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Aims and Scope

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

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Notes to Contributors

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

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Nigeria's Monetary Conditions Index

Tule, M. K., A. M.Isah, P. N.Okafor,I.Pedro, S. A.Ukeje,K. Oji, and S. Oladunni*

Abstract

The paper aimed to construct a monetary conditions index (MCI) for Nigeria to aid the evaluation of the stance of monetary policy. Quarterly data for 91-day treasury bill rate (TBR), real exchange rate (RER), inflation rate (INF), real private sector credit (RCP), and real gross domestic product (RGDP), covering the period 2000Q1 to 2014Q1, were utilised. The period coincided with key reforms in the money and foreign exchange markets, culminating in the adoption of a new monetary policy framework in 2006. Following some econometric diagnostic tests, an aggregate demand function was estimated using the Johansen co-integration technique. The resultant long-run coefficients were applied to the deviations of the MCI component variables to derive the monetary conditions indices. The narrow and broad MCIs suggested a relatively tight monetary environment with the broad MCI being more volatile, compared with the narrow MCI due to the inclusion of the credit component, which reflects the continual swings in banking system liquidity. Our findings revealed that the exchange rate is a strong channel of monetary policy transmission mechanism in Nigeria, and thus very crucial in the conduct of monetary policy.

Keywords: Interest rates, Credit and Monetary Policy

JEL Classification Numbers: E43, E51 & E52

I. Introduction

Monetary policy is one of the two main tools of macroeconomic policy management, the other being fiscal policy. Both policy tools are used to guide an economy towards a level of output (Gross Domestic Product) that is optimal with regard to employment. Central banks as the monetary authority of countries formulate and implement monetary policy by controlling money supply through several mechanisms. Compared with fiscal policy, monetary policy has proved to be a more flexible and powerful instrument for achieving economic stabilisation objectives, in the short to medium term, because it can be adjusted quickly, when need be, in response to macroeconomic developments.

**The authors are staff of the Monetary Policy Department, Central Bank of Nigeria. The views expressed in this paper are those of the authors and do not necessarily reflect the opinions of the Central Bank of Nigeria.*

Recent events surrounding the global financial crisis have amply demonstrated the uses and abuses of monetary policy in open economies. In particular, the use of quantitative easing to restart growth shows that monetary policy can adopt unconventional strategies (buying or selling private securities) when conventional strategies (buying or selling government securities) are unable to achieve stabilisation objectives. Mishkin (1995), Monetary Policy Committee (BOE) (1999), and Kuttner and Mosser (2002) identified six (6) channels of transmission of monetary policy, namely: the interest rate; the wealth effect; the exchange rate; the monetarist (relative asset price changes); the narrow credit (bank lending); and the broad credit (balance sheet) channels. Through these six channels changes in overnight interest rate by the central bank affect the level of aggregate demand and the inflation rate, ultimately. The six channels are commonly compressed into three: interest rate, exchange rate and credit channels due to the significant effect of monetary policy on these three variables, particularly in the short-run. Monetary policy actions, operating through these channels, generate an overall monetary condition in an economy beyond what a central bank's policy rate would suggest.

A Monetary Conditions Index (MCI) is an index number, relative to a base period, calculated from a linear combination of two or all of these three economy-wide financial variables relevant to monetary policy. It is a summary statistic of the monetary condition in an economy. In all cases, the variables include short-term interest rate and exchange rate. MCI calculated using only the interest and exchange rates is termed a narrow MCI, while that calculated using all the three variables is termed broad MCI. The purpose of calculating the index is to provide information on the economy, inflation and the general monetary environment in a country to guide monetary policy. A change in the index indicates the stance of monetary policy: how 'tight' or 'loose' monetary conditions in an economy are relative to the reference or base period. The use of MCI began with the Bank of Canada in the early 1990s. The Bank used it as a short-run operational target of monetary policy. Other monetary authorities in New Zealand, Turkey, the United Kingdom and Australia, some international organisation's (such as the OECD) and large business corporations, especially banks have also adopted the technique of MCI as decision-making tool. Calculation of MCI is done within a model in which the GDP or inflation path is dependent on two or all the three monetary policy variables: interest rate, exchange rate and volume of credit to the economy.

MCI serves as an indicator of monetary policy stance. Also some major central banks, including the Bank of Canada, its counterparts in New Zealand, Australia, Norway, Sweden and the European Central Bank, have at one time or the other, used MCI as operational target. The International Monetary Fund (IMF), Goldman Sachs, JP Morgan, Deutsche Bank and Merrill Lynch also calculate MCIs and use them to appraise the monetary conditions in different countries. Although various institutions use the index for varying reasons, there is monetary authority that has embraced it explicitly to serve as a policy rule. The indicator usually provide supplementary information to certain central banks to enable them identify divergence between actual monetary conditions and the desired stance of policy.

The objective of this paper is to rejuvenate the estimation of MCI for Nigeria and to test the outcome in order to enhance the efficiency of monetary policy in Nigeria. This paper would extend earlier efforts by Oleka and Masha (2003) and Yaaba (2013) in the estimation of monetary conditions index for Nigeria. It is believed that, the construction and maintenance of MCI for Nigeria could be used by the central bank and other policy makers to evaluate the stance of monetary policy. A good MCI could also be useful in the following ways: (i) provide additional insights on monetary conditions; (ii) serve as potent indicator under a multiple indicator approach such that the contribution of each of the channels of monetary policy transmission to the general monetary condition (beyond the overnight interest rate and or exchange rate) can be evaluated; (iii) provide policy makers with necessary flexibility to respond more appropriately to local and foreign financial markets dynamics; (iv) allow monetary policy authorities the chance to continuously rebalance priorities between output growth and price stability in a flexible and time variant manner depending on the underlying macroeconomic and financial conditions evident in the MCI; (v) help to determine which of the variables (determinants) is more important in influencing monetary condition in a given period; (vi) serve as a leading indicator of price movement and economic activity; (vii) complement the money demand function, which lacks precision; (viii) guide monetary policy decisions, using forecasts of MCI through the forecast of its determinants.

Following the introduction, Section 2 considers the conceptual issues, literature review and country experiences. In Section 3, data and methodology are presented, while estimation and results are presented and discussed in section 4. Section 5 provides a medium-term forecast of the MCI, while section 6 concludes the paper.

II. Conceptual Issues, Literature Review and Country Experiences

II.1 Conceptual Issues

Monetary policy implementation frameworks are based on monetary policy transmission mechanism. In small open economies, the monetary policy transmission mechanism depends on the depth of the financial market, the degree of financial innovation, the intensity of international capital flows and the extent of trade openness. Financial deepening links the financial and the real sectors closely and where the domestic financial market of a country is well linked to the global financial market, exchange rate will be an important channel of monetary policy transmission to the real economy.

Conceptually, a change in Monetary Conditions Index is taken to mean the extent of tightening or easing of the monetary conditions; in which a number is used to summarise the degree of pressure that monetary policy exerts on the economy. The use of MCI is premised on the assumption that monetary policy impacts general price level principally through two channels, namely: interest rates and exchange rates. When monetary policy stimulates interest and exchange rates in the upward direction, inflation rises and generates economic slowdown through fall in aggregate demand and vice versa (Kesriyeli and Kocaker, 1999).

The level of investment and domestic demand are usually influenced by interest rates. Adjustments to the interest rate elicit reaction in market interest rates, both short- and long-term. The effects of adjustments in market interest rates usually influence savings and lending rates. Changes in the saving rate tend to impinge on the spending pattern of individuals while changes in the lending rate have effects on firms' investment decisions. Also, variations in aggregate consumption and investment are directly linked to changes in the gross domestic product (GDP).

In the second channel, exchange rate plays a dominant role. The exchange rate is the relative price of foreign currencies vis-à-vis domestic currency. Ideally, both foreign and domestic monetary conditions should have influence on the exchange rate. Adjustment in the exchange rate alters the relative prices of

domestic and foreign goods and services. Price movement affects economic agents' spending patterns. Exchange rate changes can also affect inflation rate directly, with the transmission coming through the prices of imported goods. In today's global economy, imported goods constitute important determinants of firm's costs and individuals' consumption expenditures. Domestic currency appreciation tends to lower the domestic price of imports, while depreciation of the domestic currency increases the price of imported goods. Hence, another key channel through which monetary policy actions are transmitted to the ultimate objectives of policy, which include inflation and output in a small open economy, is the exchange rate.

II.2 Literature Review

According to Peng and Leung (2005), the model of the effect of the three variables on aggregate demand represented by real GDP growth (y) is as follows:

$$y = \alpha_0 + \beta r - \beta_1 reer + \beta_2 cr + u_t \quad (1)$$

where y represents output growth; r represents interest rate; reer represents real effective exchange rate; cr represents the volume of credit; u_t represents the error term; and β, β_1 and β_2 are parameters, which determine the weights of the monetary policy variables in the MCI. The alternative model of the effect of the monetary policy variables on the general price level (π_r) is as follows:

$$\pi_r = \alpha_0 + rgdp_{gr} + \beta r - \beta_1 reer + \beta_2 cr + u_t \quad (2)$$

where $rgdp_{gr}$ represent real GDP growth rate; and other terms represent the same variables as in 1 above. These are single equation models. However, there are also models, such as Osborne-Kinch and Holton (2010) that are based on multiple equations and trade shares. Here, weight for exchange rate is said to depend on the ratio of exports to gdp in the long-run and the weight for interest rate is simply one less this ratio. The trade share models are rarely used while the single equation models are widely used. However, the multiple equation models are more rigorous because they take into account the cumulative lagged impact of the different variables, thereby incorporating the relevant lags within which the economy reacts to monetary policy shocks. A broad MCI would be calculated, from a single equation model as:

$$MCI = \alpha_0 + r + \beta_1/_\beta Reer - \beta_2/_\beta Credit \quad (3)$$

To calculate a narrow MCI from a single equation model, we have:

$$MCI = a_0 + r + \beta_1/_{\beta} Reer \quad (4)$$

The theoretical model of Broad MCI as determined from the aggregate demand function using real GDP growth (y) as the dependent variable is as follows (Peng and Leung, 2005):

$$y = a_0 + \beta r - \beta_1 Reer + \beta_2 Credit \quad (5)$$

$$MCI = a_0 + r + \beta_1/_{\beta} Reer - \beta_2/_{\beta} Credit \quad (6)$$

Where *y* is real output growth, *credit* is real credit growth, *r* is real interest rate and *reer* is the real effective exchange rate. Thus, an increase in MCI indicates a tightening of monetary conditions, while a lowering of MCI indicates the easing of monetary conditions. Specifically, a one-point adjustment in the MCI is equal in its impact on output growth to a one percentage point adjustment in real interest rate (Peng and Leung, 2005). The weights used in constructing the MCI are thought of as the elasticity of output in respect of the real interest rate (β) and real exchange rate (β_1). There are a number of studies that have estimated MCI for different countries using either an inflation function or aggregate demand function.

Kesriyeli and Kocaker (1999) constructed the MCI using inflation function for Turkey and derived relevant weights using the coefficients of real effective exchange rate and real interest rate. Hataiseree (2000) constructed MCI for Thailand with an inflation function, using the autoregressive distributed lag model to derive the relevant weights. The inflation model included import price index, interest rate, nominal effective exchange rate, government fiscal indicator and agricultural price index. The estimated weight ratio for exchange rate and interest rate for Thailand is 3.3:1. In 2000, the Hong Kong Monetary Authority used the real interest rate and real effective exchange rate to construct MCI after estimating the aggregate demand function in the reduced form to obtain relevant weights. The ratio of exchange rate and interest rate weights is 4.25:1. The MCI at time t denoted as MCI $(v)_t$ is a weighted sum of changes in exchange rate (e) and interest rate (R) from their base levels in a base year (t = 0):

$$MCI\ (v)_t = a_{v,e}(e_t - e_0) + a_{v,R}(R_t - R_0) \quad (7)$$

The MCI is determined mainly by the weights $a_{v,e}$ and $a_{v,R}$, being the measures of the exchange rate and the interest rate, and the base year. Weights are the key parameters in the construction of the MCI. They are used to reflect the effects of adjustments in policy instruments on the target variable v, which typically is either output (y), proxied as real GDP or inflation represented by change in consumer price index, Δp_t. The weights usually applied to construct the MCI can be obtained from an existing econometric model or from fresh estimates of a model. Deriving new estimates requires modeling the objectives of monetary policy, which in many countries is either maintaining stable price level or ensuring robust economic growth.

Kesriyeli and Kocaker (1999) estimated the MCI for Turkey, based on the price (inflation) equation because they thought that the exchange rate was the driving force in the adjustment process. Also, in their view, the MCI should reflect the linkage between the operational (interest) and ultimate (inflation) targets. Traded goods and services was foreign exchange rate sensitive, while investment and durable consumer goods expenditure were interest rate sensitive. Overall, the usefulness of the MCI in different countries is dependent on the prevailing economic conditions.

The most popular approach for estimating weights for the relevant monetary instruments used in calculating MCI was the approach adopted by Gonzalez-Hermosillo and Ito (1997), which involved estimating single equation relating the objectives of monetary policy to the policy instruments. They were derived from the coefficient estimates from an estimated model relating the policy objectives (i.e. inflation and economic growth) to the policy instruments (i.e. interest rates and foreignexchange rate). It had been adopted by Kesriyeli and Kocaker (1999) for Turkey, Lin (1999) for Taiwan, Hataiseree (2000) for Thailand,Apaa-Okelloand Opolot, (2011) for Uganda andOlekah and Masha, (2003) for Nigeria, among others.

II.3 Country Experiences

Canada

The Bank of Canada is the first to use Monetary Conditions Index (MCI) in 1990 in the effort to understand monetary policy stance and its implications for the economy. Since then, MCI usage had become popular in several other countries. Bank of Canada has been pursuing inflation targeting as a monetary policy framework since 1991 and the MCI is employed as a short-term operational reference variable. Based on the forecasts of quarterly inflation, the Bank set a target path for

the MCI internally, which should be compatible with inflation trends. At intervals, the monetary conditions is examined to ascertain the need for possible reassessment of the price outlook and, thus, for adjusting the MCI path. In case the monetary policy course requires a redirection, owing to significant discrepancy between the actual and the expected MCI, measures are taken to influence the behavior of the short-term interest rate. If the MCI is adopted as an operating target, interest rate targeting horizons would be expanded to cover exchange rate shocks.

In constructing MCI, the Bank of Canada applied the weights derived from estimating an aggregate demand equation given that the output gap and the expected inflation are considered the principal drivers of inflation. In addition, adjustments in aggregate demand are seen as the key determinants of change in the output gap. The Bank of Canada changed its initial specification earlier based on inflation and adopted aggregate demand as the dependent variable in order to prevent the market from being alarmed. Also, with inflation as the dependent variable, a temporary or one-off price shock could be mistaken as the beginning of an inflation spiral.

Canada recorded significant success in the use of the MCI in early 1990s owing to the heavy impact of shocks associated with adjustments in Canadian dollar portfolio. However, in the second half, real shocks on the currency were prevalent, thus, offsetting interest rate responses. Consequently, the Bank of Canada abandoned the use of MCI as operational target of monetary policy in 1998 but it continued to recognise the significance of MCI in the description of its policy stance and communication with the markets.

India

Owing to the liberalisation of financial markets in India, the importance of interest and exchange rates in influencing monetary conditions increased to a great extent. The growing importance of these variables in the transmission of monetary policy qualifies the MCI as a key indicator under the multiple indicator approach introduced in 1998 by the Indian monetary authority. Kannan et. al., (2006) constructed a narrow monetary conditions index (NMCI) for India, taking into consideration both exchange and interest rate channels. They also constructed a broad monetary conditions index (BMCI), which incorporated credit growth as a supplementary indicator of monetary conditions. Their findings reveal that interest rate was more important compared to exchange rate, in influencing the Indian monetary conditions.

Turkey

Kesriyeli and Kocaker, (1999) constructed MCI for Turkey and derived weights using a price equation. The adoption of inflation model was justified based on the consideration that exchange rate was a major factor in the adjustment process of the Turkish price level. Their findings reveal that in spite of the high interest rate and real exchange rate appreciation, which reflected the tight monetary policy, output growth and inflation maintained an uptick. They warned that increase in price level and output growth should not be understood as the impacts of central bank's policy measures. They noted that, for Turkey, a country with high inflation history, short-term interest rates may not be effective in addressing inflationary pressures. Huge debt servicing had induced significant resource transfer from public to the private sector, thus, resulting in a boost in the domestic demand through income and wealth effects. Furthermore, capital inflow induced by high real interest rates, constitute another contributor to the boost in the Turkish domestic demand, it recorded high investment and output growth rate between 1995 and 1998.

China

Peng and Leung, (2005) constructed MCIs for assessing the Chinese monetary and financial conditions. They extended the narrow MCI to reflect the effect of bank credit as it was considered as a major channel through which monetary policy is implemented in China. The MCI showed an easing of monetary conditions between 2002 and 2003. However, policy measures intended to curb credit boom and raise interest rates in 2004 resulted in tighter monetary conditions. This was marked by a considerable rise in the MCI, which indicated a reversal of about half of the earlier easing.

II.4 Lessons from the Review of Country Experiences

The review of literature on country experiences reveals that MCI could serve as a useful tool in the conduct of monetary policy in Nigeria. It is being used by monetary authorities essentially as an indicator for monetary conditions and for supplementing monetary aggregates that had proved to be good leading indicators of output. The use of growth equations for calibration of relative weight of MCI components is popular. Result of the studies on MCI for developed countries showed that short-term interest rates can be employed as a monetary policy tool more effectively than other monetary policy tools to attain price stability and improved output growth. The Bank of Canada took into account the close

linkages between Canada's money and foreign exchange markets in constructing the MCI. The experience of the Bank of Canada is that basing MCI on inflation caused the market to regard the index as reflecting forecast inflation, which it is not. Accordingly, basing it on GDP or output is chosen to avoid misunderstanding. The Reserve Bank of India constructed a broad MCI, which incorporated credit growth as an additional indicator of monetary condition.

III. Data and Methodology

III.1 Data

The data for this study were sourced from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS), covering the period 2000Q1 to 2014Q1. The choice of the sample period was informed by a number of considerations. Data showed evidence of relative macroeconomic stability during the estimation period. Also, it was during the period that the dual exchange rate regime was abolished, financing of fiscal deficit through creation of high powered money by the central bank through Ways and Means Advances reduced drastically to the current situation where the fiscal authority remained a net creditor to the economy. The period also coincided with the time substantial reforms were undertaken in the money and foreign exchange markets, culminating in the adoption of a new monetary policy implementation framework in 2006. Moreover, it is believed that, this period depict the era during which monetary policy assumed a greater relevance in the economy.

Quarterly data on interest rate, real exchange rate, inflation rate, real private sector credit and real GDP (in logarithms) for the period 2000Q1 to 2014Q1 were used. The interest rate used is the 91-day treasury bill rate. In the money market, there are several interest rates, depending on tenor and purpose. There is the monetary policy rate (CBN policy rate), the interbank call rate, the treasury bill rate, deposit and lending rate, among others. It is, therefore, important that a rate be chosen which is most representative in signaling market expectations. A rate chosen must reflect the time period applicable to the MCI constructed. The diagnostic properties of the data were examined to check for the presence of unit root using the augmented Dickey Fuller (ADF), and Phillips Peron (PP) Tests.

III.2 Model Specification

Narrow MCI at time t or MCI_t is defined as the weighted sum of changes in the interest rate (r) and exchange rate (rer) from their levels in a chosen base year (t=0). For broad MCI, we include other variables such as credit to take account of other evolving channels of monetary policy transmission mechanism.

Narrow: $$MCI = \beta_r (r_t - r_0) + \beta_{rer}(rer_t - rer_0) \quad (8)$$

Broad: $$MCI = \beta_r (r_t - r_0) + \beta_{rer}(rer_t - rer_0) + \beta_{cr}(Cr_t - Cr_0) \quad (9)$$

Where: β_r , β_{rer}, β_{cr} are the respective weights for the real interest rate, real exchange rate, and private sector credit variables. In specifying the model for deriving the weights for the MCI, there is a choice between basing it on aggregate demand or on inflation. The two models may be specified and estimated as follows:

Aggregate Demand model:

$$rgdp_t = \alpha + \beta_1 rgdp_{t-p} + \beta_2 rcps_{t-p} + \beta_3 rer_{t-p} + \beta_4 rtbr_{t-p} + \xi_t \quad (10)$$

for: β_1, β_2, $\beta_3 > 0$; $\beta_4 < 0$

Where: $rgdp$ = real GDP (in logarithms),

$rtbr$ = real interest rate (per cent),

rer = real exchange rate,

$rcps$ = real credit (growth rate, per cent)

ξ_t = the residual term.

Thus, aggregate demand is represented by the real GDP, while inflation is represented by year-on-year headline inflation rate. Theoretically, in equation 10, the coefficients β_1 β_2 and β_3 are expected to be positively signed while β_4 should be negatively signed. The Johansen co-integration estimation technique was applied to model the aggregate demand function specified in equation 10. The estimation of aggregate demand function to derive weights for the construction of the MCI is well documented in the literature (see Freedman (1994), Duguay (1994), Abubabkar and Yaaba (2013), etc.

The applicable weights were determined from the co-efficients derived from the long-run equation in the Johansen framework. Thus, we derived the respective weights based on the parameters of real exchange rate, 91-day treasury bill rate and real growth in real private sector credit. We then constructed the Narrow MCI and Broad MCI (BMCI) for Nigeria. The broad MCI offers some understanding on the sources of changes in the monetary conditions and the relative importance of the three channels of monetary policy transmission.

