Bullion

Volume 44 | Number 4 Article 6

12-2020

Impact of monetary policy on inflation rate in Nigeria: Vector Autoregressive Analysis

Eggon Ahmed Henry
Nassarawa State University, Keffi

Ajidani Moses Sabo
Nassarawa State University, Keffi

Impact of Monetary Policy on Inflation Rate in Nigeria: Vector Autoregressive Analysis

Eggon Ahmed Henry
Department of Economics, Faculty of Social Sciences
Nasarawa State University, Keffi

Ajidani Moses Sabo
Department of Economics, Faculty of Social Sciences
Nasarawa State University, Keffi

ABSTRACT

The Nigerian monetary authorities have implemented several monetary management policies with the aim of achieving price stability and economic growth in the country, but without success. This study was conducted to examine the impact of monetary policy management on inflation in Nigeria during the 1985- 2019. Autoregressive distributed lag analysis was employed on time series data covering the period. It was found that while monetary policy rate and foreign exchange rate impacted negatively on inflation; broad money supply impact positively on it. Therefore, the study recommended that monetary authorities should fix the exchange rate at where the value of naira will rise. Besides, government should direct more investment on productive activities in other to increase output of goods and services in the country. This will lead to a fall in inflation rate and hence economic growth in the country.

KEY WORDS: Broad Money supply, Economic growth, Foreign Exchange Rate, Inflation Rate, Monetary Policy Rate.
JEL Classification: E52 C01 C22

1.0 Introduction

The core idea of monetary policy has been construed to mean price stability at the expense of other key performance indicators like economic growth that culminates to job creation which measures the growth performance of a nation, stable broad money supply as well as prime lending and exchange rates which determine financial sector's stability in an economy . This is why the main objective of monetary policy in Nigeria has been to ensure price and monetary stability. This is achieved mainly by causing savers to avail investors of surplus funds for investment through appropriate interest rate structures; stemming wide fluctuations in the exchange rate of the naira; proper supervision of banks and related institutions to ensure financial sector soundness; maintenance of efficient payments system; application of deliberate policies to expand the scope of the financial system so that domestic economies, which are largely informal, are financially included. Financial inclusion is particularly important in the sense that the larger it is, the larger is the interest rate sensitivity to production and aggregate demand and the more effective monetary policy is in stabilizing prices (Mbutor, 2010).

Consequently, the effectiveness of monetary policy in taming inflationary trends in developing economies such as the Nigerian economy has been in doubt although appreciable progress has

been made in this regard since the introduction of various financial sector reform programs in 1986. Goshit (2006) undertook a theoretical examination of the causes of financial sector's instability in Nigeria and its implications for the development of the economy and reported that ensuring a sound and stable financial sector has been a difficult task for the monetary authorities. This is due to rapid financial sector liberalization, loose monetary policy and excessive fiscal spending, banking malpractice, undue political interference in banking operations, as well as, poor internal governance of the financial institutions. This study views an effective monetary policy as the major tool of enhancing financial sector's stability in Nigeria through the stabilization of prices. Thus, the Nigerian monetary policy framework has continued to face several challenges. No wonder, the CBN is increasingly focusing more on the aspect of price stability, recognizing its relevance in macroeconomic stability for sustainable output and employment growth. In contrast, economists have disagreed, about whether price stability and money supply should be the central objective of macroeconomic policies or whether these policies should serve broader monetary policy goals (Nwosa et al, 2011).

For Nigeria and other developing countries, growth policies are better delivered as full packages since fiscal and monetary policies are inextricable, except in terms of the instruments and implementation authorities. However, monetary policy appears more potent in correcting short-term macroeconomic maladjustments because of the frequency in its application and altering the policy tools, relative ease of its decision process and the sheer nature of the sector which propagates its effect to the real economy – through the financial system. This is why investigating the effectiveness of monetary policy under market mechanisms in controlling inflation in the Nigerian economy is relevant.

Since mid-1980s, inflation has become so serious and contentious a problem in Nigeria and other developing economies. Though inflation rate is not new in the Nigerian economic history, the recent rates of inflation have been a cause of great concern to many. During the period under review (1985–2017), there has been a dwindling trend in the inflationary rates leading to major economic distortions. The continued over valuation of the naira in 1980s, even after the collapse of the oil boom engendered significant economic distortions in production and consumption as there was a high rate of dependence on import which led to balance of payment deficits. This resulted into taking loans to finance such deficits. An example was the Paris Club loan, which was a mere$5.39billion in 1983 and subsequently rose to $21.6billion in 1999 (CBN 2001).

