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# Relative Impacts of Monetary Policy Instruments on Economic Growth in Nigeria

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## Abstract
*The objective of this study is to empirically determine the impact of monetary policy instruments on economic growth in Nigeria with Autoregressive Distributed Lag Model (ARDL) and Vector Error correction model (VECM) as methodology, after necessary test on reliability of data are conducted. Also, due to the change in government policy i.e 2006 bank consolidation, test for structural stability was carried out using CUSUM, CUSUMSQ and Chow test. Standardized regression was used to find out the comparative or relative impacts of the monetary policy instruments (Monetary policy rate, Cash reserve ratio, and Exchange rate) on the target variable (Economic growth,). From the analysis of the model for both alternative sub periods, the coefficients of the estimated regression (for both ARDL and VECM) are not the same in the two sub periods. There are significant changes in the coefficients of the policy variables. This means that the 2006 structural reform in the financial sector in Nigeria brought changes in monetary policy rate, CRR , exchange rate and also changes in economic growth. Also, from the two sub periods CRR does not have any significant effects on economic growth in short run, but it has effects in the long run. In the short run, in both sub periods, monetary policy rate does not have significant effect on economic growth. Also in the long run, it does not have significant effects on economic growth in both sub periods. In the short run and long run, for both sub periods, exchange rate has a consistent negative and significant effect on economic growth in Nigeria. Hence, Economic growth is more sensitive to exchange rate compared to monetary policy rate and cash reserve ratio in Nigeria. However, since exchange rate has significant impact on economic growth, combined with the present structure of Nigeria economy, revaluation of naira (exchange rate revaluation), will surely promote drastic increase in output level in Nigeria*

**Keywords:** Exchange Rate, Economic Growth, Monetary Policy Rate, Cash Reserve Ratio
**JEL Classification**: E52, O42

## 1. Introduction
Monetary Policy refers to the use of instruments and measures designed and implemented by the Monetary Authority to regulate the value supply and cost of money in an economy, in consistent with the anticipated level of economic activities. The policy instruments used by Monetary Authority to affect these macroeconomics policy targets are known as monetary policy instruments, which include bank rate (monetary policy rate), money supply, exchange rate, required reserves, domestic credit, liquidity ratio, and Open Market Operation (OMO). The

effects of monetary policy depend on the structure of the economy under analysis, the approach being adopted, the choice of instruments used and the identifying restrictions imposed on the models (Chuku, 2009). An appropriate measurement of the effects of monetary policy on macroeconomics policy targets is therefore essential for effective policy making and for choosing among alternative macroeconomic frameworks. The responses of macroeconomic policy targets to the trio of Bank rate, which is also known as Monetary Policy Rate (MPR), Cash reserve ratio and Exchange rate and their comparative impacts in achievement of monetary policy goals cannot be over emphasised. Although, a lot of works have been done in this area, such as Mangani (2009), Oluwole & Olugbenga (2015) the key interest is to find out if Bank rate in combination with other instruments like Exchange Rate and Cash Reserve Ratio can determine variation in macroeconomic goals like price stability, economic growth, full employment etc. Also, there is need to know the comparative impact of these three monetary policy instruments on the macroeconomics policy targets. Policy makers should know the prime or the most effective monetary policy instrument(s) in their country.

The study is an attempt to determine the most suitable of the monetary policy instruments for achieving economic growth, so as to aid the CBN in making a decisive policy. Hence, the broad objective of this study is to empirically determine the effects of monetary policy instruments on economic growth in Nigeria. While specific objectives of the research work are: to empirically determine the effect of bank rate, cash reserve ratio and exchange rate on economic growth in Nigeria both in the short run and long run; and to rank these monetary policy instruments in term of their comparative effectiveness in achieving economic growth.

## 2. Literature Review

*2.1 Conceptual Review*

*Required Reserves (RRs):* Reserve Requirements or Required Reserves are the minimum percentage of deposits that banks need to keep as reserves with central banks. This part of deposits cannot be used to provide private credit or to buy securities. Higher reserve requirements therefore reduce the money multiplier: For a given monetary base, broad money will decrease with higher reserve requirements. If the central bank targets quantities and keeps the monetary base constant, the effects of an increase in reserve requirements are analogous to a standard monetary contraction. Higher reserve requirements increase the level of interest rates. In order to fulfil the reserve requirements without reducing credit extended, banks need to attract more deposits, which drives up deposit rates. The increased marginal funding costs in turn will drive up lending rates as well and raise the general level of interest rates (CBN 2015)

*Bank Rate (Monetary Policy Rate)***:** The most influential economics tool the Central Bank has under its control is the ability to increase or decrease the monetary policy rate( Bank rate or Discount rate) .Shifts in this crucial interest rate have a drastic effect on the building blocks of macroeconomics, such as consumer spending and borrowing. For banks and depository institutions, the monetary policy rate is the interest rate assessed on short-term loans acquired from Central Banks (CBN 2015).

*Exchange Rate:* Exchange rate is the ratio between a unit of one currency and the amount of another currency for which that unit can be exchanged at a particular time. Exchange rate plays a vital role in a country's level of trade, which is critical for every free market economy in the world. It is therefore, not surprising that, exchange rate is among the most watched, analyzed and government manipulated monetary policy instruments. Most countries attempt to moderate their domestic currency fluctuations by imposing restrictions on exchange rate movements.

*Economic Growth:* A key challenge that modern economies are faced with is the achievement and sustenance of economic growth and development with the ultimate objective of enhancing the welfare of its citizens. Todaro (2005) define economic growth as the increase overtime of an economic capacity to produce those goods and services needed to improve the wellbeing of the citizens by increasing number and diversity. It is a steady process overtime by which the production capacity of the economy brings about rising level of national income

*2.2 Theoretical Literature Review*

*2.2.1 The Mundel – Fleming Theory of Monetary Policy*

The inability of the original Keynesian model to link the demand side to the supply side of the economy was however addressed by the Neo-Keynesian models starting with the Hicks ISLM model, which tried to simultaneously solve the product and money markets, and showed income and interest rates as linking variables that clear the two markets. The Keynesian Theory; is based on the presence of unemployment equilibrium in the economy and the issue of short run assumption. The Keynesian analysis believes that there are three motives for holding money; precautionary, transactions and speculative. The demand for precautionary and transactions motives is determined by the level of income and that of speculative motive is determined by the interest rate Today, the ISLM model as extended by Mundell- Fleming (1963) has metamorphosed into a large scale model that links the real and nominal variables.

Mundell was of the opinion that in order to achieve internal balance and external balance simultaneously, there is a need to apply monetary and fiscal policy simultaneously. Internal balance refers to domestic balance, i.e full employment with price stability. External balance refers to equilibrium in the balance of payment, which can be enhanced by economic growth. He highlights the fixed exchange rate so as to achieve equilibrium in the balance of payment since a freely fluctuating exchange rate system external balance is automatically achieved.

In order to achieve external balance, there is need to bring about equality between imports and exports. Expansionary monetary policy can be resorted to by reducing the rate of interest (MPR). It will lead to increase in the level of income (output i.e economic growth) and employment. Contractionary monetary policy can be resorted to by enhancing the rate of interest (MPR) which will lead to reduced investment, income (output) and employment. It will also lead to reduction in imports, i.e it will reduce inflation and deficit in the balance of payments.

*2.2.2 The J Curve Theory of Currency Depreciation and Economic Performance*

The J-curve effect is a type of diagram where the curve falls at the outset and eventually rises to a point higher than the starting point, suggesting the letter J. While a J-curve can apply to data in a variety of fields, such as medicine and political science, the J-curve effect is most notable in both economics and private equity funds; after a certain policy or investment is made, an initial loss is followed by a significant gain.

An example of the J-curve effect is seen in economics when a country's trade balance initially worsens following a devaluation or depreciation of its currency. The higher exchange rate first corresponds to more costly imports and less valuable exports, leading to a bigger initial deficit or a smaller surplus.

