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Datatric Research Consulting, Nigeria

2012

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Abstract

This paper critically examines the dynamic interaction between monetary policy tools in stimulating economic growth, as well as stabilizing the economy from external shocks in Nigeria. The paper considered key monetary time series variables and real growth of output in formulating Vector Autoregressive (VAR) models which showed interdependence interaction between the period of 1970 and 2007. The time series properties of the selected variables are examined using the Augmented Dickey-Fuller unit root test and the results revealed that only growth of real output and broad money supply are stationary at levels, while saving, lending and exchange rates were found stationary at first difference. The long-run dynamic interaction was established through the Johansen's Trace and Maximum Eigenvalue tests. The pair-wise Granger-Causality test conducted showed that the growth rate of real output is not a leading indicator for any monetary variables. Other innovation accounting tests were also carried out like impulse responses function to test for the response of growth in real output to innovation shock on monetary variables. Also, the forecast error variance decomposition (FEVD) is used to decompose the monetary shock on the growth rate of real output in Nigeria. Proper policy recommendations were proffered based on the results emanated from the econometric analyses.

***Key words**:* Monetary policy, Monetary Instruments, Economic growth, VAR, Impulse shock response, Variance decomposition

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Section 1.

Introduction

Monetary policy is the process by which the central bank or monetary authority of a country controls the supply of money, availability of money, and cost of money or rate of interest to attain a set of objectives oriented towards the growth and stability of the economy (Wikipedia, 2010). Monetary policy on the other hand, refers to the specific actions taken by the Central Bank to regulate the value, supply and cost of money in the economy with a view to achieving Government's macroeconomic objectives. For many countries, the objectives of monetary policy are explicitly stated in the laws establishing the central bank, while for others they are not (CBN, 2006).

Monetary policy is usually used to attain a set of objectives oriented towards the growth and stability of the economy. The objectives of monetary policy may vary from country to country but there are two main views. The first view calls for monetary policy to achieve price stability, while the second view seeks to achieve price stability and other macroeconomic objectives. The macroeconomic objectives include full employment of scare resources, economic growth, and balance of payment equilibrium. The Central Bank of Nigeria, like other central banks in developing countries, achieves the monetary policy goal through the amount of money supplied.

Monetary policy focuses on the relationship between the rates of interest in an economy, that is the price at which money can be borrowed, and the total supply of money. Monetary policy uses a variety of instruments to control one or both of these, to influence outcomes like economic growth, inflation, exchange rates with other currencies and unemployment. Where currency is under a monopoly of issuance, or where there is a regulated system of issuing currency through banks which are tied to a central bank, the monetary authority has the ability to alter the money supply and thus influence the interest rate (to achieve policy goals). The beginning of monetary policy as such comes from the late 19th century, where it was used to

maintain the gold standard. A policy is referred to as contractionary if it reduces the size of the money supply or raises the interest rate. An expansionary policy increases the size of the money supply, or decreases the interest rate. Furthermore, monetary policies are described as follows: accommodative, if the interest rate set by the central monetary authority is intended to create economic growth; neutral, if it is intended neither to create growth nor combat inflation; or tight if intended to reduce inflation.

On the basis of the significance of monetary policy tools in stabilizing the entire economy, this study aim to examine and analyse the dynamic interaction of monetary policy tools in stimulating economic growth, as well as stabilizing the economy from external shocks in Nigeria. The paper is organized as follows. Section 2 reviews previous literature on the interaction of monetary policy instruments with economic growth, and also the mechanism of stimulating the economy amidst shocks. Section 3 provides an overview of the Nigeria monetary system from 1970 to 2007, and Section 4 describes the data and the methodology employed in the study. The econometric evidence and implications of the findings are discussed in section 5 and later recommends and conclude the study.

Section 2.

2.0 Monetary Policy Mechanism and Economic Stability: Empirical Review

Generally, both fiscal and monetary policies seek at achieving relative macroeconomic stability. Over the year, two issues have been subjects of debate in this regard. First is the superiority of each of these policies in the achievement of macroeconomic stability. While the Keynesians argued that fiscal policy is more potent than monetary policy, the monetarists led by Milton Friedman on the other hand believed the other way round. Although the focus of this paper is neither to join in nor extend the debate, based on countries' experience and the fact that monetary policy is often free from political interference, the study analyses how monetary policy can be employed to stabilize economic growth in Nigeria. The second issue concerns the definition of macroeconomic instability.

Macroeconomic instability can be regarded as a situation of economic malaise, where the economy does not seem to have settled in a steady equilibrium position (Akinlo, 2007; An and

Sun, 2008), thereby making it difficulty to make predictions and good planning. The definition of macroeconomic instability above suffers from lack of precision. The monetary policy focuses precisely on the achievement of price stability, with respect to both domestic and external prices. While inflation rate is often used to track movement in domestic price level, exchange rate is used as policy tool in ensuring external stability and enhancing export performance (Caballero and Corbo, 1989). In addition, exchange rate policy impacts on the outcome of stabilization measures and debt management strategies (Busari, Omoke, and Adesoye, 2005; Busari and Olayiwola, 1999), especially in developing countries.

