed that a one standard innovation shock in MPR would lag by two weeks before affecting NSE 30 return in the fourth week. The NSE 30 return would, however, quickly recover from any shock in the monetary policy rate and would resume its steady path by the start of the fifth week. Exchange rate shock would affect NSE30 return negatively in the first 2-weeks and

thereafter pick up within the second and third week. It would resume its steady path from the start of the sixth week. A shock from the dummy, representing financial system stability (DSB) would be mild, but negative within the first 4-weeks. It, however, became positive by the fifth week and thereafter maintained a steady path for the remaining period. A shock from the 91-Day Treasury bill (TBR91) would also be positive and small within a period of 2 weeks after which it became negative and remained in that region for the entire period. Thus, for TBR91 returns to asset prices would become negative, but smooth from the third and fourth week, respectively, until the end of the third month. But the MPR, Exchange rate and DSB shocks, on the other hand, translated to very small positive returns to NSE 30 from the fifth week until the end of the period. Almost all response of NSE 30 return to DSB was positive, except the first four weeks and the change was smooth.

Fig. 9: Impulse Response Function

Response of NSE30R to MPR

Response of NSE30R to EXR

Response of NSE30R to TBS91

Response of NSE30R to DSB

Source: Eviews output

Variance Decomposition

Evidence from the 12 weeks forecast horizon suggested that the proportion of forecast error variance at the end of 12 weeks is 86.0 per cent for ASIr and 97.0 per cent for NSE30 return. The result from the variance decomposition shed further light on the interaction between monetary policy and ASIr and NSE 30 returns. From the variance decomposition, the dummy for financial systems instability or structural break, DSB, accounted for the largest component in the variation of ASIr in the entire period. It peaked at 7.104 in the twelfth period. MPR followed behind DSB and accounted for the second largest component (peaking at 3.105) in the variation of ASIr, while exchange rate accounted for the third largest component, peaking at 1.697.

For the NSE 30 returns, exchange rate accounted for the largest component in the variation in the entire period, peaking at 1.042 in the twelfth period. DSB followed behind exchange rate and accounted for the second largest component in the variation of NSE 30 returns, while MPR accounted for the third largest component. The implication of the forgoing is that monetary policy rate adjustment should be complemented by exchange rate and treasury bills adjustment to achieve steady returns on asset prices.

Table 9: Variance Decomposition of ASIr and NSE30

Variance Decomposition of All Share Index (ASIr)					
Explained by shocks in					
Horizon	S.E.	ASIr	MPR	EXR	TBS91	DSB
2	3.241907	97.048	1.305	1.0594	0.274	0.310
4	3.338289	91.997	2.795	1.594	0.368	3.003
6	3.418136	88.454	2.772	1.644	0.353	5.886
8	3.435039	87.657	2.857	1.670	0.394	6.312
10	3.449476	86.931	3.013	1.709	0.396	6.682
12	3.464656	86.171	3.105	1.697	0.397	7.104
Variance Decomposition of NSE30 return					
2	4.550977	98.450	0.001	0.212	0.893	0.391
4	4.570597	97.707	0.008	0.346	1.018	0.850
6	4.573685	97.585	0.021	0.362	1.032	0.886
8	4.575033	97.530	0.030	0.366	1.035	0.914
10	4.576363	97.475	0.037	0.370	1.039	0.943
12	4.577688	97.421	0.045	0.374	1.042	0.972

Source: Eviews output

V.   Recommendations and Conclusion

The study assessed the impact of monetary policy actions on asset prices using weekly Nigerian data from January 2007 to October 2013. The results indicated that a change in the monetary policy rate would result in a decline in the All Share

Index returns. The findings indicated that monetary policy influenced asset prices significantly as from the fourth week for the All Share Index returns (ASI returns). Despite the model's general goodness of fit, MPR and TBR-91 were not statistically significant at their individual probability levels. Only exchange rate policy and the dummy for financial system instability (DSB) were found to be significant, signifying that they were critical to enhancing asset price returns. The impulse response revealed that while financial system instability took time to affect asset prices, it took a while to get out of it and even longer to recover fully. The impulse response function obtained from the VEC estimation, indicated that a one standard deviation (innovation) shock in MPR would be positive and lag by two weeks before affecting ASI return in the fourth week. With regard to the pair-wise granger causality, the result showed a unidirectional causality from NSE 30 to monetary policy at lags one to three. At lag four, however, a bi-directional causality was found between monetary policy and ASI returns, an indication of monetary policy - asset prices interaction and the fact that monetary policy was a significant determinant of asset price returns in Nigeria.

For the NSE 30 return, the study revealed that monetary policy rate and the 91-Day Treasury bill rate also significantly explained the variation in asset prices by the probability level. The trend showed that a one standard innovation shock in MPR would lag by two weeks before affecting NSE 30 return in the fourth week. However, the NSE 30 return would quickly recover from any shock in the monetary policy rate and would resume its steady path by the start of the fifth week.

Our results showed that the predominant sources of asset price volatility were due largely to interest rate shocks and exchange rate shocks and financial system stability. The authorities must endeavour to provide forward guidance to anchor investors' expectations and the direction of the market. Changes in the monetary policy rate affect the behaviour of consumers, businesses and the stock market. The indirect effect of tightening the monetary policy rate is that banks increase the rates that they charge their customers to borrow money. Businesses are also, indirectly affected by an increase in the policy rate as they too borrow money from banks to run and expand their operations. When the banks make borrowing more expensive, companies might not borrow as much and will pay higher rates of interest on their loans. Less business spending can slow down the growth of a company, resulting in decreases in profit and thus, asset prices.

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