Due to the competitive, relatively low-priced exports, the affected country's exports of the goods in question start to increase as outside demand for the lower-priced option increases. Local consumers also purchase less of the more expensive imports and focus on local goods as the exchange rate makes certain locally produced items more affordable than the imported counterpart. The trade balance eventually improves to better levels compared to before devaluation.

*2.3 Empirical Review*

Barakchian and Crowe (2015), used conventional VAR method to assess the effects of monetary policy shocks on the economy of USA. After a contractionary monetary policy shock, short term interest rates increased, resulting in aggregate fall. In the two target variables, domestic output and price index responded very slowly. His result confirms results of Romer and Rome (2004). Diego (2010) adopted Structural Autoregressive VAR and his findings show increase in interest rate after contractionary monetary policy in Argentina. The interest shock resulted in temporary increase in output, while the shock has no significant effects on price level. However, the contractionary monetary policy produced an appreciation of the exchange rate, thus, no evidence of exchange rate puzzle.

Khan (2016) analysed the output effects of monetary policy. He examined the relationship between the growth of GDP and different monetary aggregate in 20 Sub Saharan African economies and found that credit growth has a statistically significant relationship with GDP growth than money growth in the countries. Mishra et al (2010) assessed the effectiveness of monetary policy by investigating the dynamics of the short run and long run relationship between money supply and output in India for the period 1950-2009. The estimation of the vector error correction model based on VAR indicated the existence of long run bidirectional causality between money supply and output and unidirectional causality from price level to money supply and output.

Jewaid, Qadri & Ali (2014) empirically assessed the effects of monetary policy, fiscal policy and trade policy on economic growth of Pakistan using annual time series data from 1981-2009. The policy variables are money supply, government expenditure and trade openness. In their methodology, they used error correction method, and found that monetary policy is statistically significant factor of domestic growth and it is more effective than fiscal policy in Pakistan. Also, Mugume (2011) examined the effectiveness of monetary policy transmission in Uganda to analyze the dynamic effect of monetary policy shocks. He used the Structural Vector Autoregressive (SVAR), approach to find the effects of monetary policy innovations on output, proxy by GDP, and inflation, proxy by consumer price index. The results of the estimated impulse-response functions are overall consistent with economic theory.

Chuku (2016) identified the effects of monetary policy on two monetary policy variable targets, domestic output and consumer price index and three alternatives policy instruments (money supply, minimum rediscount rate, and real exchange rate),in Nigeria. He found evidences that monetary policy shocks of money supply have modest effects on domestic output and consumer price index. Similarly, Oluwole and Olugbenga (2015) also found money growth (M2) as the most significant variable affecting output. Also, Adefeso and Mobolaji (2010) adopted Vector Error Correction Estimation (VECM) technique to determine the relative effectiveness of monetary policy and fiscal policy. Their results showed that the effects of monetary policy are stronger than fiscal policy. From the results, money stock is the most significant variable affecting output. This empirical finding confirms earlier findings of Oluwole and Olugbenga

(2015) that money growth (M2) is the most significant variable affecting output and consumer price index.

Also, Olorunfemi and Dotun (2013) assessed the impact of monetary policy on economic performance in Nigeria. Their non policy variable are inflation and domestic growth policy for GDP. They applied the co-integration estimation technique and Vector Error Correction (VECM). They found a negative relationship between interest rate and domestic output, while inflation rate is positively related to interest rate. At variance with this study, Saibu and Oladeji (2008) use GARCH model to assess the effects of fiscal and monetary policy shocks on real output in Nigeria. Their results showed that fiscal and monetary policy shocks had no significant effects on real output, and money supply is not statistically significant factor of output.

Qin & Pilipinas (2013) empirically investigated the effects of monetary policy on macro economy of China. They used three monetary policy instruments; interest rate, reserve ratio and money supply. Two policy targets were also adopted; GDP growth and Consumer price index. They carried out a simulation analysis on their macroeconomic model. Their findings indicated that GDP effect is virtually neutral in the long run when interest rate is used, but statistically significant when reserve ratio and money supply are used. This indicates that the use of interest rate as a monetary policy instrument is the most effective on consumer prices index, but is least effective on GDP growth. Similarly, Gamber and Haks (2005) also used macro economic model and two target variables; GDP and consumer price index. Their policy variable are 3 month treasury bills, a nominal interest rate and they applied simple three equations macro models. They found GDP growth rate and consumer price index are statistically significant. Their result did not correlate with that of Qin et al (2005).

Also, Star (2013) examined the real effects of monetary policy on economic performance in Russia, Ukraine, Belarus and Kazakhstan. He estimated a reduced form VAR, using five monetary policy variables; output, prices, money supply, interest rate and exchange rates. His findings indicate that increase in interest rate is associated with a significant drop in output. In all the Common Wealth of Independent States countries, an unanticipated shock to money stock leads to higher prices. In Ukraine and Belarus, a positive shock to real exchange rate i.e a depreciation, increase in price level relative to where it was suppose to be. Similarly, Cortis and Kong (2007) determined the impact of monetary policy shocks on only one of the target variable; real domestic output, in China. They applied vector error correction method and used impulse response function to trace the effects of interest rate and money supply on output. Their findings show that bank interest rate is the most significant factor of monetary policy; a better indicator when compared to money supply as a tool for monetary policy. However, Mangani (2009) found that exchange rate was the single most important variable affecting consumer price index. He used only one monetary policy target; price index. His result did not conform with earlier result where interest rate is the most significant variable affecting price index. In a related study, Raghavan et al (2009) measured the effects of Malaysian monetary policy using two estimation techniques a Vector Autoregressive (VAR) and Structural Vector Autoregressive Moving Average (SVARMA). The authors compared the impulse responses generated by VARMA models with those generated by VARs for the pre and post crises period. In their findings, VARMA impulses were more significant to those generated by VAR.

Adigwe (2017) in a study on monetary policy and economic growth in Nigeria, used the ordinary least square method to analyze the data between 1980-2010. The result of the study shows that monetary policy represented by money supply exerts a positive impact on GDP growth but a

negative impact on the rate of inflation. The recommendation of the study shows that monetary policy should facilitate a favorable investment climate through appropriate interest rates, exchange rate and a liquidity management mechanism and the money market should provide more financial instruments that satisfy the requirements of the evergreen sophistication of operators. while Olusegun (2016) investigated the effective monetary policy as a recipe for macroeconomic stability in Nigeria, using annual time series data from 1981 to 2014. The paper employed the OLS methodology with all the BLUE assumption. The results show that considering the lending rate magnitude, a 1% increase in RGDP (the proxy for economic growth) is brought about by a 0.86% increase in narrow money supply (M1) a 0.63% increase in broad money supply (M2) a 258% decrease in inflation rate (INFLARATE) a 1276.3% increase in the lending rate (LEDRATE) and a 143.9% increase in gross fixed capital formation. This implies that an increase in the lending rate and other related variables will lead to a significant increase in real GDP, proxy for economic growth in Nigeria. These indicate that indeed monetary policy has an effect on economic stability in Nigeria. Boghebo (2015) studied the monetary policy an economic growth in Nigeria between1980-2011. The data were extracted from the central bank statistical bulletin with selected macroeconomic variables, such as gross domestic product, inflation and balance of payment, using ordinary least square method and error correction model

*2.4 Theoretical Framework*

The theoretical framework adopted for this study follows essentially the Neo-Keynesian ISLM framework which suggests that:

National Income identity: $Y= C + I +G – (X-M)$..... 1

With the following structural equations:

Money Demand function: $Md/P = KY + \beta i$ , $K > 0, i < 0$ ..... 2

Money supply function : $Ms/P = m_1 B/P + m_2 i$ , $m_1, m_2 > 0$..... 3

Money market equilibrium : $Md = Ms$ ..... 4

Where Y is output, C is consumption, I is investment, G is government spending, X is export, M is imports, Yd is disposable income, T is tax, i is interest rate, E is exchange rate, B is external reserves, P is general price level, (price stabilty).