Thus, this study examines the dynamic interaction between monetary policy tools and economic growth since a decade after independence to 2007 fiscal year. As a means of achieving this, a simple monetary model with rational expectation that emphasizes the fiscal role of the real exchange rate is used. The fiscal role of real exchange rate is particularly relevant to Nigeria since the bulk of government revenue is derived from foreign exchange earnings. In the theoretical model, the links between high inflation and the joint volatility of the real exchange rate and inflation rate, and some aspects of government's fiscal and exchange rate policies are illustrated in a rational expectation equilibrium framework. Consequently, inflation rate and the real exchange rates are jointly determined by the equilibrium of the model. This is derived from the sunspot equilibria theory in which Woodford (1986), Shigoka (1994) and Drugeon and Wignolle (1996) have demonstrated that macroeconomic instability is related to multiple rational expectation equilibria.

However, several empirical studies have been carried out to investigate the dynamic nexus between monetary policy and economic growth among which are An and Sun (2008), Bernanke (1986), Chete (1995), Busari, Omoke and Adesoye (2005), Dale and Haldane (1993), Faust and Rafiq and Mallick (2008), Rogers (2003), Mallick (2010), and Montiel (1991).Though, this paper considered another dynamic approach in ascertains the mechanisms of interaction between monetary policy and economic growth in Nigeria using detailed econometric shocks accounting techniques. Although, the overview of monetary policy management in Nigeria is reviewed in the next section in order to give detail accounts of the several monetary reforms eras the country has undergone over the years.

Section 3.

3.0 Overview of Monetary Policy Management in Nigeria

Monetary policy in the Nigerian context refers to the actions of the Central Bank of Nigeria to regulate the money supply, so as to achieve the ultimate macroeconomic objectives of government. Several factors influence the money supply, some of which are within the control of the central bank, while others are outside its control. The specific objective and the focus of monetary policy may change from time to time, depending on the level of economic development and economic fortunes of the country. The choice of instrument to use to achieve what objective would depend on these and other circumstances. These are the issues confronting monetary policy makers.

Over the years, the objectives of monetary policy have remained the attainment of internal and external balance of payment. However, emphases on techniques/instruments to achieve those objectives have changed over the years. There have been two major phases in the pursuit of monetary policy in Nigeria since the inception of the Cental Bank of Nigeria, namely, before and after 1986 Structural Adjustment Programme (SAP). The first phase (1959-1986) placed emphasis on direct monetary controls, while the second phase (1986-date) relies on market mechanisms or market-based controls.

The era of direct controls was a remarkable period in monetary policy management in Nigeria, because it coincided with several structural changes in the economy; including the shift in the economic base from agriculture to petroleum, the execution of the civil war, the oil boom and crash of the 1970s and early 1980s respectively and the introduction of the Structural Adjustment Programme (Chuku, 2009; Garba 1996). The economic environment that guided monetary policy before 1986 was characterized by the dominance of the oil sector, the expanding role of the public sector in the economy and over-dependence on the external sector. In order to maintain price stability and a healthy balance of payments position, monetary management depended on the use of direct monetary instruments such as credit ceilings, selective credit controls, administered interest and exchange rates, as well as the prescription of cash reserve requirements and special deposits. During this period CBN's monetary policies focused on fixing

and controlling interest rates and exchange rates, selective sectoral credit allocation, manipulation of the discount rate and involving in moral suasion. Reviewing this period, Omotor (2007) observes that monetary policy was ineffective particularly because the CBN lacked instrument autonomy and goal determination, being heavily influenced by the political considerations conveyed through the Ministry of Finance. The CBN (2010) also posited that the use of market-based instruments was not feasible at that point because of the underdeveloped nature of the financial markets and the deliberate restraint on interest rates. The most popular instrument of monetary policy was the issuance of credit rationing guidelines, which primarily set the rates of change for the components and aggregate commercial bank loans and advances to the private sector.

The Structural Adjustment Programme (SAP) was adopted in July, 1986 ushered in a new era of monetary policy implementation with market-friendly techniques in Nigeria and against the crash in the international oil market and the resultant deteriorating economic conditions in the country. It was designed to achieve fiscal balance and balance of payments viability by altering and restructuring the production and consumption patterns of the economy, eliminating price distortions, reducing the heavy dependence on crude oil exports and consumer goods imports, enhancing the non-oil export base and achieving sustainable growth. The capacity of the CBN to carry out monetary policy using market friendly techniques was letter reinforced by the amendments made to the CBN Act in 1991 which specifically granted the CBN full instrument and goal autonomy. In line with the general philosophy of economic management under SAP, monetary policy was aimed at inducing the emergence of a market-oriented financial system for effective mobilization of financial savings and efficient resource allocation. The main instrument of the market-based framework is the open market operations. These operations are conducted wholly on Nigerian Treasury Bills (TBs) and Repurchase Agreements (REPOs), and are being complimented with the use of reserve requirements, the Cash Reserve Ratio (CRR) and the Liquidity Ratio (LR). These set of instruments are used to influence the quantity-based nominal anchor (monetary aggregates) used for monetary programming. On the other hand, the Minimum Rediscount Rate (MRR) is being used as the price-based nominal anchor to influence the direction of the cost of funds in the economy. This rate has generally been kept within the range of 26 and 8 percent since 1986. As a companion to the use of the MRR, the CBN latter

introduced the Monetary Policy Rate (MPR) in 2006 which establishes an interest rate corridor of plus or minus two percentage points of the prevailing MPR. Since 2007, this rate has been held within the band of 10.25 and 6 percent.

Section 4.