The Economic Recovery Emergency Fund of 1986 where one percent of workers' salaries was deducted monthly to build the funds was meant to curb inflationary trends in Nigeria. This gradually and greatly reduced the purchasing power of the working class. But the policy measures failed as the prices of goods and the profits of corporate bodies were not controlled. Therefore, as prices rose, the labor unions agitated for higher wages, resulting in further higher prices (Agba, 1994). The factors behind the unsatisfactory performance of monetary policy management and economic growth in Nigeria can be explained within the purview of domestic and external factors. In the domestic front, there has been the problem of corruption, poor governance, mismanagement of resources, and bank failures have led to inadequate funds for productive sectors, in particular manufacturing sub-sector, leading to poor performance, which has worsened the Nigerian economic performance. In the external front, there has been the problem of consistent fall in exchange value of naira as a result of excess importation of manufactured goods over exportation

leading to dwindling foreign exchange earnings for Nigeria and hence her inability to finance economic growth programs and to import the needed raw materials and technologies that could be used to quicken the pace of economic growth towards fighting inflation in Nigeria. It is against this background this study was designed to examine the impact of monetary policy on inflation in Nigeria during the 1985-2019. The paper is divided into five sections. Section 1 is the introduction. Section 2 deals with literature review, including conceptual and theoretical review, and theoretical framework as well as empirical review. Section 3 contains methodology and data. Section four is concerned with data presentation and interpretation of results. Finally, conclusion and recommendations are contained in section 5.

2.0 Literature Review

2.1 Conceptual and Theoretical Review

Monetary policy is a deliberate action of the monetary authorities to influence the quantity, cost and availability of money and credit to achieve desired macroeconomic objectives of internal and external balances (CBN, 2011). Sani et al (2012) defined monetary policy as the combination of measures taken by monetary authorities (e.g. the CBN and the Ministry of Finance) to influence directly or indirectly both the supply of money and credit to the economy and the structure of interest rate for economic growth, price stability and balance of payments equilibrium.

By definition, inflation is a persistent and appreciable rise in the general level of prices (Jhingan, 2002). Not every rise in the price level is termed inflation. Therefore, for a rise in the general price level to be considered inflation, such a rise must be constant, enduring and sustainable. The rise in the price should affect almost every commodity and should not be temporal. But Dernburg and McDougall (1980)'s definition is more explicit referring to inflation as a continuing rise in prices as measured by an index such as the Consumer Price Index (CPI) or by the implicit price deflator for Gross National Product (Jhingan 2002). Thus, a practical definition of inflation would be persistent increase in the general price level at a rate considered too high and therefore unacceptable (Hameed, 2010).

There are three approaches to measure inflation rate. These are the Gross National Product (GNP) implicit deflator, the Consumer Price Index (CPI) and the producer price index (PPI). The period to period changes in the two latter approaches (CPI and PPI) are regarded as direct measures of inflation. There is no single-one of the three that rather uniquely best measures inflation. The Consumer Price Index (CPI) approach, though it is the least efficient of the three, is used to measure inflation in Nigeria as it is easily and currently available on monthly, quarterly and annual basis (CBN, 1991).This study views inflation as a function of monetary policy. This means that keeping inflation at tolerable level depends on the effectiveness of monetary policy.

Monetary policy is the macroeconomic policy laid down by the central bank. It involves management of money supply and interest rate and it is the demand side economic policy used by the government of a country to achieve macroeconomic objectives like inflation, consumption, growth and liquidity (The Economic Times, 2018). All central banks have three tools of monetary policy in common. Most have many more. They all work together in an economy by managing bank reserves.

The monetary authorities have six major tools of monetary management. First, it sets a reserve requirement, which tells banks how much of their money they must have on reserve each night. If it weren't for the reserve requirement, banks would lend 100 percent of the money you've

deposited. Not everyone needs all their money each day, so it is safe for the banks to lend most of it out. The CBN requires that banks keep a certain percent of deposits on reserve. That way, they have enough cash on hand to meet most demands for redemption. For instance, when the Fed wants to restrict liquidity, it raises the reserve requirement. The Fed only does this as a last resort because it requires a lot of paperwork. It's much easier to manage banks' reserves using the Fed funds rate. This is the interest rate that banks charge each other to store their excess cash overnight. The target for this rate is set at the eight annual Federal Open Market Committee meetings. The Fed funds rate impacts all other interest rates, including bank loan rates and mortgage rates.