After substituting the structural equations into equation (1) and (10), we obtain the IS equation and LM equation respectively. Equating the IS equation to LM equation, we obtain the general equilibrium equation for output (Y),;which is expressed in functional form thus:

$Y = f ( i, Ms, E, B ,P, G_0, T, U)$. ..... 5

Where U represents the parameters in the general equilibrium equation

The explanatory variables in equation (3.4.9c ) above are monetary policy instruments and fiscal policy instruments. The monetary policy instruments in the equation, which is the main focus of this research, include i (interest rate also known as Monetary policy rate), E (Exchange rate), Ms (Money supply), B (External reserves). This equation shows how changes in the monetary policy variables ( e.g changes in CRR, MPR, Exchange rate) affect macroeconomic policy targets like inflation, output level (GDP). Within this framework, the monetary authority can target the interest rate (MPR), Exchange rate or it can target the money supply using either the interest rate (MPR) or the monetary base as its instrument ( and this include required reserves).

**3. Methodology**

*3.1 Data*

In line with the objectives of the research work, a single model is formulated from the theoretical framework for the macroeconomics policy target (dependent variables), namely economic growth. Furthermore, the model (linear functions) is specified along in line with the hypotheses. The linear equation is used for the estimation of the coefficients of long and short run equation. In addition, the study introduced structural breaks and break points to the data. The 2006 recapitalization of banks and insurance companies really made the monetary sector, which is a subset financial sector, deregulation a reality. Hence, the structural break was applied to two sub-periods for the model from 1981Q1 - 2006Q4 before recapitalization policy in Nigeria and from 2007Q1 – 2016Q4 after recapitalization policy in Nigeria.

The study used Quarterly time series data from 1981:1 to 2016:4. And these data was sourced from Central Bank of Nigeria (CBN) publications and National bureau of statistic. The first stage in the empirical investigation will be to analyse the time series properties of the data using the unit root (Augmented Dickey-Fuller) test to determine the order and level of difference stationary of the variables on the first order autoregressive process AR(1). The second set of analysis is to determine the co-integrating vectors that span the variables in the models to see if they are integrated of any order. In other words, we test whether the dependent variable and the explanatory variables have long run relationship, that is, whether they are co-integrated. If co-integration is established, it suggests the presence of causality between the independent and dependent variables at least in one direction (Gujarati, 1995).

In order to obtain estimates and results that are consistent and not methodology biased, two econometric estimation techniques will be used. And these are Autoregressive Distributed Lag Model (ARDL) and Vector Error Correction Model (VECM) after necessary test on reliability of data are conducted. The study adopts Autoregressive Distributed Lag (ARDL) approach developed by Pesaran *et.al.* (2001) to estimate equations. The choice of the ARDL is based on several considerations. Firstly, ARDL does not require stationarity of the data. In order words, ARDL can be applied irrespective of whether the underlying regressors are stationary at I(0) or I(1) or a mixture of both. Secondly, it has a small sample property. Thirdly, ARDL provides unbiased estimates of the long run model as well as valid t- statistics even when some of the regressors are endogenous (Harris and Sollis, 2003).

The presence of co-integration forms the basis for Vector Error Correction Model (VECM) specification. The VECM will be designed to capture the short- run deviations that may occur in estimating the long- run co-integration equation (Engle and Granger, 1987). Thus the models will be specified in their explicit stochastic error correction form. Conclusions and findings will be deduced from VECM estimates after being compared with the ARDL estimates. Also, test for structural stability will also be carried out using CUSUM, CUSUMSQ and Chow test. T-statistics and F-statistic will be used to carry out statistical significance at 95% confidence level. Coefficient of multiple determination ($R^2$) will also be used to judge the strength of the estimated standardized regression equations. Also, Durbin Watson statistic will be used to test for the presence of serial correlation (Autocorrelation), which is also common in time series data.

Standardized regression will be used to find out the comparative or relative impact of the monetary policy instruments (Bank rate, Cash reserve ratio, and Exchange rate) on the target variable (Economic growth). This will be done by computing the Beta coefficients of each explanatory variable (the monetary policy instrument).

*3.2 Model Specification*

In specifying the empirical model, the study adapts the Neo Keynesian ISLM model (Hick 1937) and Mugume (2011).

Thus, the general functional forms of the model is specified as follows:

GDPGR = f ( BR, CRR, ER,MS, )..... ..... 6

Where;

GDPGR = Gross Domestic Product Growth Rate

BR = Bank Rate, also known as monetary policy rate (MPR)

CRR = Cash Reserve Ratio

ER = Exchange rate

MS = Broad Money supply

In line with the objective of this study and the dynamic nature of the variables in the models, the comparative impact of bank rate, CRR and Exchange rate on economic growth in Nigeria is examined using Autoregressive distributed lag (ARDL) framework. As earlier said, the study adopts autoregressive distributed lag (ARDL) approach and Vector error correction model (VECM) to estimate equation (3.2.1). The statistic underlying the procedure is the F- statistic in a generalized Dickey – Fuller type regression, which is used to test the significance of the variables under consideration in an unrestricted equilibrium correction model.

Equation ( 3.2.1) can be stated in econometric forms as well as to reflect the structural break. Following studies by Chow (1960) and Klein (1965), we specified both pooled and structural break models in partial log linear form as follow:

*Time period of 1981:1-2016:4 (The pooled period)*

$GDPGR = a_0 + a_1BR + a_2CRR + a_3ER + a_4lnMSt + U$ ..... 7

*Time period of 1981:1 – 2006:4 (Period before recapitalisation)*

$GDPGR = b_0 + b_1BR + b_2CRR + b_3ER + b_4lnMSt + U$ ..... 8

*Time period of 2007:1- 2016:4 (Period after recapitalisation)*

$GDPGR = c_0 + c_1BR + c_2CRR + c_3ER + c_4lnMSt + U$ ..... 9

The hypotheses to be tested after the structural break are whether the coefficient of the variables after the break is equal to the coefficient of the variables before the break:

$b_1 = c_1\ b_2 = c_2\ b_3 = c_3\ b_4 = c_4$

The Assumptions of the above models are:

i. The Error terms are normally and randomly distributed.
ii. There is no relationship between successive error term, $E(U_i, U_j)$ , where $i \neq j$.
iii. Absence of serial correlation between the error term and the explanatory variables.
iv. Expected value of error term is equal to zero.
v. The variance of the error term is constant.

Following Pesaran et.al (2001), the Autoregressive Distributed lag (ARDL) formats of the above equations are formulated as follow:

$GDPGR_t = \beta_0 + \sum\delta_0 GDPGR_{t-i} + \sum\delta_1 BR_{t-i} + \sum\delta_2 CRR_{t-i} + \sum\delta_4 lnMS_{t-i} + e_t$ ..... 10

The specification of a long run relationship that will capture the short run deviations that might have occurred in estimating the long run co integrating equation requires an Error Correction term. Following Pesaran et al (2001) the Error Correction representation of the above ARDL model (3.2.5) is given as:

$\Delta GDPGR_t = \beta_0 + \beta_1 GDPGR_{t-1} + \beta_2 BR_{t-1} + \beta_3 CRR_{t-1} + \beta_4 ER_{t-1} + \beta_5 lnMS_{t-1} + \sum\delta_0 \Delta GDPGR_{t-i} + \sum\delta_1 \Delta BR_{t-i} + \sum\delta_2 \Delta CRR_{t-i} + \sum\delta_3 \Delta ER_{t-i} + \sum\delta_4 \Delta\ lnMS_{t-i} + e_t$ ..... 11

Where $\beta_0$ represents the drift component, $\Delta$ is the first difference operator and a, b, c, d, and e are the optimal lag lengths for each incorporated series. $\delta_i : i = 0,1,2,3,4$, are the short run dynamic coefficients, $\lambda : = 1,2,3,4,5...$ are the long run multipliers long run multipliers of the models. $e_t$ represents the stochastic term. The terms with the summation signs are used to model the short run dynamic structure.