4. Methodology

This paper employed the by Sim (1980, 1992) Vector Autoregressive (VAR) model in analyzing the dynamic interaction between monetary policy variables and economic growth in Nigeria. Other tests like Johansen multivariate cointegration test and Granger-causality test are employed to determine the long-run relationship (hence, possibly causally related i.e. mechanism of interaction) between selected money market variables and economic growth in Nigeria. The Augmented Dickey-Fuller (ADF) unit root test is used to examine the properties of the time series variables and to determine the order of integration. Furthermore, the impulse response and error variance decomposition analyses are used to examine the dynamic and mechanism of relation among the variables as a result of innovation shock. The choice of the lag length of the time series variables are based on the minimum Akaike and Schwarz Information Criterion.

4.1 VAR specified model

Vector Autoregressive model is employed in analyzing the dynamic interaction between monetary policy tools -proxies as Lending rate (LR), Savings rate (SR), Exchange rate (EXR) and Growth rate of broad money supply (GM2)-and economic growth (GRY) in Nigeria based on the structural model specified below:

$$GRY_t = \sum_{i=1}^{p} \delta_{1i} LR_{t-i} + \sum_{i=1}^{q} \phi_{1i} SR_{t-i} + \sum_{i=1}^{m} \eta_{1i} EXR_{t-i} + \sum_{i=1}^{n} \lambda_{1i} GM2_{t-i} + \sum_{i=1}^{k} \psi_{1i} GRY_{t-i} + \alpha_1 + u_{1t}$$

$$LR_t = \sum_{i=1}^{p} \delta_{2i} LR_{t-i} + \sum_{i=1}^{q} \phi_{2i} SR_{t-i} + \sum_{i=1}^{m} \eta_{2i} EXR_{t-i} + \sum_{i=1}^{n} \lambda_{2i} GM2_{t-i} + \sum_{i=1}^{k} \psi_{2i} GRY_{t-i} + \alpha_2 + u_{2t}$$

$$SR_t = \sum_{i=1}^{p} \delta_{3i} LR_{t-i} + \sum_{i=1}^{q} \phi_{31i} SR_{t-i} + \sum_{i=1}^{m} \eta_{3i} EXR_{t-i} + \sum_{i=1}^{n} \lambda_{3i} GM2_{t-i} + \sum_{i=1}^{k} \psi_{3i} GRY_{t-i} + \alpha_3 + u_{3t}$$

$$EXR_t = \sum_{i=1}^{p} \delta_{4i} LR_{t-i} + \sum_{i=1}^{q} \phi_{4i} SR_{t-i} + \sum_{i=1}^{m} \eta_{4i} EXR_{t-i} + \sum_{i=1}^{n} \lambda_{4i} GM2_{t-i} + \sum_{i=1}^{k} \psi_{4i} GRY_{t-i} + \alpha_4 + u_{4t}$$

$$GM2_t = \sum_{i=1}^{p} \delta_{5i} LR_{t-i} + \sum_{i=1}^{q} \phi_{5i} SR_{t-i} + \sum_{i=1}^{m} \eta_{5i} EXR_{t-i} + \sum_{i=1}^{n} \lambda_{5i} GM2_{t-i} + \sum_{i=1}^{k} \psi_{5i} GRY_{t-i} + \alpha_5 + u_{5t}$$

Where $\delta_{ij}, \phi_{ij}, \eta_{ij}, \lambda_{ij}, \psi_{ij}, and\ \alpha_{ij}$ are parameters to be estimated in each system of equations.

4.2 Johansen Multivariate Cointegration Test

This paper employed VAR-based cointegration test using the methodology developed in Johansen (1997). The Johansen multivariate cointegration test is to investigate the long-run relationship of the monetary policy variables and growth of real GDP as a system of interdependent equations. The relationships among the variables are based on the following model:

Consider a VAR of order *p*

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + Bx_t + \varepsilon_t \qquad (6)$$

Where y_t is a *k*-vector of non-stationary I(1) variables, x_t is a *d*-vector of deterministic variables, and ε_t is a vector of innovations. We can rewrite this VAR as

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-1} + Bx_t + \varepsilon_t \qquad (7)$$

Where $\Pi = \sum_{i=1}^{p} A_i - \mathrm{I}, \qquad \Gamma_i = -\sum_{j=i+1}^{p} A_j$

Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank $r < k$, then there exist *k x r* matrices α and β each with rank *r* such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is I(0). *r* is the number of cointegrating relations (the cointegrating rank) and each column of β is the cointegrating vector, and α represents the speed of adjustment parameters.

Johansen developed two likelihood ratio tests for testing the number of cointegration vectors (*r*): the trace and the maximum Eigenvalue test. The trace statistics test the null hypothesis of $r = 0$ (i.e. no cointegration) against the alternative that $r > 0$ (i.e. there is one or more cointegration vector). The maximum Eigenvalue statistics test the null hypothesis that the number of cointegrating vectors is *r* against the alternative of $r + 1$ cointegrating vectors.