IV. Presentation and Discussion of Results

Results of the unit root tests showed that the variables were integrated of order one $I(1)$. The result of the unit root test that was carried out on the variables is summarised in the table below:

Table 1: Results of Unit Root Tests

Variables	ADF		PP		Order of Integration
	Level	1st Difference	Level	1st Difference	
LRGDP	0.8793	0.0000	0.8557	0.0000	I(1)
LRER	0.3555	0.0000	0.3567	0.0000	I(1)
LRCP	0.9413	0.0000	0.9190	0.0000	I(1)
RTBR	0.3676	0.0000	0.3515	0.0000	I(1)

NB: Values are probability levels of significance

In order to obtain valid inferences on the relevant parameters, standard diagnostic tests were performed on the variables. The test suggest presence of unit root, a stable system and an optimal lag length of 1 based on the Schwarz information criterion. Also, the co-integration test revealed that the variables are co-integrated in the long-run. Consequently, we implemented the Johansen co-integration procedures on the aggregate demand function in equation 10. The long-runcoefficients as obtained in the estimation are shown in Table 2:

Table 2: Johansen Long-run coefficients

LRGDP	RTBR	LRER	LRCP	CONSTANT
	-0.000497	0.703324	0.245980	10.11942

The underlying assumption in the literature is the direct linkage between output (or inflation) and interest rate, exchange rate and credit for the computation of the monetary conditions index. This is shown in table 3:

Table 3: Long-run coefficients/MCI Weights

	Variables	Coefficients	MCI Weights	Apriori Expectations	Estimated Coefficients/ MCI Weights
1	**Real Exchange Rate (RER)**	β_3	θe	$\beta_3 > 0$	0.703324
2	**Real Treasury Bills Rate (TBR)**	β_2	θc	$\beta_2 < 0$	-0.000497
3	**Real Credit to Private Sector (RCP)**	β_4	θr	$\beta_4 > 0$	0.245980

The values of the estimated coefficients suggest that a one-percentage point rise in interest rate could contract real output by 0.0005 percentage points, with a quarter lag. It also suggests that one-percentage point depreciation of the real exchange rate would expand the country's real output by 0.7 percentage points, with a lag of one (1) quarter. In the same vein, a one-percentage point increase in the real credit to private sector would expand the economy by 0.25 percentage points, after a lag of one (1) quarter.

Overall, the results indicate that movement in the real exchange rate had a dominant influence on real output in Nigeria. The diagnostic statistics do not indicate any serious problem in terms of model specification, stability and functional form. The estimated coefficients are within the given range, implying parameter consistency. The interaction among the coefficients would be transmitted into the Monetary Conditions Index as they are applied as weights to changes in the respective variables in the index. The values of the derived coefficients represent the weights applied for the corresponding variables relevant in the computation of the MCI for Nigeria. The MCI was computed by calculating the deviations of the variables from their base period values. The deviations are then weighted with the coefficients of the Johansen estimation to compute the broad and narrow monetary conditions for Nigeria.

While figures 1 and 2, show movements in the different components of the Broad and Narrow Monetary Conditions Index; figures 3 and 4 represent the Narrow and Broad Monetary Conditions Index for Nigeria plotted against the base period index, respectively. The Narrow MCI and broad MCI are plotted against the Monetary Policy Rate (MPR) in figures 5 and 6.

Figure 1:

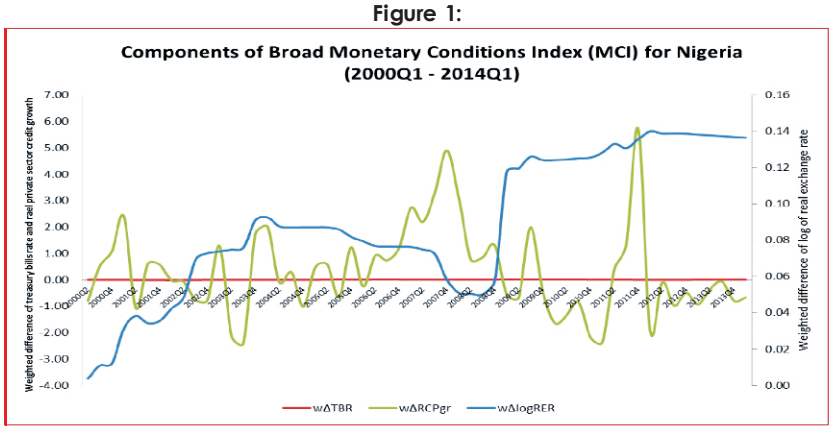
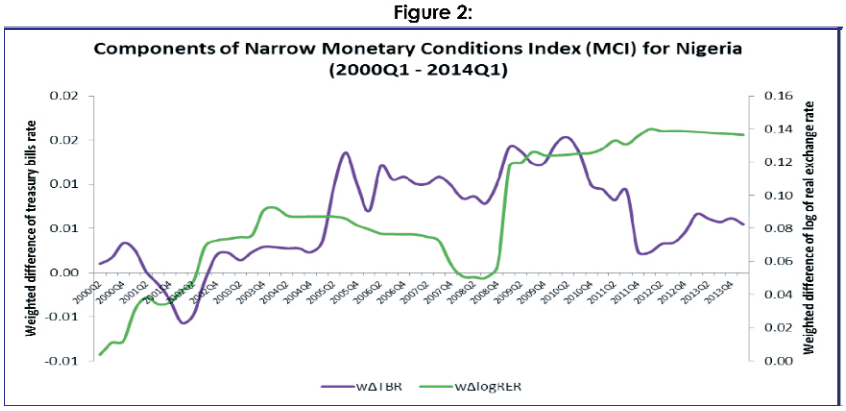
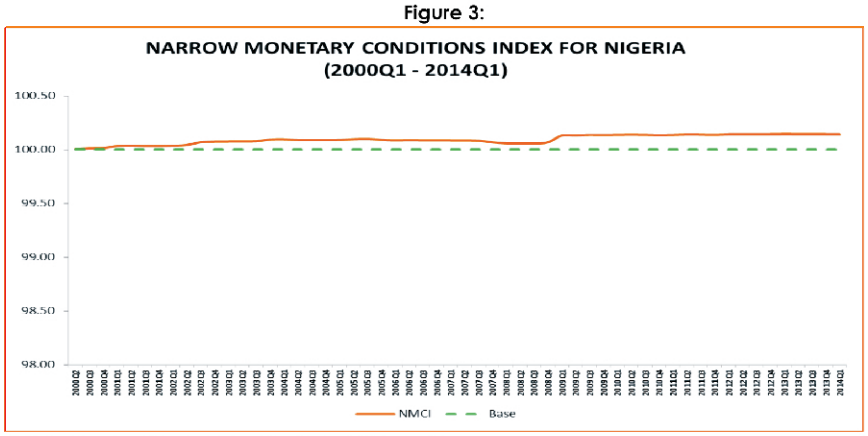


Figure 2:



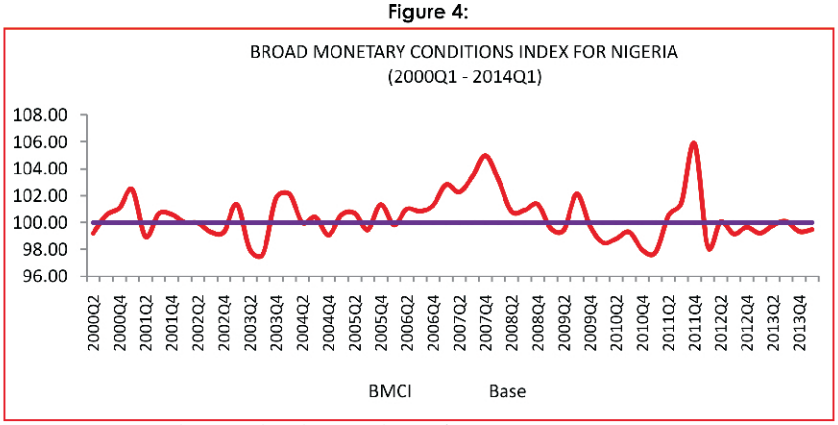
NB: 2000Q1 base perioc value is ass'gned an index of 100.

Figure 3:



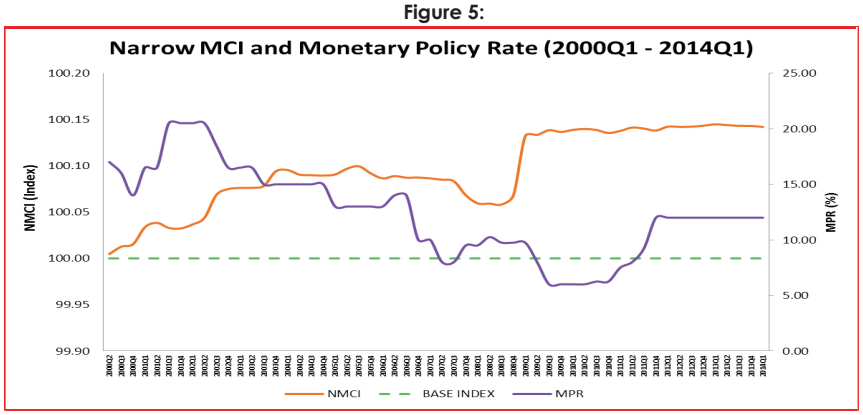
NB: 2000Q1 base period value is assigned an index of 100

Figure 4:



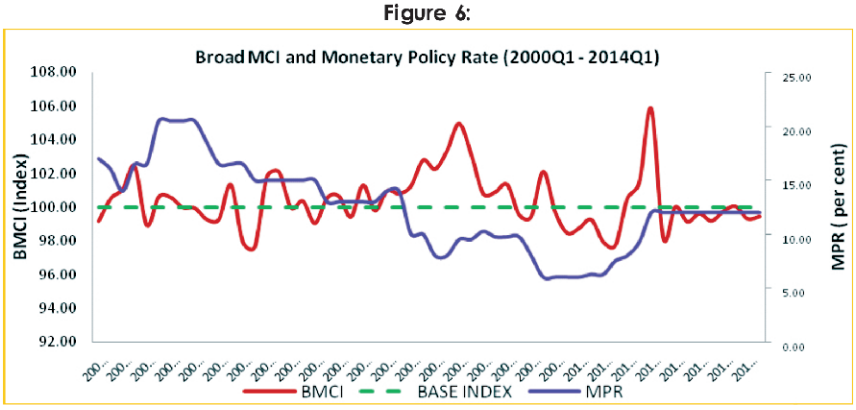
NB: 2000Q1 base period value is assigned an index of 100

Figure 5:



NB: 2000Q1 base period value is assigned an index of 100.

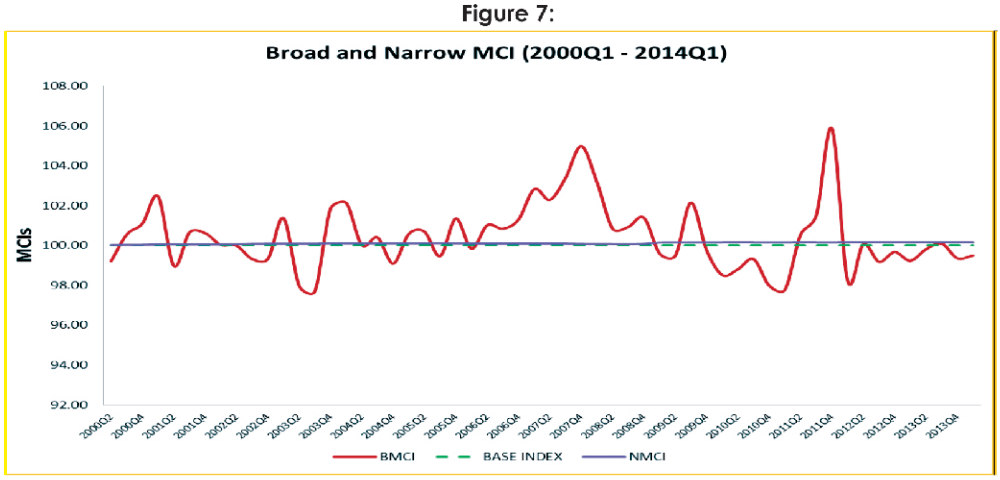
Figure 6:



The Narrow and Broad Monetary Conditions Index

Considering the Narrow Monetary Conditions Index (NMCI) from figure 3, the monetary conditions has been stable and tight, except for the loose stance that was experienced briefly between 2001:Q3 and 2002:Q2. The tightness of the narrow monetary conditions in Nigeria was moderate and less volatile. The Broad Monetary Conditions Index on the other hand, exhibited significant volatility over the entire sample period. Notably, the credit component of the BMCI is the major cause of the volatility in the BMCI. The trend reflects the continual swings in banking system liquidity and credit flow to the private sector. Credit to private sector depends greatly on the liquidity condition in the banking system. In determining banking system liquidity in Nigeria, fiscal and monetary operations are critical. The main fiscal operation, which has implications for banking system liquidity, is the Federal Accounts Allocation Committee (FAAC)/Federal Government disbursements, relating to the regular monthly allocations to statutory authorities and drawdown from excess crude account, among others. Monetary operations that result in mop-up exercise are usually in response to fiscal injections that could exert inflationary pressures on the economy. Monetary operations, which have had significant effects on banking system liquidity, especially in recent times, include those of bank rescue, AMCON operations and quantitative easing.

Figure 7:



NB: 2000Q1 base period value is assigned an index of 100

Relatively, BMCI was less volatile between 2000 and 2005, indicating benign monetary environment. However, following the banking sector consolidation in 2005/6, banking sector credit to the private sector grew substantially with the recapitalisation of banks. Also, during this period, there was further liberalisation of the foreign exchange market, leading to tight monetary conditions, in pursuit of greater stability. With the onset of the global economic crisis in 2007/8, which was transmitted into the Nigerian economy through exchange rate channel, and capital outflows, leading to tighter liquidity conditions in the banking system, credit to the private sector initially dried up during 2009/10; indicating tighter BMCI. However, between 2010Q1 and 2011Q2, growth in credit to the private sector resumed following the quantitative easing measures taken by the Bank and the impact of fiscal injections in the period. This was reflected in the more expansionary monetary conditions that became manifest through the declining BCMI during the period. The aggressive tightening stance of the Bank from 2011Q3 was pursued to address excess liquidity concerns. However, in 2012Q1, AMCON bonds repurchase provided ample liquidity and thus, relaxed the tight monetary conditions as indicated by the sharp decline in Broad MCI. The findings from the study of the MCI for Nigeria provide indication for the stance of monetary policy between 2000 and 2012. It shows how interaction between output, interest rate, exchange rate, inflation and credit suggest the stance of monetary policy overtime in a quantitative manner. The MCI can be used to evaluate the effectiveness of monetary policy tools and instruments employed in pursuing specific objectives. Thus, it can serve as a veritable guide to policy. The MCI takes cognisance of other key variables that determine monetary policy stance apart from interest rate.

From the foregoing, our findings suggest that Narrow MCI is more stable and less volatile than the Broad MCI (see figure 3) and that both broad and narrow MCIs suggest that monetary conditions, over time, have been tight relative to the base period (see figures 3 & 4). Also, the two (2) MCIs have been moving in the opposite direction to the actual policy stance as indicated by the MPR (see figures 5 & 6), thus, suggesting that the market monetary conditions is at variance with the Bank's signalling instrument, the MPR. We also found that, Interest rate (i.e. MPR) when considered alone is a poor indicator of the stance of Monetary Policy in Nigeria given the existence of other channels.

V. MCI Forecast

A forecast of the MCI can provide some useful idea about the future trajectory of market conditions with a view to guiding decision-making on the policy stance. In order to forecast the behavior of the MCI for 2014Q2 – 2014Q4, a Box-Jenkins Autoregressive Integrated Moving Average (ARIMA) specification was set up. Quarterly real exchange rate (rer), real credit to private sector (rcp) and treasury bills rate (tbill) were used to develop forecasts of both the BMCI and NMCI. For the Narrow MCI, our estimates indicate that the Narrow MCI is positively related to the real exchange rate with a 1-quarter lag and negatively related to treasury bill rate.

Figures 8 and 9 show forecasts of the NMCI and BMCI from 2007:Q1 – 2014:Q4. The forecast models, forecasts evaluation and residual graphs are shown in the appendix.

Figure 8:

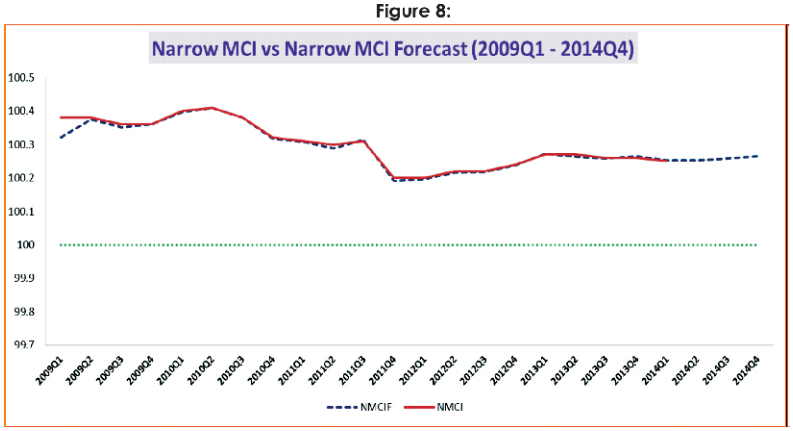
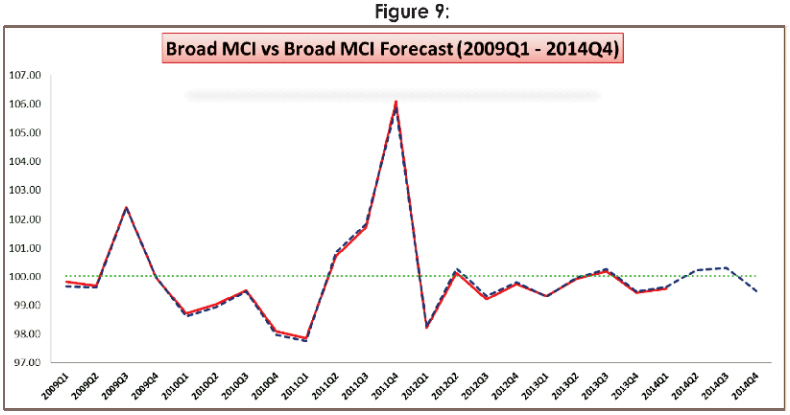


Figure 9:



From figure 8, the narrow MCI is expected to remain tight and stable close to its 2014Q1 level over the next three (3) quarters, if the real exchange rate and treasury bills rate assumes their current trends over the forecast horizon. On the other hand, the forecast of the BMCI shown in figure 9 indicates that looseness in the monetary conditions may reduce over the forecast period.

VI. Summary and Conclusion

An important outcome of the study is that Monetary Conditions Index (MCI) may be useful as a supplementary variable to evaluate the efficacy of the conduct of monetary policy in Nigeria. In particular, changes in the monetary conditions index show the monetary policy stance between periods, depending on the evolving importance of various monetary policy transmissions channels. The MCI can be used in any of the following ways: (i) to complement an existing operating target (in which case an equilibrium MCI is agreed); (ii) a monetary policy rule (in which case the components of MCI, which are under control, are adjusted to compensate for changes in others that are exogenous); and (iii) as an indicator of policy stance (in which case changes in MCI provides information about the policy stance). MCIs would also be used to determine which of the variables of interest are more important among the channels for monetary policy transmission as well as the speed of adjustment following monetary policy decision.

Monetary conditions in Nigeria could be measured by an MCI which is a weighted sum of interest rates, real exchange rate and real credit growth. The estimated MCI shows a volatility and upward trend in the better part of the period, reflecting monetary policy tightening during the greater part of the sample period considering the challenges of liquidity surfeit faced by the Bank. The Monetary Conditions Index for Nigeria captures the dynamics of monetary policy innovations, which indicate the stance of policy in the review period. A clear outcome from the study is the role real exchange rate plays in determining the monetary condition. The value obtained for the coefficient of exchange rate in our regression model tends to accord a critical role to the exchange rate channel in the monetary policy transmission mechanism in Nigeria. It reveals that exchange rate is a dominant determinant of the monetary conditions and thus, very crucial in the conduct of monetary policy.

In conclusion, it is crucial to note that, although both broad and narrow MCIs moved in the opposite direction to the policy stance for the most part of the sample period, the narrow MCI tend to reflect the stance of monetary policy better, especially in recent times. Barring any serious shocks that can distort the trend of determinant variables, the NMCI is expected to maintain its current value for the next three (3) quarters; while looseness in the BMCI is expected to be sustained.