Finally, the short run dynamic parameters of the model associated with the long run estimates can be obtained by estimating the following Error Correction Models given as:

$\Delta GDPGR_t = \beta_0 + \sum \delta_0 \Delta GDPGR_{t-i} + \sum\delta_1 \Delta BR_{t-i} + \sum \delta_2 \Delta CRR_{t-i} + \sum \delta_3 \Delta ER_{t-i} + \sum \delta_4 \Delta\ lnMS_{t-i} + \lambda ECM_{t-1} + e_t$ ..... ..... 12

Where ECM is the error correction term (representing the residual of the co integrating equation). $\lambda$ represent the coefficients of the ECM term for model (3.2.7) and its known as speed of adjustment. It shows how quickly the variables converge to equilibrium (i.e, speed of adjustment back to long run equilibrium after a short run disturbance). It should be statistically significant and negatively signed.

**4. Result**

*4.1 Unit Root Test of Stationarity*

The data were tested for unit root by using the Augmented Dickey Fuller (ADF test). Non spatiality of time series data has often been regarded as a problem in empirical analysis. Working with non-stationary variables leads to spurious regression result from which further inference is meaningless. The first step is therefore to test for stationarity of the variables using Augmented Dickey Fuller unit root test: Table 4.1.1 below shows the unit root test result

Table 4.2: Augmented Dickey Fuller test for Unit Root

| Variables | ADF Static | Critical Value 1% | Critical Value 5% | Critical Value 10% | Order of Integration |
|---|---|---|---|---|---|
| ΔGDPGR | -11.148 | -4.0298 | -3.4418 | -3.1455 | I(1) |
| ΔlnMS | -9.6360 | -4.0249 | -3.4422 | -3.1457 | I(1) |
| ΔEXR | -10.7767 | -4.0239 | -3.4418 | -3.1455 | I(1) |
| ΔCRR | -9.2621 | -2.5816 | -1.9431 | -1.6152 | I(1) |
| ΔBR | -6.5092 | -4.0259 | -3.4427 | -3.1460 | I(1) |

*Source: Author's computation*

The ADF Statistic of each of the variables is greater than the critical values (1%, 5% and 10%). It shows that all the series are I(1) variable and significant at 1 %. This reveals that the data does not contain I(2) series, hence provides support for the use of ARDL model.

*4.3 Test for Co integration*

*4.3.1 Co-integrating result before structural break for the model (1981:1 to 2006:4)*
Table: 4.3.1: Co-integrating Result Before Break

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.1 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.350985 | 107.5399 | 84.37817 | 0.0012 |
| At most 1 * | 0.260340 | 65.17462 | 60.08629 | 0.0387 |
| At most 2 | 0.172308 | 35.62128 | 39.75526 | 0.2204 |
| At most 3 | 0.134675 | 17.08811 | 23.34234 | 0.4084 |
| At most 4 | 0.029281 | 2.912391 | 10.66637 | 0.8868 |

*Trace test indicates 2 cointegrating eqn(s) at the 0.1 level; * denotes rejection of the hypothesis at the 0.1 level; **MacKinnon-Haug-Michelis (1999) p-values*

The table 4.3.1 above reports the co integration test results before the structural break for model 1. The trace statistic test indicates 2 co-integrating relationship or vectors at 10% level of significance. To determine the co- integrating test, we compare the trace statistic to the critical value. The trace statistics value (65.1746) is greater than the critical value (60.08629). Thus the VECM is estimated using 2 co-integrating vectors.

*4.3.2 Co-integrating result after structural break for the model (2007:1 to 2016:4)*
Table: 4.3.2: Co-integrating Result After Break

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.1 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.797533 | 134.6671 | 84.37817 | 0.0000 |
| At most 1 * | 0.651054 | 70.78005 | 60.08629 | 0.0117 |
| At most 2 | 0.337684 | 28.66650 | 39.75526 | 0.5821 |
| At most 3 | 0.195467 | 12.18600 | 23.34234 | 0.7990 |
| At most 4 | 0.083467 | 3.486272 | 10.66637 | 0.8144 |

*Trace test indicates 2 cointegrating eqn(s) at the 0.1 level; * denotes rejection of the hypothesis at the 0.1 level; **MacKinnon-Haug-Michelis (1999) p-values*

The table 4.3.2 above reports the co integration test results after the structural break for model 1. The trace statistic test indicates 2 co-integrating relationship or vectors at 10% level of significance. To determine the co- integrating test, we compare the trace statistic to the critical value. The trace statistics value (70.78) is greater than the critical value (60.08). Thus the VECM is estimated using 2 co-integrating vectors.

*4.4: Test for Structural Stability of Model*

The Central Bank of Nigeria in 2006 embarked on extensive financial system and monetary policy reformation with the recapitalization of banks and non-banks (financial institutions). Consequent to this reform, this study carried out structural stability test to determine the structural break in our models. A structural change is said to have taken place when a change is observed in the regression parameters of the estimated models. Any structural break is accompanied by the change in relevant model coefficients. Such changes can be shifted in intercepts or slopes (or both). Since the parameters of econometrics models form the basis of optimal decision rules and in turn determines policy decisions, these emphasised the importance of parameters stability in empirical studies. Also, ignoring structural changes in empirical studies can lead to false conclusion and wrong policy recommendation.

This study applied three stability tests: Chow test, Cumulative sum of recursive residuals (CUSUM) and Cumulative sum of the square of recursive residual (CUSUMSQ). Both CUSUM and CUSUMSQ are applied on the residuals of all variables of VECM model. If the plot of CUSUM and CUSUMSQ statistics stays within the critical bound of 95% level of significance, the null hypothesis is that coefficients in the error correction model cannot be rejected. If any of the lines crosses, the null hypothesis of coefficient constancy at 95% level of significance will be rejected. That means the equation parameters are considered unstable (structural break presence), if the whole sum of recursive error gets outside the two critical lines of both test; while in Chow test, the F statistic is compared with the theoretical at 5% level of significant and (N-2K, K) degree of freedom. If the F statistic is greater than the critical values, we reject the null hypothesis of no structural break.

Figure 4.4.1A

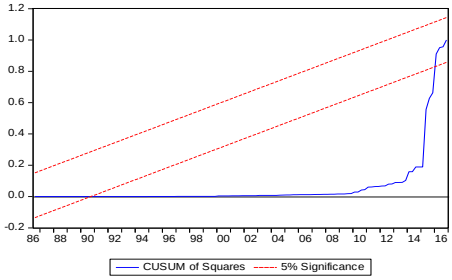



Figure 4.4.1 B

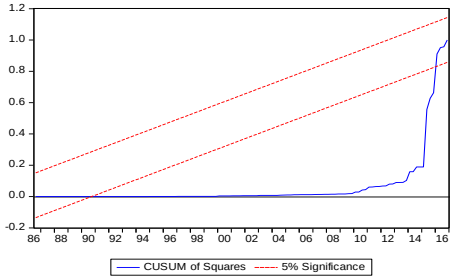



Table 4.4.1 Chow Breakpoint Test: 2006Q1

| | | | |
|---|---|---|---|
| F-statistic | 1.204255 | Prob. F(5,133) | 0.3106 |
| Log likelihood ratio | 6.331733 | Prob. Chi-Square(5) | 0.2753 |
| Wald Statistic | 6.021275 | Prob. Chi-Square(5) | 0.3042 |

*Source: Author's computation*

From figure 4.4.1A and B above it can be seen that the plot of the CUSUM and CUSUMSQ statistics do not stay within the critical bound of 95% level of significance, hence, the null hypothesis of coefficient constancy at 95% level of significance is rejected. This is also supported by the chow test. From table 4.4.1, since the F-statistic (1.204) is greater than the critical value (0.3106), we reject the null hypothesis of no break at specified breakpoints. Therefore, model (economic growth) shows that there was structural break and the result is accepted. The study will proceed to estimate the two sub periods i.e 1981:1 to 2006:4 and 2007:1 to 2016:4