4.3 Granger-causality Test

In order to examine whether there are lead-lag relationships between the monetary policy variables and real GDP, we run the Granger-causality test. If the time series of a variable is non-stationary, I(1) and is not cointegrated, the variable is converted into I(0) by first differencing and Granger-causality test can be applied as follows:

$$\Delta X_t = \vartheta_x + \sum_{i=1}^{k} \rho_{x,i} \Delta X_{t-1} + \sum_{i=1}^{k} \psi_{x,i} \Delta Y_{t-1} + \varepsilon_{x,t}, \qquad (8)$$

$$\Delta Y_t = \vartheta_y + \sum_{i=1}^{k} \rho_{y,i} \Delta Y_{t-1} + \sum_{i=1}^{k} \psi_{y,i} \Delta X_{t-1} + \varepsilon_{y,t}, \qquad (9)$$

Where ΔX_t and ΔY_t the first difference of time series variable while the series is nonstationary. However, if a variable is non-stationary and cointegration, the Granger-causality test will be run based on the following equations:

$$\Delta X_t = \vartheta_x + \sum_{i=1}^{k} \rho_{x,i} \Delta X_{t-1} + \sum_{i=1}^{k} \psi_{x,i} \Delta Y_{t-1} + \varphi_x ECT_{x,t-1} + \varepsilon_{x,t}, \qquad (10)$$

$$\Delta Y_t = \vartheta_y + \sum_{i=1}^{k} \rho_{y,i} \Delta Y_{t-1} + \sum_{i=1}^{k} \psi_{y,i} \Delta X_{t-1} + \varphi_y ECT_{y,t-1} + \varepsilon_{y,t}, \qquad (11)$$

Where φ_x and φ_y are the parameters of the ECT term, measuring the error correction mechanism that drives the X_t and Y_t back to their long run equilibrium relationship and this translate the vector error-correction (VEC) model. The null hypothesis for the equation (8) and (10) is $H_o : \sum_{i=1}^{k} \psi_{x,i} = 0$, suggesting that the lagged item ΔY_t do not belong to the regression. Conversely, the null hypothesis for the equations (9) and (11) is $H_0 : \sum_{i=1}^{k} \psi_{y,i} = 0$, that is the lagged term ΔX_t do not belong to the regression. These hypotheses are tested using F-test.

4.4 *Innovation Accounting*

Innovation accounting such as the impulse response function and forecast error variance decomposition (FEVD) is used in analyzing the interrelationships among the variables chosen in the system of equation (1) to (5). The impulse response functions are responses of all variables in the model to a one unit structural shock to one variable in the model. The impulse responses are plotted on the Y-axis with the period from the initial shock on the X-axis. Formally, each $\phi_{jk}(i)$ is interpreted as the time specific derivatives of the VMA(∞) function (Enders,1995):

$$\phi_{jk}(i) = \frac{\partial X_{jk}}{\partial \ell_k} \qquad (12)$$

Equation (12) measures the change in the j^{th} variable in period *t* resulting from a unit shock to the k^{th} variable in the present period.

The FEVD measures the proportion of movement in a sequence attributed to its own shock to distinguish it from movements attributable to shocks to another variable (Ender, 1995). In the FEVD analysis, the proportion of Y variance due to Z shock can be expressed as:

$$\frac{\sigma_z^2\left[\delta_{12}(0)^2+\delta_{12}(1)^2+.....+\delta_{12}(m-1)^2\right]}{\sigma_y(m)^2} \qquad (13)$$

One can see that as *m* period increases the $\sigma_y(m)^2$ also increases. Further, this variance can be separated into two series: y_t and z_t series. Consequently, the error variance for *y* can be composed of ℓ_{yt} and ℓ_{zt}. If ℓ_{yt} approaches unity it implies that y_t series is independent of z_t series. It can be said that y_t is exogenous relative to z_t. On the other hand, if ℓ_{yt} approaches zero (indicates that ℓ_{zt} approaches unity) the y_t is said to be endogenous with respect to the z_t (Ender, 1995).

Section 5.

Empirical Results and Implications

5.1. Unit Root Test Results

The Augmented Dickey-Fuller unit root test result is presented in table 2. The ADF results reveals that the time series variables-growth rate of real GDP and money supply exhibit consistent trend over the period. This implies that only the growth rate of real output and money supply in levels reject the null hypothesis of non-stationary and they are taken to be integrated of order zero, I(0). The other incorporated time series variables, lending rate, savings rate and exchange rate are found unstable and non-mean reverting. This implies that they accept the null hypothesis of non-stationary in levels. But accept reject the null hypothesis at first difference and this indicates that they are stationary at first difference. These results are consistent with previous literature that found most monetary variables non-stationary and non-mean reverting.

For the essence of other subsequent tests, all the considered macroeconomic and monetary time series variables are regarded to be stationary at first difference and integrated of order one i.e. I(1).

Table 2: Unit Root Test Results: Monetary and Macroeconomic Variables

Variable	ADF Tau Statistics		Order of Integration
	Intercept	Trend	
GRY	**-2.8684*** (5)**	**-4.3202* (6)**	**0**
GM2	**-3.5680** (1)**	**-3.5111***(1)**	**0**
LR	**-6.8706* (1)**	**-6.9065* (1)**	**1**
SR	**-6.1218* (1)**	**-6.4258* (1)**	**1**
EXR	**-3.4625** (1)**	**-3.6478** (1)**	**1**

Notes: *Significant at 1% level, **Significant at 5% level, ***Significant at 10% level. The value in parenthesis is the lag length based on the minimum Akaike and Schwarz Information Criteria.

5.2 VAR Diagnostic Test Results

Prior before the cointegration test, VAR diagnostic tests were carried out on the estimated VAR model. In selecting the appropriate lag number, the VAR lag order selection criteria test was employed and lag of 3 is selected for subsequent test based on the minimum Final Prediction Error (FPE) and Akaike information Criteria (AIC). In examining the stability of the VAR model at lag 3, the AR roots test result reveals that the VAR models for the endogenous variables-GRY, LR, SR, EXR and GM2- are stable because there modulus are less than one and lies inside the unit circle.