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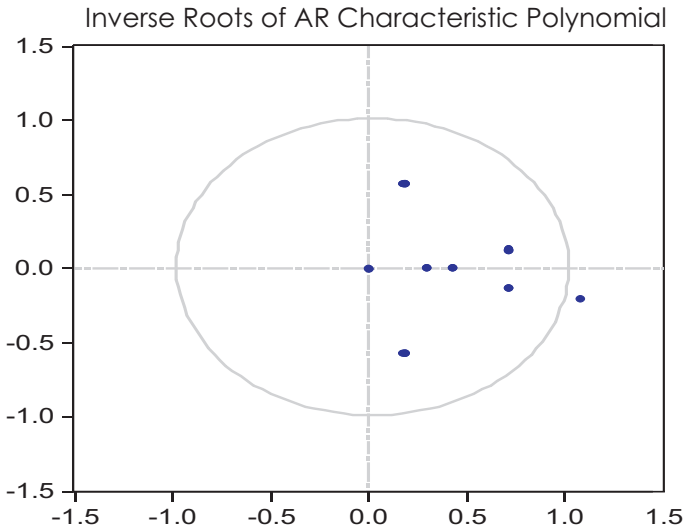
APPENDICES

Appendix 1: :



Appendix 2: Quarterly Broad and Narrow Monetary Conditions Index for Nigeria

	BMCI	_	NMCI	ΔNMCI
2000Q2	99.20		100.00	
2000Q3	100.53	1.33	100.01	0.01
2000Q4	101.09	0.56	100.02	0.00
2001Q1	102.45	1.35	100.03	0.02
2001Q2	98.96	-3.48	100.04	0.00
2001Q3	100.64	1.67	100.03	-0.01
2001Q4	100.60	-0.03	100.03	0.00
2002Q1	100.01	-0.59	100.04	0.00
2002Q2	99.97	-0.04	100.04	0.01
2002Q3	99.30	-0.67	100.07	0.02
2002Q4	99.30	0.00	100.07	0.01
2003Q1	101.36	2.05	100.08	0.00
2003Q2	97.96	-3.40	100.08	0.00
2003Q3	97.68	-0.28	100.08	0.00
2003Q4	101.83	4.15	100.09	0.02
2004Q1	102.13	0.30	100.10	0.00
2004Q2	100.01	-2.12	100.09	0.00
2004Q3	100.38	0.38	100.09	0.00
2004Q4	99.08	-1.30	100.09	0.00
2005Q1	100.57	1.49	100.09	0.00
2005Q2	100.68	0.11	100.10	0.01
2005Q3	99.45	-1.22	100.10	0.00

2006Q4	101.29	0.46	100.09	0.00
2007Q1	102.81	1.52	100.09	0.00
2007Q2	102.28	-0.53	100.09	0.00
2007Q3	103.38	1.10	100.08	0.00
2007Q4	104.97	1.59	100.07	-0.02
2008Q1	103.17	-1.80	100.06	-0.01
2008Q2	100.83	-2.34	100.06	0.00
2008Q3	100.91	0.09	100.06	0.00
2008Q4	101.37	0.46	100.07	0.01
2009Q1	99.58	-1.79	100.13	0.06
2009Q2	99.46	-0.12	100.13	0.00
2009Q3	102.13	2.67	100.14	0.01
2009Q4	99.74	-2.39	100.14	0.00
2010Q1	98.51	-1.24	100.14	0.00
2010Q2	98.79	0.29	100.14	0.00
2010Q3	99.30	0.50	100.14	0.00
2010Q4	97.97	-1.33	100.14	0.00
2011Q1	97.76	-0.20	100.14	0.00
2011Q2	100.53	2.77	100.14	0.00
2011Q3	101.49	0.95	100.14	0.00
2011Q4	105.85	4.36	100.14	0.00
2012Q1	98.21	-7.63	100.14	0.00
2012Q2	100.05	1.83	100.14	0.00
2012Q3	99.17	-0.88	100.14	0.00
2012Q4	99.65	0.49	100.14	0.00
2013Q1	99.22	-0.44	100.14	0.00
2013Q2	99.79	0.57	100.14	0.00
2013Q3	100.08	0.29	100.14	0.00
2013Q4	99.35	-0.73	100.14	0.00
2014Q1	99.48	0.13	100.14	0.00

NB: 2000Q1 base period value is assigned an index of 100

Appendix 3:
NMCI Forecast Model
Dependent Variable: NMCI
Method: Least Squares
Sample (adjusted): 2001 Q1 2010 Q1
Included observations: 53 after adjustments
Convergence achieved after 37 iterations
MA Backcast: 2000 Q2 2000Q4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	98.80997	0.083034	1189.992	0.0000
LRER(-1)	0.325171	0.016609	19.57781	0.0000
TBR	-0.017454	0.000374	-46.67941	0.0000
AR(1)	0.259218	0.086102	3.010589	0.0043
AR(3)	-0.720709	0.082152	-8.772864	0.0000
MA(1)	-0.100934	0.060956	-1.655859	0.1047
MA(2)	-0.093945	0.055882	-1.681124	0.0997
MA(3)	0.966513	0.027618	34.99639	0.0000

R-squared	0.991709	Mean dependent var	100.2192
Adjusted R-squared	0.990419	S.D. dependent var	0.110503
S.E. of regression	0.010816	Akaike info criterion	-6.077236
Sum squared resid	0.005265	Schwarz criterion	-5.779834
Log likelihood	169.0468	Hannan-Quinn criter.	-5.962869
F-statistic	768.8966	Durbin-Watson stat	1.949863
Prob(F-statistic)	0.000000		

Inverted AR Roots	.54+.77i	.54-.77i	-.82
Inverted MA Roots	.54+.83i	.54-.83i	-.99

Appendix 4:
BMCI Forecast Model
Dependent Variable: BMCI
Method: Least Squares
Date: 07/2/15 Time: 16:46
Sample (adjusted): 2001 Q3 2014 Q1
Included observations: 51 after adjustments
Convergence achieved after 6 iterations

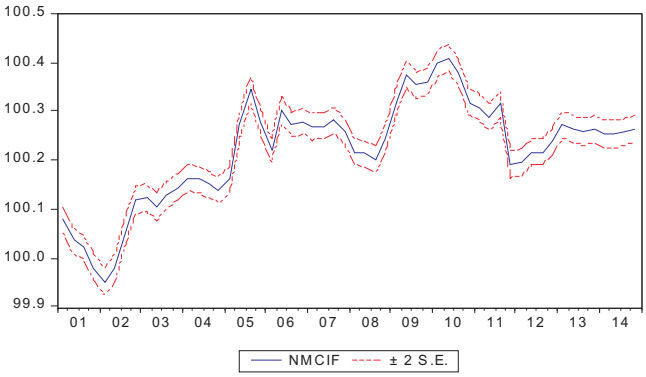
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	97.16542	0.852540	113.9716	0.0000
LRER(-1)	0.471804	0.226408	2.083861	0.0430
TBR(-4)	-0.011191	0.004328	-2.585616	0.0131
LRCP	27.02742	0.216254	124.9799	0.0000
LRCP(-1)	-27.00317	0.220224	-122.6170	0.0000
AR(1)	0.496726	0.146349	3.394127	0.0015
AR(2)	-0.315073	0.149833	-2.102832	0.0412

R-squared	0.997551	Mean dependent var	100.5445
Adjusted R-squared	0.997217	S.D. dependent var	1.749780
S.E. of regression	0.092315	Akaike info criterion	-1.800343
Sum squared resid	0.374972	Schwarz criterion	-1.535190
Log likelihood	52.90874	Hannan-Quinn criter.	-1.699020
F-statistic	2986.581	Durbin-Watson stat	1.824555
Prob(F-statistic)	0.000000		

Inverted AR Roots	.25-.50i	.25+.50i

Appendix 5:

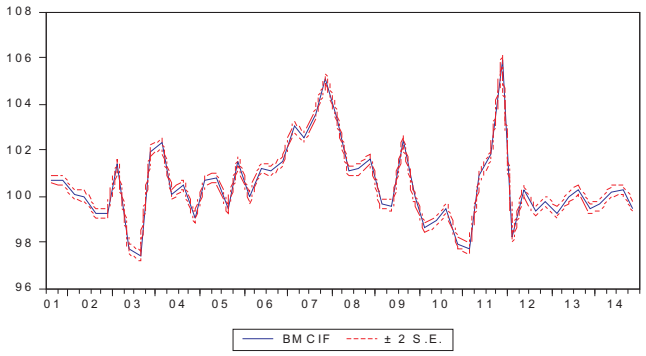
NMCI Forecast Evaluation



Forecast: NMCIF	
Actual: NMCI	
Forecast sample: 2000Q1 2014Q4	
Adjusted sample: 2001Q1 2014Q4	
Included observations: 53	
Root Mean Squared Error	0.010738
Mean Absolute Error	0.006423
Mean Abs. Percent Error	0.006408
Theil Inequality Coefficient	5.36E-05
Bias Proportion	0.000024
Variance Proportion	0.003042
Covariance Proportion	0.996934

Appendix 6:

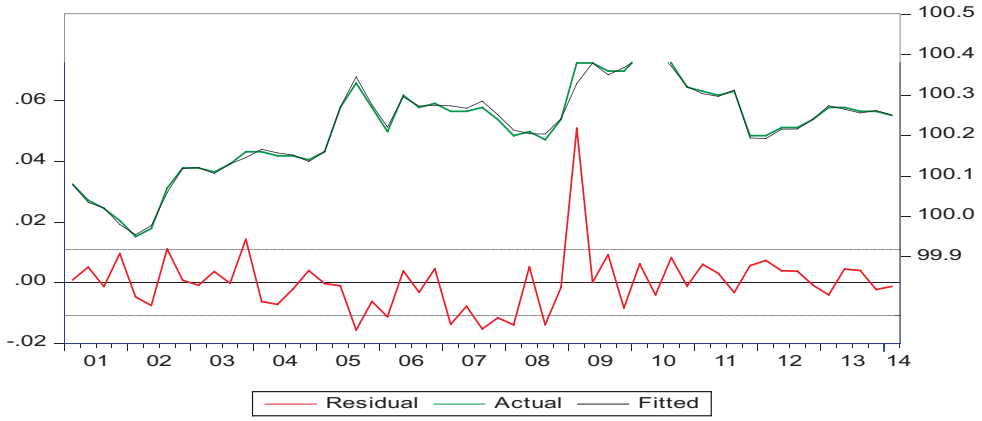
NMCI Forecast Evaluation



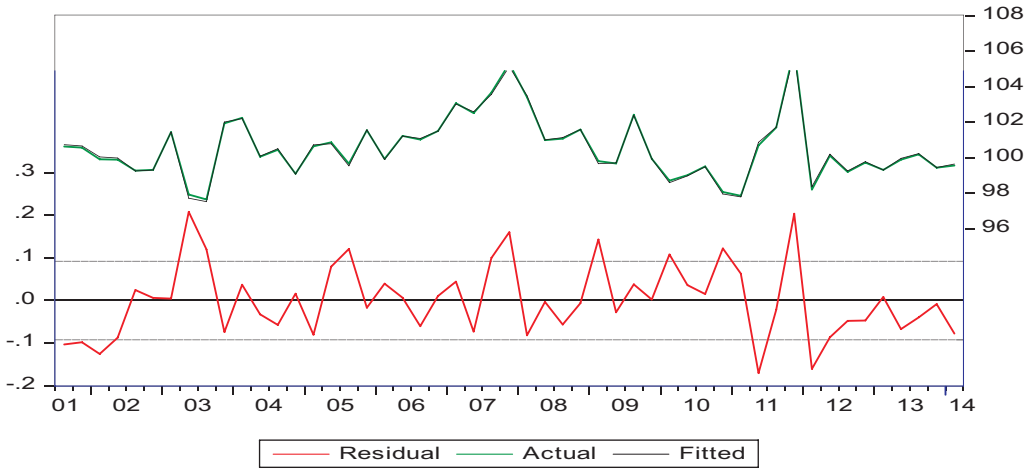
Forecast: BMCIF	
Actual: BMCI	
Forecast sample: 2000Q1 2014Q4	
Adjusted sample: 2001Q3 2014Q4	
Included observations: 51	
Root Mean Squared Error	0.097030
Mean Absolute Error	0.077323
Mean Abs. Percent Error	0.076970
Theil Inequality Coefficient	0.000482
Bias Proportion	0.000001
Variance Proportion	0.000184
Covariance Proportion	0.999815

Appendix 7:

Residual Graph of the NMCI forecast model



Appendix 8:
Residual Graph of the BMCI forecast model



Quality of Governance and Stock Market Performance: The Nigerian Experience

Ajide, K. B.*

Abstract

The paper examined the impact of governance on stock market performance using quarterly data series spanning 1996Q1 to 2010Q4. An ARDL bound testing methodology was employed to explore such causal relationship. Long-run stable relationships were established through the error correction terms of each of the measures used to the tune of -0.4821,-0.4034 and -0.4080 for all share price index, market capitalisation and the value of total stock traded, respectively. Findings indicate that macroeconomic and financial stability should be constantly maintained and promoted as it constitutes a drag on the stock performance; any acts of corruption should be eschewed as it scares away potential investors into the country and the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies should be enhanced altogether.

I. Introduction

The stock market performance is an important barometer by which the financial health of an economyis gauged. The centrality of the market as well as its functionality has been accentuated by the recent global financial crises occasioned by the sub-prime mortgage lending originated in the US housing market. The contagious impact of the resulting crises had unavoidably inflicted unquantifiable collateral damages to all and sundry. The cost of damage experienced, however, depends, to a greater extent, on the level of integration of a country's financial market with the international capital market. The inevitable outburst of the crises has consequently forced many economies to embark on bail out schemes in their various domains in order to save some of the ailing sectors and companies which may not ordinarily have survived such calamity-imposing phenomenon.

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Evidences have, however, shown that governance and stock market performance are somewhat inseparable; thus, suggesting they both go parripassu. This is underscored by the fact that a precondition for financial market development is the improvement of the institutions, which govern the process of exchange. Aggarwal et. al., (2002) noted that fund managers invest less in countries with poor legal environments and low corporate governance standards. Thus, better governance environments can increase returns to shareholders by reducing both transaction costs and agency costs (Hooper et. al.,, 2009). Further, a well governed country or firm as the case may be, tends to score highly in stock market ratings than a poorly governed one. More importantly, the post-financial crises' reports of countries poor and volatile stock market prices have lent credence to the fact that the enormity of firm-specific corporate governance abuses thrives under the ambiance of poor country-level governance environments of the country concerned.

Observably, the African continent is notorious for her poor governance records and this has been found to constitute a stumbling block on her growth trajectory for decades. Unarguably, Africa has had a chequered past in terms of good governance records as compared with the advanced countries. The history of poor and bad governance is particularly appalling for sub-Saharan Africa where dictatorial tendencies and sit-tightism syndrome seem more prevalent than any other continents in the world. Nigeria, just like other countries within the sub-region had witnessed series of regime shifts from the extreme decree-based to constitutionally-inclined system of governance. Amid these developments, several cases of mis-governance remain the common feature of Nigeria's socio-economic and political landscape. Thus, effective functioning of any investment activity hinges on good corporate governance mechanisms, which in turn depend on the quality of governance framework of a country. This is because firms do not operate in a vacuum as they are affected by the governance systems in which they operate. Specifically, the issue bordering on corporate governance problem has been found to be more prevalent in the financial segment of the economy. This in effect, implies that the quality of a country's governance is known to have rippling effects on the operation of financial and capital markets through its influence on the availability of external financing, cost of funding, market valuations, and quality of investments (see, Hail and Leuz, 2006; Hooper et. al., 2009; Chen et. al., 2009; Giannetti and Koskinen, 2010; Chiou et. al., 2010; among others for detailed exposition).

[1] The important interaction between governance mechanism at firm level and country-level governance framework is illustrated in a number of cross-country studies such as Klapper and Love (2004), Durnev and Kim (2005), Chen et.al., 2009, Bruno and Claessens (2009), among others.

The situation has so degenerated to the extent that there are reported cases of flagrant abuses of corporate governance codes and guidelines among the management and other top decision making units of organisations. This is rampart among the financial institutions in the economy. For instance, government at different points in time has had to interfere with running and workings of the Nigerian financial sector owing largely to corporate governance abuses by the financial and other fund managers alike. As a corollary, some experts and stock analysts have attributed post-global financial crises crash of the Nigerian Stock Exchange market, in part to governance abuses among the financial managers as well as captains of the industry. In view of the various misgovernance and extreme intervention through battery of reforms by the government towards maintaining sound financial architecture, the pertinent question remains: to what extent does governance influence stock market performance in Nigeria.

Most empirical studies that had been conducted in the past focus mainly on firm-specific corporate governance as it affects stock market returns or prices as the case may be. This study charts a different path as it beams a searchlight on the country-level governance environment under which firm-specific corporate governance is implemented. The underlying assumption is that if a sound country-level governance structure exists, then all things being equal, all other sub-governance structures will be bettered. Governance factor apart, literature is also replete on other factors as playing contributory roles on stock market performance. These include but not limited to country ratings (Erb et. al., 1995; Bekaert et. al., 1997; Bekaert and Harvey, 2000, Cantor and Packer, 1996), valuation ratios (Campbell and Shiller, 1998; Fama and French, 1992; Maroney et. al., 2004; Claessens et. al., 1998; Groot and Verschoor, 2002), inflation rates (Erb et. al., 1995; Hooper, 2009), population demographics (Bakshi and Chen, 1994; Bekaert et. al., 1998), exchange rates (Bailey and Chung, 1995; Harvey, 1995), and sovereign spreads (Gendreau and Heckman, 2003).

The novelty of this study over the previous related studies stems from the following grounds: First, we are not aware of any country-specific studies on governance-stock market performance for Nigeria thus signifying that ours represent the first empirical attempt at investigating such relationship for the country. Second, literature on the subject is scanty and is usually conducted at the cross-country or sectional levels. As a consequence, this study adds new empirical evidence to the existing stock of knowledge. Third, an advanced econometric technique of Bound testing approach of ARDL is employed. Lastly, a high frequency dataset is used thus guaranteeing the credibility of estimates as well as ensuring a more robust

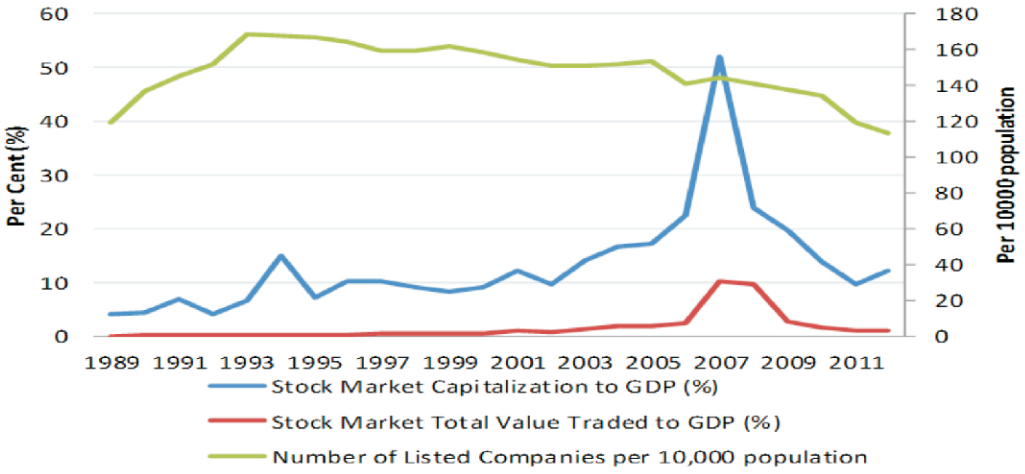
policy recommendations.

While section one gives the introductory part, section two presents the stylised facts about governance and stock market performance in Nigeria. Section three reviews the literature on governance-stock market performance nexus with a view to situating the issue in the proper perspective and also the layout of the theoretical framework on which the study is anchored. The methodological tools to be adopted is properly outlined in section four. Section five presents the empirical analysis of the findings while section six concludes and gives policy recommendations.

II. Stylised Facts on Governance and Stock Market Performance in Nigeria

This section presents some stylised information about the trends of key variables like value of total stock traded, market capitalisation, all share price index, number of listed companies, inflation, real interest and exchange rates as well as the components of governance index for Nigeria. It can be observed from Figure 1 that there have been sustained growths both in the values of total value of stock traded and market capitalisation. The latter witnessed unprecedented jumps in growth beginning from 2002 up till 2007 before it nosedived sharply due mainly to global financial crises occasioned by sub-prime mortgage lending originated in the US housing bubble in the late 2007. Similar pattern of movements are also observed in the case of the former.

Figure 1: Trends of Stock Market Performance in Nigeria (1988-2012)

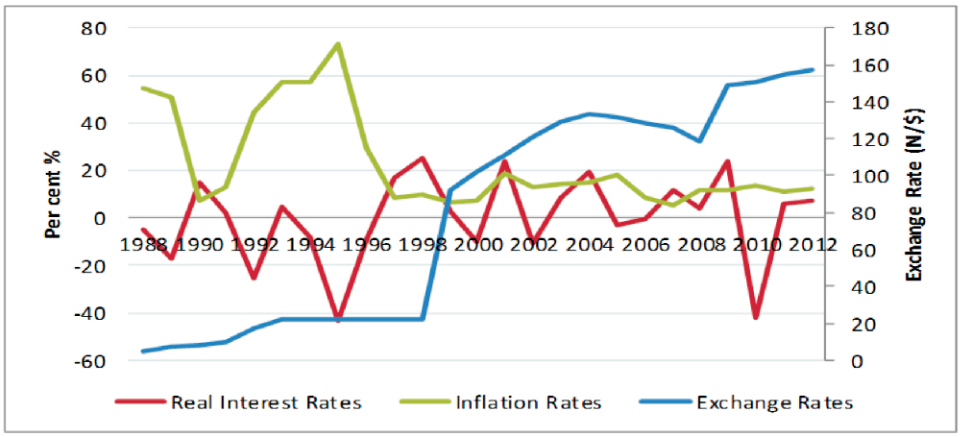


Source: Author's Graphed based on World Development Indicators (WDI, 2015)

We also observed consistent upward trend of movements in the number of listed companies in Nigeria but slight downward trends became noticeable between 2006 and 2012. The fall in the number of companies can be said to be due to the spate of liquidations experienced by the listed companies for the reasons that has to do with corporate governance problems like insider dealings, irrecoverable debts, falsification of accounting records, etc.