*4.5 Presentation and interpretation of Regression Results*

*4.5.1 ARDL Results for model 1 before break (1981:1 to 2006:4)*

Table: 4.5.1: ARDL Short run And Long Run Results befo**re break**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| *Short run coefficients* | | | | |
| D(GDPGR(-1), 2) | -0.207322 | 0.242202 | -0.855985 | 0.3945 |
| D(GDPGR(-2), 2) | -0.392025 | 0.186266 | -2.104651 | 0.0384 |
| D(GDPGR(-3), 2) | -0.279761 | 0.129786 | -2.155564 | 0.0340 |
| D(CRR, 2) | 6.047410 | 13.934147 | 0.433999 | 0.6654 |
| D(BR, 2) | 2.803886 | 4.202857 | 0.667138 | 0.5066 |
| D(EXR, 2) | -4.311143 | 1.708604 | -2.523310 | 0.0009 |
| D(EXR(-1), 2) | 0.283379 | 1.341317 | 0.211269 | 0.8332 |
| D(EXR(-2), 2) | -6.339874 | 1.335594 | -4.746857 | 0.0008 |
| D(EXR(-3), 2) | -5.431457 | 1.441031 | -3.769147 | 0.0003 |
| D(LNMS, 2) | 0.319089 | 0.129276 | 2.468273 | 0.0157 |
| D(LNMS(-1), 2) | -0.351784 | 0.146221 | -2.405843 | 0.0184 |
| D(LNMS(-2), 2) | -0.181192 | 0.162991 | -1.111669 | 0.2695 |
| D(LNMS(-3), 2) | 0.487032 | 0.184972 | 2.632999 | 0.0101 |
| CointEq(-1) | -0.881742 | 0.281174 | -3.135928 | 0.0024 |
| Cointeq = D(GDPGR) - (6.8585*D(CRR) + 3.1799*D(BR) + 5.9882*D(EXR) + 0.7161*D(LNMS) + 12.6891 ) | | | | |
| *Long Run Coefficients* | | | | |
| D(CRR) | 6.858481 | 15.638897 | 0.438553 | 0.6621 |
| D(BR) | 3.179940 | 4.959014 | 0.641244 | 0.5232 |
| D(EXR) | 5.988239 | 3.938629 | 1.520387 | 0.0023 |
| D(LNMS) | 0.716056 | 0.208846 | 3.428629 | 0.0010 |
| C | 12.689111 | 12.196859 | 1.040359 | 0.3012 |

*Source: Author's Computation*

From the coefficients of the estimated ARDL model in table 4.5.1 above, there is a positive relationship between bank rate and economic growth both in the short run and long run. This is not theoretically in line and it is different from ours a-priori expectation. However, these results are not statistically significant because the t-statistic is less than the critical value. This result is different from the finding of Cortis and Kong (2007), which shows that bank rate is the most significant factor of growth. But this result correspond with the finding of Qin et al (2009), which stated that the use of interest rate has no significant impact on economic growth. Also, in the short run, current value of Exchange rate, with second and third lag values have negative and statistically significant relationship with economic growth. This is theoretically in line for an economy that is import dependent like Nigeria. The third lag value of exchange rate is also statistically significant. The negative relationship between economic growth and exchange rate at various lags means that the persistent devaluation of naira is inimical to economic growth in Nigeria. And the statistical significance of the estimates shows how sensitive the Nigerian economy is to exchange rate. Also, this shows that exchange rate as a monetary policy instrument, has a significant impact on economic growth in Nigeria in the short run. This result is

similar to that of Chuku (2009), Okwu et al (2011), but contrary to that of Mugume (2011). However, from the long run ARDL result, there is a positive relationship between exchange rate and economic growth, and the effect is statistically significant at 10% (critical value at 10% is 1.289 which is less than the t- statistic 1.5204). Cash Reserve Ratio (CRR) has positive relationship with economic growth both in the short run and long run. This is not theoretically in line and it is different from our apr iori expectation. However, the result is not statistically significant both in short run and long run. This shows that economic growth is not sensitive to changes in CRR in Nigeria. The coefficient of the error correction term had the right sign and it is significant at 5%.

*4.5.2 ARDL Results for model 1 after break (2007:1 to 2016:4)*

Table: 4.5.2: ARDL Short run And Long Run Results after break

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| *Short Run Coefficients* | | | | |
| D(GDPGR(-1), 2) | -0.463169 | 0.401100 | -1.154749 | 0.2601 |
| D(GDPGR(-2), 2) | -0.798489 | 0.347721 | -2.296350 | 0.0311 |
| D(GDPGR(-3), 2) | -0.686465 | 0.270381 | -2.538883 | 0.0183 |
| D(CRR, 2) | 58.637722 | 21.801205 | 2.689655 | 0.0131 |
| D(CRR(-1), 2) | -34.707594 | 21.930696 | -1.582603 | 0.1272 |
| D(CRR(-2), 2) | -35.613788 | 23.241791 | -1.532317 | 0.1391 |
| D(CRR(-3), 2) | 77.335526 | 34.026316 | 2.272815 | 0.0327 |
| D(BR, 2) | -496.152343 | 219.862434 | -2.256649 | 0.0338 |
| D(EXR, 2) | -16.124361 | 9.943921 | -1.621529 | 0.0492 |
| D(LNMS, 2) | 0.594813 | 0.473681 | 1.255725 | 0.2218 |
| D(LNMS(-1), 2) | 0.712480 | 0.486895 | 1.463313 | 0.1569 |
| D(LNMS(-2), 2) | 0.317664 | 0.538560 | 0.589840 | 0.5610 |
| D(LNMS(-3), 2) | 1.538261 | 0.539568 | 2.850915 | 0.0090 |
| CointEq(-1) | -0.583731 | 0.475423 | -1.227813 | 0.2319 |
| Cointeq = D(GDPGR) - (102.8338*D(CRR) -849.9679*D(BR) -27.6229 *D(EXR) -3.8330*D(LNMS) + 2179.9425 ) | | | | |
| *Long Run Coefficients* | | | | |
| D(CRR) | 102.833758 | 79.891431 | 1.287169 | 0.2108 |
| D(BR) | -849.967890 | 854.813275 | -0.994332 | 0.3304 |
| D(EXR) | -27.622946 | 7.210671 | -3.830842 | 0.5642 |
| D(LNMS) | -3.833003 | 4.528072 | -0.846498 | 0.4060 |
| C | 2179.942531 | 2038.746060 | 1.069257 | 0.2960 |

*Source: Author's Computation*

From the estimated ARDL model presented in table 4.5.2 above, the current value of CRR and third lags value have a positive relationship with economic growth and the result is statistically significant at 5%. But, CRR at both lags 1 and lags 2 have a negative relationship with economic growth. This is in line with the apriori expectation. But this relationship is not statistically significant at even 10% (because the t-statistics are less than the critical value i.e 1.68). This also means that this instrument does not have significant impact on economic growth in Nigeria in this period. Bank rate has a negative relationship with economic growth, this is theoretically in line.

And the result is statistically significant. This result confirms the earlier finding of Barakchian and Crowe (2010) and Star (2005) that showed that increased in interest is associated with a significant drop in output. This result is different from what was obtained in the model before structural break.

Exchange rate has a negative relationship with economic growth, and this relationship is statistically significant at 10%. This result is confirmed by the finding of Mangani (2009), which state that exchange rate was the single most important variable affecting output level and consumer price index. This is the same with the result obtained in the model before structural break, where exchange rate in lags 2 and 3 period has a negative and significant relationship with economic growth. This negative relationship between exchange rate and economic growth points to the fact that depreciation of naira does not favour economic growth in Nigeria. Practical experience shows that the results are expected because depreciation of exchange rate only favours countries with strong domestic production base for tradable country.

From the long run ARDL estimates, only exchange rate has significant, but negative relationship with economic growth. Although bank rate has the correct sign, the relationship is not significant. From the long run ARDL estimated model before and after structural break, exchange rate has a statistical significant but negative relationship with economic growth.

*4.5.3 VECM Results before structural break (1981:1 to 2006:4)*

*4.5.3.1 Short run Estimates of model 1 before structural break*

The vector error correction regression estimates of the short run dynamic specification for the policy target variable economic growth model (model 1) before structural break is shown in Table 4.5.3.1 below.