Also, the VAR Lag Exclusion Wald test result indicates that all the endogenous variables are jointly significant at lag 3.

5.3 Johansen Multivariate Cointegration Test Results

The Johansen's Trace and Maximum Eigenvalue tests result is shown in table 3. According to Johansen (1997), if restrictions are imposed on the deterministic components of the johansen's multivariate model, five possible models exist. In this study, the third (intercept only) and fourth (intercept and trend) models restriction options are employed as it is programmed in

E-Views 5.1., since Johansen (1997) posited that the other models restriction options that are too restrictive or least restrictive are unlikely to occur in practice. At McKinnon-Haug-Michelis 5% significance level of the Trace and Max Eigenvalue tests suggest that the incorporated variables are cointegrated with r = 2 and r = 0 respectively for third variant model. While for the fourth model the variables are cointegrated with r = 3 and r = 0 at 5% significance level of the Trace and Max Eigenvalue tests respectively. Empirically, it is common for the estimated test statistics to show different result. However, in the Max Eigenvalue test, both the null and alternative hypotheses are more specific. Therefore, the rank will be dependent on the Max Eigenvalue test results, which implies that there at most none cointegration vector (r = 0) in model 3 and 4.

Table 3: Unrestricted Cointegration Rank Test (Max. Eigen value and Trace Statistics)

R	Max. Eigen Statistic	Trace Statistic	Max. Eigen Statistic	Trace Statistic
R=0	50.3002* (33.8769)	104.563* (69.8189)	69.5331* (38.3310)	139.903* (88.8038)
R≤1	20.0508 (27.5843)	54.2623* (47.8561)	23.9816 (32.1183)	70.3696* (63.8761)
R≤2	19.4137 (21.1316)	31.2115* (29.7971)	19.5017 (25.8232)	46.3880* (42.9153)
R≤3	11.2411 (14.2646)	11.7979 (15.4947)	15.8207 (19.3870)	26.8863* (25.8721)
R≤4	0.5567 (3.84147)	0.55673 (3.84147)	11.0656 (12.5180)	11.0656 (12.5180)

*Denotes rejection of the hypothesis at the 0.05 level. The value in parenthesis represents the critical value at 0.05 level.
Source: Authors Computation (2011)

5.4 Pair-wise Granger-Causality Test Results

The pair-wise Granger-Causality test is conducted to examine the lead-lag relationship among the monetary and macroeconomic variables incorporated in this study. The results are reported in table 4. None of the monetary variables-LR, SR, EXR, and GM2-are found to Granger cause growth rate of real output in pairs and jointly. The result indicates that saving rate, exchange rate and growth rate of money supply Granger cause changes in lending rate pair wise

and jointly. Growth rate of money supply is the only monetary variables that cause savings rate pair wise and other variables are found to significantly Granger cause savings rate.

The reported results also reveal that savings rate Granger cause exchange rate and while bi-causality exist between lending rate and exchange rate. All incorporate variables are found to significantly cause changes in Exchange rate. While, none variables Granger cause growth rate of money supply pair wise and jointly. Therefore, our empirical findings suggest that growth rate of real output is not a leading indictor for any monetary variables incorporated in this study.

Table 4: ***Pair-wise Granger-Causality Test***

VARIABLES	GRY	LR	SR	EXR	GM2	ALL
GRY	**---**	**0.9785**	**0.9806**	**0.9951**	**0.4674**	**0.9687**
LR	**0.4286**	**---**	**0.0028**	**0.0354**	**0.0964**	**0.0121**
SR	**0.4130**	**0.4720**	**---**	**0.5207**	**0.0014**	**0.0164**
EXR	**0.8915**	**0.0411**	**0.0000**	**---**	**0.5269**	**0.0069**
GM2	**0.1232**	**0.1836**	**0.4941**	**0.9322**	**---**	**0.1717**

Source: Authors Computation (2011)

5.5 Impulse Response Analysis

The innovation accounting test result for impulse response function of monetary variables on the real economic growth is presented in table 5 and the graphical result is shown in figure 1. The impact of a shock to the growth rate of real output experienced a mixed positive and negative effect. But the shock only exert negative effect on real output growth at 3rd and 7th year time horizon and these were found significant.

The effect of a shock to each of the selected monetary variables to real growth rate of GDP exert a mix of positive and negative effect throughout the 10 years time horizon of the analysis. Randomly, in terms of the highest magnitude growth rate of money supply (GM2), lending rate (LR), saving rate (SR) and Exchange rate (EXR) were found to exert positive effect

on real growth of GDP as a result of a unit shock in the 1st, 2nd, 1st and 6th period respectively. On the other effect, savings rate (SR), Exchange rate (EXR), growth of money supply (GM2) and lending rate (LR) were found to intact negative effect on the growth of real output as a result innovation shock mechanisms in the 4th, 1st, 4th and 1st period respectively. The effect of a shock to exchange rate to real output growth reveals a significant negative effect response all through the first 4 years period strengthen till the 4th period horizon. The negative effect transited to positive effect in the 5th period, response of a shock to exchange rate to real output growth from the 6th to 10th year period were found negative and this significantly strengthen although the horizon.