The macroeconomic environment can also be explained within the context of macroeconomic instability as captured by the inflationary trend, real interest rates and exchange rate, respectively. Double digit inflation rates largely characterised the Nigerian experience and this became heighted in 1995 when the rate was well over 70 percent. Beginning from 1996 till 2012, there were remarkable declines from the rates owing largely to policy targets aimed at maintaining price stability usually at single digit. For the real interest rates, the values were in large part negative for the most part of the period under consideration. With double digit inflation rate and negative values of real interest rates, the performance of stock were adversely affected. Further, the value of naira to dollar kept depreciating for the large part of the period as can be observed from Figure 2.

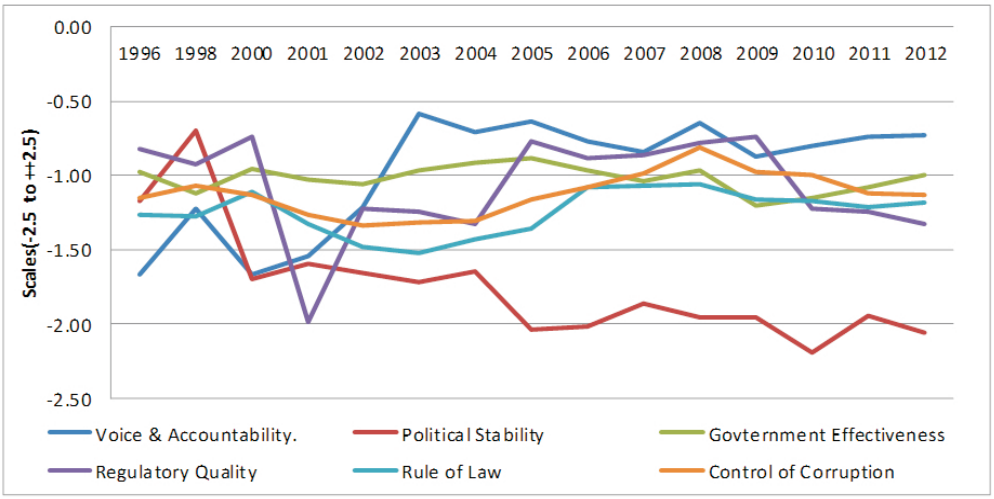
Figure 2: Trends of Inflation, Real Interest and Exchange rates in Nigeria (1988-2012)



Source: Author's Graphed based on World Development Indicators (WDI, 2015)

The components of governance index like voice and accountability, political instability, government effectiveness, regulatory quality, rule of law and control of corruption are in negative values beginning from 1996 up till 2012, thus, portending bad and worsening condition of governance in the country. Of the components, political instability drifts away from the baseline as compared to others as can be observed from the diagram. Same goes for rule of law and control of corruption lines.

Figure 3: Trends of Governance Dimensions in Nigeria (1996-2012)



Source: Author's Graphed based on World Governance Indicators (WGI, 2013)

III. Literature Review on Governance-Stock Market Performance Nexus

Extensive literature has documented the importance of stock market development in stimulating economic growth[2]. The strand of literature that dwells on the relationship between governance and stock market performance is still emerging and scanty. The seminal work of Jensen and Meckling (1976) provided the early literature on governance but focused on firm-level agency costs[3] arising from the ownership and control delineation structure of firms. The more recent literature (see, La Porta et. al., 1997, 1998, 2000; Ball et. al., 2000; Gul and Qui, 2002; Shleifer and Wolfenson, 2002) shifted the focus from firm-specific corporate governance to country-level governance environments.

Garcia and Liu (1999) empirically explored the determinants of stock market development, particularly market capitalisation. They also examined the association between financial intermediary development and stock market development using a sample of fifteen industrial and developing countries from 1980 to 1995. They concluded that real income level, saving rate, financial intermediary development, and stock market liquidity are important predictors of market capitalisation, while macroeconomic stability does not have any explaining power. They confirmed that stock market development and financial intermediary development are complements rather than substitutes.

[2] For example, Demirguc-Kunt and Levine (1996a), Singh (1997), and Levine and Zervos (1998) find that stock market development plays an important role in predicting future economic growth. *The World Bank Economic Review issue of* May 1996 is dedicated exclusively to the role of the stock markets in economic growth.

[3] Love (2010) provides a good review on corporate governance and performance around the world.

Lombardo and Pagano (2000) estimated the correlation between the quality of the institutional environment and the return on equity for a cross-section of national stock market indices from both developed and emerging markets. They use several measures of the return on equity, such as the total return on national equity markets (controlling for risk premia), accounting-based measures of return including dividend yields and earning-price ratios (controlling for international differences in growth and inflation), and the degree of initial public offering (IPO) underpricing. They found that all estimates reveal a positive correlation between the risk adjusted return on equity and measures of the quality of legal institutions. These measures include the origins of the judicial system, respect for the law, lack of corruption among government officials, quality of accounting standards and the risk of contract repudiation. The same results were found when they used accounting measures of the rate of return on equity: both the dividend yield and the earnings-price ratio were found to be positively correlated with measures of the quality of legal institutions.

Naceur et. al., (2007) investigated the determinants of stock market development in 12 Middle-Eastern and North-African region countries, employing fixed and random estimation technique. Their results showed that saving rate, financial intermediary, stock market liquidity and stabilisation variables appeared as important determinants of stock market development. In addition, it was found that financial intermediaries and stock markets are complements rather than substitutes in the growth process.

Hooper et. al., (2009) used international asset pricing models to investigate the link between the quality of government institutions and the performance of global stock markets. The results demonstrate a significant positive association between stock market performance measures and the quality of the institutional environment. Performance measures examined for the cross-section of countries were the average monthly stock index excess returns and the Sharpe ratio. All measures of performance were adjusted for global and local risk factors known to explain their international variation. The quality of governance is also found to be negatively associated with stock market total risk and idiosyncratic risk, consistent with the notion that stable institutions are linked to reduced variations in equity returns. These findings suggest countries with better developed governance systems have stock markets with higher returns on equity and lower levels of risk.

Lowry et. al., (2010) examined the link between country-level governance and global stock market returns. They found a negative relation between governance quality and equity return. Countries with low governance scores, on average, had higher equity returns than those with high governance scores after controlling for global risk factors known to influence international equity returns. The implication is that investors associate low governance quality with increased risk and, thus, demand higher risk premium. They also confirmed from their result that the quality of governance as measured by political stability and absence of violence is key governance dimension affecting international equity returns, suggesting that heightened investor concerns over political risks had profound impact on equity markets. Interestingly, they found no evidence that variation in equity returns is affected by the governance indicator representing voice and accountability.

The foregoing provides the basis for the void the study intends to plug, which distinguishes it from previous studies at least in a major respect. To the best of our knowledge, this paper represents one of the pioneering studies that has examined the possible impacts of governance on stock market performance for the sub-Saharan region at a country-specific level.

IV. Model Specification, Data and Estimation Techniques

This section presents a framework to model the impact of governance on the stock market performance and the objective is to identify the simple relationship between stock market performance, components of governance index and some selected key macroeconomic variables. In line with the previous empirical studies, the causal relations among the variables is, thus, specified as follows:

STKPERF = f (GOVERNANCE _ FACTORS,CONTROL _ VAR .....(1)

Where STKPERF represents stock market performances, GOVERNANCE_FACTORS as components of governance index and CONTROL_VAR stands for other control variables. GOVERNANCE _ FACTORS can be decomposed as:

(GOVERNANCE _ FACTORS,CONTROL _ VAR f (CC, GE,PS, RL, RQ, VA).....(2)

Governance comprises of six governance measures (World Governance Indicators-WGI) provided by the World Bank as proxies of countries' governance quality (Kaufmann et al., 2006). The indicators are constructed using an unobserved components methodology (Kaufmann et al., 2010). Control of Corruption (CC) captures perceptions of the extent to which public power is

exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. *Political Stability and Absence of Violence* (PS) measures the perceptions of the likelihood that the government will be destabilised or overthrown by unconstitutional or violent means, including domestic violence and terrorism. *Government Effectiveness* (GE) captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. *Regulatory Quality* (RQ) indicates perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. *Rule of Law* (RL) represents perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. *Voice and Accountability* (VA) captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. We then specify the empirical model as:

$$STKPERF_i = f(CC, GE, PS, RL, RQ, VA, INF, RINR, EXCR) \quad (3)$$

Where $STKPERF_i$ stands for stock market performance and subscript $_i$ represents the three measures used as proxy for stock market performance such as all-share price index, market capitalisationand value of total stock traded.

A positive relationship ishypothesised between any of the stock market performance measures and governance indicators. That, an improvement or increase in any of the governance indicators is expected to increase the value of stock market performance. Hence CC, GE, PS, RL, RQ and VA in relation to stock performance measures should be greater than zero and the converse holds in the case of the diminution in governance indicators. Inflation reduces the value of stock market performance, thus, suggesting that it has negative effects on stock market activities. A higher interest rate has a tendency of stimulating stock market activity and conversely a lower rate of interest discourages investment activities.
In this case a negative relationship is hypothesised. Finally, an inverse relationship is posited between exchange rates and stock market performance. Symbolically, it can be stated as:

IV.1 Methodology

The methodology adopted inthis study is designed to assess the impact of thez governance on stock markets performance in Nigeria. In this study, the Autoregressive Distributed Lag (ARDL) approach to cointegration as outlined by Pesaran and Pesaran, 1997 and Pesaran and Shin, 1998 was used. The ARDL model has been chosen here because it has numerous advantages. Firstly, it can be applied irrespective of whether the individual regressors are integrated of the order I(0) or I(1). Secondly, the ARDL model takes sufficient number of lags to capture the data generating process from a general to specific modeling framework (Laurenceson and Chai, 2003). Thirdly, the ARDL approach yields superior estimates of long-run coefficient, and, the diagnostic tests of the estimated equation are more reliable Gerrard and Godfrey, 1998, p.235 and Laurenceson and Chai 1998, p 405). Fourthly, from the ARDL model, one can derive a dynamic error correction model (ECM) through a simple linear transformation (Banarjee et. al., 1994, pp 50-52). The ECM also helps us to measure the short-run relationship among the model's variables. Finally, the ARDL model is a more appropriate measure in the case of a smaller sample. Since the sample size of our study is limited to 60 observations, it provides more motivation for the study to apply the ARDL approach for analysis.

$$\Delta STKPERF_t = \xi_0 + \sum_{i=1}^{p}\xi_1 \Delta STKPERF_{t-i} + \sum_{i=1}^{p}\xi_2 \Delta INF_{t-i} + \sum_{i=1}^{p}\xi_3 \Delta RINR_{t-i} + \sum_{i=1}^{p}\xi_4 \Delta EXCR_{t-i} + \sum_{i=1}^{p}\xi_5 \Delta CC_{t-i} + \sum_{i=1}^{p}\xi_6 \Delta GE_{t-i} + \sum_{i=1}^{p}\xi_7 \Delta PS_{t-i} + \sum_{i=1}^{p}\xi_8 \Delta RL_{t-i} + \sum_{i=1}^{p}\xi_9 \Delta RQ_{t-i} + \sum_{i=1}^{p}\xi_{10} \Delta VA_{t-i} + \Xi_1 STKPERF_{t-i} + \Xi_2 INF_{t-1} + \Xi_3 RINR_{t-1} + \Xi_4 EXCR_{t-1} + \Xi_5 CC_{t-1} + \Xi_6 GE_{t-i} + \Xi_7 PS_{t-i} + \Xi_8 RL_{t-i} + \Xi_9 RQ_{t-i} + \Xi_{10} VA_{t-i} + \sigma_t \quad (4)$$

where Δ = 1st difference of a variable, L indicates that the data set are expressed in natural logarithms,

ξ_0 is a constant,

ρ is a maximum lag order,

ξ_1---------------- ξ_{10} represent the short-run coefficients (error correction dynamic),

Ξ_1-----------------Ξ_{10} correspond to the long-run relationship, i time trend, and, σ_t; is the white noise error.

The implementation of the ARDL approach involves two stages. First, the existence of the long-run nexus (cointegration) between variables under investigation is tested by computing the F-statistics for analysing the significance of the lagged levels of the variables. Pesaran, Shin, and Smith(1999) and Narayan(2004) have

provided two sets of appropriate critical values for different numbers of regressors (variables). This model contains an intercept or trend or both. One set assumes that all the variables in the ARDL model are I(0), and another assumes that all the variables are I(1). If the F-statistic lies above the upper-bound critical value for a given significance level, the conclusion is that there is a non-spurious long-run level relationship with the dependent variable. If the F-statistic lies below the lower bound critical value, the conclusion is that there is no long-run level relationship with the dependent variable. If it lies between the lower and the upper limits, the result is inconclusive. The general form of the null and alternative hypotheses for the F-statistic test is as follows:

$$H_O: \Xi_1 = \Xi_2 = \Xi_3 = \Xi_4 = \Xi_5 = \Xi_6 = \Xi_7 = \Xi_8 = \Xi_9 = \Xi_{10} = 0$$
$$H_O: \Xi_1 \neq \Xi_2 \neq \Xi_3 \neq \Xi_4 \neq \Xi_5 \neq \Xi_6 \neq \Xi_7 \neq \Xi_8 \neq \Xi_9 \neq \Xi_{10} \neq 0 \quad \text{.....(5)}$$

Secondly, if the cointegration between variables is identified, then one can undertake further analysis of long-run and short-run (error correction) relationship between the variables.*The error correction representation of the series can be* specified as follows:

$$\Delta STKPERF_t = \xi_0 + \sum_{i=0}^{p} \xi_1 \Delta STKPERF_{t-i} + \sum_{i=0}^{p} \xi_2 \Delta INF_{t-i} + \sum_{i=0}^{p} \xi_3 \Delta RINR_{t-i} + \sum_{i=0}^{p} \xi_4 \Delta EXCR_{t-i} + \sum_{i=0}^{p} \xi_5 \Delta CC_{t-i} +$$

$$\sum_{i=0}^{p} \xi_6 \Delta GE_{t-i} + \sum_{i=0}^{p} \xi_7 \Delta PS_{t-i} + \sum_{i=0}^{p} \xi_8 \Delta RL_{t-i} + \sum_{i=0}^{p} \xi_9 \Delta RQ_{t-i} + \sum_{i=0}^{p} \xi_{10} \Delta VA_{t-i} + \psi\, ECT_{t-1} + \varepsilon_t \quad \text{....(6)}$$

Where Ψ is the speed of adjustment parameter and ECM is the residuals obtained from equation 1 (i.e. the error correction term). The coefficient of the lagged error correction term Ψ is expected to be negative and statistically significant to further confirm the existence of a co-integrating relationship.

Data Source

The data were sourced from Central Bank of Nigeria (CBN) Statistical Bulletin various issues, Nigerian stock market fact book, World Development Indicators (WDI) 2012, World Governance Indicators (WGI) by Kaufmann et.al., 2012.

V. Analysis of Empirical Results

Following the convention in contemporary time series investigations, to avoid spurious regression estimates, unit root tests are carried out. The results of Ng and Perron (2001) unit root tests are reported in Table 1. Ng–Perron test is preferred as the results are more reliable and consistent compared with the traditional ADF and P–P tests. DeJong et. al., (1992) and Harris and Sollis (2003) argued that due to their poor size and power properties,these tests are not reliable for small sample size. These tests will over-reject the null hypotheses when it is true and accept the null when it is false. Ng–Perron test circumvents the problem of over-rejection of null hypothesis and can be applied on small sample size. Table 1 shows that some variables are I(0) while some are I(1), thus, providing the justification for the use of ARDL.

Table.1: Results of the Ng-Perron unit root test

Variables	MZa		MZt		MSB		MPT	
	Level	First Diff.	Level	First Diff.	Level	First Diff.	Level	First Diff.
ALLSHR	-12.63241**	-34.9812***	-3.7617	-3.1341	0.1176	0.1157	27.8918	3.6424
MKTCAP	-17.9712**	-52.9081***	-4.6175	-2.9087	0.1852	0.1091	19.1981	4.4526
TVSTK	-5.7432	-29.9342***	-1.8767	-5.0917	0.2343	0.1324	29.4524	5.2561
CC	-4.9871	-18.9816**	-0.9871	-2.9871	0.5464	0.1171	21.2341	6.6123
GE	-5.1551	-19.8614**	-1.1232	-3.3141	0.4231	0.1615	17.9021	6.2871
PS	-7.9770	-22.9123***	-1.4526	-4.0041	0.3081	0.1342	19.0341	4.2561
RL	-4.0918	-28.9181***	-1.4352	-3.1173	0.2322	0.1228	20.1020	3.8791
RQ	-5.9776	-20.0198**	-0.9898	-2.8979	0.3397	0.1671	18.7681	3.9082
VA	-4.4616	-19.0445***	-0.7876	-4.7521	0.2871	0.1342	19.7657	5.0245

Note: ***(**)* indicate the significance at the 1 per cent,5 per cent and 10 per cent respectively

Given a relatively small sample size, a lag length of 2 is used in the bounds test. The results of the bound test are given in table 2. The critical values used in this paper are extracted from Narayan (2004)[4]. The F-statistic for the models are 6.5866, 9.8981 and 10.9538, which are greater than the upper critical bounds both at the 1 and 5 per cent significance levels. This suggests that there is a long-run relationship among stock market performance (all-share price index, market capitalisation and value of total stock traded) and inflation, real interest rate, exchange rates, components of governance index such as control of corruption, government effectiveness, political instability, rule of law, regulatory quality and voice and accountability, respectively.

[4] Narayan (2004) has provided critical values that are considered to be more appropriate for ARDL modeling using small samples as compared to Pesaran and Pesaran (1997) and Pesaranet.al., (2001). These critical values are based on small sample size between 30 and 80 observations, unlike Pesaran and Pesaran (1997) and Pesaran et al (2001) which are based on 500 and 1000 observations and suitable for large sample size.

Table 2: Estimated ARDL Models and Bounds F-test for Co integration

Models for estimation	Lag Length	F-Statistics	Critical value at 1 per cent	Critical value at 5 per cent
$(ALLSHR / INF, RINR, EXCR, CC, GE, PS, RL, RQ, VA)$	2	6.5866	3.674-5.019	2.694-3.829
$(MKTCAP / INF, RINR, EXCR, CC, GE, PS, RL, RQ, VA)$	2	9.8981	3.674-5.019	2.694-3.829
$(TVSTK / INF, RINR, EXCR, CC, GE, PS, RL, RQ, VA)$	2	10.9538	3.674-5.019	2.694-3.829

Source: Computed

Notes: The critical values (CV) for the lower I(0) and upper I(1) bounds are taken from Narayan (2005, Appendix: Case II).

Table 3 presents long-run static results of an ARDL model. From Table 3, Inflation rate was found to conform with a priori expectation of model 1 with and without control for autocorrelation problems. In 1(a) a one per cent increase in inflation rate will lead to -1.44 per cent decrease in all-share price index and this is statistically significant at 1.0 per cent level. This seems logical as increasing rate of inflation has a depressing impact on share prices as suggested by the result. The real rate of interest also does not repudiate theoretical expectation. This is particularly true since an increase in the real interest rate tends to drive up the demand for shares and which consequently stimulates increase in the prices of shares. This is statistically significant at a conventional level of 1.0 per cent in both 1a and 1b respectively. The depreciating value of naira vis-à-vis dollar measured by exchange rate appeared insignificant in 1(a) but statistically significant in 1(b) and this can be said to be due to costly nature of the rate of exchange of naira to dollar mostly by foreigners when purchasing shares in Nigeria. Also, three out of the six components of governance index comply with theoretical predictions.

These include control of corruption (CC), government effectiveness (GE) and regulatory quality (RQ) respectively. Variations, however, exist in terms of variables significance in both 1(a) and 1(b). Five components appeared as significant in the former whereas three were significant in the case of the latter. A marginal increase in the unit of corruption control will make share prices to command much higher prices than the case when corruption was made to thrive. A unit increase in the coefficient of control of corruption (CC) will make all share price index to rise by 37.0 and 48.0 per cent, respectively. Also, the level of government effectiveness will likely increase share prices by 1.43 and 1.10 percent, respectively. The coefficient on political instability variable conveys a contrary *a priori* signs, thus,confirming the declining impact of the variable on share prices.

This is plausible as no individual or country would want to invest in a country that is embroiled in political turmoil as witnessed by Nigeria. In fact, the level of significance occurs at 1.0 per cent in model 1 both with and without autocorrelation problems. Furthermore, the deficiency in the freedom of voice and accountability and rule of law also exert negative impact on the share prices whereas regulation impinges positive effects as can be observed on the table. Unlike 1(a), none of the component variables appear statistically significant in 1(b). For model 2, the resulting outcomes are almost similar to model1 except for the variable of voice and accountability component that has negative association with market capitalisation at the highest level of statistical significance of 1.0 per cent most especially after controlling for problems of autocorrelation that invalidated model 2(a). Noticeably, the impact of corruption control seems to exert greater influence on market capitalisation at least at a 1 per cent level as indicated on the table.

Model 3 also share similar traits with models 1 and 2 in many respects. The slight difference, however, seems to occur in 3(b) when the impact of regulatory quality imposes significant negative impacts on the total value of stock traded on the floor of the stock exchange market. The possible explanation can be likened to the fact that firms or companies will only be allowed to trade in their stocks provided all the laid down rules guiding the conduct of the trading processes are duly complied with. More importantly, the basic statistics measured by R-squared show that all the models' dependent variables are adequately explained by the explanatory variables at over 90.0 per cent while the Durbin-watson statistic fall within the acceptable region for models 1b, 2b and 3c that were controlled for autocorrelation problems. In addition, all the models (those controlled for autocorrelation) passed the diagnostic tests relating to residual normality and serial correlation.