The Fed's third tool is its discount rate. That's how it charges banks to borrow funds from the Fed's fourth tool, the discount window. The FOMC sets the discount rate a half-point higher than the Fed funds rate. The Fed prefers banks to borrow from each other. Fifth, the Fed uses open market operations to buy and sell Treasury and other securities from its member banks. This changes the reserve amount that banks have on hand without changing the reserve requirement. Sixth, many central banks use inflation targeting to manage monetary policy. It clearly sets expectations that they want some inflation. The Fed's inflation goal is 2 percent for the core inflation rate. People are more likely to buy if they know prices are rising. In addition, the Federal Reserve created many new tools to deal with the 2008 financial crisis. These included the Commercial Paper Funding Facility and the Term Auction Lending Facility.

Economic growth is defined in Business Dictionary (2001) as increase in a country's productive capacity as measured by comparing gross domestic product (GDP) in a year with the GDP in the previous year. Increase in capital stock, advances in technology and improvement in the quality and level of literacy are considered to be the principal causes of economic growth (Faridi, 2012). According to Dernburg and McDougall (1980) and Jhingan (2002) economic growth is the growth of the potential output of an economy as a result of expansion in stock of capital and in labour force as well as improvement in the productivity of both labour and capital. It is related to a quantitative sustain increase in a country's per- capital output accompanied by expansion in its labour force, consumption, capital and volume of agricultural trade. It is important to state that no individual(s) or country can export what it did not produce.

2.2 Theoretical Framework

This study is situated on the famous quantity theory of money propounded by Fisher (1911). The theory in its simplest form depicts that changes in the stock of money supply will be translated into equi-proportionate change in the general price level (inflation rate). This is based on the assumption that at full employment, the level of transaction (national output) and velocity is constant, or at least change slowly (Adenuga et al, 2000). Thus, inflation will be directly proportional with the quantity of money stock. The starting point of the quantity theory of money is the popular identity:

$$MV=PY \ldots\ldots (2.1)$$

Where M = money supply, V = velocity of money in circulation, Y = real national output, and P = aggregate price level. From equation 2.1, we can derive another equation as follows:

$P=MV/Y$ or

$$V=PY/M \ldots\ldots (2.2)$$

Sequel to the above, the proportional relationship between the money stock and general price level (inflation) can be shown in the elasticity of the price level with respect to the money supply is:

$$Epm=\partial P/\partial M . M/P \ldots\ldots (2.3)$$

Differentiating equation 2.1 totally yields:

$$M\partial V+V\partial M=P\partial Y+Y\partial \ldots\ldots (2.4)$$

But Y and V are constant at full

employment, i.e. change in Y and V is zero at full employment. Thus, equation 2.4 yields:

$V\partial M = Y\partial P$ ----------(2.5)

$\partial P/\partial M = V/Y$ ----------(2.6)

Substituting equation 2.6 into equation2.3 yields:

$Epm = V/Y.\ M/P$ ----------(2.7)

From equation 2.2, $V=PY/M$. Substituting this into equation 2.7 yields:

$Epm = 1/Y.\ PY/M.\ M/P = 1$ ----------(2.8)

Equation 2.8 above depicts that there is a direct proportional relationship between the general price level (inflation) and the growth rate of money supply, when velocity and output are constant. That is, in a regression of inflation on money supply growth, the coefficient of money is expected to be unity (1). The proportional relationship imply that a permanent increase in money growth leads to an equal increase in the rate of inflation (general price level).

2.3 Empirical Review

Inflation is one of the most important economic variables that can distort economic activities of any country. As a result, there exist a large number of empirical studies on the determinant of inflation. Khan and Schimmelpfennig (2006) examined the relative importance of monetary factors and structural list supply-side factors for inflation in Pakistan. A stylized inflation model is specified that includes standard monetary variables (money supply, credit to the private sector), exchange rate, as well as wheat support price as a supply-side factor that has received considerable attention in Pakistan. The model is estimated for the period January 1998 to June 2005 on a monthly basis. The results indicate that monetary factors have played a dominant role in recent inflation, affecting inflation with a lag of about one year. Changes in the wheat support price influence inflation in the short run, but not in the long run. Furthermore, the wheat support price matters only over the medium term if accommodated by monetary policy.

Amarasekara (2009) examined the impact of monetary policy on inflation and economic growth in Sri Lanka. The impact of money supply growth, changes in exchange rate and interest rate on inflation and economic growth was analyzed using a vector autoregressive (VAR) framework with two lags. The study adopted a quarterly, seasonally adjusted data from 1978 to 2005 on variables such as interest rate, money supply, inflation and real GDP in Sri Lanka. Results from the study indicated that inflation in Sri Lanka does not fall after contractionary changes in monetary policy. Furthermore, inflation reduced immediately exchange rate appreciated and the rate of interest also rose following a contractionary reserve shock.

