

## The Role of Central Bank of Nigeria's Analytical Balance Sheet and Monetary Survey in Monetary Policy Implementation

<sup>1</sup>Sani I. Doguwa and Sunday N. Essien

---

*This paper discusses the significance of Central Bank of Nigeria's (CBN) monetary aggregates in the implementation of monetary policy. The Analytical Balance Sheet and monetary survey are shown to be useful tools in the analysis of monetary and credit developments in the economy. It also discusses the role of the aggregates in monetary policy implementation through the adjusted money multiplier, which explains how policy actions of the CBN influence the broad money supply. Finally, the paper attempts to estimate the Taylor-type monetary policy reaction function for Nigeria using the monetary policy rate and reserve money since December 2006 when the monetary policy rate was first introduced by the Bank. The paper finds that the reaction function fits the actual policy performance of real monetary policy rate and reserve money as the implied paths of the reaction functions fit the actual paths of the policy variables rather closely.*

---

**Keywords:** Adjusted Money Multiplier, Monetary Survey, Monetary Policy Reaction Function, Reserve Money

**JEL Classification:** C33, E52, E58

### 1.0 Introduction

Policy makers in the field of monetary policy are deeply dependent on the availability of timely, relevant and reliable data provided by statisticians. Central Bank's analytical balance sheet and monetary survey are among the required information supplied to monetary policy committee for effective decision making on interest rates. Alongside the more traditional role of collecting data and assisting in the correct interpretation of data, statisticians also need to be more involved in communicating the results to the markets, media and wider public.

The Central Bank of Nigeria's (CBN) assessment of liquidity pressures influences the setting of monetary policy rate (MPR)<sup>2</sup>. This assessment of the

---

<sup>1</sup> The authors are staff of Statistics Department, Central Bank of Nigeria, Abuja. The views expressed in this paper are those of the authors and do not necessarily represent the official views of the Bank. The authors are particularly grateful to the staff of Money and Banking Statistics Office for the provided research assistance. A version of this paper was presented at the 32<sup>nd</sup> Annual Conference of the Nigerian Mathematical Society held at Obafemi Awolowo University Ile-Ife Nigeria between 25-28 June, 2013.

<sup>2</sup> MPR replaced MRR on December 8, 2006 as the cornerstone of monetary policy implementation.

economy and the resulting MPR decision is the most important stage of monetary policy. The CBN then announces the stance of policy – the MPR decision and the associated Monetary Policy Statement – and executes operations in the financial market which are consistent with this decision.

Ultimately, the objectives of monetary policy is to ensure that the liquidity within the system is in tandem with the objective of price stability, maintenance of balance of payment equilibrium, promotion of employment, output growth and sustainable development. Though, all these objectives are necessary for the attainment of internal and external balance and promotion of long run economic growth, price stability remains the overriding objective of monetary policy.

Monetary policy in Nigeria relies on the CBN's influence on short-term interest rates because it is through these rates that household and corporate spending decisions are affected. In the present monetary policy regime, standing facilities<sup>3</sup> are some of the instruments employed to gauge the effectiveness of the policy. The CBN can either use symmetric or asymmetric corridor around the MPR. It is the duty of the Monetary Policy Committee (MPC) to set both the MPR and its symmetric or asymmetric corridor during the MPC meetings.

The Bank is always willing to supply overnight funds to banks at the prescribed standing lending facility rate and pay interest on banks' overnight deposits with the Bank at the prescribed standing deposit facility rate. The rates on these two facilities are meant to influence the overnight rates in the financial market to fall within the prescribed path (corridor) of the MPR. This paper, therefore, highlights the role and importance of the CBN analytical balance sheet and the monetary survey in monetary policy strategy and implementation.

For ease of exposition, the rest of the paper is structured as follows: section two discusses the Central Bank analytical balance sheet and the Central Bank survey. Section three presents the deposit money banks analytical balance

---

<sup>3</sup> The CBN standing facilities was introduced on December 11, 2006 to effectively manage liquidity and avoid interest rate volatility in the banking system. The two rates on these facilities provide the interest rate corridor – the lower band is the standing deposit facility rate prescribed as some basis points below the MPR, while the upper band of the corridor is the standing lending facility rate which is also prescribed as some basis points above the MPR.

sheets and the monetary survey. While section four discusses monetary policy strategy and implementation, section five concludes the paper.

## 2.0 Structure of Central Bank Analytical Balance Sheet and Central Bank Survey

### 2.1 Structure of Central Bank Analytical Balance Sheet

Whereas every central bank's balance sheet is dissimilar, showing both history and the peculiar operational structure in that economy, they can usually be explained using the same categories as presented in Table 1.

