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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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# 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.

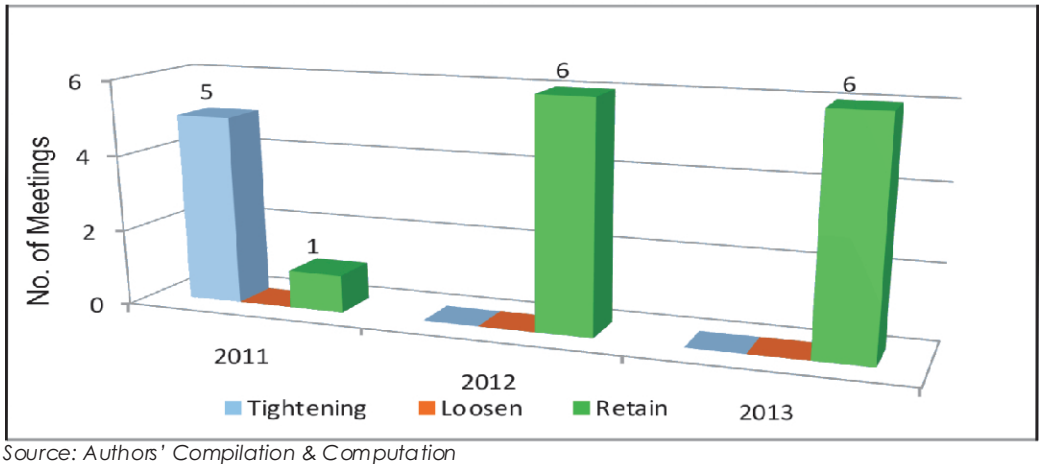
### II.3 MPC Voting Patterns at the Central Bank of Nigeria

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.

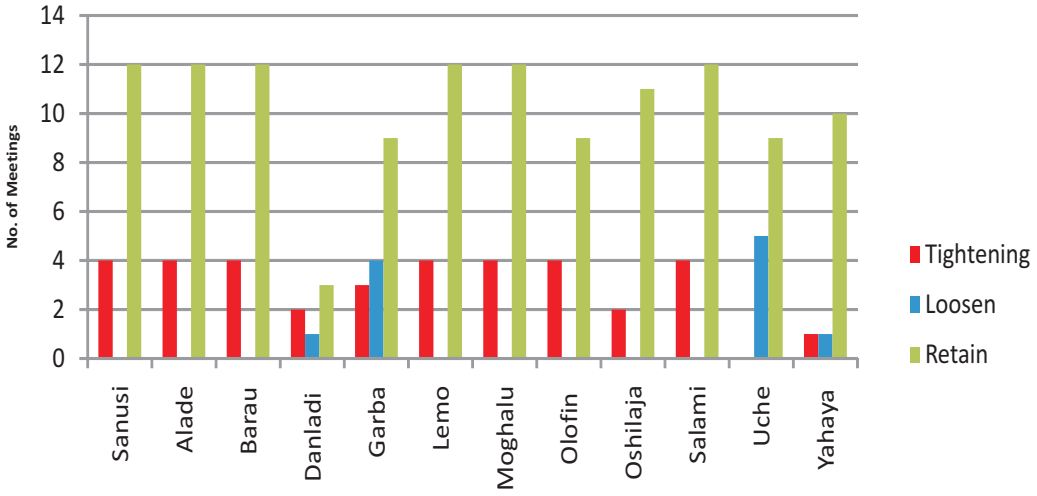
**Figure 1: Summary of MPC Decisions 2011-2013**




*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, $\alpha$. 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 $\text{Diff}_{t-1}$). 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 $\text{Diff}_{t-1}$ 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

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

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 $(\alpha)$ 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, $\delta$ 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** ($\alpha$'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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