Table 4.5.3.1: Results of Short Run VECM Before Break

| Regressor | Coefficient | Standard Error | T-statistics |
|---|---|---|---|
| ΔGDPGR(-1) | -0.7894 | 0.1357 | -5.8194 |
| ΔGDPGR(-2) | -0.8579 | 0.1508 | -5.6868 |
| ΔGDPGR(-3) | -0.4903 | 0.1506 | -3.2541 |
| ΔGDPGR(-4) | -0.0218 | 0.1251 | -0.1745 |
| ΔCRR(-1) | -16.4199 | 18.4018 | -0.8923 |
| ΔCRR(-2) | -17.4586 | 18.8220 | -0.9275 |
| ΔCRR(-3) | -9.3479 | 17.1832 | -0.5440 |
| ΔCRR(-4) | -6.9818 | 13.9269 | -0.5013 |
| ΔBR(-1) | 5.2987 | 6.8628 | 0.7721 |
| ΔBR(-2) | 4.3253 | 6.5652 | 0.6588 |
| ΔBR(-3) | 2.7967 | 5.9243 | 0.4720 |
| ΔBR(-4) | 2.7145 | 4.6355 | 0.5855 |
| ΔEXR(-1) | -0.5559 | 1.8270 | -0.3043 |
| ΔEXR(-2) | -4.2087 | 1.9562 | -2.1514 |
| ΔEXR(-3) | -5.5425 | 1.9599 | -2.8279 |
| ΔEXR(-4) | 3.7618 | 1.7309 | 2.173 |
| Intercept | 5.2123 | 25.3214 | 0.2058 |
| Ecm1 | -0.08014 | 0.00951 | -8.4367 |
| $R^2$= 0.6971 | | | |
| Adjusted $R^2$ = 0.6082 F- statistics = 7.84 | | | |
| Akaike A/C = 12.116 Schwarz sc = 12.7 | | | |

*Source: Author's computation*

From the results in table 4.5.3.1 above, CRR has negative relationship with economic growth from lags 1 to 4. This conforms to the a priori expectation but they are not statistically significant even at 10 %. This shows that CRR does not affect economic growth in this period. These results correspond with what was found in the ARDL estimates. And it correlates with the finding of Qin et al (2004), which showed that reserve ratio is for addressing inflation and not GDP. Bank rate from lags 1 to lags 4 has a positive relationship with economic growth. This is also contrary to the a priori expectation. And the result is not statistically significant. This result conforms to the ARDL result. However, this result is contrary to the findings of Star (2005), which state that increase in interest rate is associated with a significant drop in output. This shows that in the short run, bank rate as a monetary policy instrument does not affect economic growth in Nigeria. Also, Exchange rate from lags 2 to lags 4 has a negative relationship with economic growth and the result is statistically significant at 10%. This is consistent with what was obtain in the ARDL estimates. This result is similar to that of Khan (2010) which analyzed the output effect of exchange rate. However, Exchange rate at lags 1 has a negative but significant relationship with economic growth. The coefficient of error correction term had the right sign and it is significant.

The coefficient of determination ($R^2$) shows that the model has a good fit because 69.71% variation in economic growth is explained by the estimated regression equation. And all the regressors are simultaneously different from zero because the $R^2$ is statistically significant, since the F-statistics is greater than the critical value at 5%.

*4.5.3.2 Long run Estimates of model 1 before structural break*

Table 4.5.3.2: Results of Long Run VECM Before Break

| Regressor | Coefficient | Standard error | T statistics |
|---|---|---|---|
| ΔCRR(-1) | -193.3518 | 56.0058 | -3.4523 |
| ΔBR(-1) | 85.3578 | 17.8610 | 4.7790 |
| ΔEXR(-1) | -13.60647 | 5.6623 | -2.40297 |
| ΔLnMS(-1) | -2.1643 | 0.5768 | -3.7517 |
| Intercept | 39.806 | | |

*Source: Author's computation*

The long run estimates of the VECM shows that CRR has a negative relationship with economic growth and the result is statistically significant. This is in line with the monetarist view. This shows that in the long run, CRR may be a significant monetary policy instrument that can be used by the monetary authority to achieve economic growth; however, this result is different from what was obtained from the long run ARDL estimates. Bank rate has a positive and significant relationship with economic growth and it is statistically significant, this result is contrary to most empirical work earlier reviewed; Olorunfemi and Dotun (2008), Diego (2010) and Cortis and Kong (2007). Exchange rate has negative relationship with economic growth and the relationship is statistically significant. This result is consistent with what was obtained in the long run ARDL estimates.

*4.5.3.3 VECM Results after structural break (2007:1 to 2016:4)*

Table 4.5.3.4 Short Run Estimates of Model 1 after Structural Break

| Regressor | Coefficient | Standard Error | T-statistics |
|---|---|---|---|
| ΔGDPGR(-1) | -0.1785 | 0.2958 | -0.6034 |
| ΔGDPGR(-2) | 0.01679 | 0.3153 | 0.05327 |
| ΔGDPGR(-3) | 0.03519 | 0.38075 | 0.09244 |
| ΔGDPGR(-4) | 0.271326 | 0.41811 | 0.64894 |
| ΔCRR(-1) | 1.079721 | 40.3682 | 0.02675 |
| ΔCRR(-2) | 3.11138 | 39.6533 | 0.07846 |
| ΔCRR(-3) | 39.63406 | 40.3848 | 0.98141 |
| ΔCRR(-4) | -40.17960 | 54.0349 | -0.7436 |
| ΔBR(-1) | 101.4149 | 245.861 | 0.41249 |
| ΔBR(-2) | 166.7 | 310.472 | 0.53697 |
| ΔBR(-3) | -101.732 | 320.990 | -0.3169 |
| ΔBR(-4) | -65.8008 | 279.345 | -0.2355 |
| ΔEXR(-1) | 16.3452 | 40.3774 | 0.40481 |
| ΔEXR(-2) | 76.7467 | 40.2581 | 1.90636 |
| ΔEXR(-3) | -35.4846 | 12.6492 | -2.80528 |
| ΔEXR(-4) | -70.9475 | 40.9470 | -1.73266 |
| Intercept | 30.4365 | 276.967 | 0.10989 |
| Ecm1 | -0.39966 | 0.18644 | -2.1436 |
| $R^2$= 0.7507 Adjusted $R^2$ = 0.4599 F- statistics = 2.5817 | | | |
| Akaike A/C = 18.01616 Schwarz sc = 18.9450 | | | |

*Source: Author's computation*

From the results in table 4.5.3.4 above, CRR has positive relationship with economic growth from lag 1 to lag 3, excepts that of lag 4 that is negative. Only the CRR at lag 4 conforms to the apriori expectation. However, they are all individually not statistically significant even at 10%. This shows that CRR does not affect economic growth in this period. This is confirmed by the finding of Qin et al (2005). They said that CRR is a significant variable for inflation control. Bank rate from lags 1 to lags 2 has a positive relationship with economic growth and this is also contrary to the a priori expectation. But bank rate from 3rd lag to 4$^{th}$ lag has negative relationship with economic growth, but the relationship is as well, not statistically significant. This result conforms to the ARDL result. This shows that in the short run, bank rate does not affect economic growth in Nigeria. Also, Exchange rate at lags 1 has a positive relationship with economic growth but the result is not statistically significant even at 10%. However, Exchange rates at lags 3 and lags 4 have a negative and significant relationship with economic growth. This corroborate with the fact that depreciation of naira does not support economic growth in Nigeria and also the significance of exchange rate as a monetary policy instrument. The coefficient of error correction term had the right sign and it is statistically significant.

The coefficient of determination ($R^2$) shows that the model has a good fit because 75.07% variation in economic growth is explained by the estimated regression equation. And all the

regressors are simultaneously different from zero because the $R^2$ is statistically significant, since the F-statistics is greater than the critical value at 5%.