**Table 1: The Central Bank Analytical Balance Sheet**

<b>TOTAL ASSETS</b>	<b>TOTAL LIABILITIES</b>
<b>FOREIGN ASSETS</b>	
Gold	<b>RESERVE MONEY</b>
IMF Reserve Tranche	Currency in Circulation
Foreign Currencies	Head Office
Demand Deposits at Foreign Banks	<b>Deposit Money Banks' Deposits:</b>
<i>Of which: Domiciliary Accounts</i>	Commercial Banks
Treasury Bills of Foreign Governments	Commercial Banks Demand Deposits
SDR Holdings	Commercial Banks Special Deposits
Attached Assets	Commercial Banks Required Reserves
Regional Monetary Cooperation Funds	Merchant Banks
Other Foreign Assets	Merchant Banks Demand Deposits
Claims on Trade Debt Prom Notes/Attached Assets	Merchant Banks Required Reserves
<b>CLAIMS ON FEDERAL GOVERNMENT</b>	Non Interest Bank
Treasury Bills & TB Rediscounts	Non Interest Bank Demand Deposit
Treasury Bills	Non Interest Bank Required Reserves
Treasury Bills Rediscounts	
<b>Nigerian Converted Bonds</b>	
Treasury Bond Stock	
Treasury Bonds Sinking Funds Overdrawn Account	
Treasury Bonds Interest	
<b>Overdrafts to Federal Government</b>	
Overdraft on Budgetary Accounts	<b>CBN SECURITIES</b>
Federal Government(Ways & means)	CBN Bills
<b>Development Stocks</b>	
Development Stocks Account	<b>PRIVATE SECTOR DEPOSITS</b>
Development Stocks Sinking Funds Overdrawn Account	Non-Financial Public Enterprises (Parastatals):
Development Stocks Interest	Federal Government Parastatals 1/
<b>Treasury Certificates</b>	Private Sector Corporations Deposit
Other Claims on Federal Government	State and Local Government Deposits and Parastatals
Claims on Federation & Mirror Accounts	State Government Parastatals
<b>CLAIMS ON STATE AND LOCAL GOVERNMENT</b>	State Government Deposits
Overdrafts to States & Local Governments:	Local Government Deposits
Overdrafts to State Governments	Other Financial Institutions Deposits
Overdrafts to Local Governments	Development Banks
<b>Claims on State &amp; Local Govt.(Branch Position)</b>	Other Financial Institutions
<b>CLAIMS ON NONFINANCIAL PUBLIC ENTERPRISES</b>	
Overdrafts to Non-Financial Public:	<b>SHORT-TERM FOREIGN LIABILITIES</b>
Overdrafts to Federal Parastatals	Non-Resident Deposits of:
Overdrafts to State Parastatals	Foreign DMBs (Current Accounts)
other Claims on Non-fin. Publ. Ent.	Foreign Central Banks
<b>CLAIMS ON (NON-FINANCIAL) PRIVATE SECTOR</b>	Other Foreign Financial Institutions
<b>CLAIMS ON DEPOSIT MONEY BANKS</b>	Other Foreign Customers
Loan to Deposit Money Banks	<b>Liabilities to Foreign Monetary Authorities:</b>
(Overdrafts to) Merchant Banks	Treasury Bills Held by Foreign Monetary Authorities
Other Claims on DMBs	SME World Bank Loan A/C
<b>CLAIMS ON OTHER FINANCIAL INSTITUTIONS (OFI's)</b>	SME Drawdown Account
Development Banks	Other Foreign Liabilities
Other Claims on OFI's:	
<i>of which AMCON Bonds</i>	<b>LONG-TERM FOREIGN LIABILITIES</b>
Loans to OFIs	Long-Term Liabilities
Investment in OFI's	Trade Debt Promissory Notes A/C
Miscellaneous Claims on OFIs	
<b>UNCLASSIFIED ASSETS</b>	
Participation in International Organisations	<b>FEDERAL GOVERNMENT DEPOSITS</b>
IMF Currency Subscriptions:	Budgetary Accounts
IMF Local Currency Subscription (CBN Accounting Records)	Deposits on Nigerian Converted Bonds
IMF Non-Negotiable Interest Bearing A/C (CBN acc. records)	Deposits on Development Stocks
IMF Securities Account (CBN acc. records)	Deposits on Treasury Certificates
IMF Accounts Valuation Adjustments	Other Federal Govt Deposit
SDR Allocation #1 (rev. discrepancy)	<b>Federation &amp; Mirror Accounts</b>
IMF Gold Tranche A/C (CBN Accounting Records)	<i>of which</i>
Holdings of SDRs (CBN Accounting Records)	Federal Government (Excess Crude)
IBRD Subscriptions	Subnationals Government (Excess Crude)
<b>Total Receivables</b>	Sovereign Wealth Fund (SWF)
Receivables	<b>CAPITAL ACCOUNTS</b>
Income Receivable:	Capital
A/c of Exports	Reserves
Impersonal Accounts	Provisions
Interest Receivables	Undisbursed Profits
Other Income Receivable	Revaluation Accounts
Exchange Difference on Promissory Notes	Foreign Assets Revaluation A/C
Foreign Assets Revaluation Accounts	Fixed Assets Revaluation
Fixed Assets Revaluation	
<b>Inter Banks Clearing</b>	<b>UNCLASSIFIED LIABILITIES</b>
<b>Non-Financial Assets</b>	Inter Bank Clearing
<b>Miscellaneous unclassified Assets</b>	Income
<b>Expenses</b>	Expense

The central bank analytical balance sheet (CBN-ABS) is a gross basis functional classification of all accounts that are being operated in the CBN, for the purpose of analyzing reserve money and its determinants. The source of the CBN ABS is the statistics module in Oracle ERP (Corporate book of the Bank<sup>4</sup>) linked to the trial balance and the accounts are driven by analytical codes. These analytical codes which are set of alpha-numeric combination of values from a coding list prepared by the Statistics Department are meant to classify the accounts by residency, institutional sectors and instruments. Each account in the general ledger is assigned a pair of both asset and liability code that will be driven by the *balance it carries* as at when the ABS is generated.

The CBN ABS is prepared in both detailed and summary formats. The CBN ABS showing the list of all the accounts having the same codes and closing with the same form of balance, that is, asset or liability balance is the “Detailed CBN ABS”, while the one showing only the total balances of each parent categories without listing the accounts that constituted the balances is called the “Summary CBN ABS”. The summary CBN ABS is an abridged version of the detailed.

**TABLE 2: Central Bank Survey Outline**

<b>Foreign Assets (Net)</b>
<b>Foreign Assets</b>
<b>Long-Term Foreign Liabilities</b>
<b>Short-Term Foreign Liabilities</b>
<b>Net Credit to Government</b>
Claims On Fed. Govt
Fed Govt Deposits
<b>Net Credit to Private Sector</b>
Claims on Private Sector
Private Sector Deposits
<b>Net Claims on DMBs</b>
Claims on DMBs
CBN Securities
<b>Other Assets Net</b>
Other Assets
Other Liabilities
<b>Reserve Money</b>
<b>Currency in Circulation</b>
<b>DMBs Deposits</b>
Required Reserves
Current Account balances

## 2.2 Central Bank Survey

The central bank survey is derived from the summary CBN-ABS depicting both the determinants and components of Reserve Money. The reserve money (also referred to as high powered money, base money or monetary base) is the

<sup>4</sup> In this paper, the word “Bank” refers to the Central Bank of Nigeria.

main component on the liability side of the central bank analytical balance sheet. It plays a key role in monetary analysis and policy formulation. If the quantity of money, rather than price, is the focus of monetary policy implementation, then the aggregate amount of the central bank account holders is mostly important.

At a minimum, reserve money should include currency in circulation and legal reserves. In many countries, holdings of central bank securities used for liquidity management are not included in reserve money, ostensibly because central banks would like to see the impact of liquidity management instruments on reserve money. Central bank securities held by deposit money banks can only be included in reserve money, if the securities could be used to satisfy reserve requirements. However, practice varies from country to country, but typically reserve money includes currency issued by the central bank [whether held by deposit money banks (vault cash) or by nonbank public (currency outside banks)], required reserves and transaction balances of operating deposit money banks with the central bank.