Table.3: Long-run Estimates of an ARDL Model

	Model 1		Model 2		Model 3	
	Dependent variable: All Share Price Index (ALLSHR)		Dependent variable: Market Capitalisation (MKTCAP)		Dependent variable: Value of Total Stock Traded (TVSTK)	
	Without control for Autocorrelation (1a)	Control for Autocorrelation (1b)	Without control for Autocorrelation (2a)	Control for Autocorrelation (2b)	Without control for Autocorrelation (3a)	Control for Autocorrelation (3b)
Intercept	3.5757 (14.3953)***	4.8481 (3.3958)***	9.2514 (32.9616)***	10.4438 (9.7502)***	9.5388 (22.8671)***	11.8101 (6.3107)***
INF	-0.0144 (-4.4447)***	-0.0060 (-2.4505)**	-0.0192 (-5.2289)***	-0.0095 (-3.4873)***	-0.0188 (-3.4492)***	-0.0096 (-2.2630)**
RINR	0.0092 (4.9883)***	0.0066 (4.8788)***	0.0109 (5.2132)***	0.0079 (5.2764)***	0.0153 (4.9225)***	0.0111 (4.7690)***
EXCR	-0.0003 (-0.2692)	-0.0034 (-3.2698)***	0.0019 (1.3721)	-0.0021 (-1.8255)*	0.0029 (1.4608)	-0.0021 (-1.1640)
CC	0.3796 (1.7926)*	0.4759 (2.1198)**	1.4135 (5.9072)***	0.6018 (2.3958)**	3.4169 (9.6081)***	1.9109 (4.9082)***
GE	1.4309 (7.3791)***	1.1012 (5.1663)***	1.2863 (5.8708)***	0.8980 (3.7678)***	1.8450 (5.6660)***	1.7138 (4.6353)***
PS	-1.0328 (-9.8977)***	-0.6195 (-5.5134)***	-1.3479 (-11.4320)***	-0.9684 (-7.7013)***	-1.5293 (-8.7268)***	-0.8669 (-4.4441)***
RL	-0.5689 (-2.1620)**	-0.0209 (-0.0923)	-0.7783 (-2.6179)**	-0.2194 (-0.8679)	-1.5516 (-3.5115)***	-0.5090 (-1.3018)
RQ	0.0607 (0.4542)	0.0222 (0.2216)	0.0974 (0.6446)	0.0109 (0.0974)	-0.3460 (-1.5416)	-0.5082 (-2.9286)**
VA	-0.4480 (-4.1084)***	-0.1714 (-1.4161)	-0.8088 (-6.5646)***	-0.5030 (-3.7141)***	-0.4249 (-2.3202)**	-0.2560 (-1.2230)
AR(1)	-	0.9845 (37.5734)***	-	0.9800 (36.0174)***		0.9807 (39.7411)***
Basic Statistic						
R^2	0.928	0.977	0.963	0.988	0.964	0.987
D.W	0.6240	2.1129	0.6065	2.1162	0.6448	2.1662
Diagnostic Tests						
^{2} -	4.9248 (0.0852)	211.003 (0.8212)	5.1188 (0.0774)	187.783 (0.4211)	5.6677 (0.0588)	438.790 (0.2862)
^{2} -	2.07E+24 (0.0000)	0.6931 (0.7780)	1.68E+24 (0.0000)	0.6814 (0.7890)	9.80E+23 (0.0000)	0.7856 (0.6864)
^{2} -	157.57 (0.0000)	0.5075 (0.4790)	116.134 (0.0000)	0.5354 (0.4672)	1.88.195 (0.0000)	0.2506 (0.6185)
^{2} -	85.946 (0.0000)	8.1990 (0.0061)	73.376 (0.0000)	6.8289 (0.0118)	11.5095 (0.0013)	4.5025 (0.0387)
^{2} -	24.486 (0.0000)	0.1978 (0.8212)	25.974 (0.0000)	0.2142 (0.8079)	23.049 (0.0000)	0.4500 (0.6402)

The results of the short-run dynamics associated with the ARDL are reported in table 4. The coefficient of ECM (-1) showed the speed of adjustment from short-run to long-run and for all the models, they are statistically significant with negative signs. The coefficient of the lagged error correction term for model 1 (-0.4821) is negative and statistically significant. The magnitude of the coefficient implies that 48 per cent of the disequilibrium caused by previous quarter's shocks converges back to the long-run equilibrium in the current quarter.Banarjeeet. al., (1994) noted that significant lagged error term with negative sign is a way to prove that the established long-run relationship is stable. The deviation of all share price index from short-run to the long-run is corrected by 48.2 per cent each quarter. Just like in the long-run, inflation and exchange rates reduce all share price index by meager 0.006 and 0.0034 percent, respectively. The real rate of interest exerts a positive impact on share prices as indicated by t-value of 3.2117. Of the components of governance index, the impacts of control of corruption, government effectiveness and political instability stand out prominently as they are statistically significant at both 1 and 5 per cent levels but with alternating signs. While that of corruption and political instability carry negative signs and the coefficient on government effectiveness bears a positive sign. Other components remain insignificant with alternating signs.

In the same vein, error correction models for both models 2 and 3 confirm the existence of a stable long-run relationship and cointegration relationship among variables. Table.4 shows that the coefficients on the error correction term ECM (-1) are statistically significant with the negative expected signs. This confirms the existence of a stable long-run relationship among the variables. The coefficients on ECM (-1) for models 2 and 3 are -0.403 and -40.8 per cent, which suggests fast adjustment processes. Nearly 40 and 41 per cent of the disequilibrium of the previous quarter's shock adjusts back to the long-run equilibrium in the current quarter. All other variables remain as they are in the long-run static results.

Table.4: Estimates of Short-run Dynamics of an ARDL Model

	Model 1	Model 2	Model 3
	Dependent variable: All Share Price Index (ALLSHR)	Dependent variable: Market Capitalisation (MKTCAP)	Dependent variable: Value of Total Stock Traded (TVSTK)
Intercept	0.0126(1.7273)*	0.0143(1.7291)*	0.0258(2.0545)**
Δ INF	-0.0060(-2.3981)**	-0.0095(-3.4198)***	-0.0096(-2.2222)**
Δ RINR	0.0066(4.7991)***	0.0080(5.2017)***	0.0112(4.7116)***
Δ EXCR	-0.0034(-3.2117)***	-0.0021(-1.7955)*	-0.0021(-1.1566)
Δ CC	0.4787(2.0891)**	0.5992(2.3395)**	1.9032(4.7981)***
Δ GE	1.1085(5.0847)***	0.9074(3.7247)***	1.7321(4.5911)***
Δ PS	-0.6148(-5.0847)***	-0.9617(-7.4865)***	-0.8550(-4.2990)***
Δ RL	-0.0190(-0.0826)	-0.2187(-0.8499)	-0.5057(-1.2701)
Δ RQ	0.0175(0.1712)	0.0046(0.0404)	-0.5195(-2.9373)**
Δ VA	-0.1648(-1.3550)	-0.4919(-3.6271)***	-0.2391(-1.1373)
ECM(-1)	-0.4821(-2.3611)**	-0.4034(-2.2032)**	-0.4080(-2.4012)**
AR(1)	0.0078(0.0058)	-0.0244(0.0244)	0.0011(0.0010)
Basic Statistics			
R^2	0.538	0.635	0.66
D.W	1.999	1.996	2.000

Source: Computed by the author.

VI. Conclusion and Policy Recommendations

The paper examined the impact of governance on stock market performance using quarterly data series spanning 1996Q1 to 2010Q4. An ARDL bound testing methodology was employed to explore such causal relationship. The important role of the variables like inflation, real interest rate and exchange rate were clearly brought to fore as influencing the performance of stock measured through all share price index, market capitalisation and the value of total stock traded. Of interest, however, are the key roles of the components of governance index on the stock performance. Notably, control of corruption and government effectiveness exert positive impact while political instability had a dampening impact on such measures of stock performance. More importantly, long-run stable relationships were established through the error correction terms of each of the measures used to the tune of -0.4821,-0.4034 and -0.4080 for all share price index, market capitalisation and the value of total stock traded, respectively. Emanating from this, are a few policy messages, which includes: macroeconomic and financial stability should be constantly maintained and promoted as it constitutes a drag on the stock performance; any acts of corruption should be eschewed as it scares away potential investors into the country and the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies should be enhanced altogether.

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Responsiveness of Nigeria's Short-Term Interest Rates to Changes in the Policy Rate

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Abstract

This paper appraised the efficacy of the Monetary Policy Rate (MPR) as an anchor for other short-term interest rates in the economy. Adopting the vector autoregression approach, the responses of Nigeria's short-term interest rates to changes in the interbank rate (proxy for MPR) was modeled. The paper found that the pass-through from MPR to money market interest rates in the long-run is higher for the prime and lending rates than for changes in the Treasury bill rate and 3-month deposit rate. Overall, there seemed to be an asymmetric impact with an increase or fall in the interbank rate.

Keywords: Interest rate pass-through, money market rates, vector error correction

JEL Classification Numbers: E43, E52, G21

I. Introduction

The cardinal objective of the monetary policy of the Central Bank of Nigeria (CBN) is price stability. The recent modification of its monetary policy framework, beginning end-December, 2006 was to steer the term structure of interest rates towards equilibrium by stabilising short-term interest rates around the MPR. At the time of introduction, the new framework was expected to narrow the spread, stabilise interest rates around the MPR and create a seamless transmission path to achieving key monetary policy objectives. The understanding, though arguably, was that with money supply being endogenously determined, the central bank could influence aggregate liquidity levels through the daily liquidity of the banking system by influencing the direction/movement of the interbank interest rate.

There were palpable challenges militating against the efficacy of the new monetary policy framework. The first was the identification of the operating target. This is due to the fact that CBN does not pre-announce an explicit target for the operational variable and provide refinancing facilities to the banking system through its main refinancing operations. The second was that the time path to achieving the operating target had not been previously determined.
Thus, allowing the overnight interbank interest rate to have an implicit MPR target

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with a symmetric corridor of 200 basis points on the standing facilities was rather arbitrary. The wide corridor apparently suggests an implicit accommodation of 400 basis points spread in short-term interest rates, characterising a general leaning against the wind monetary policy. The outcome since December 2006 and through the heat of the global financial and economic crises shows that short-term interest rates deviated widely from the MPR. The fact that the MPR and other money market interest rates moved in opposite directions, most of the time during the period, was rather paradoxical. The observed movement in market interest rates could be due to extraneous shocks rather than a response to changes in the monetary policy rate.

In this regard, it becomes pertinent to ask what the pattern of pass-through from the MPR to market interest rates is? Other questions that come to mind include: how effective are the intermittent interventions of the CBN in reducing interest rate volatility? Are the short-term interest rates responding to some unanticipated shocks? Or are the banks enjoying arbitrages created by the defined corridor around the MPR? Is the behaviour of short-term interest rates constant or time-varying since the introduction of the new framework? What are the drivers of the perceived distortions in the short-term interest rates?

These questions are derived from the fact that the interbank interest rate is a rate on unsecured interbank lending, thereby incorporating default risks into its premium, while lending by the CBN is collaterised. This implies, therefore, that the CBN lending may not be a perfect substitute for the instrument whose rate it is tacitly targeting because funding and liquidity risks, probably, may alter the path of the resulting market rates in a time varying manner. In addition, anecdotal evidence suggests that the interbank rate has been trending upward and increasingly volatile, requiring interventions by the CBN to alter the path of the market interest rates.

While these issues have been extensively studied and understood in other jurisdictions, there are no clear insights into the issues in Nigeria to help the understanding of the transmission mechanism from MPR to short-term market rates. It is, therefore, necessary to fill this gap by attempting to provide answers to the above raised questions. Consequently, analysis of CBN policy actions vis-à-vis the responsiveness of short-term market rates was conducted.

To achieve this objective, the paper is structured into six sections. Following this introduction, the paper provided insights to the theory of the anchor rate and banks' short-term interest rate behaviour as a guide to the empirical work in Section 2. In Section 3, the paper examined the CBN monetary policy framework since independence. Section 4 reviewed Nigeria's basic interest rate data. Section 5, presented the methodology and the results, while Section 6 summarises and concludes the paper.

II. Literature Review

The consistent assessment of inflation developments and prospects is key in the conduct of monetary policy. Although central banks do not directly control inflation, they however, do have the instruments to affect its determinants. These variables are known as "operating targets", and include, among others, the short-term interest rates. Given a regime of monetary policy, involving an interest rate corridor (with reserve requirement and averaging), the overnight interest rate, on any day within the reserve maintenance period, should equal the rate expected to prevail on the last day of the maintenance period, based on current information. The overnight interest rate expected on the last day of the maintenance period should also equal the probability of the weighted average of the rates of the standing facilities. The literature is replete with evidence that banks' lending rates are key indicators of the marginal cost of short-term external funding in the economy (De Bondt, 2002; Borio and Fritz,1995 and Kobayashi, 2007).

As shown by Borio and Fritz (1995), Bredin et. al., (2002), de Bondt (2002) and Kobayashi (2007), the policy rate is the single most important determinant of the opportunity cost of funds for banks and, therefore, a critical input into their loan decision making model. However, where banks do not respond visibly to changes in the policy rate, due to the existence of structural rigidities which prevent the transmission of monetary policy impulses from the policy rates, then, they place higher premium on the inter-bank money market rate. Banks, therefore, employ the money market rate to benchmark decisions affecting the optimisation of their objective functions such as growth in asset size and profits, as well as a determination of their marginal cost of funds. Klein (1971) and Monti (1971) demonstrated the relevance of the interbank rate, which related the marginal revenue (cost) of the other assets.

Although the interbank rate is beyond the control of the intermediary, nevertheless, under certain conditions, it is an ideal representation for gauging banks' marginal cost of funds because it initiates and intermediates the changes anticipated by monetary policy. As shown by Borio and Fritz (1995), under volatile money market conditions, the interbank rate may be a better indicator of persistent rather than the transitory movement of rates.

As Stiglitz and Weiss (1981) suggested, interest rate stickiness might lead to credit rationing which might affect the effectiveness of monetary policy. Given constant credit risk premium in a perfectly competitive market conditions, the loan rate is expected to match squarely with marginal cost of fund. Klemperer (1987) showed that this movement would generally be small in non-collusive monopolistic and oligopolistic market structures. However, when changes in the policy rate were anticipated, they might be factored into the retail interest rates.

As Bredin and O'Reilly (2004) indicated, the term structure of interest rates also influenced the behaviour of interest rates in the economy. The proportion of retail interest rates, which was fixed or variable determined the relative importance of movements in short or long-term interest rates, and this impacted on the degree of pass-through from policy rate to money market rates, and to retail rates. Sarno and Thornton (2000) showed that there might be a more than unidirectional causality between the interbank rate and the retail rates.

Mozzami (1999) and Angeloni and Ehrmann (2003) estimated the dynamics of the response of retail interest rates to changes in either the policy rate or the market interest rate. Adopting single equation models in error correction specifications, they estimated the degree of interest rates pass through in a number of industrial and emerging market economies. The results revealed significant differences in the degree of response of the market rates both across interest rates and across countries.

Mojon (2000) and Cottarelli and Kourelis (1994) further investigated the pass-through of policy rates into market rate by relating country specific characteristics to the degree of pass-through in the short-run. Using panel data, they related the degree of pass-through to the extent of banking competition, money market factors, financial structure and banks' cost of funds in the short-run. The studies revealed that high retail prices, absence of competition and vol.atility of money market rates determined the degree of response of short-term rates to changes in the policy rate.

Cottarelli and Kourelis (1994) showed that banks were not neutral conveyors of monetary policies as their internal adjustment mechanisms tended to produce rates, which were characterised by a lower variance than the policy rate. Moreover, the reaction of banks to changes in the policy rate was often tinted with influences of market competition, perception and expectations about the future performance of the market. Similarly, sticky changes in the market rate lent credence to the views of Rotenberg and Saloner (1987) and Hannah and Berger (1991) that price stickiness increased with market concentration and that the speed of adjustment of the responsiveness of market rates to changes in the policy rate increased with anticipation of persistence in changes to the policy rate.

III. Interest Rates Trends and Selected Macroeconomic Indicators in Nigeria

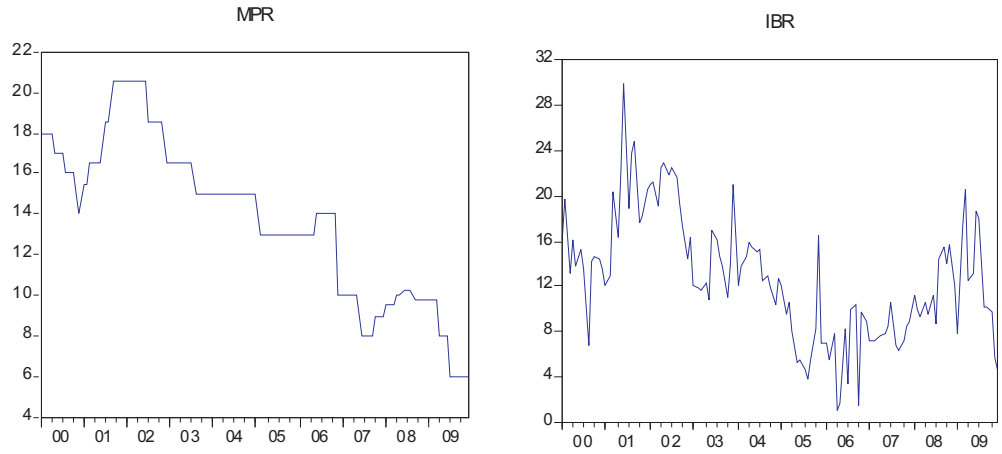
Following the economic and trade liberalisation drive, which led to the introduction of the Structural Adjustment Programme (SAP) in 1986, the CBN embarked on the liberalisation of the financial markets and the introduction of a market-based interest rate policy. However, in some few instances of serious inflationary pressure and general market failure, temporary caps were placed on upward interest rate movements as a necessary condition for stabilising the market and forestalling negative spill-over to other sectors of the economy. Since 1996, however, interest rates were fully deregulated, with the market playing a key role in credit pricing and allocation. The CBN, however, retained its discretion to intervene in the market to ensure orderliness and credibility.

Figure 1 shows the monthly trend in the monetary policy and interbank interest rate over the last decade. The monetary policy rate witnessed an initial decline in 2000, and then rose from 2001 to 2002 before declining steadily till 2009. This reflected the expansionary monetary policy stance in line with the prevailing liquidity conditions. The increasing oil prices and high aggregate demand as well as increased government spending necessitated the expansion in money supply with further pressure on domestic prices and the foreign exchange rate during the period.

The monthly average interbank call rate maintained a gradual downward trend from 2001 to end-2006, with spikes from 2003 to 2005, but rose steadily thereafter. It was, however, generally volatile throughout the period. The figures indicated that the interbank and monetary policy rates were non-correlated. There were signs of lagged response between the interbank and monetary policy rate; however, the lagged impact was largely a random walk. The correlation between the MPR and the IBR is positive, but low at 15.2 per cent[5] .

[5]For details see table 2 in section 5

Figure 1: Monetary Policy and Interbank Interest Rates

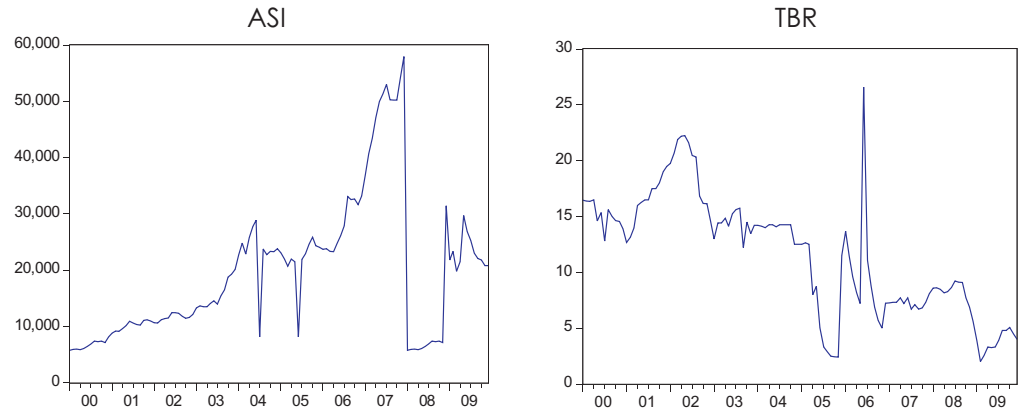


Source: CBN

Since 2006, specifically after the bank consolidation exercise, the interbank rate experienced upward surge, contrary to several cuts in the official interest rate during the period. Several reasons were advanced, which include the argument that banks were not trading amongst themselves at the interbank market because of counter-party risks and other non-market related altruistic egoism of the major banks. The Nigerian banking system is generally oligopolistic in structure. Between July and August, 2009, the CBN embarked on new policy initiatives geared towards reducing the interbank rate and promoting effective trading amongst banks at the interbank market. These new initiatives included the guarantee of interbank market transactions, the retention of the official interest rate at 6.0 per cent since July 2009, and the establishment of the Asset Management Coroporation of Nigeria. These new measures led to a gradual decline in the inter-bank interest rate and a fast narrowing of the spread between lending and deposit rates.