However, as earlier said, the short run does not tell us much about the effects of monetary policy instruments on macroeconomics policy targets because they are adjustment mechanism toward the long run equilibrium. The usefulness of the error correction models produce better short run forecast and hence provides the short run dynamics essential to obtain long run equilibrium.

*4.5.3.5 Long run Estimates of model 1 after structural break*

Table 4.5.3.5: Results of Long-run VECM after Break

| Regressor | Coefficient | Standard error | T statistics |
|---|---|---|---|
| ΔCRR(-1) | 126.674 | 47.0380 | 2.69302 |
| ΔBR(-1) | -90.9753 | 562.556 | -0.16172 |
| ΔEXR(-1) | 113.3461 | 49.244 | 2.30172 |
| ΔLnMS(-1) | 6.024267 | 1.92043 | 3.13693 |
| Intercept | -182.8465 | | |

*Source: Author's computation*

The long run estimates of the VECM after structural break, shows that CRR has a positive relationship with economic growth and the result is statistically significant. Bank rate has a negative relationship with economic growth, this is theoretically inline, but it is not statistically significant. Exchange rate has positive relationship with economic growth and the relationship is statistically significant. This finding is the same with that of Raghauan et al (2009).

*4.5.3.6 Summary Results before and after Structural Break*

From the analysis of model 1 for both alternative sub periods, the coefficients of the estimated regressions (for both ARDL and VECM) are not the same in the two sub periods. There are significant changes in the coefficients of the policy variables. This means that the 2006 structural reform in the financial sector in Nigeria brought changes in bank rate, CRR , exchange rate and also changes in economic growth.

Also, from the two sub periods CRR does not have any significant effects on economic growth in short run, but it has effects in the long run. In the short run, in both sub periods, bank rate does not have significant effect on economic growth. Also in the long run, bank rate does not have significant effects on economic growth in both sub periods. In the short run and long run, for both sub periods, exchange rate has a consistent negative and significant effect on economic growth in Nigeria.

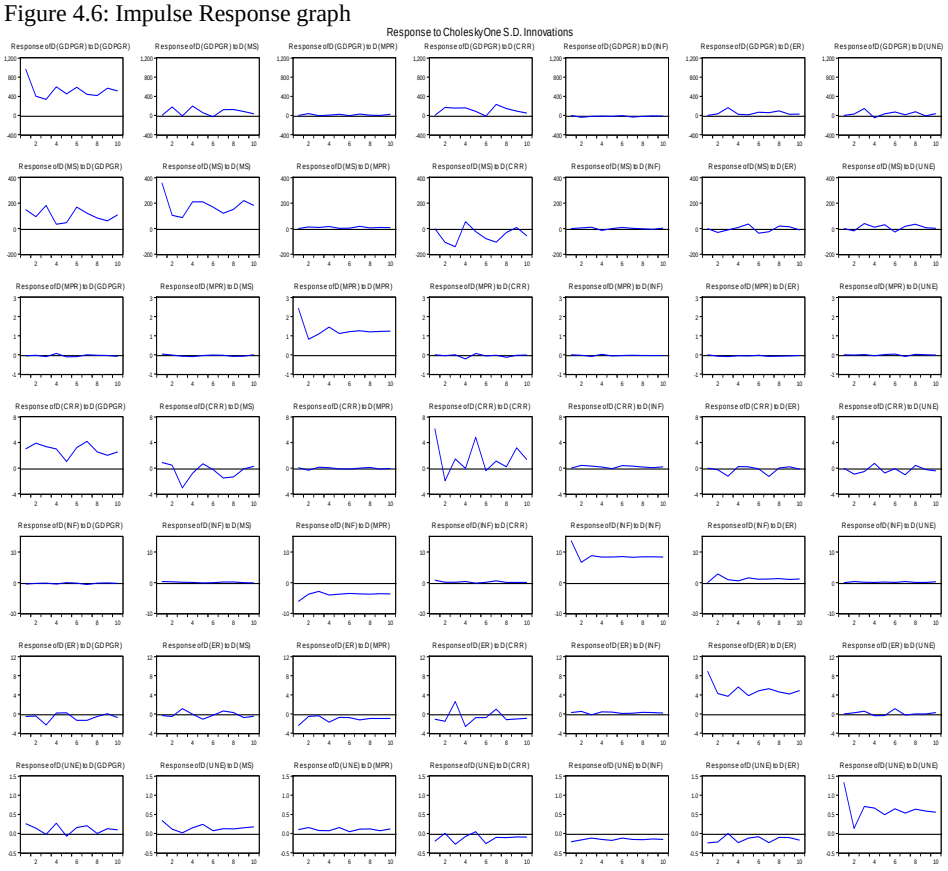
*4.6 Impulse Response Analysis of Monetary Policy Instruments on Economic Growth*

The graphs display the effects (impulse response) of a one – standard deviation monetary policy shock defined as an exogenous, unexpected and temporary rise in the bank rate, cash reserves ratio, exchange rate and money supply. Each panel illustrates the response of the target variable (economic growth) to its own one – standard deviation changes which corresponds to a positive shock, the response of the target variable to a one – standard deviation changes in all the monetary policy instruments (corresponding either to a positive or a negative shock), the response of each policy variable to its own one – standard error innovation or changes, and the response of each policy variable to other policy variables.

The analysis holds that a zero value is an indication of non – effect of monetary policy shock on the target variables and as a result, the target variable continues on the same path it would have

followed, had there been no policy shocks in the system. A positive or negative value thus indicates that shocks would cause the variable to be above or below its natural path. The solid lines depict the estimated effects, while the dashed lines show the boundaries of a 95% confidence interval. The solid line is the point estimate while the dotted lines represent a one – standard error confidence bound around the point estimate. The size of the shocks and monetary policy change or innovation is measured by standard deviations of the corresponding orthogonal errors obtained from the model estimation. The impulse responses estimated for the three models support widely held conventional views of many macroeconomic dynamics.

Figure 4.6: Impulse Response graph




*4.6.1 Analysis of the Impulse Responses Shock to Economic Growth*

The responses of economic growth to a one standard deviation shock to monetary policy rate (MPR), cash reserve ratio (Crr) and exchange rate are presented in figure 4.6 above. It is evident that the response of GDP growth rate to an expansionary shock in the MPR in Nigeria is not favourable and it is not statistically significant. The estimated effects line (impulse response line) remains almost on the zero value line or line of no – effect. This indicates a non – effect of

monetary policy shock on the target variable (i.e economic growth), which also means that the target variable continues on the same path it would have followed had there been no policy shocks in the system. This indicates that output level does not respond steadily to changes in the MPR in Nigeria. This result corroborate those of Chuku (2009) and Mugume (2011). It is also supported by the findings from the ARDL and VECM analysis carried out in section 4.5 above. One could have expected the increase in MPR to affect GDP growth rate negatively and the decrease in MPR to affect GDP growth rate positively through investment. The explanation could be credited to the fact that in Nigeria, MPR has no significant effects on Deposit money banks lending rate.

Measuring the economic growth responses to monetary innovation in Crr, the impulse – response results graphically revealed a sluggish response of GDP growth rate to a positive Crr shock. In the 1st and 5th quarter , GDP growth rate has zero response. The responses became positive but weak after the 6th quarter. And the response remains persistently decreasing from the 7th quarter. This shows that output level in Nigeria does not respond to changes in Crr. This is also in line with the findings from the ARDL and VECM analysis.

The impulse response also shows that GDP growth rate also respond positively but sluggishly in the entire periods except in the 5th and 9th quarter, to shocks in the foreign exchange rate. At the early stage, i.e 1st quarter, output level was not responsive to the exchange rate depreciation policy because the impulse response line was on zero line. The response of output level slightly improves from the 3rd quarter but with a down turn at the 5th quarter. GDP growth rate response to exchange rate shock after the 5th quarter has been persistently positive but the response has not being significantly impressive. Practical experience shows that the results are expected because depreciation of exchange rate is expected to favour countries with strong domestic production base for tradable in the country. Though the output response to shocks in exchange rate is insignificant, it is theoretically consistent for an import dependent economy like Nigeria not to promote currency depreciation policy. Also, output level is relatively sluggish in response to shocks in monetary policy variables.