**Table 3: Deposit Money Banks Consolidated Analytical Balance Sheet**

<b>TOTAL ASSETS:</b>	<b>TOTAL LIABILITIES:</b>
<b>RESERVES</b>	
Currency	
Deposits with CBN:	
[i] Reserve Requirements	
[ii] Current Accounts	
<b>CLAIMS ON CENTRAL BANK</b>	
[i] CBN Bills	
[ii] Stabilization Securities	
[iii] Shortfall/excess credit/others	
<b>FOREIGN ASSETS</b>	
Claims on Non-resident Banks:	
[i] Balances held with banks outside Nigeria	
[ii] Balances held with offices and branches outside Nigeria	
[iii] Loans & Advances to Banks outside Nigeria	
Bills Discounted Payable outside Nigeria	
<b>CLAIMS ON CENTRAL GOVERNMENT</b>	
Treasury Bills / Treasury Bills Rediscounted	
Treasury Certificates	
FGN Bonds	
Loans & Advances to Central Government	
Bankers Unit Fund	
<b>CLAIMS ON STATE &amp; LOCAL GOVERNMENT</b>	
Loans & Advances to State Government	
Loans & Advances to Local Government	
<b>CLAIMS ON OTHER PRIVATE SECTOR</b>	
Loans & Advances to Other Customers (Gross)	
Loans & Advances to Nigeria Banks Subsidiaries	
Bills Discounted from non-bank sources	
Investments:	
[i] Ordinary Shares	
[ii] Preference Shares	
[iii] Debentures	
[iv] Subsidiaries	
[v] Other Investments	
Commercial papers	
Bankers Acceptances	
Factored Debt	
Advances under Lease	
<b>CLAIMS ON OTHER FINANCIAL INSTITUTIONS</b>	
Placement with Discount Houses	
<b>UNCLASSIFIED ASSETS</b>	
Fixed Assets	
Domestic Inter-Bank Claims	
Money at call outside banks	
Certificates of Deposit	
Placement with Discount Houses	
Other Assets:	
Miscellaneous(others)	
<b>DEMAND DEPOSITS</b>	
Private Sector Deposits	
State Government Deposits	
Local Government Deposits	
<b>TIME &amp; SAVINGS DEPOSITS 2/</b>	
<b>Time Deposits:</b>	
Private Sector Deposits	
State Government Deposits	
Local Government Deposits	
<b>Savings Deposits:</b>	
Private Sector Deposits	
State Government Deposits	
Local Government Deposits	
<b>FOREIGN CURRENCY DEPOSITS</b>	
Domiciliary Accounts	
<b>MONEY MARKET INSTRUMENTS:</b>	
Certificate of Deposit Issued	
Notes & Deposit (Cash) certificates	
<b>BONDS</b>	
Debentures	
<b>FOREIGN LIABILITIES:</b>	
Balance Held for offices and branches Abroad	
Balance held for banks outside Nigeria	
Money at call with foreign banks	
Loans & Advances from other banks outside Nigeria	
<b>CENTRAL GOVERNMENT DEPOSITS</b>	
Federal Government Time Deposits	
Federal Government Demand Deposits	
Federal Government Savings Deposits	
<b>LIABILITIES TO CENTRAL BANK</b>	
Loans & Advances from CBN	
CBN Overdrafts to banks	
<b>CAPITAL ACCOUNTS:</b>	
Capital	
Reserve Fund	
Reserves for Depreciation & non-performing assets	
Loans & Advances from Federal and State Government	
Total Loans/Lease Loss Provision	
<b>UNCLASSIFIED LIABILITIES:</b>	
Inter-bank liabilities	
Loans & Advances from Other creditors	
Letters of Credit	
Takings from Discount Houses	
Other Liabilities:	
Miscellaneous	

---

### **3.0 Structure of DMBs Analytical Balance Sheet and Monetary Survey**

#### **3.1 Structure of DMBs Analytical Balance Sheet**

By the CBN Act, all deposit money banks (DMBs) are required to electronically submit their balance sheets to the Central Bank of Nigeria on monthly basis. The submitted financial balance sheet is consolidated by the electronic Financial Analysis and Surveillance System (e-FASS). The consolidated financial balance sheet, which is on net basis, is transformed into the analytical form by mapping each line on the balance sheet into its analytical position to produce the aggregated deposit money banks' analytical balance sheet. The DMBs-ABS is also on gross basis as the CBN-ABS (see Table 3).

#### **3.2 Monetary Survey**

In 2010, the CBN introduced a new banking model which categorized deposit money banks into commercial, merchant and specialized banks. Nigeria's monetary survey now comprises of the balance sheets of the CBN, Commercial Banks, Merchant Bank and Non-Interest Bank. The monetary survey is an aggregate balance sheet of the entire banking system in a given country comprising the central bank and the deposit taking institutions. The methodology of compilation is unified at the international level within the framework of the IMF member countries.

**Table 4: Basic Monetary Survey Format**

- **ASSETS**
  - Net Foreign Assets (NFA)**
  - Net Domestic Assets (NDA)**
    - Domestic credit (Net) (NDC)**
      - Claims on Government (net) (NCG)**
        - Memo: Claims on Federal Government less FMA
        - Memo: Federation and Mirror Accounts (FMA)
      - Claims on Private Sectors (CPS)**
        - Claims on State and Local Governments (CSLG)**
        - Claims on Non-Financial Public Enterprises (CNFP)**
        - Claims on other Private Sectors (COPS)**
    - Other items (net) (OIN)**
  - **LIABILITIES**
    - Broad Money ( $M_2$ )**
    - Narrow Money ( $M_1$ )**
    - Quasi Money (QM)**

The basic framework of the monetary survey includes two levels of data compilation and presentation. In the first level, the financial balance sheets of individual DMB from the e-FASS are aggregated into analytical format (DMBs-ABS). Analytical reporting aims at providing data classified by residency, sector and instruments on gross basis. In the second level, the DMBs-ABS and CBN-ABS are consolidated into a monetary survey based on the IMF Money and Banking Statistics Manual.