Figure 2 indicates charts for the All Share Index (ASI) and the Treasury Bill Rate (TBR). As shown in the correlation matrix, the two variables have a negative correlation of 21.2 per cent. The ASI trended upward with occasional drops in 2004 and 2005. However, the market witnessed substantial turbulence at end-2007 and throughout 2008, following the shock of the global financial and economic crises. Since 2009, the market has been struggling to rediscover itself. The movement in the TBR was not particularly determinable but exhibited clear stochastic trend as its initial upward movement between 2001 and 2002 was followed by a gradual downward trend. Consequently, from a high of 23.0 per cent in 2002, the TBR dropped to a low of 3.0 per cent in 2005 before it rose astronomically to 15.0 per cent and peaked at above 25.0 per cent at end-2005 and in 2006, respectively.

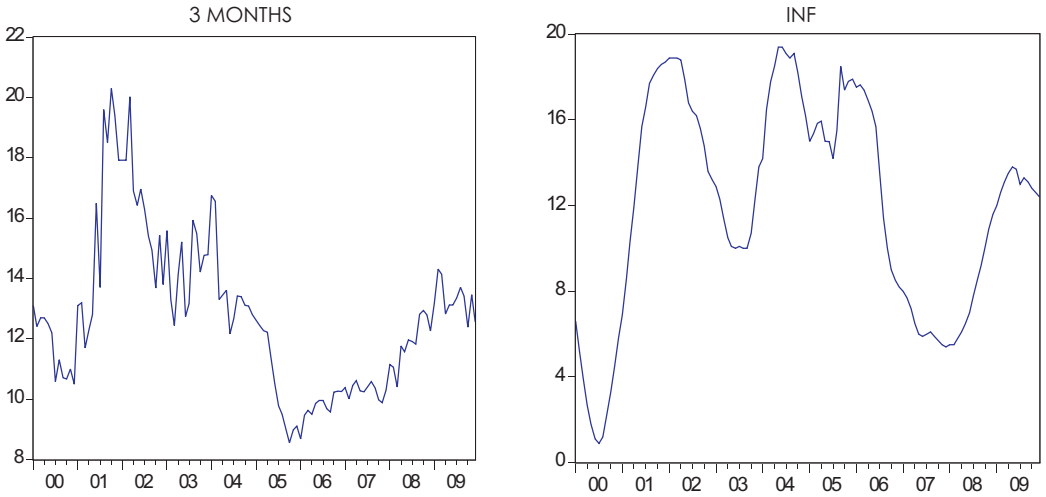
Figure 2: All Share Index and Treasury Bill Rate



Source: ASI is from Nigeria Stock Exchange, TBR from CBN

The 3-month interest rates exhibited signs of high volatility throughout the period as shown in Figure 3. From an initial drop in 2000, the 3-months interest rate rose from about 10.3 per cent in 2000 to peak at over 20.0 per cent in 2001 before it declined to a low of 8.3 per cent in 2005. There were occasional spikes throughout the period.

Figure 3: Inflation and 3-Months Interest Rates

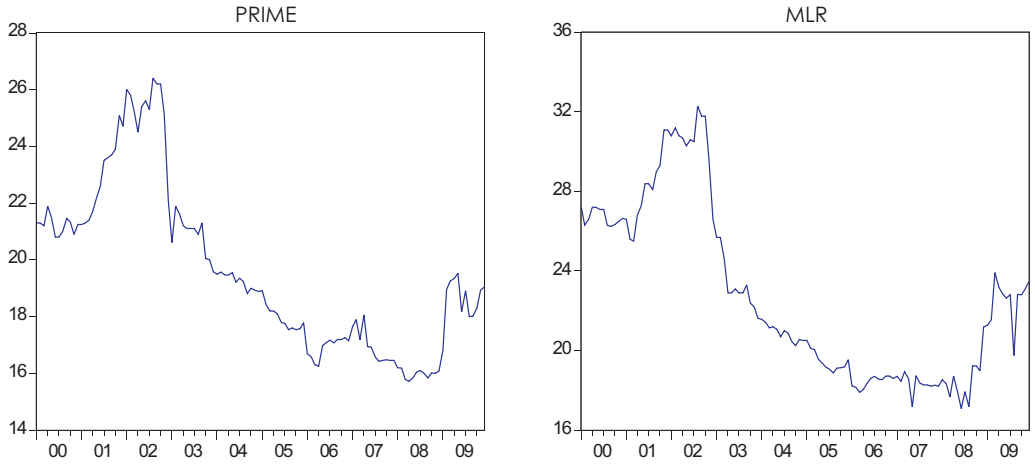


Source: -3-Months Data from CBN, INF from National Bureau of Statistics

The smooth inflation curve suggests some degree of random walk. Generally, the inflation rate moved from a low of under 2.0 per cent in 2000 to a high of 19.0 per cent in 2004 before it declined generally. However, the inflation rate did not exhibit the high volatility shown by the other rates. Inflation was weakly correlated with the other variables. With the 3-months rate, inflation had a correlation of 40.7 per cent over the reviewed period.

The prime and maximum lending rates had very high correlations as shown in Figure 4. The two variables were 95.9 per cent correlated. From an initial but steady rise in 2000, both rates reached a climax in 2002 at 26.2 per cent (32.0 per cent for the MLR) before trended downward to 16.0 per cent (18.0 per cent for MLR) in 2008.

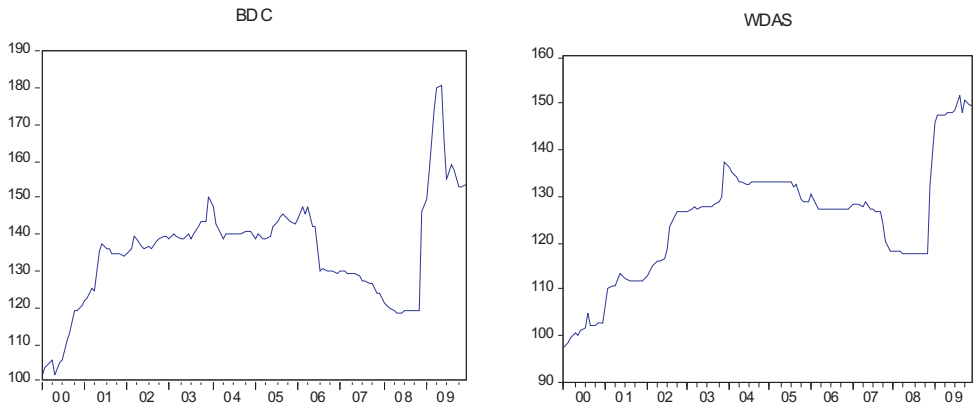
Figure 4: Maximum and Prime Lending Rates



Source: Prime and MLR were sourced from CBN

The Bureau de change (BDC) and wDAS exchange rates depreciated substantially over the last decade, with the BDC rate depreciating faster than the wDAS. The cross correlations indicated that the two rates are positive highly correlated (about 88.08 per cent). The implication is that the rate in either segment of the foreign exchange market was influenced largely by rates in the other market. As precedence indicates, the official exchange rate appears to have been influenced largely by developments in the free market Bureau de change.

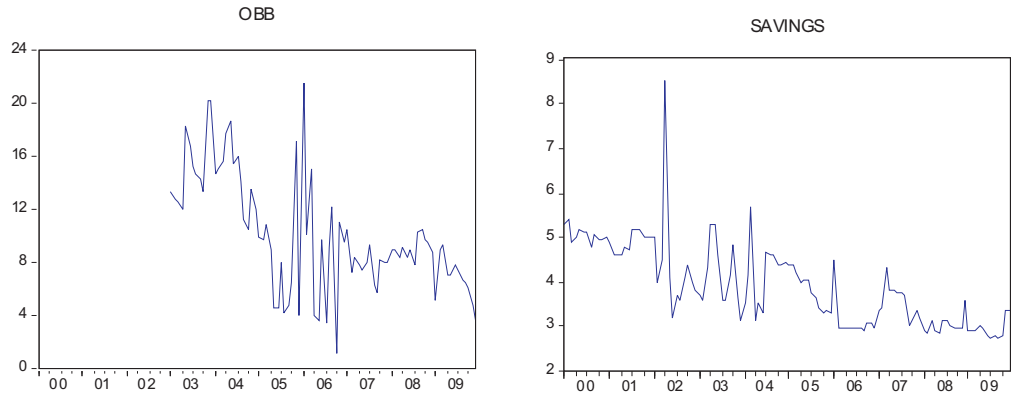
Figure 5: Bureau de Change and Official Exchange Rates



Source: CBN

While the Open Buy Back (OBB) exhibited high volatility during the review period, the savings interest rate was relatively muted. The OBB is a collaterised rate that should be largely insulated from the vagaries of market risks. It plunged from a high of 20.0 per cent in 2003 to 2.0 per cent in 2006. The savings rate decelerated gradually towards 3.0 per cent, except for the hike in 2002.

Fig. 6: Open Buy Back (OBB) and Savings Interest Rate



Source: CBN

IV. Methodology

IV.1 Data

Monthly data over the period January 2000 - August 2014 was used and they were obtained from the CBN Statistical Bulletin. All variables were represented in percentages. Within this period, four fundamental issues were noted for altering the course of monetary policy and interest rate developments in the country. A banking consolidation exercise was carried out, effective December 2005. This development reduced the number of deposit money banks (DMBs) from 89 to 25. In December 2006, a new monetary policy framework was introduced, with a new MPR, to replace the erstwhile Minimum Rediscount Rate (MRR). A feature of the new framework was the establishment of a lending and deposit facilities and a symmetric corridor of 400 basis points around the MPR. In July 2008, the global economy began to witness signs of financial crisis which, by 2009 had evolved into the global financial and economic crises. In July 2009, the Monetary Policy Committee (MPC) of the CBN de-risked the money market at the heat of the global financial and economic crises to encourage interbank lending. That policy move led to a crash of short-term interest rates below historical levels. The MPR does not change as frequently as do other variables in the paper. Consequently, this paper used the interbank call rate as a proxy for the MPR in the models.

IV.2 Time Series Properties

A unit root test was conducted on the variables using the Augmented Dickey Fuller tests under the option "*trend and intercept*". The lag length of 3 was chosen based on information provided by the Schwarz information criteria. The unit root test assumes that the series has a unit root and that it is an autoregressive of order 1 [AR (1) process of order 1] that is $y_t = \rho y_{t-1} + u_t$; was tested against null hypothesis that H_0: p = 1. The alternate hypothesis is that H_1: /p/ < 1. The assumption is that y_t of the null hypothesis is non-stationary and is a random walk without drift. In the alternate hypothesis, y_t is a stationary AR (1) process. Dickey and Fuller (1979, 1981) assumed that the disturbance term is white noise. The Dickey Fuller test is based on the equation:

$$\Delta y_t = \alpha + \beta_t + py_{t-1} + \theta_t \Delta y_{t-1} + \theta 2\ \Delta y_{t-2} + ... + e_t \quad (1)$$

$$q = \rho + \beta_t + py_{t-1} + \Sigma\ \theta_t \Delta py_{t-1} \quad (2)$$

Where:

*q*is the white noise residual in the model. The lags are included to eliminate the existence of serial correlation in the model.

The co-integration properties of the data was examined using the standard Johansen procedure, leading to the estimation of the vector error correction models, accounting for the dynamics of the short-run changes in the long-term interest rate.

V.3 Models

In an efficient market framework, the MPR should determine long-term fluctuations in short-term interest rates, and also serve as the common factor driving the market interest rates. The theory of interest rate pass-through postulates a zero-change (i.e. constant) mark-up. Using co-integration techniques, the identified co-integrating vectors were, therefore, expected to explain the sources of disequilibrium in the money market rates and the persistence in the wide deviations from equilibrium. A vector autoregressive model was specified to analyse the pass-through impact to other market interest rates to adjustments in the policy rate.

IV.3.1 Vector Autoregression (VAR)

The VAR model was employed to show the channels through which the interbank interest rate/MPR may affect other money market rates. It shows how a shock to one variable in form of a one unit increase in the error term, for that variable, causes the variables in the system to vary in subsequent periods, assuming no other shocks disturbed the system at the same time. Consequently, the VAR equations, as specified, were assumed to sufficiently capture the combined effects of all the structural relationships among the variables

The mathematical representation of the VAR relates the current realised value of a variable as dependent on its lagged values and a current white noise innovation as:

$$Y_t = \varepsilon_t + \alpha_0 + \sum_{j=1}^{q} \alpha_j Y_{t-j} \quad (3)$$

This autoregressive specification can be extended to include the lagged values of another variable to the right as shown in equation 4 below:

$$Y_t = \varepsilon_t + \sum_{j=1}^{q} \alpha_j Y_{t-j} + \alpha_0 + \sum_{j=1}^{q} \beta_j X_{t-j} \quad (4)$$

To create a vector autoregressive model, we expressed X in a form similar to equation 4 above. Consequently, equations 4 and 5, taken together, are referred to as the vector autoregressive model.

$$X_t = \varepsilon_{xt} + \sum_{j=1}^{q} \tau_j X_{(t-j)} + \gamma_0 + \sum_{j=1}^{q} \gamma_j Y_{(t-j)} \quad (5)$$

Thus, a p^{th} order vector autoregressive model was specified to be of the form:

$$y_t = c + \varphi_1 y_{t-j} + \varphi_2 y_{t-2} + ... + \varphi_p y_{t-p} + \varepsilon_t \quad (6)$$

where:

$\varepsilon_t \sim iidN(o\Omega)$.

y_t is a n x 1 vector of endogenous variables at time t and c is the intercept.

The paper adopted relevant diagnostics tests and appropriate lag selection criterion to confirm the stability of the VAR. y_t is a representative of the variable setinter-bank (call) rate as the impulse variable and maximum lending, 3month deposit, Treasury bill, as well as the prime lending rates.

V. Empirical Results

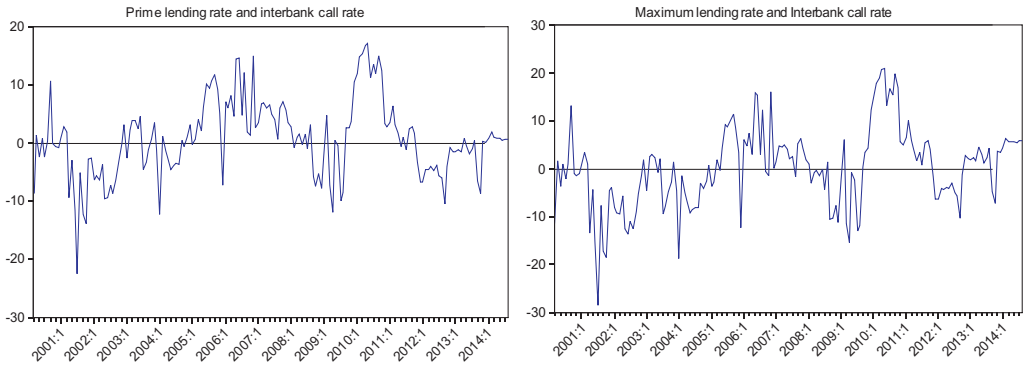
V.1 Time Series Properties

From the results of the unit root tests, all variables in the models, except the Treasury bill rate had a unit root. The variable was stationary at level. All other variables were stationary only at first-difference. In the evaluation of the existence or otherwise of co-integration, one co-integrating equation was identified for the bivariate VAR case of the selected interest rate variable and the interbank call rate.

V.2 Results from the Bivariate Vector Error Correction (VEC) Models

To a large extent, the equilibrium errors (Figure 7) derived from the co-integrating relation between the different rates, over the sample period, reflect positive errors in period of monetary policy tightening (i.e. falling interbank rates). Negative equilibrium errors also appear to mimic periods of rising interbank rate.

Figure 7: Co-integrating Relations of Relevant Interest Rate and the IBCR



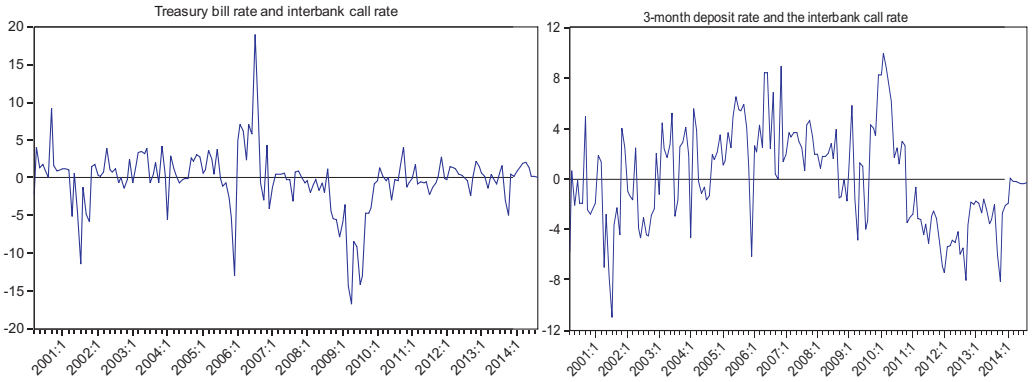
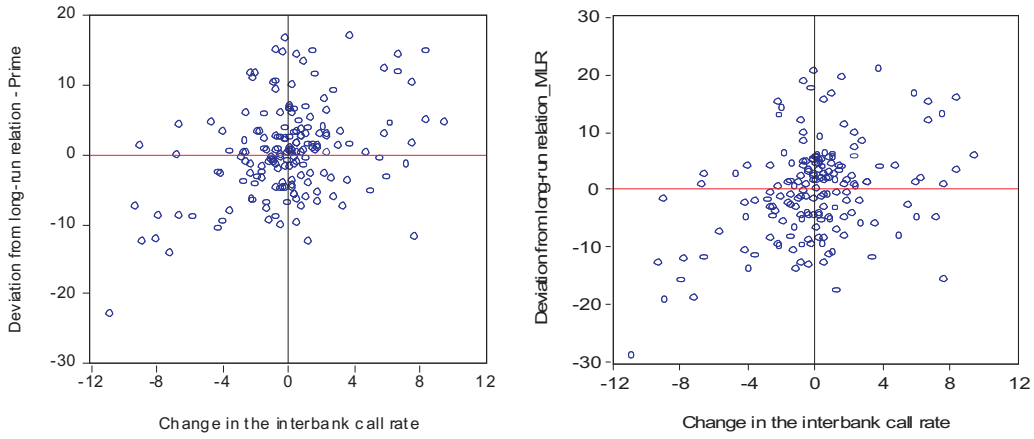


Figure 8 evaluates asymmetric response of various interest rates to changes in the policy rate proxied by the interbank call rate. To examine this, retail rate adjustment is viewed from perspective of deviations from the long-run relations obtained from a bivariate VECM. Following Burgstaller (2005:7), "positive equilibrium errors, in general, are interpreted as representing times of falling policy or market rates. Negative deviations are proposed to stem solely from a more restrictive monetary policy or cost increases in the interbank market". A scatter plot of the equilibrium error and the change in the interbank call rate indicates an apparent asymmetric showing rather than a perfect correlation between the two indicators.

Figure 8: Co-integrating Relations between selected interest rates and changes in the IBCR



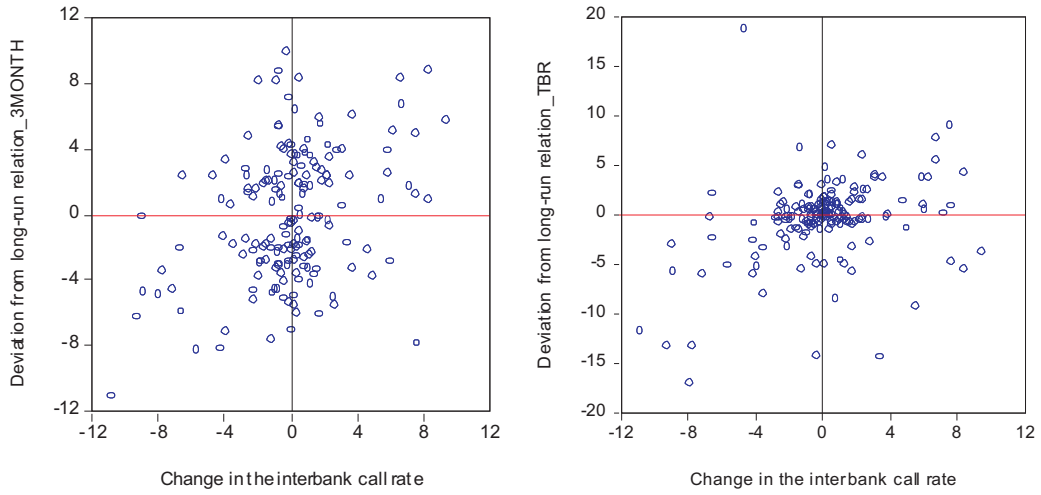


Table 1: Estimates of Pass-through Parameters

Interest Rate	Co-integrating Parameter	Impact Multiplier	Long-run Multiplier
Prime lending rate	-0.014	-0.011	1.51
Maximum lending rate	-0.010	0.021	1.91
3-month deposit rate	-0.096	-0.060	0.92
Treasury bill rate	-0.129	-0.030	0.93

Applying the standard Johansen approach with unrestricted constants the co-integrating relations were estimated. From the bivariate VECM results (Table 1), the co-integration parameters and long-run multipliers are differentiated for the various interest rate measures. There is a faster adjustment for the Treasury bill rate (0.129 percentage point) and 3-month deposit rate (0.096 percentage point) within the month the shock takes place; an evidence of the stickiness of lending rates when policy rate is adjusted downward, except if there is a chance of a customer revolt. However, their long-run impact is lower than the prime (1.5 percentage points) and maximum lending rate (1.9 percentage points). The impact in the 3-month deposit rate demonstrates its rigidity to changes in monetary policy, reflecting banks unwillingness to allow market dynamics to dictate the pace of change, given its role as, perhaps, input into bank production.