Table 5: Response of GRY to a Innovation Shock on Monetary Variables

Period	GRY	LR	SR	EXR	GM2
1	26.41286	0.000000	0.000000	0.000000	0.000000
2	0.661238	1.435209	-1.519377	-0.561482	-4.784431
3	-0.698744	-2.950748	1.946143	-0.676967	6.775426
4	2.888098	2.491797	-0.859577	-1.407471	0.779630
5	4.244178	-1.345469	-2.067679	0.680554	-2.988222
6	0.039586	-0.588694	-2.626996	-1.292019	0.986474
7	-1.008252	0.413860	0.628658	-1.872272	1.501353
8	0.108553	-0.004842	-1.313031	-0.021831	-0.253768
9	0.438500	-0.158383	-1.391095	-0.824163	2.573096
10	0.424186	0.979957	-0.895035	-1.280670	0.835889

Source: Authors Computation (2011)

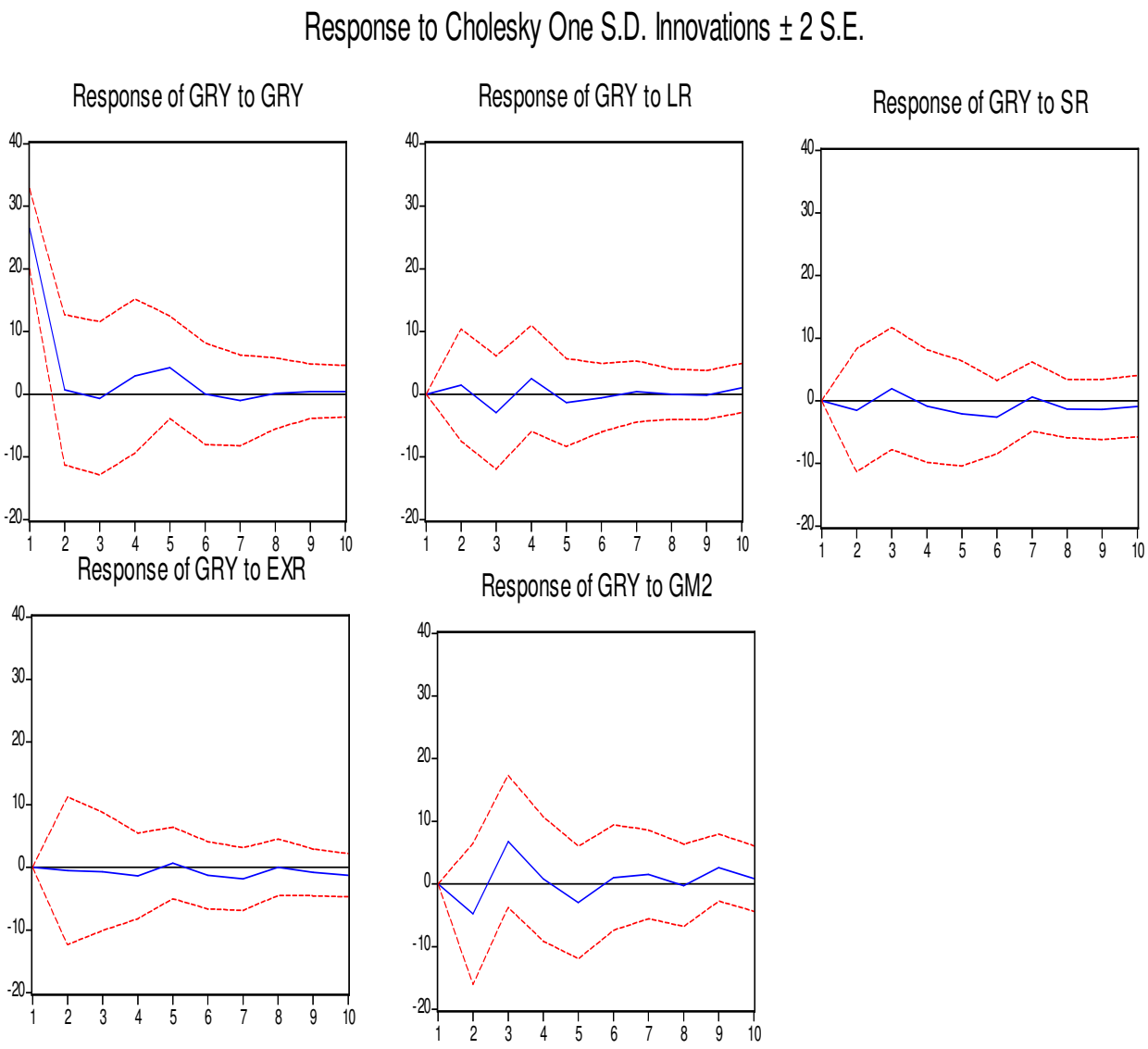

Fig. 1. Impulse Response of GRY to Shocks in Monetary Variables

5.6 Forecast Error Variance Decomposition Analysis

The results of forecast error variance decomposition (FEVD) are presented in table 5. The test results revealed that FEVD for the real growth rate of GDP could be attributed to growth rate of money supply (GM2), savings rate (SR) and lending rate (LR), after 10 years, which account for 10.23% and 2.6% respectively. Even, after 5 years the innovation of growth rate of real output is still more attributable to growth rate of money supply (GM2), savings rate (SR) and lending rate (LR), which stood at 9.37%, 1.33% and 2.30% respectively. The result interestingly revealed that the FEVD for real growth rate of GDP is still more attributable to itself compared to any of the monetary variables selected both in the 5^{th} and 10^{th} year. Considering the first three quarters of the time frame for the analysis of FEVD for real growth rate of GDP, the result revealed that the growth rate of money supply (GM2), savings rate (SR) and lending rate (LR) are the three most important monetary variables that account for the innovation in real output growth in Nigeria. Although, Exchange rate (EXR) was found less significant in explaining the forecast error variance. However, FEVD results indicated that there is significant evidence to show that the variance in the real growth rate of GDP can be accounted for by innovation in it self over the 10 years period, compare to any of the next important factors taken as the growth rate of money supply (GM2), savings rate (SR) and lending rate (LR).