It is pertinent to note that the monetary survey is the main source of monetary statistics and contains a lot of important indicators necessary for macroeconomic analysis. The process of compiling monetary survey for the central bank is premised on the reclassification of the balance sheet into the broad categories of aggregates indicated in Table 4. This reclassification of the banking system balance sheet could be illustrated using the balance sheet identity as follows;

$$M_2 = NFA + NDC + OAN \quad (1)$$

And

$$NDC = NCG + CPS \quad (2)$$

Where:

$M_2$	=	Broad Money
$NFA$	=	Net Foreign assets
$NDC$	=	Net Domestic Credit
$NCG$	=	Net credit to Government
$CPS$	=	Credit to Private sector
$OAN$	=	Other assets net

Thus,

$$M_2 = NFA + NCG + CPS + OAN \quad (3)$$

In terms of flow, that is changes in stock, the identity can be rewritten as:

$$\Delta M_2 = \Delta NFA + \Delta NCG + \Delta CPS + \Delta OAN \quad (4)$$

Therefore,

$$\Delta M_2 = \Delta NFA + \Delta NDA \quad (5)$$

where net domestic assets ( $NDA$ ) is the sum of aggregate domestic credit (net) and other assets (net). Following the balance sheet identity that assets must equal liabilities, it can be seen that changes in money supply ( $M_2$ ), that is, the left hand side of (5) reflects changes in the assets side of the balance sheet, that is, the right hand side of (5). For instance, an increase in external assets, which is reflected in foreign assets of the banking system, is mirrored by an increase in the level of money supply via monetization. The same applies to

It should be noted that the CBN-ABS provides highlights on the monetary base and its determinant, while the monetary survey presents money supply and its determinants.

#### **4.0 Monetary Policy Strategy and Implementation**

Producing high quality CBN-ABS and monetary survey remain a core task of a central bank. It is a central input not only for our decision-making processes, but also for communicating our decisions, and thus, for the credibility of monetary policy actions. Distinction between the various type of monetary policy lies primarily with the set of instruments and targets/variables that are used by the monetary authority to achieve their goals as shown in table 5:

**Table 5: Types of Monetary Policy Regimes**

Monetary Policy	Target Market Variable	Long-Term Objective
Inflation Targeting	Interest on overnight Debt	Inflation Rate
Monetary Aggregates	The growth in Money Supply	Inflation Rate
Fixed Exchange Rate	The Spot Price of the Currency	The Spot Price of the Currency
Gold Standard	The Spot Price of the Currency	Low inflation as measured by the Gold price
Mixed Policy	Usually Interest Rates	Usually Unemployment and Inflation Rate

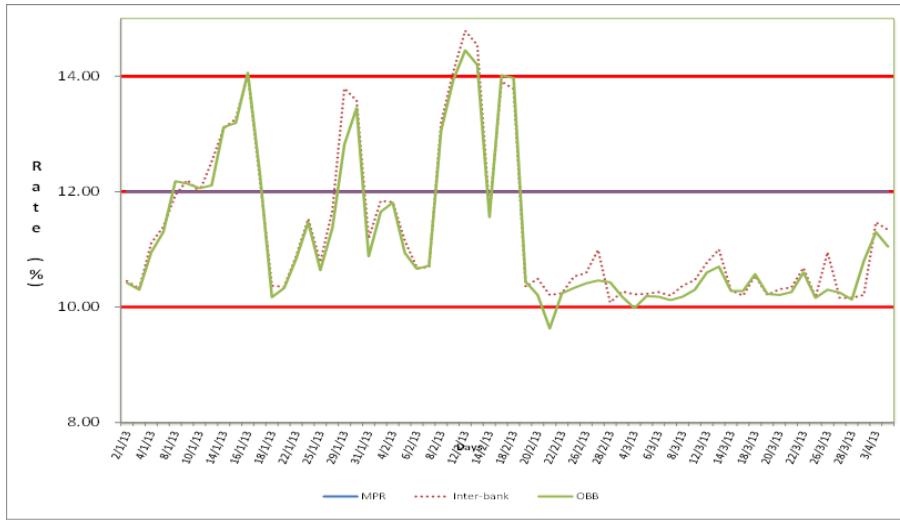
In practice, to implement any type of monetary policy, the main tool used is modifying the amount of reserve money. Under the current implementation regime, monetary policy is implemented by changing the size of the reserve money, largely through open market operations (OMO)<sup>5</sup>.

Interest rate is another vital tool in monetary policy implementation. For instance, the contraction of money supply can be achieved indirectly by increasing the monetary policy rate. In Nigeria, the CBN set the discount rate,

---

<sup>5</sup> OMO was introduced by the CBN in March 1993 but commenced operation in June 1993 as a major tool of monetary control.

as well as achieve the desired monetary policy rate (MPR) by OMO. The plot of MPR and interest rates on overnight debt in Chart 1 reflects this assertion.



**Chart 1:** Plot of MPR, Inter-bank and OBB rates

#### 4.1 The Role of $M_2$ and Monetary Policy Implementation

The Multiplier model of  $M_2$  originally developed by Brunner (1961) and Brunner and Meltzer (1964), has become the standard paradigm to explain how policy actions of central banks influence  $M_2$ . The framework of monetary control builds on the link between liquidity supplied by the Central Bank and the deposit and credit created by banks. Hence the supply of money is determined by the reserve money created by the CBN and the multiplier that relates reserve money and broad money. The multiplier model decomposes movements in  $M_2$  into the part that is due directly to CBN policy actions (the adjusted reserve money) and the part that is due to changes in technology and/or the tastes and preferences of depository institutions and the public (the adjusted multiplier).

Under the indirect monetary control,  $M_2$  would be expressed as the product of a money multiplier and the reserve money, with the latter as the main intermediate instrument of monetary management. For the reserve money to act as the main link to  $M_2$ , a priori expectation of the money multiplier is that it should be stable over time. Following Garfinkel and Thornton (1991), Doguwa (1994) examines the standard multiplier model of  $M_2$  in the case of Nigeria. The results in Doguwa (1994) reveal that the CBN policy actions are

independent of the adjusted multiplier, indicating that the multiplier in Nigeria has been relatively stable over time, thus suggesting the appropriateness of using the adjusted reserve money as an indicator of the effects of the CBN policy action on the money stock ( $M_2$ )