As noted by Hofmann and Misen (2004), banks have some control on the price setting for rates and follow a mark-up pricing rule as observed by Winker (1999). This eventually results in the high spread between the deposit and lending rates and, possibly, the presence of imperfect competition on markets for loans and deposits. Structural deficiencies in the banking system hinder a smooth transmission of monetary policy. As rightly observed by de Bondt (2002), structural rigidities could prevent the transmission of the monetary policy signals. To compensate for such deficiencies, banks place higher premium on movement in the interbank rate to benchmark decisions affecting the optimisation of their objective functions such as growth in asset size, profits and the determination of their marginal cost of funds. It can also be observed that the magnitude of long-run impact between the prime (1.5) and maximum (1.9) lending rates is also different. It brings out an important behaviour of banks usually to shield and negotiate rates and the timing of the effective date for implementation with their prime customers. The ability of the market to isolate permanent from transitory monetary policy actions determines the impact of monetary policy changes when they do occur. Temporary changes characterise sluggish pass-through effects from the market, but the market may adjust more quickly to permanent policy changes.

In the Nigeria context, competition has been hampered by structural inefficiencies, such as the dominance of a few banks, holding over 50.0 per cent of industry assets; a high component of government deposits held at the banks and the effect of global spill-over on the domestic economy, among others.

V.3 Policy Issues

The results of this paper largely reflect the conditions of the Nigerian financial system, the banking system and money market. The financial system is developing and not sufficiently deep as a global financial centre. The banking system is oligopolistic in nature with a few large banks controlling the market. This non-competitive structure of the banking system encourages collusion as the major banks play market makers and stultify reforms of the system. The absence of competition is fuelled by the presence of a large volume of public sector funds, which are often used to swing the foreign exchange market and frustrate policies that are not desirable by the big banks. The absence of competition for deposits and collusion by the major banks affects the money market, which starved off interbank funds as banks restrain from lending to themselves in that segment of the market preferring to keep their deposits with the central bank or speculate in the foreign exchange market.

The significant but asymmetric reaction to the interbank rate by all the variables is indicative that the IBR is an ideal representation for gauging banks' marginal cost of funds as it serves to intermediate the changes anticipated by the market to changes in monetary policy. The interbank interest rate is the most appropriate interest rate to play this role in oligopolistic markets as it becomes a reflection of changes in general market conditions rather than the discretionary decisions of individual market players. Besides, under such volatile money market conditions, the interbank rate becomes a better indicator of the persistent rather than the transitory movement in interest rates.

The examination of Nigeria's money market interest rates revealed the absence of steep sloping curves. While more competitive markets are associated with steep sloping interest rate curves, less competitive markets exhibit gentle sloping curves. More importantly, this feature of the interest rate curves in Nigeria has implications for the degree of competition for loan facilities, which is critical in determining the interest rate spreads. Asymmetric information may play a key role in variations in the interest rate spreads but more importantly, for Nigeria, collusion by market participants could be a major factor.

As shown by Thorton (2000), where short-term sources of funds dominate, changes in the interbank rate are likely to impact retail interest rates in the economy faster. However, if capital market sources dominate, the link between the interbank and retail rates would be weaker. With a huge portfolio of short-term public sector deposits, the Nigerian banking system operates at the short end of the market. Consequently, this reflects in the quick return to equilibrium of most variables due to innovations in the interbank rate, while changes in the MPR take longer period to return to equilibrium.

The absence of competition for funds by the market participants significantly impacts the responses of the variables to innovations in the policy rate. As Cottarelli and Kourelis (1994) pointed out, the reaction of banks to changes in the policy rate is often tinted with influences of market competition, perception and expectations on future price developments. Banks are not neutral conveyors of monetary policy impulses. Consequently, their internal adjustment mechanisms produce rates which are characterised by a low speed of adjustment to changes in the policy rate. Given these conditions, the speed of adjustment was expected to be very low because, as found by Hannah and Berger (1989), price stickiness increases with market concentration and the speed of adjustment to changes in the policy rate with anticipation of persistence in changes to policy.

VI. Summary and Conclusion

The paper examined the responsiveness of interbank interest rates to changes in the MPR, as well as other short-term interest rates. The paper found that while external shocks might have had serious impact on the outcomes of monetary policy over the last 10 years, the more fundamental issues related to the absence of competition in the banking sector. The oligopolistic structure of the banking system, which encourages collusion by the big banks, has undermined the transmission of monetary policy impulses through the money market, thereby leading to very large responsive lags. A deliberate policy to reduce the size of banks would lead to the emergence of strong and effective banking institutions that are more competitive.

The large volume of public sector funds has discouraged competition and depth of the banking system as banks do not make efforts to compete for customer deposits. On the other hand, fiscal operations of the government have ostracised a large section of customer base, as banks prefer granting loans to government than the private sector. This crowding out effect has equally affected the depth of the banking system, while the laissez-faire banking attitude to granting loans has frustrated the transmission mechanism of monetary policy impulses to the real economy.

A gradual withdrawal of government funds from the deposit money banks is advocated if monetary policy would be effective. A situation where banking sector liquidity cycles are defined by injection and withdrawal of public sector deposits with attendant gyrations in money market interest rates is anti-thetical to effective monetary policy. Indeed, high volatility in the interbank interest rates has been a major frustrating factor to the effectiveness of monetary policy in Nigeria. A more prudent regime of fiscal operations is advocated to address the crowding out effect of government fiscal operations and resort to deficit financing.

The ability of the market to isolate permanent monetary policy action from transitory one determines the impact of monetary policy changes. The CBN is responsible for understanding the impulse of the market at all times. At the moment, knowledge gap seem to exist between the Bank and the market. While the market appears to make a clear distinction between transitory and permanent monetary policy actions, the monetary authorities do not seem to understand market perception of its policy actions. Consequently, the CBN expects the market to react always and in a particular magnitude and direction to its policy changes. This is misleading to the authorities as the impression could be conveyed that the market does not react to changes in the policy rate when indeed the market may have perceived such changes as transitory.

Since the interbank interest rate is the ideal variable for determining the banks' marginal cost of funds in volatile oligopolistic markets, trying to stabilise the interbank rate as an operational target variable without addressing the structural rigidities in the market would further raise the rates as the market is quick to identify and penalise official meddling. Besides, banks use the interbank rate to benchmark their optimising decisions concerning growth in asset size and profits. The CBN needs to encourage competition for both funds and loans in the banking system and break up the oligopolistic structure of the banking system to ensure the emergence of a more competitive banking system. There is also the need to alter the liquidity cycle in the banking system and transform it from short-term dominated to long-term dominated sources of funds.

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Analysis of Monetary Policy Decision Making among Heterogeneous Monetary Policy Committee (MPC) members at the Central Bank of Nigeria

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Abstract

This paper provided an empirical analysis of policy-makers' voting patterns on interest rates in Nigeria. Employing a (pooled) Taylor rule and using real-time data obtained from published personal statements of monetary policy committee members at the Central Bank of Nigeria (CBN), the paper tests for preference heterogeneity among MPC members. The aggregate reaction function as well as individual reaction functions for MPC members were used to tests whether there is a difference between the voting patterns of internal members and that of external members of the committee. Our results suggest evidence of heterogeneity among MPC members and that the voting patterns of the internal members are statistically different from that of the external members.

Keywords: Panel Data Analysis, Interest Rate Decision, Monetary Policy, Central Banking

JEL Classification: C23, E43, E52, E58

I. Introduction

The Central Bank of Nigeria Act, 2007 granted operational autonomy to the Bank and, in accordance with global practice, created the Monetary Policy Committee (MPC)[1]. According to Section 12 Sub-sections (1-5) of the Act, the Committee is made of 12 members, comprising the Governor, as the Chairman, the four Deputy Governors, two members representing the Board of Directors of the Bank, three members to be appointed by the President of the Federal Republic of Nigeria, and two members to be appointed by the Governor of the Bank. The Committee, which is responsible for setting interest rates for the economy, meets every two months to consider developments in domestic and global economies and on the basis of their considerations take actions that signal monetary policy stance.

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

[1] Monetary policy decisions by a committee are now more common than by a single policy-maker, for example, the Central Bank of New Zealand and the Central Bank of Israel.

Extant literature emphasises the valuable implications of diversity in monetary policy committees (Chappell et. al., 1997, Harris and Spencer 2009, Jung and Kiss 2012, Apel et. al., 2013). Particularly, diversity of views across members reflecting in large part, skills, backgrounds and individual preferences, is an important feature of the decision making process. To introduce heterogeneity, the committee members are usually drawn from people with different backgrounds including banking sector, academia, government and other relevant professions. The CBN publishes personal statements of MPC members which includes information concerning members' voting records. This voting record provides valuable information on the preference behaviour and diversity among Committee members and the short-term interest rate expectations (Horvath, Smidkova and Zapal, 2010).Thus, when a committee member holds a contrary view to the majority, the position is registered by casting a dissenting vote which is recorded in the personal statement of such a member.

Gerlach-Kristen (2006) argues that revealing the diversities among MPC members tend to make central banks more predictable, which in turn, supports anchoring of inflation expectations and smoothing interest rates volatilities. More importantly, studies of preference heterogeneity in developing countries are scarce and in some jurisdictions not available. Furthermore, since knowledge of preference heterogeneity helps anchor inflation expectation, it is prudent that this study be given adequate attention in Nigeria in view of the importance of price stability in the Bank's mandate.

Riboni and Ruge-Murcia (2008) have argued that systematic differences among members of MPC are critical to the decision-making process of monetary policy committees. King (2002) emphasises the pooled-knowledge benefits of committees over individuals in decision making process and pointed out that diverse opinion during discussions at each MPC meetings are crucial to the committee's performance. It is against this backdrop that this study sets out to investigate the interest rate setting behaviour of MPC members at the Central Bank of Nigeria with a view to testing the heterogeneity hypotheses among members. In particular, the study estimates both aggregate and individual Taylor-rule functions for MPC members at the CBN in order to establish the voting pattern of members and whether they are affected by type of membership, such as internal vs external members. In other words, we want to establish whether the voting patterns of internal members are statistically different from that of the external members.

The rest of the paper is organised as follows. Section two discusses monetary policy process at the central bank of Nigeria, with some stylised facts regarding preference behaviour of MPC members. Section three contains literature review, while Section four discusses the methodology employed, and specifies empirical models used to test heterogeneity in MPC decisions. Section five discusses the results of the empirical analysis while Section six contains policy implications, and conclusions.

II. Monetary Policy Process at the Central Bank of Nigeria

II.1 Compositions of MPC

The Monetary Policy Committee at the Central Bank of Nigeria (MPC) was created in 2007 by an Act of Parliament (CBN Act. 2007). In Nigeria, decisions on the design, formulation and implementation of monetary policy are made by this Committee. Table 1 shows the members of MPC, their institutional affiliations, as well as their membership status.

Table 1: Monetary Policy Committee Members as at December 2013

		Status	Institutional Affiliation	Basis for Membership
Sanusi L. Sanusi		Governor and Chairman	CBN	Governor CBN
TundeLemo		Dep.Gov. and Member	CBN	Deputy Governor
Sarah Alade		Dep.Gov. and Member	CBN	Deputy Governor
Suleiman Barau		Dep.Gov. and Member	CBN	Deputy Governor
Kingsley Moghalu		Dep.Gov. and Member	CBN	Deputy Governor
Orosanya Stephen		Board Member	Federal Min. of Finance	Representing the Board
Anastasia M. Daniel-Nwobia		Board Member	Ministry of Finance	Perm. Sec. Fed Min. of Finance
Adedoyin R. Salami		Member	Lagos Business School	Appointed by the CBN Gov.
John Oshilaja		Member	Consultant	Appointed by the CBN Gov.
Abdul-Ganiyu Garba		Member	Ahmadu Bello University	Appointed by the President
ShehuYahaya		Member	AfDB	Appointed by the President
Chibuike U. Uche		Member	University of Nigeria	Appointed by the President

Source: Authors' Compilation

II.2 Decision Making Process

The Bank has an independent committee responsible for monetary policy through the setting of monetary policy rate (MPR). The Committee meets every other month to review and discuss developments in both domestic and global economies with a view to fine tuning policy decisions on interest rates and other monetary policy instruments. During their meetings, the Committee is furnished with Economic Reports prepared by staff members of the CBN that adumbrates various developments in the domestic and global economies covering different sectors as well as inflation forecasts. Based on these reports and their private information and investigations, they discuss and take decisions on the policy rate to guide market transactions for the next two months. The outcome is determined by a simple majority of votes and which are often published.

Members come to the meeting with their individual perceptions about the economy which may differ among them. They have similar public information set augmented with private information in different forms which may be linked to a particular background or proficiencies of individual members. This explains cases of dissents from the consensus projection as some individual members tend to attach varying importance to certain types of information than others. Later, sharing of information occurs during the discussions at the committee meetings (Geanakoplos, 1992; Bicchieri, 1993). Member's individual policy choice is eventually based on private information as well as the shared information obtained during discussions with colleagues at the meeting (Bhattacharjee and Holly, 2006).

According to Bhattacharjee and Holly (2006), the MPC decision-making process is in two-stages. The consideration of the state of the economy, involving presentation of staff analysis and forecasts, and information sharing by members, occur in the first stage (Gerlach-Kristen, 2003; Meade and Stasavage, 2004).The second stage involves committee's discussion and interest rate setting decision. Some committee members tend to take divergent positions from the central view in spite of the information sharing by members. The differences in opinions are usually on the state of the economy and the possible effects of interest rates changes on inflation and output (Bhattacharjee and Holly, 2006).

During the voting periods, the chairman calls on members to vote on whether the committee should retain, tighten or loosen monetary policy stance. Thereafter, they vote on how much each member wants the policy rate to be changed with the chairman stating the results or voting after every other member has voted.

Each member is expected to vote for retention, tightening or loosening of the policy rate and to state briefly the reasons for voting in that manner. After every round of voting, another round of voting is conducted to check if any member has been persuaded by the arguments of colleagues to change position. It is after this round that a final decision is taken based on a simple majority.

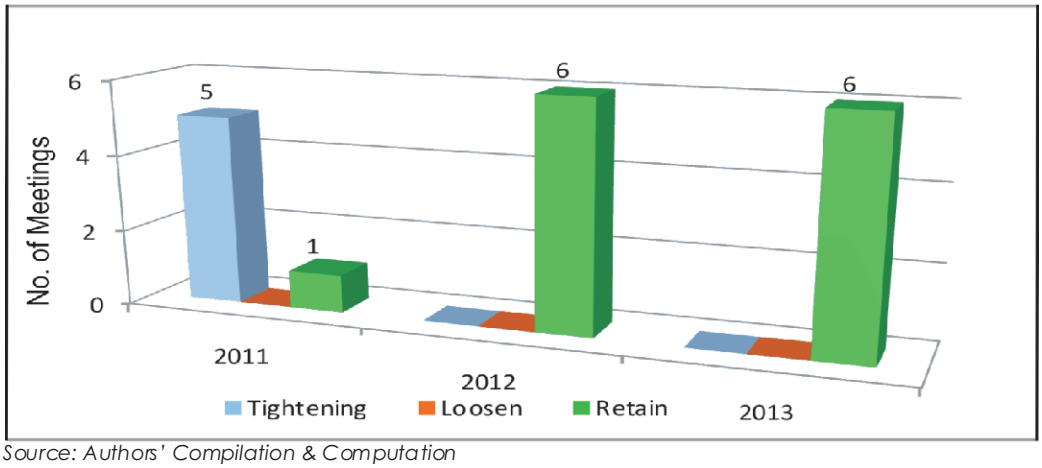
II.3 MPC Voting Patterns at the Central Bank of Nigeria

This section discusses the voting pattern and characteristics of MPC members between 2011 and 2013. The preference behaviour of committee members in terms of both policy direction and the distribution of dissent was considered during the period 2011 –2013. This reflects the period for which individual member's personal statements were published. The individual statements contain each member's preferred interest rate and explanations on why such a member chose the rate.

The committee had 18 meetings from 2011 to 2013, an average of 6 meetings per year. The frequency of policy rate change reduced from 83 per cent in 2011 to zero per cent in 2012 and 2013, indicating its general bias to policy tightening during the reviewed period. The preference for tightening during the 2012-2013 period reflects the Committee's efforts to curb inflationary pressures arising from persistent excess liquidity in the banking system during this period.

Figure 1 shows that in the period 2011 to 2013, the committee retained interest rates more than they did tighten or loosen. In particular, the committee tightened 5 times, and loosened only once in 2011.

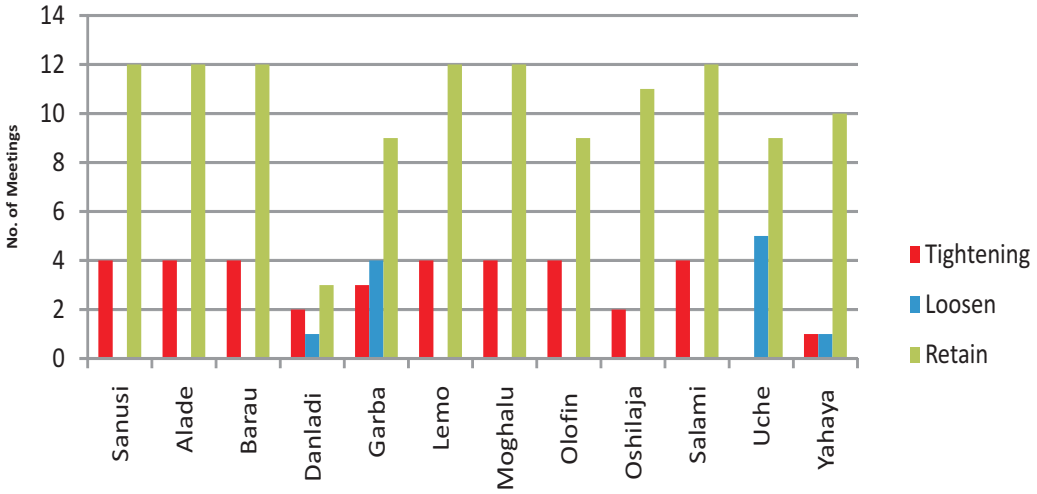
Figure 1: Summary of MPC Decisions 2011-2013



Source: Authors' Compilation & Computation

Figure 2 shows the key voting characteristics of MPC members in a three year period, 2011-2013. There is observed variance between internal and external members of the committee in their voting patterns. Unlike the former, the external members usually dissent for tightening than easing policy rates.

Figure 2: Key Voting Characteristics of MPC Members 2011-2013



Source: Authors' Compilation & Computation

Table 2 shows the voting pattern of MPC members between 2011 and 2013. During this period, about 46 per cent of the decisions were taken by unanimity, a relatively significant ratio. In 2011, for example, dissents in favour of tightening constitute about 83 per cent of the decisions taken, retention of interest rate amounted to about 16.67 per cent while there was no decision to ease policy stance during the period. The voting statistics also show that the "activism" ratio (the ratio of tightening to the overall policy decisions) was 80 per cent, a significantly high activism ratio.

Table 2: Key Voting Pattern of MPC (2011-2013)

Key Voting Characteristics of Monetary Policy Committee 2011-2013			
	2011	2012	2013
Number of Voting members	12	12	12
Internal members	5	5	5
External members	7	7	7
Number of meetings	6	6	6
Meetings with tightening	5	0	0
Meetings with easing	0	0	0
Meetings with no changes	1	6	6
Frequency of policy rate changes			
Tightening (per cent)	83.33	0	0
Easing (per cent)	0.00	0	0
Retain (per cent)	16.67	100	100

Source: Authors' Compilation & Computation

III. Literature Review

III.1 Theoretical Literature

Several theoretical literature describe preference heterogeneity in MPC decision making process. A number of studies including Gerlach-Kristen (2003) and Horvath et. al., (2010) have shown that some degree of dissent offer very useful information about future policy direction.

Thus, dissent among committee members could be a useful aspect of the monetary policy process. In preferring interest rates increase when inflationary pressure is high, the behaviour of committee members is said to be in tandem with economic theory and to be exhibiting homogeneity in policy preferences even with heterogeneous policy reaction functions. The systematic heterogeneity of members is linked to their membership type (whether external or internal), career and professional background (such as central banking, private sector, public sector or academia) which eventually translate to biased reaction function notwithstanding the projections (Horvath et. al., 2010).

The information cascade model developed by Bikhchandani, Hirshleifer, and Welch, (1998) suggests that committee members base their preferences beyond their own personal information prior to the meeting. They incorporate opinions of

central bank staff articulated in the staff report to the MPC in addition to information gathered from fellow members during discussions at meetings. However, members attach varying weights to this information in their judgments and interest rate setting choice which may be attributed to their backgrounds in terms of type of membership, profession, expertise and length of time served as MPC member. Bhattacharjee and Holly (2006) observed that MPC decision-making is in two stages. First is consideration based on the economic developments and information sharing during meetings and two, decisions which are reached by majority of votes, cast by members.

Meade and Stasavage, (2004) noted that there are basically two groups in every MPC committee, namely the "Hawkish" and the "Dovish" groups. The hawkish group are those who believe that price stability should be achieved by aggressively raising interest rates to tame aggregate demand. The dovish group comprise of developmentalists who believe that the best approach to achieving price stability is to create a conducive environment for growth by ensuring that credit is available to economic agents at affordable prices. For them, lower interest rates will unlock credits to the private sector which in turn increases production and subsequently leads to reduced prices. This is akin to the Backus and Driffill (1985) model of an in∆nite-horizon sphere where two kinds of policy makers exist: The first one is a strategy that encourages the maximisation of social welfare while the second chooses zero inflation. Sibert (2002) suggests that policy makers have varying reaction functions and tend to differ in voting pattern over time due to strategic behaviour.