*4.7 Variance Decomposition Analysis for Economic Growth*

The results of the variance decomposition reveal the dynamic behavior of the variables in the ARDL and VECM system of equations. In particular, we based the analysis of variance decomposition on the forecast error variance in order to capture the direction of which variables effect is larger, so that we can subsequently make a distinction on the importance or significance of the variables in the system.

From table 4.7.1, the result of variance decomposition of GDP growth rate at the 9th period indicates that about 88% of the forecast error variance of GDP growth rate is accounted by the previous growth rate of GDP; while the remaining 10.22% is accounted for by the shocks in the monetary policy variables which include MPR, Crr, and Exchange rate. Out of this 10.22% variation in GDP growth rate, MPR accounts for only 0.10%, this is relatively very insignificant. Crr accounts for 5.17% variation in GDP growth rate, while exchange rate accounts for only 1.45%.

Table 4.7.1: Results of Variance Decomposition of GDP Growth Rate

| Period | S.E. | D(GDPGR) | D(MS) | D(MPR) | D(CRR) | D(INF) | D(ER) | D(UNE) |
|---|---|---|---|---|---|---|---|---|
| 1 | 971.2218 | 100.0000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 | 0.000000 |
| 2 | 1082.217 | 94.43966 | 2.690427 | 0.133788 | 2.441626 | 0.113665 | 0.098840 | 0.081996 |
| 3 | 1164.506 | 89.97243 | 2.332067 | 0.117018 | 3.799137 | 0.127056 | 2.033223 | 1.619072 |
| 4 | 1334.964 | 88.56955 | 3.962903 | 0.091221 | 4.315503 | 0.109025 | 1.578926 | 1.372872 |
| 5 | 1414.042 | 89.15638 | 3.709804 | 0.115543 | 4.206462 | 0.114811 | 1.417404 | 1.279591 |
| 6 | 1534.725 | 90.33014 | 3.186641 | 0.099284 | 3.581463 | 0.097995 | 1.387411 | 1.317071 |
| 7 | 1619.237 | 88.53315 | 3.428004 | 0.120651 | 5.226671 | 0.128698 | 1.369959 | 1.192867 |
| 8 | 1686.982 | 87.63991 | 3.686105 | 0.112332 | 5.519439 | 0.133200 | 1.597480 | 1.311538 |
| 9 | 1785.618 | 88.48863 | 3.496617 | 0.100271 | 5.173770 | 0.121720 | 1.446111 | 1.172882 |
| 10 | 1859.743 | 89.19447 | 3.251948 | 0.110974 | 4.841539 | 0.118974 | 1.356718 | 1.125380 |

*Source: Author's computation*

*4.8 Comparative Impact Analysis of Monetary Policy Instruments using Standardize Regression*

This is done in order to achieve the fourth objective of this research work which is to rank the monetary policy instruments in term of their comparative effectiveness in achieving the selected macroeconomic goals in Nigeria. This analysis is carried out using standardize regression. The size of the estimated coefficients of the policy variables which is called beta coefficients is the basis for the comparative impact analysis. Unlike the impulse response and variance decomposition analysis, the explanatory variables in the standardize regression for each model will be limited to the identified monetary policy instruments.

*4.8.1 Results of the estimated standardized regression*

Table: 4.8.1 Standardized Regression Result

| Regressors | Coefficient | Stan. error | T- ratio | probability | Beta coeff. |
|---|---|---|---|---|---|
| EXR | 71.559 | 9.836 | 7.27 | 0.000 | 0.7536 |
| CRR | 204.419 | 19.34 | 10.57 | 0.000 | 0.4394 |
| MPR | 112.94 | 58.63 | 1.93 | 0.056 | 0.7482 |
| InMs | -411.9 | 275.81 | -1.49 | 0.138 | -0.1510 |
| intercept | -2055.69 | 1157.88 | 1.93 | 0.078 | |
| $R^2$ = 0.8118 , Adjusted $R^2$ = 0.8064, F- statistics (4 , 139) = 149 | | | | | |

*Source of table: Authors computation*

From table 4.8.1above, the estimated standardized regression is well behaved because 81.18% variation in economic growth is explained by the estimated regression equation. The model has a good fit and it is statistically significant at 5% since the F –statistics (149) is greater than the critical value (2.37). This means that all the estimated coefficients are all simultaneously different from zero. The results show that if the standardized exchange rate increases by one standard deviation, on the average, the standardized GDP growth rate increases by about 0.7537standard deviation, holding other factors constant. Also, if the standardized CRR increases by one standard deviation, on the average, the standardized GDP growth rate increases by about 0.4394 standard deviation, holding other factors constant. Also, if the standardized monetary policy rate (MPR), also known as bank rate increases by one standard deviation, on the average, the standardized GDP growth rate increases by about 0.0748 standard deviation, holding other factors constant.

Exchange rate and CRR are individually statistically significant.The highest beta coefficient of the policy variables is exchange rate which is *0.7537*.This means that exchange rate as a policy instrument, has the greatest impact or effect on achieving economic growth in Nigeria. The next in the rank is CRR, while the last within the scope of the study is MPR which beta coefficient is only 0.0748.

*4.9 Policy Implications of Findings*

The results of the data analysis generated vital issues that concern policy evaluation and hence a reliable guide for effective monetary policy implementation in Nigeria. Monetary innovations are not all neutral, it rather depends on the monetary policy instruments that are been used.

Firstly, the central bank interest rate i.e monetary policy rate which is also known as bank rate does not have significant impact on the output level in Nigeria. This could be attributed to the high interest rate which is excessively higher than the bank rate. The high gap between interest rate or lending rate and the monetary policy rate (i.e non sensitivity of interest rate to monetary policy rate) has made this instrument a non veritable policy instrument for achieving economic growth. Also, cash reserve ratio does not have consistent significant impacts on the output level. This may also be due to the non sensitivity of interest rate to CRR. However, exchange rate has a consistent significant impact on the output level in Nigeria. This is expected of a country that import almost every product in the market, but export just very few products. More than 95% of the country's total exports are made up of oil and gas. As a result, the inflow of export receipts is highly dependent on oil prices, and hence, on the performance of the oil sector. In effect, external shocks are often transmitted to the domestic economy through oil price shock which eventually affect the exchange rate. The recent economic recession in Nigeria can be traced to exchange rate problem.

**5. Conclusion and Recommendation**

The critical need for the achievement of sustainable economic growth, a single digit inflation rate and massive reduction in unemployment rate in Nigeria cannot be over emphasized. The study shows the empirical facts about monetary policy instruments that monetary authority can deploy to achieve these objectives. Also, the study shows the empirical facts that not all the monetary policy instruments are effective tools in macroeconomic management in Nigeria.

Overall, the study found that economic growth responds sluggishly and negatively to a positive shock in cash reserve ratio and monetary policy rate and their impacts on economic growth are not significant in the short run. However, in the long run, cash reserve ratio has a significant impact on economic growth, while monetary policy rate does not have significant impact on economic growth even in the long run. The reasons why the output level in Nigeria is not sensitive to monetary policy rate may be due to the non statistical significant correlation between monetary policy rates and deposit money banks lending rate which is the transmission through which monetary policy rate should affect economic growth. With efficient response of money stock to adjustment in cash reserve ratio, cash reserve ratio may become a significant monetary policy tool to achieve sustainable economic growth in Nigeria. Although, the response of economic growth to positive shocks in exchange rate is not entirely sluggish, the relationship is negative and statistically significant. In both short run and long run, exchange rate has negative and significant impact on economic growth. The negative relationship means that the depreciation of naira affects Nigeria output level negatively. Practical experience shows that the results are expected because depreciation of exchange rate is not expected to favour countries with poor or weak domestic production base like Nigeria. However, since exchange rate has

significant impact on economic growth, combined with the present structure of Nigeria economy, revaluation of naira (exchange rate revaluation), will surely promote drastic increase in output level in Nigeria.

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