The Broad money ( $M_2$ ) is defined as

$$M_2 = C^p + DD^{ps} + DD^p + QM \quad (6)$$

Where  $C^p$  = currency held by the non - bank public

$DD^{ps}$  = private sector demand deposits at deposit money banks

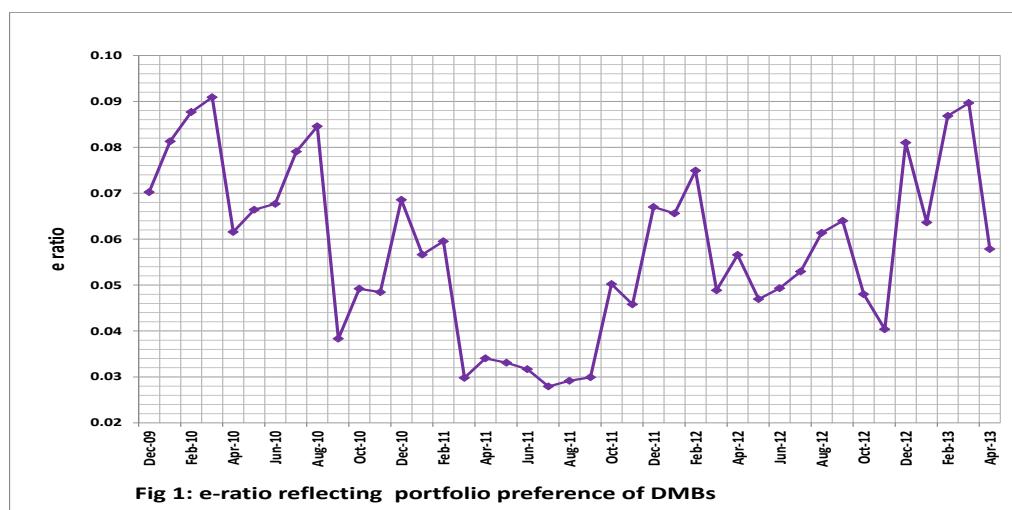
$DD^p$  = other financial institutions deposits (private sector) at CBN

$QM$  = private sector time and savings deposit at banks

The reserve money on the other hand is simply the sum of currency with non-bank public,  $C^p$ , cash at banks  $C^b$  and the balances of the banks at the CBN, comprising required reserves,  $RR$  and other reserves  $OR$ , that is,

$$RM = C^p + RR + OR \quad (7)$$

The sum of  $C^p$  and  $C^b$  provides currency in circulation. The other reserves comprises of vault cash of banks, current account balances and standing deposit facility at the CBN.



The bank balances at CBN can be affected directly by the Bank sales or purchase of government debt instruments in the open market. The CBN has a

simple system of statutory reserve requirements, with required reserves, RR given by

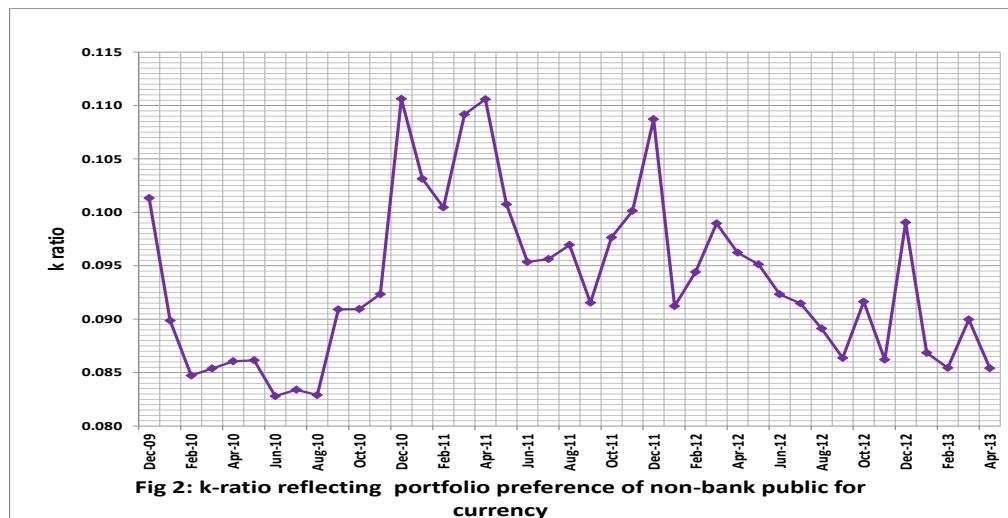
$$RR = r(DD^p + QM) \quad (8)$$

Where  $0 < r < 1$  and  $r$  denotes the cash reserve requirement ratio. A change in  $r$  also would constitute a monetary policy action by the CBN.

Banks build up other reserves for purposes of clearing and other banking activities such as foreign exchange bidding and overnight investment in SDF at the CBN. Therefore  $OR$  can be expressed as,

$$OR = e(DD^p + QM) \quad (9)$$

Where,  $e$  denotes the ratio of other reserves that are held against private sector demand, savings and time deposits at banks, and is expected to reflect the portfolio preference and/or behavior of the depository institutions (Fig 1).



The model is completed by assuming that currency with non – bank public and other financial institutions deposits with CBN are held in some proportion  $k$  and  $p$ , respectively, of private sector demand deposits with banks and quasi money. The currency ratio  $k$  (Fig 2) reflects the portfolio preference of the non-bank public for currency. Thus

$$C^p = k(DD^p + QM) \quad (11)$$

$$DD^{ps} = p(DD^p + QM) \quad (12)$$

From equation (6), and (7);

$$M_2 = (1 + k + p)(DD^p + QM) \quad (13)$$

and

$$RM = (k + r + e)(DD^p + QM) \quad (14)$$

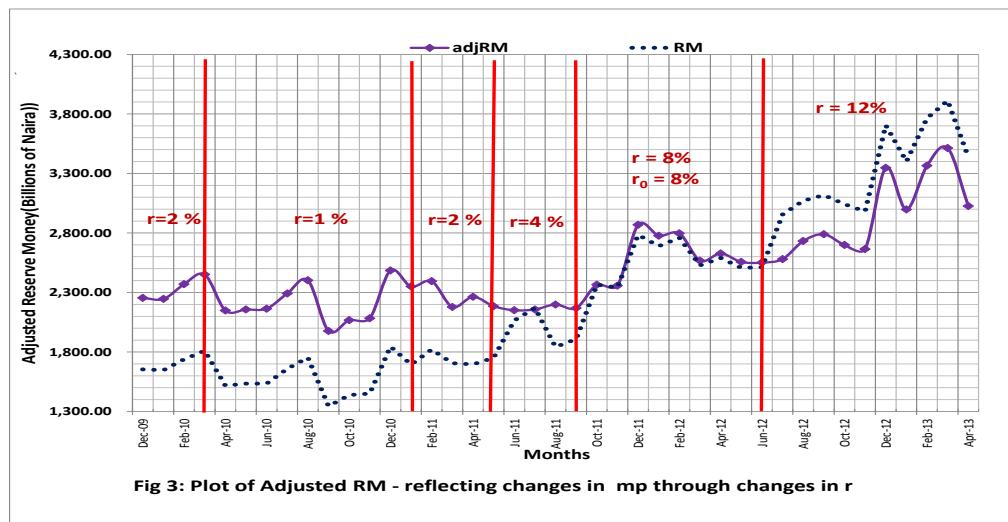
Therefore,

$$m_2 = \frac{(k + p + 1)}{(k + r + e)} \quad (15)$$

and

$$M_2 = m_2 RM \quad (16)$$

where  $m_2$  is the broad money multiplier.