The voting behaviour is crucial in understanding the observed heterogeneity among MPC members across central banks. Causes of dissent voting behaviour include internal and external status, skills and experiences of members amongst others. The information provided in the voting records or the minutes of the committee show dissenting voters and the direction of the voting (ease or tightness) at each meeting which allows behavioural analysis of dissent voting.

Bhattacharjee and Holly (2005), considered a Committee arrangement where there are three distinct sources of uncertainty: (1) committee members may differ on their reaction function to interest rates, inflation and output, giving rise to different policy rules; (2) Members may have access to different private information sets leading to heterogeneity in their individual policy rules. Information asymmetries in committee decision making are explained by diverse professional experiences, information handling skills and independent "private" information. These information asymmetries tend to increase with the committee's

size (Erhart and Vasquez-Paz, 2007); (3) Members may also have diverse opinions about the size of the output gap and in∆ation expectations. Therefore committee members are bound to hold different preferences and policy views even as they respect the strategy and the objective of the central bank.

III.2 Empirical Literature Review

Empirical studies on the preference behaviour of MPC members are relatively few, with existing ones concentrating on monetary policy committees of advanced economies of America and Europe. Riboni and Ruge-Murcia (2008) studied the Bank of England MPC using the standard New Keynesian framework, allowing members to hold different views and have different weights attached to output and inflation stabilisation. The study revealed that MPC members are equally homogeneous in their policy preferences but differ in their policy reaction functions which may be linked to the nature of their membership and career backgrounds. Besley et. al.,(2007) investigated heterogeneity hypothesis of the Bank of England MPC by comparing coefficients of individual policy reaction functions using vote records of the Committee members. The results suggest the existence of heterogeneity in the Bank of England MPC decisions making.

Havrilesky and Gildea (1991), Havrilesky and Schweitzer (1990), Gildea (1990), and Belden (1989) have studied the US Federal Open Market Committee (FOMC) decisions using descriptive statistics. They analysed differences in the voting behaviour of the Board members and have revealed that external and internal members differ in voting patterns and that the former dissent more by voting for a lower interest rate.

Spencer (2006) and Gerlach-Kristen (2003) also investigated the voting pattern at the Bank of England MPC using dissenting votes by comparing dissenting frequencies between internal and external members. The findings of both studies mirrored the one obtained on heterogeneous preference of the US FOMC members by Havrilesky and Gildea (1991), Havrilesky and Schweitzer (1990), Gildea (1990), and Belden (1989). Contrary to Havrilesky and Gildea (1991), Havrilesky and Schweitzer (1990), Gildea(1990), and Belden (1989); Tootell (1991, 1999) find no methodical variation in the US FOMC members' voting patterns.

Apel et. al., (2013) examined heterogeneity in MPC members' preferences in Sweden and Norway. They employed a direct approach using standard loss function. Some of their findings suggest significant preferences heterogeneity at the Riksbank and Norges Bank MPC; that nature of membership (external vs internal) has effects on preference distribution within the MPC committees.

Jung and Kiss (2012) have investigated preference heterogeneity of the central bank of Hungary MPC and the National Bank of Poland MPC during the period 2005- 2010. They employed (individual) voting records and estimated (pooled) Taylor-type reaction functions of the committee using economic and financial information and voting records. The study suggests that diversity by voting pattern was an essential characteristic of MPC. It also finds random preference heterogeneity among committee members and attributes preferences variation to membership status (chairman, internal member, external member).

While the existing literature contains information on heterogeneity of MPC members of selected central banks (in the U.S. and U.K.), researchers have paid relatively little attention to the issues of preference heterogeneity among committee members in less developed economies. Currently, there is little, empirical evidence on the preference heterogeneity in decision making process among committee members at the CBN. A robust investigation into the voting pattern at MPC meetings in Nigeria is required to strengthen existing knowledge and to inform policy makers about the implications of some of their actions on the overall policy objective of the Bank. A number of questions have not been robustly discussed among scholars concerning MPC activities in Nigeria. What is the reaction function of the MPC members? Are there significant differences among members' preferences? What are the sources of such differences? These and other key questions are critical to monetary policy making and answers to such questions would provide improve monetary policy process in Nigeria.

IV. Methodology

This section discusses the model of MPC decision making process and approach for estimating its parameters. The policy implication of individual MPC members expressed through interest rate reaction functions are specified in the model, while analysing the interactions between these policy preferences and final interest setting decision of the committee. This allows estimation of the policy reaction functions of individual committee members.

IV.1 Reaction Function of the Monetary Policy Committee

The study estimates pooled Taylor-type reaction functions of the CBN Monetary Policy Committee. In addition to information from staff reports, inflation forecasts generated from Research Department of the CBN, output projections form part of the broad data/statistics available to MPC members at the time of policy decisions.

Nigeria's economy is small and open; import price changes and exchange rate volatility have a significant inflationary implication. Thus, exchange rate changes influence discussions at the MPC meeting. Given this scenario, the Taylor rule is either modified by incorporating exchange rate variation as an independent variable or a replacement of the output gap in the policy rate model. Our model depends on the traditional monetary policy rule by Taylor (1993) and its modification by Svensson (1997) and other studies.

$$i_t = \alpha + \beta E_t(\pi_t - \pi^*) + \gamma E_t(y_t - \dot{y}) + pi_{t-1} + \varepsilon_t \quad (1)$$

The nominal policy interest rate, i_t is the rate agreed by members at time, t and is a function of the preference parameter, α. The predicted inflation gap, i.e. the deviation of forecast inflation from actual inflation is given as $E_t(\pi_t - \pi^*)$ while the predicted output gap i.e. the deviation of actual output from potential output is $E_t(\pi_t - \pi^*)$. At the CBN, MPC members normally consider inflation forecasts, 6 months ahead instead of inflation gap[2]. For our analysis, therefore, we use inflation forecast in the next 6 months in place of inflation gap. In line with extant literature, the lagged value of the policy rate.

For Nigeria, the conventional policy reaction function can be adjusted to incorporate other variables relevant to our own environment. Thus the reaction function for CBN is expressed as:

$$R_i = \alpha + \lambda i_{t-1} + \beta E_t(\pi_t - \pi^*) + \gamma E_t(y_t - \dot{y}) + \ldots + \delta f\chi + \phi \text{Diff}_{t-1} + \mu \text{Dum} + \varepsilon_t \quad (2)$$

Where R denotes the agreed policy interest rate at the end of the meeting. In addition to the use of the conventional Taylor-rule type of variables to explain voting behaviour, our specifications include three additional variables capturing specific features of the economy and some individual members characteristics: One variable captures the effect of exchange rate fx, the other captures the difference between member j's period $(t-1)$ chosen policy rate and the MPC's period $(t-1)$ policy rate (hereafter denoted as Diff_{t-1}). This last term represents the magnitude of individual dissent and majority view of the committee in the previous meeting. Therefore, $\text{Diff}_{t-1} = 0$ implies that an individual has casted assent vote while a positive or negative value of Diff_{t-1} denotes dissent vote in favour of tightening or losing interest rate, respectively. Finally, a dummy variable is includedto capture the effects of member type, hereafter denoted as DUM which

[2]A horizon of about 3 months ahead corresponds to the policy horizon normally considered by the committee.

takes the value 1 when a member is an internal member and zero otherwise. If DUM is significant, it is interpreted the voting patterns of the internal members are different from that of the external members.

Individual Policy Reaction Functions

Since we are interested in individual preferences, a more robust alternative to the aggregate Taylor rule is a reaction function in which parameters are allowed to vary across MPC members. If only the intercept changes with the N MPC members, then we have a Fixed Effect (FE) model which can be written in the form

$$i_{j,t} = \alpha_j + \lambda i_{t-1} + \beta E_t(\pi_t - \pi^*) + \gamma E_t(y_t - \dot{y}) + ... + \delta f\chi + \phi \text{Diff}_{t-1} + \upsilon_{j,t} \quad (3)$$

j = 1,..., N.

Where $i_{j,t}$ is the preferred interest rates for the individual members and $\upsilon_{j,t}$ is the individual error term for the j^{th} member. All other variables remain as defined in equation (2). The variables inflation, output gap and nominal foreign exchange rate may vary over time but not across individual members.

IV.2 Estimation Procedure

Each committee meeting was treated as an observation, and we recognise members' vote for interest rate setting decision as either maintaining the status quo policy rate or for rate increase or decrease. For each rate reported higher than the agreed rate, we term 'tightening' and for each rate that is lower than the agreed MPR rate, we term 'easing'. If a vote cast is equal to the agreed MPR rate, we term it 'maintain status quo'. To account for possible inertia in policymaking, and interest rate smoothing strategies of the MPC, we include the lagged policy interest rate as an explanatory variable in the equation. Output gap is computed by decomposing real GDP into its trend and deviation components using the Hodrick-Prescott filter. Thereafter we used an interpolation method known as "quadratic match sum" to obtain the monthly series. We used the 6 months inflation forecasts to proxy for the expected inflation.

We estimate the 'Fixed effects' and the 'Random effects' models for the aggregate reaction function. We use the Hausman test to check whether model parameters of the fixed and random effects are statistically different from each other. The preliminary indication for systematic variances in the preference parameter intercept (α) is the rejection of the random effects model across members. The variable ,*DUM*, represents the dummy variable indicating the type of membership for each MPC member, i.e. whether internal or external member. The variable , *DUM*, assumes the value 1 if a member is an internal member and assumes the value 0 (zero) if a member is an external member.

If the coefficient of the dummy variable is statistically significant, it suggests that the voting patterns of external members are significantly different from the voting patterns of the internal ones. This condition confirms evidence of heterogeneity among MPC members .

IV.3 Data and Sources

Monthly data were collected for all variables covering the period, March 2011 to December 2013. This period is chosen to coincide with period that MPC personal statements were made available to the public. The data sets used for the econometric investigation are the agreed policy rates (MPR that is communicated to the general public at the end of the meeting), individual members' policy rate preferences for that meeting, the output gap and inflation forecast for 6 months ahead exchange rate We use the exchange rate at the BDC segment of the foreign exchange market. This rate is preferred since more users access this segment more than other segments. Data on inflation forecasts were obtained from Research Department of the central Bank of Nigeria while exchange rates are available at the CBN website. Policy rates for each meeting are from MPC Communiqués published immediately after every meeting, individual policy rate preferences are obtained from the records of their personal statements.

V. Presentation and Discussion of Results

V.1 Descriptive Statistics

Tables 3 and 4 show the descriptive statistics and the correlation coefficients among the variables used in the regression. Except for the Forecast inflation, all the variables are negatively skewed suggesting the presence of left tail while the Kurtosis of the variables, except RGDP, are close to three suggesting that they are not high peaked. The Jaque-Bera statistics obtained could not reject the hypothesis of normal distribution for all the variables except MPR.

The correlation coefficients are shown in Table 4. The table reveal that the correlation coefficient between the current and forecast inflation and between the MPR and exchange rate are high. For this reason there is a high threat of autocorrelation. However, we dropped the forecast inflation, (which is not significant), lagged MPR was used as an explanatory variable instead of the current value.

Table 3: Descriptive Statistics

	t	1	*	Lfx	gap	1
Mean	11.20455	11.90456	10.30848	157.85848	11.20222	0.943954
Median	12.00000	12.00000	10.10000	157.45000	11.22402	0.2045883
Maximum	12.00000	12.450000	13.70000	169.90000	11.44551	45.058282
Minimum	7.500000	8.300000	7.800000	145.27800	10.92007	0.2509781
Std. Dev.	1.584168	1.684167	1.483933	1.733696	0.146234	0.014901
Skewness	-1.528230	-1.428260	0.510988	-0.093273	-0.169838	-0.898005
Kurtosis	3.506051	3.501050	2.748048	1.562937	1.791916	2.663798
Jarque-Bera	13.19730	13.49830	1.523382	2.887430	2.165414	4.590689
Probability	0.001362	0.000162	0.466876	0.236049	0.338678	0.100727
Sum	369.7500	368.7600	340.1800	348.1000	369.6734	166.4505
Sum Sq. Dev.	80.30682	82.36481	70.46582	96.18242	0.684300	0.007105
Observations	33	33	33	33	33	33

Source: Author's computation

Table 4: Correlation Coefficients among Variables

Correlation						
t-Statistic	Lfx	$L\pi$ *	$LGDP_{gap}$	$LDiff_{t-1}$	i_{t-1}	i_t
Lfx	1.000000	-0.715511	-0.355217	0.000115	0.785511	0.215747
$L\pi$ *	-0.715511	1.000000	0.141547	0.00120	-51669121	-0.669121
$LGDP_{gap}$	-0.355217	0.468656	1.000000	0.00000	0.251243	0.261240
$LDiff_{t-1}$	0.194299	-0.168352	0.00000	1.000000	0.251243	0.000150
i_{t-1}	0.785511	-51669121	0.251243	0.397419	1.000000	0.9700000
i_t	0.584521	0.66789	0.2651240	0.000150	0.9700000	1.000000

Source: Author's computation

V.2 Results of the Aggregate Reaction Function

Equation (2) represents the monetary policy reaction function for the MPC members at the Central Bank of Nigeria using aggregate data. The coefficients of the variables were obtained using ordinary least-squares (OLS) estimation of the reduced-form equation derived from our model to explain the post meeting Monetary Policy Rate. The results of this analysis will be compared with the coefficients of the individual members' reaction function equations to determine whether there is the presence of heterogeneity among MPC members in their preferences rates.

Table 5 indicates that the inflation and output gap variables are positively signed in accordance with a priori expectations. In addition the two variables jointly differ from zero (p = 0.00015 and p = 0.00011 respectively). The inflation forecast was consistently not significant and wrongly signed. Thus, we replaced the forecast with a three month lead inflation figure $L\pi(+3)*$ which became strongly significant at 1 per cent level of significance ($p-value$ =0.0015).

It appears the committee focuses on 3-month inflation expectation and not six month inflation forecast. The results of our analysis suggest that the voting pattern of MPC members in Nigeria is consistent with theory. In the first place, estimates of the lead inflation coefficient is positive and significant, suggesting that members vote to raise the policy rate when inflation expectations is high. The coefficient of output gap is also positive and significant ($p-value$ =0.00011) indicating that the committee lowers rate when the output gap widens in other to boost aggregate demand. Members tend to vote to increase the policy rate when the local currency is perceived to have depreciated or when there are pressures at the foreign exchange market. It is expected that higher interest rates will engender foreign capital inflows into the country. If exchange rates appreciate more than the committee deems optimal, they tend to reduce policy rates which creates liquidity in the banking system. This motivates the Bank to play actively in the foreign exchange market which tends to bring the exchange rate to its optimal level.

The coefficient of the lagged values of the policy rate (i_{t-1}) is high and significant suggesting considerable inertia in policymaking (the parameter, has magnitude of 0.652302 and p — value=0.0000). The high value of the coefficient in our model suggests that variations in the interest rate at any time, t, are explained by the previous interest rate reflecting the Bank's efforts at interest rates smoothing.

It is also instructive to note that the slope of the lagged interest rate is larger in the aggregate reaction function compared to the magnitude in the individual reaction function. The Committee is more reluctant in changing interest rate than individual members some of who may be more disposed to changing interest rates more frequently than the Committee decisions. This may be an indication of preference heterogeneity among the Committee members.

The term, $Diff_{t-1}$ measures the magnitude of individual dissent in relation to the Committee's decision. A $Diff_{t-1}$ =0 implies that the individual casts a consent vote while a positive and negative values indicate that individual dissents in favour of tightening and easing rates, respectively . The coefficient of $Diff_{t-1}$ is consistently negative and significant indicating that members dissent particularly towards lowering interest rates.

Monetary policy committees are often differentiated based on their membership status, as in external or internal. Thus, preference heterogeneity has been ascribed to this type of membership status. Member type (dummy Variable used as proxy for internal and external membership) is important – Member type is positively and statistically significant at the 5 per cent, suggesting that internal and external members vote differently from each other during the sample period. Thus member type could be one source of heterogeneity among MPC members in Nigeria

Table 5: Parameter Estimates for the MPC Aggregate Reaction Function

Dep. Variable: Policy Rate	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.327532	0.09548	-2.759672	0.04549**
$L\pi^*$	-0.250710	0.424271	3.777064	0.51304
$LGDP_{gap}$	0.146443	0.051358	2.825127	0.00011***
$L\pi(+3)^*$	0.465411	0.014487	2.597245	0.00015**
i_{t-1}	0.652302	0.116064	5.620189	0.0000***
DUM	0.250780	0.125390	1.80001	0.02100**
$Diff_{t-1}$	-0.02450	0.008479	2.88942	0.0024***
R-squared	0.732697	Mean dependent variable		11.25000
Adjusted R-squared	0.701421	S.D. dependent variable		1.519222
S.E. of regression	0.326780	Akaike info criterion		1.285446
Sum squared residue	2.379492	Schwarz criterion		1.521187
Log likelihood	-13.63897	Hannan-Quinn criterion		1.359277
F-statistic	83.15029	Durbin-Watson stat		1.718774
Prob.(F-statistic)	0.000000			

V.3 Individual Members Reaction Function

The previous section is an aggregate analysis of MPC voting pattern. The analysis is performed as a crude proxy to measure differences in the policy preferences across committee members. It relates the number of dissents to total votes. The inferences drawn from the analyses are first indication of diversity across committee members. The aggregate measure is, however, sample average that does not indicate nor account for the pattern of dissents. This section reports the results of the pooled regression estimates as a way of confirming the differences among MPC members as suggested in the previous section and to investigate the

possible sources of these differences. Table 6 shows the results of the individual reaction functions (equation 4) of the Committee members as computed using pooled data analysis of all the Committee members voting records. The upper panel shows the parameter estimates for the common variables, the economic variables that do not differ across MPC members. The size of these coefficients and their empirical significance are quite comparable across different specifications. Except for the inflation forecast variable, all other variables are significant and in line with theory. The lower panel of the Table shows the individual intercepts or the fixed effects for each committee member. They are interpreted as how much individual preferences deviates from the committee mean. They measure preference heterogeneity among MPC members. The results at the lower panel confirm preference heterogeneity among MPC members in Nigeria.

The results of the estimates are quite interesting. As in the aggregate reaction function, the results of the individual reaction function reported in Table 6 indicate that the inflation and output parameters are correctly signed and significant. MPC members individually tend to vote for higher rates if inflation expectations are high and tend to vote for lower rates when growth performance is poor and that their preferences are jointly different from zero. Substantial inertia exist in policy making, as the parameter of the one period lagged interest rate is high and significant. Moreover, observed differences in the coefficients of the lagged values of the policy rate between aggregate regression and the pooled regression, as established by Wald-tests, suggest that an individual policy-maker is more inclined to changing his policy rate than committees as a whole. Policy rate reacts positively to depreciation of the domestic currency vis-à-vis the US dollar. The parameter estimate for the exchange rate, δ remained positive and significant in all the models suggesting that the exchange rate play crucial role in the interest rate decisions of the committee.

Table 6: Parameter Estimates for the Individual MPC Members Reaction Functions

	Coefficient	Standard Error	t-statistic	p-value
C	31.472451	7.151190	4.401009	0.000000
$L\pi^*$	-0.532345	0.497863	1.069260	0.056102
$LGDP_{gap}$	0.284438	0.210315	2.578416	0.001580
$L\pi(+3)^*$	0.308943	0.170769	1.809129	0.043245
I_{t-1}	0.645748	0.200592	3.219205	0.002430
$Diff_{t-1}$	-0.032567	0.015798	-2.061457	0.021045
Fixed Effects				
Individual Intercepts (α's)				
C_SANUSI				0.671533
C_LEMO				0.435678
C_ALDE				0.645678
C_SULEIMAN				0.456735
C_KINGSLEY				0.412456
C_OLOFIN				0.231568
C_SALAMI				0.185628
C_GARBA				-0.145624
C_YAHAYA				-0.127399
C_UCHE				-0.201458
C_OSHILAJA				0.357894
C_KIFASI				-0.025439

VI. Recommendations and Conclusion

The results of this study suggest the presence of heterogeneity among MPC members in Nigeria. The voting behaviour of internal members is significantly different from that of the external members and that there are significant differences in the way individual policy members respond to shocks implying higher inflationary pressures and/or lower output growth performances. One aspect that require further investigation is the desirability of such voting outcomes. The existence of external members is justified by the understanding that policy meetings and decisions benefit from external skills and expertise as the external members bring alternative views to the table. Evidence of this is readily found in the minutes of MPC meetings.

Although it could be argued that at the CBN, internal members are members in the minority, 5:7, it has been observed that appointment of two external members by the Governor of the Bank and the nomination of one member to represent the Board[3] often turns such members to act like internal members as they are often seen not ready to dissent governor's views on monetary policy. To this end, a review of the nominations into the Committee to create a higher level of external representation is recommended.

Differences across policy-makers are key characteristics of voting by monetary policy committees. This study utilises the voting records obtained from MPC

[3]The Governor as the Chairman of the Board often has powers to influence such nominee

Communiqués and personal statements of MPC members at the Central Bank of Nigeria together with available data on some key macroeconomic indicators to assess the degree of diversity among members. The study used a panel reaction function to analyse the voting pattern of CBN monetary policy committee. Our findings are in line with the suggestions in literature that external and internal members behave differently. Finally, a potential target for further research on this issue would be to interrogate whether perceived preference heterogeneity in the committees system impacts on the performance of the central banks in attaining their mandate.

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