Table 6: Forecast Error Variance Decomposition (FEVD) of GRY

Period	S.Error	GRY	LR	SR	EXR	GM2
1	26.41286	100.0000	0.000000	0.000000	0.000000	0.000000
2	26.93790	96.20005	0.283859	0.318129	0.043445	3.154518
3	28.01781	88.98934	1.371563	0.776560	0.098541	8.763995
4	28.33506	88.04670	2.114374	0.851297	0.343082	8.644550
5	28.92001	86.67470	2.246153	1.328382	0.384720	9.366040
6	29.09053	85.66177	2.260850	2.128340	0.577481	9.371555
7	29.21645	85.04402	2.261468	2.156331	0.983174	9.555008

8	29.24726	84.86637	2.256710	2.353341	0.981160	9.542422
9	29.40841	83.96104	2.234946	2.551373	1.048975	10.20367
10	29.48109	83.56826	2.334430	2.630979	1.232516	10.23381

Source: Authors Computation (2011)

5.7 Policy Implications of the Findings and Recommendation

This study has critically evaluates the dynamic interaction between monetary policy and economic growth between 1970 and 2007. The policy implications of the findings in this study have shown that there may exists conflicting policy options in achieving any of the macroeconomic objectives amidst other objectives. Out of the time series variables employed, lending rate, savings rate and exchange rate were found unstable and non-mean reverting and while the growth rate of real output and money supply are stationary at level using the Augmented Dickey-Fuller unit root test.

The Johansen Cointegration test results indicate that at McKinnon-Haug-Michelis 5% significance level of the Trace and Max Eigenvalue tests suggest that the incorporated variables are cointegrated for third and fourth variant models of the test. This implies that there exist a long-run relationship between monetary variables tools and economic growth in Nigeria. The pair-wise Granger-Causality test revealed that none of the monetary variables-LR, SR, EXR, and GM2-are found to Granger cause growth rate of real output in pairs and jointly. Therefore, our empirical findings suggest that growth rate of real output is not a leading indictor for any monetary variables incorporated in this study. Finally using innovation accounting, the Impulse Response Function (IRF) results indicate that the impact of shock to Exchange rate (EXR), Saving rate (SR), Lending rate (LR) and growth rate of money supply (GM2) on economic growth (GRY) in this research reveal a mix positive and negative effect throughout the sampled period. This was found consistent with other earlier empirical studies. The forecast error variance decomposition (FEVD) test results indicate that the variance in the real growth rate of GDP can significantly be accounted for by innovation in it self over the 10 years period, compare to any of the next important factors taken as the growth rate of money supply (GM2), savings rate (SR),

lending rate (LR) and exchange rate (EXR). This implies that there is ARCH effect associated with variance of growth rate of GDP as a result of shock to its previous growth rate.

In general, this paper proffers policy recommendations emanating from the empirical findings between the analyses period of 1970 and 2007. The level of economic growth should not be used as a barometer in determining major monetary policy rates because the result of the pair-wise Granger Causality test revealed that growth rate of real output is not a leading indictor for any of the monetary variables considered in our study. In other form, the previous performance of major monetary policy instruments should be employed as indicators of predicting the growth rate of economic output in the current period because of the long-run mechanism relationship existing among them. Since no economies of the world including Nigeria can easily avert economic shocks, therefore the monetary policy authorities should regulate the level of major monetary rates like exchange rate and lending rate which are highly shock prone towards economic growth in Nigeria. Thus, future studies can extend this study to include other monetary indicators, fiscal policy variables and examine the inherent short-run dynamic relationship through Vector Error Correction (VEC) Model.