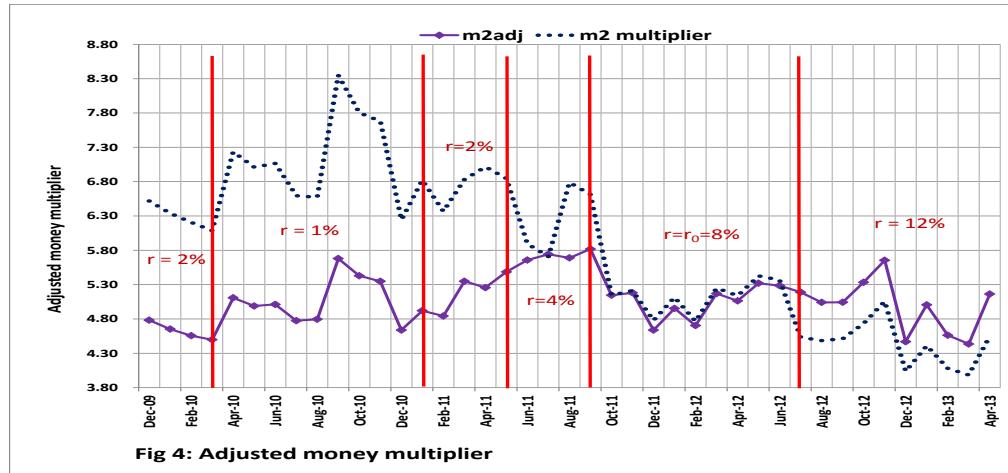
In the  $RM$  multiplier representation, policy actions are reflected not only in  $RM$  through changes in  $RR$ , but also in  $m_2$  through changes in  $r$ . With a simple adjustment of  $RM$ , the effects of the policy actions on  $M_2$  can be isolated in one measure. This alternative measure of the Reserve Money called the adjusted  $RM$ ,  $RM_{adj}$ , (see Fig 3) reflects both changes in  $RR$  and  $r$ . Thus,

$$RM_{adj} = RM + RAM \quad (17)$$

where the reserve adjustment magnitude, RAM is defined as

$$RAM = (r_0 - r)(DD^p + QM) \quad (18)$$

The adjustment magnitude measures the amount of required reserves released or absorbed by changes in  $r$  relative to  $r_0$  – the required reserve ratio during a chosen base period. In the base period  $RAM = 0$ , and  $RM_{adj}$  equals  $RM$ . A decrease in  $r$  from its base period level  $r_0$  releases reserves into the banking system and thereby increases  $RAM$  and  $RM_{adj}$ . Conversely, an increase in  $r$  reflects the reserve drain on the banking system by reducing  $RAM$  and  $RM_{adj}$ .



From equation (13) and (16) we have

$$RM_{adj} = (k + r_0 + e)(DD^p + QM) \quad (19)$$

and

$$M_2 = m_{2adj}RM_{adj} \quad (20)$$

$$m_{2adj} = \frac{(k + p + 1)}{(k + r_0 + e)} \quad (21)$$

In this characterization of  $M_2$ , all changes in monetary policy, through changes in  $r$  are expected to be reflected in the  $RM_{adj}$ . However, changes in the adjusted multiplier reflects only changes in the portfolio preferences of the depository institutions and the non – bank public. Thus the adjusted multiplier is supposed to be independent of policy, since it is not directly influenced by the policy actions of the CBN (see Fig 4).

## **4.2 Monetary Authorities Reaction Function**

The Monetary authorities reaction function, which summarizes how the monetary authorities alter monetary policy in response to economic developments, helps in predicting actual policy actions, thereby serving as a benchmark for assessing the current stance and the future direction of monetary policy. Also in macroeconomic models, the reaction function is central in evaluating the monetary authorities' policy and determining the effects of other macro policies or economic shocks.

A recent interest in monetary policy reaction functions has been motivated mainly by the work of Taylor (1993) – who proposes his rule in terms of the instrument actually used by central banks. Thus, the Taylor rule-like monetary policy is designed to keep inflation low and to do what little it can to stabilize real output fluctuations. In the spirit of Judd and Rudebusch (1998), Sanchez-Fung (2000) and Doguwa (2002), we estimate a Taylor-type monetary policy reaction function by paying particular attention to the specification, stability and dynamics of such a relation. Our version of the modified Taylor's rule to be estimated can be written as:

$$\kappa_t = \gamma_0 + \beta\pi_t + \rho DG_t + \lambda DE_t + e_t \quad (22)$$

and

$$\eta_t = \gamma_0 + \beta\pi_t + \rho DG_t + \lambda DE_t + \mu_t \quad (23)$$

where

$$DG = \log\{GDP|P\_GDP\}$$

$$DE = \log\{BDC\ Rate|Wdas\ Rate\}$$

and  $\kappa$  is the log of  $RM$ ,  $\eta$  is the real monetary policy rate,  $\pi$  is the year on year CPI inflation,  $DG$  is the percentage deviation of real  $GDP$  from its potential  $P\_GDP$  created using the Holt-Winters multiplicative three parameter method which is appropriate for series with a linear time trend and multiplicative seasonal variation.  $DE$  is the exchange rate premium between Bureau De Change rate and the official wDAS rate. The error terms  $\mu_t$  and  $e_t$  are the well-behaved disturbance terms. The parameters  $\gamma_0$ ,  $\beta$ ,  $\rho$  and  $\lambda$  are the constant term and coefficients to be estimated empirically. Both equations (22) and (23) can be seen as a 'feedback' rule in which  $\kappa$  and  $\eta$  react to expected inflation, exchange rate premium and the output gap.

Potential GDP is important because monetary policy makers use the difference between actual and potential GDP – the output gap to determine whether the economy needs more or less monetary stimulus. If the actual output is below the potential output, the policy makers would want to stimulate the economy by reducing monetary policy rate and/or reserve money. In contrast, the farthest above potential real GDP is, the higher the probability of overheating the economy, and the policy makers would respond by increasing monetary policy rate and/or reserve money. Therefore, the DG coefficient  $\rho$  in both equations (22) and (23) should be negative unless the authorities follow a “lean with the wind policy”.

A constant growth rate of money stock, an informal policy of leaning against the wind, and an explicit quantitative policy of interest rate setting all will tend to generate positive responses of the policy rate to changes in expected inflation, exchange rate premium and output gap. The most straightforward application of equations (22) and (23) is to situations where the monetary authorities set short term interest rates in response to events in the economy, in which case, these equations are the central bank monetary policy reaction functions describing how the Bank takes actions in the money market that cause the interest rate to change in response to changes in inflation and real GDP.

If the Bank ‘leaned against the wind’ by easing money market conditions in response to lower inflation or declines in production; and tightening money market conditions in response to higher inflation or increases in production, then one would expect  $\beta$  and  $\rho$  in equations (22) and (23) to be negative. In contrast, if the Bank “leaned with the wind” by tightening money market conditions in response to lower inflation or declines in production; and easing the market conditions in response to higher inflation or increases in production, then one would expect the coefficients  $\rho$  and  $\beta$  to be positive.

The coefficients of the exchange rate premium  $\lambda$  in the two equations should be negative, if the authorities are in the temperament to defend the official exchange rate. Such an outcome could be generated mainly by depletion of gross official reserves, but could also be paired with a reduction in net domestic assets in order to attempt to reduce liquidity, since less Naira with the bank and non-bank public would imply less demand for foreign currencies. The larger the exchange rate premium, the higher the probability that the official exchange rate regime could collapse. Under such

circumstances, therefore, it would be impossible to maintain an overvalued currency, given that the amount of gross international reserves is not unlimited.

**Table 6: Long and Short Run Monetary Policy Reaction functions**

Long Run Estimates			Short Run Estimates	
	$\eta_t$	$\kappa_t$	$\Delta\eta_t$	$\Delta\kappa_t$
$\gamma_0$	2.2232 <sup>b</sup> (0.9821)	-1.2947 (0.6274)	0.0142 (0.1430)	0.0098 (0.0118)
$\gamma_1$	0.8426 <sup>a</sup> (0.1188)		0.8846 <sup>a</sup> (0.2179)	
$\gamma_2$	0.2369 <sup>c</sup> (0.1316)	0.4964 <sup>a</sup> (0.1431)	0.1552 (0.0975)	0.2564 (0.1842)
$\gamma_3$	-0.1908 <sup>b</sup> (0.0791)		-0.0744 (0.1232)	
$\gamma_4$		0.7302 <sup>a</sup> (0.1764)		0.7298 <sup>a</sup> (0.1580)
$\beta_0$	-0.7443 <sup>a</sup> (0.0837)		-0.8112 <sup>a</sup> (0.0949)	
$\beta_1$	0.562 <sup>a</sup> (0.1071)		0.6059 <sup>a</sup> (0.1902)	
$\beta_2$		-0.0152 <sup>b</sup> (0.0063)		-0.01148 <sup>b</sup> (0.0054)
$\beta_3$		-0.0081 (0.0066)		-0.0135 <sup>b</sup> (0.0059)
$\rho_0$	1.1251 <sup>b</sup> (0.4275)		0.3384 <sup>b</sup> (0.3384)	
$\rho_1$		0.0450 (0.0278)		0.0304 (0.0254)
$\rho_3$	0.8080 <sup>b</sup> (0.3305)		0.5077 (0.3172)	
$\lambda_0$	0.3132 <sup>b</sup> (0.1453)		0.4143 <sup>a</sup> (0.1074)	
$\lambda_2$	-0.4744 <sup>a</sup> (0.1140)		-0.4022 <sup>a</sup> (0.1191)	
$\lambda_4$		0.0061 (0.0081)		0.0046 (0.0081)
$\Theta$			-1.0278 <sup>b</sup> (0.3862)	-1.2344 <sup>a</sup> (0.2680)
Adj R <sup>2</sup>	0.9745	0.9109	0.9047	0.6547
BG LM Test	1.2314 [0.3292]	1.7577 [0.2110]	0.7325 [0.5073]	2.5388 [0.1240]
JB White Noise	0.5647 [0.7540]	1.2483 [0.5357]	2.1124 [0.3478]	0.6026 [0.7398]
ARCH Test	0.3857 [0.5416]	0.0010 [0.9747]	0.0265 [0.8724]	0.9607 [0.3400]

*Heteroskedasticity Test: ARCH*

*Breusch-Godfrey Serial Correlation LM Test (BG LM test)*

*Standard errors in ( ), and Probability values in [ ]*

*Jarque-Bera White Noise test*

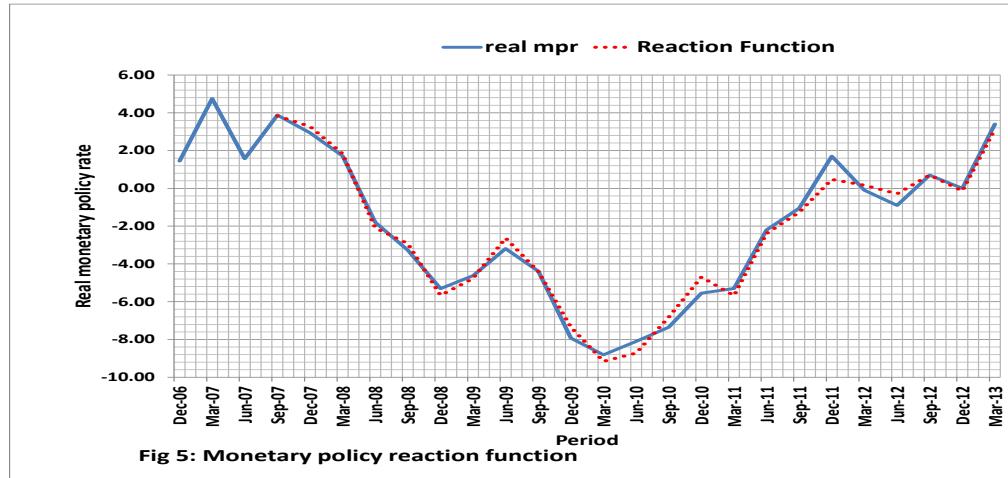
The version of equations (22) and (23) to be empirically estimated can be written as:

$$\kappa_t = \gamma_0 + \sum_{i=1}^4 \gamma_i \kappa_{t-i} + \sum_{r=0}^4 \beta_r \pi_{t-r} + \sum_{j=0}^4 \rho_j D G_{t-j} + \sum_{k=0}^4 \lambda_k D E_{t-k} + \mu_t \quad (25)$$

and

$$\eta_t = \gamma_0 + \sum_{i=1}^4 \gamma_i \eta_{t-i} + \sum_{r=0}^4 \beta_r \pi_{t-r} + \sum_{j=0}^4 \rho_j D G_{t-j} + \sum_{k=0}^4 \lambda_k D E_{t-k} + \varepsilon_t \quad (26)$$

respectively. Equations (25) and (26) are autoregressive distributed lag specifications each of order four ARDL (4,4,4,4). It is chosen in order to account for the well-known problem of preliminary, as well as wrongly measured data.