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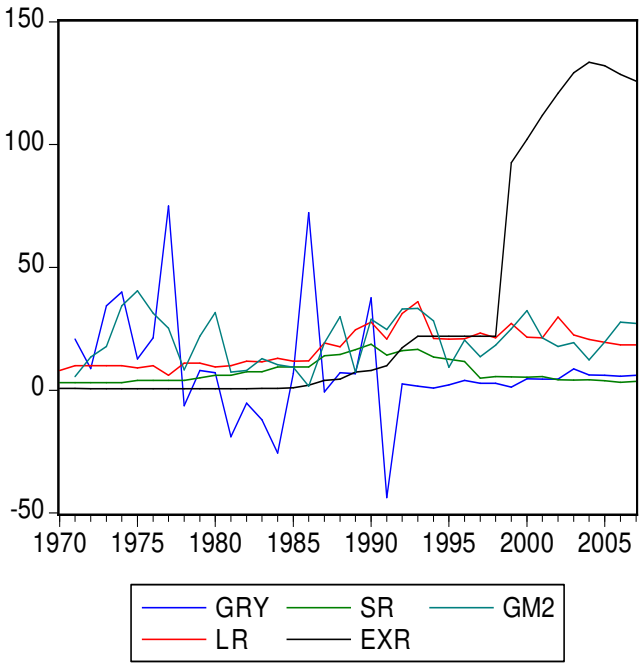
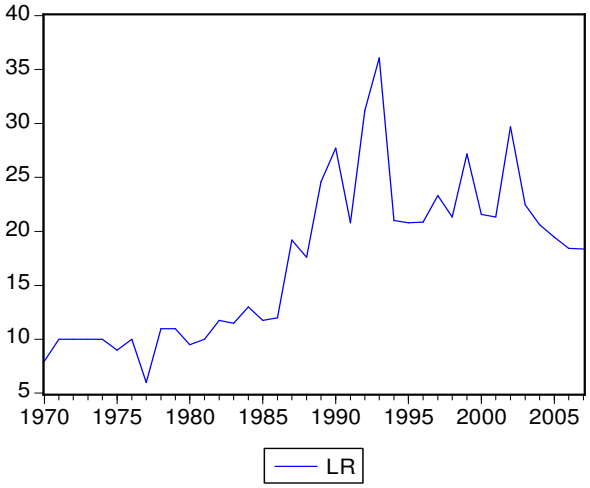
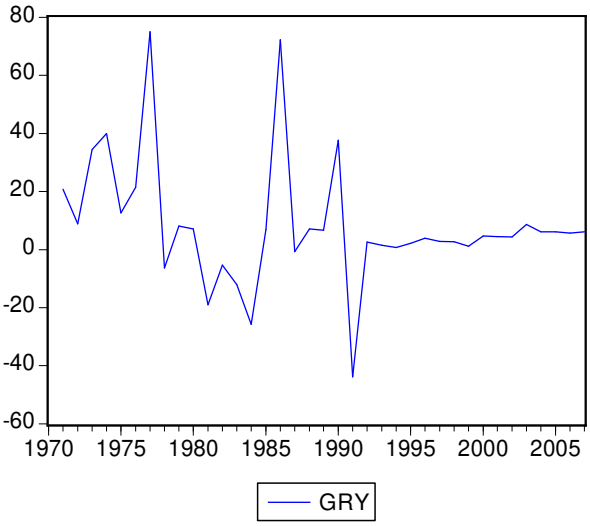
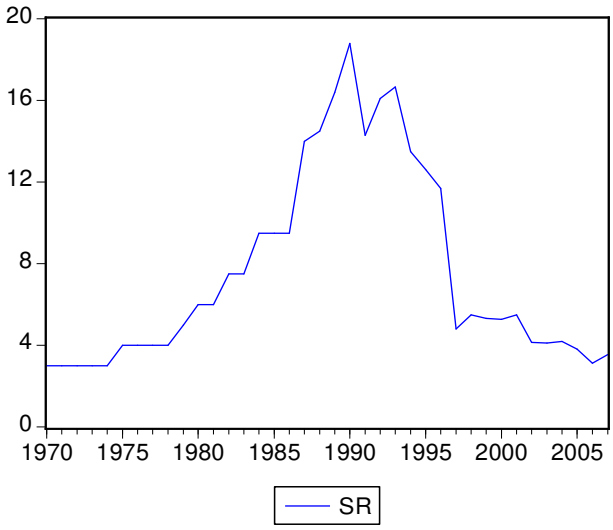
Appendix

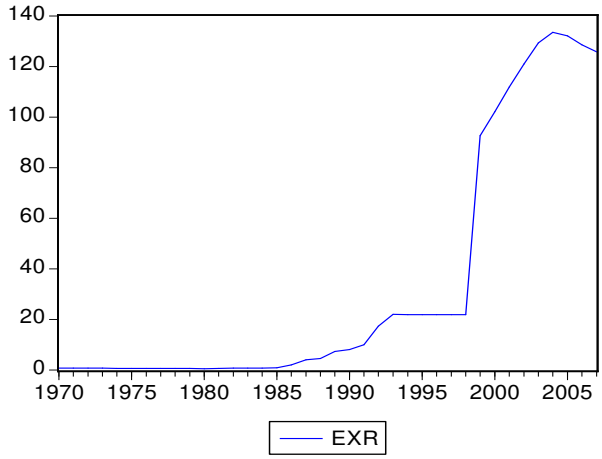
The Time Series Graphs of the Monetary and Macroeconomic Variables in Nigeria between 1970 and 2007

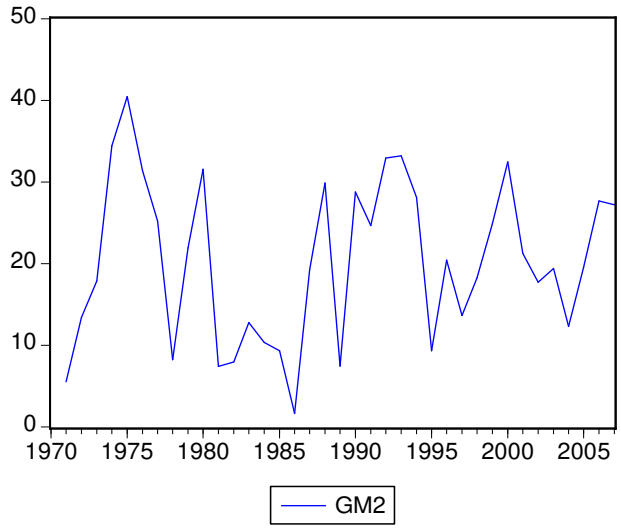









140
120
100
80
60
40
20
0
1970
1975
1980
1985
1990
1995
2000
2005
EXR


50
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30
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10
0
1970
1975
1980
1985
1990
1995
2000
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GM2