Equations (25) and (26) are estimated using quarterly data for the period 2006Q4 to 2013Q1 to coincide with the period when the new monetary management framework was introduced in CBN. The results of the estimation are shown in Table 6. The diagnostics suggest that both long-run and the short run equations are adequately determined by the data. During the estimation period, the negative coefficient of inflation in the  $\eta$  equation presented in the revealed that the monetary authorities “leaned against the wind” by easing money market conditions in response to lower inflation and tightening the money market conditions in response to higher inflation. The negative exchange rate coefficient in the  $\eta$  equation suggested that the monetary authorities defended the official exchange rate in the period.

Fig 5 and 6 presents the reaction functions which actually fit the actual policy performance of real monetary policy rate  $\eta$  and the log of the reserve money as the implied paths of the reaction functions (model 1 and 2) fit the actual paths of the policy variables rather closely.

It is interesting to find out how quick monetary authorities in Nigeria reacted to deviations from their ‘implied rules’ estimated in table 6. In order to do so,

short-run versions of (25) to (26) are estimated by using the rates of change of the variables, as well as the lagged saved residuals from such equations, or equilibrium corrections mechanisms (ECM), as explanatory variables. The coefficient of the ECM term  $\theta$  is expected to provide information regarding the speed of adjustment to the steady state relation between the variables being modeled.

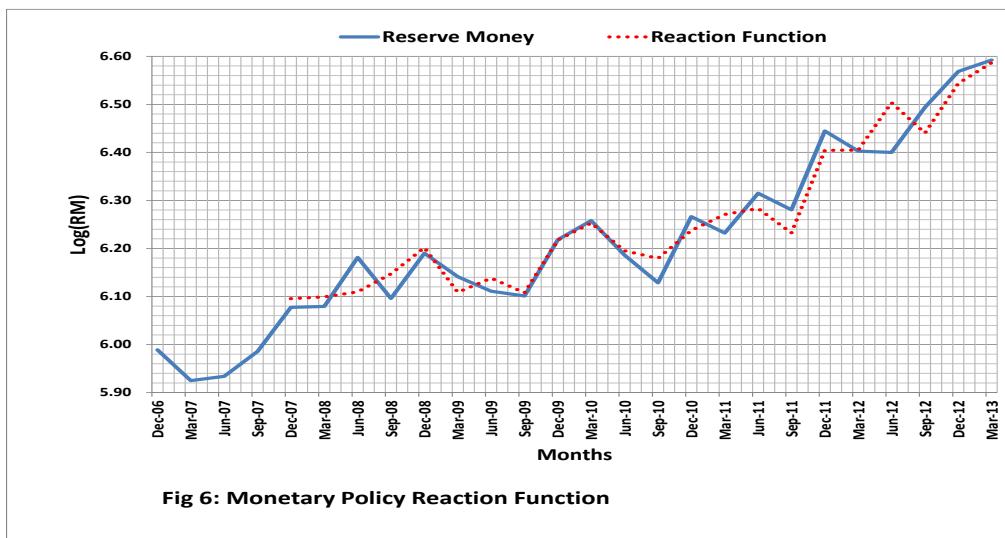
The short-run versions of equations (25) and (26) are given by:

$$\Delta \kappa_t = \gamma_0 + \sum_{i=1}^4 \gamma_i \Delta \kappa_{t-i} + \sum_{r=0}^4 \beta_r \Delta D I_{t-r} + \sum_{j=0}^4 \rho_j \Delta D G_{t-j} + \sum_{k=0}^4 \lambda_k \Delta D E_{t-k} + \theta \mu_{t-1} + \epsilon_t \quad (27)$$

and

$$\Delta\eta_t = \gamma_0 + \sum_{i=1}^4 \gamma_i \Delta\eta_{t-i} + \sum_{r=0}^4 \beta_r \Delta DI_{t-r} + \sum_{j=0}^4 \rho_j \Delta DG_{t-j} + \sum_{k=0}^4 \lambda_k \Delta DE_{t-k} + \theta \varepsilon_{t-1} + \epsilon_t \quad (28)$$

Equations (25) to (28) comply with all the diagnostic statistics reported. This suggest that the models are well fitted as all the equations error terms are not serially correlated and have stable variances (Table 6). The estimated parameter  $\theta$  in both equations are statistically significant and imply that on average, all of the deviations from the estimated monetary policy reaction functions are made up in one quarter.



## 5.0 Concluding Remarks

This paper discusses the role of the Central Bank of Nigeria's Analytical Balance Sheet and monetary survey in monetary policy implementation. The

effective management of the banking system balance sheets is critical to the success of any monetary policy regime. As such an accurate and reliable balance sheet is central to a successful implementation of monetary policy.

The Monetary Policy Committee of the CBN currently base their decisions on many factors: leading indicators, forecasts, growth in monetary aggregates, etc. There is no reason why reaction functions such as the ones estimated in equations (25) and (26) could not be added to the list of factors to be considered. Furthermore, a quarter ahead forecast of the monetary policy rate implied by the reaction function under different assumptions (on expected inflation, output gap and exchange rate premium) could be provided as a possible guide to the MPC in taking their decisions.

## References

- Brunner, K. (1961) A schema for the Supply Theory of Money. *International Economic Review*, 79 – 109.
- Brunner, K. and Meltzer, A.H. (1964). Some Further Investigations of Demand and Supply Function for Money. *Journal of Political Economy* 1-37
- Doguwa, S.I. (1994). The Multiplier Approach to Money Supply Process in Nigeria. *CBN Economic and Financial Review*, 32: 390-418
- Doguwa, S.I. (2002). Estimating Taylor-Type Monetary Policy Reaction Functions for Nigeria. *Journal of Monetary and Economic Integration*, West African Monetary Institute 2(1): 13-37
- Garfinkel, M.R. and Thornton, D.L. (1991). The Multiplier Approach to the Money Supply Process: A Precautionary Note. *Federal Reserve Bank of St. Louis*, 47-63
- Judd, J. and Rudebusch, G.D. (1998). Taylor's Rule and the FED: 1970-1997. *Federal Reserve Bank of San Francisco Economic Review* No. 3: 3-16
- Sanchez-Fund, J.R. (2000). "Estimating Taylor-Type Monetary Policy Reaction Functions for the Case of a Small Developing Economy". Unpublished paper: Department of Economics, Keynes College, University of Kent at Canterbury, England, UK