Dagher and Kovanen (2011) analyses the stability of the money demand function in Ghana using bounds testing procedure developed by Pesaran et al, (2001). They estimated an Auto-Regressive Distributive Lag (ARDL) model which includes changes in broad money, its own lags, current and lagged values of the explanatory variables. The explanatory variables include income, exchange rate, deposit rate, TB rate, US TB rate, and the US libor rate. They find that the TB rate, US TB rate and the Libor rate have no significant impact on the demand, while income and exchange rate were found to have significant effects. Specifically, they found that depreciation increases money demand as is the increase in incomes. Furthermore, they found a faster convergence of the ECM to equilibrium once there is a misalignment. Using a CUSUM and CUSUM squares test on the residuals of the ECM model, they found that the money demand was stable.

Lungu et al, (2012) examined the behavior of the demand for money in Malawi for the period 1985 to 2010. Specifically, they sought to tackle two objectives: to estimate a demand for money function; and to test for the stability of the money demand function. Their model include real money

balances, real GDP, inflation, TB rate, exchange rate, and a measure of financial depth. The model estimates showed that short-run dynamics are mainly driven by lagged money balances, prices and financial innovation. However, their results showed that the exchange rate, income and TB rate were not significant. The error correction term was negative and significant, implying that variables return to equilibrium after a shock. Using characteristic roots, they found that the estimated VECM was stable.

Gul et al, (2012) studied how monetary instruments influence macroeconomic variables such as, inflation, interest rate, real GDP, exchange rate and money supply in Pakistan. OLS was used to analyse and explain the relationship between the above mentioned variables. Secondary source of data from 1995 to 2010 was used. Results from the study showed that money supply has a strong positive correlation with inflation but negative correlation with output. Exchange rate also has a negative impact on output in Pakistan. A tightening monetary policy is expected to reduce inflation, but in the case of Pakistan, a positive interest rate shock (contractionary monetary policy) led to an increase in price level.

Asuquo (2012) investigated the impact of monetary policy on price stability in Nigeria. He examined shocks in monetary policy and its responses on inflation, market interest rate and exchange rate. Monetary policy rate was used as a proxy for monetary policy indicators. Secondary data were collected from December 2006 to February 2012. 2006 was chosen because it was when the monetary policy rate was introduced. Structural VAR framework was used to estimate the model. Results from the study revealed that market interest rate and exchange rate were more responsive to shocks in monetary policy rate than inflation in Nigeria. Furthermore, expected changes in inflation cannot be guaranteed by variations in the monetary policy rate. Other instruments, mainly, reserve requirements and open market operations used along with the monetary policy rate can effectively reduce inflation in Nigeria.

Ahiabor (2012) focused mainly on the effect of monetary policy on inflation in Ghana. Variables such as interest rate, inflation, money supply and exchange rate were studied. The research adopted secondary data source from 1985 to 2009 and critically analysed the variables quantitatively. Findings from the study confirmed a theoretically expected long-run positive correlation between inflation and money supply, an inverse relationship between inflation and interest rate, as well as, a positive relationship between inflation and exchange rate in Ghana.

Ogunsakin & Awe (2014) investigates the impact of financial sector reforms on the stability of the money demand function in Nigeria. They estimate a parsimonious error correction model (ECM) which include real broad money balances; inflation; exchange rate; foreign interest rates; savings deposit rate; Treasury bill, and a dummy for post-liberalisation era. They find that the significant determinants for money demand in Nigeria are inflation, foreign interest rates, Treasury bill rate; savings deposit rate and real GDP. A test for the stability shows that the demand for money function remained stable despite the reforms, implying using of monetary targets is still relevant.

Quartey and Afful-Mensah (2014) reviewed recent monetary and financial policies pursued, as well as, the possible inter-relationships in Ghana. They posited that any effective monetary policy should be accompanied by fiscal discipline to ease monetary difficulties associated with huge budget deficits. Data on money supply, exchange rate, inflation and lending rates were compiled from Ghana Statistical Service and Bank of Ghana Statistical Bulletin from 1997 to 2012. The study concluded that the key monetary indicators improved during the period of study. However, fiscal imbalance in the

country has restricted the results.

In Nigeria, Oyejide (1972) study constituted a pioneering attempt at providing an explanation of the causes of inflation in Nigeria, most especially from the structuralists' perspective. Specifically, the study examined the impact of deficit financing in propagating inflation processes in Nigeria and concluded that there was a very strong direct relationship between inflation and the various measures of deficit financing that were in use between 1957 and 1970. In a commissioned study for the Productivity, Prices and Incomes Board of Nigeria, Ajayi and Awosika (1980) found that inflation in Nigeria is explained more by external factors, most especially the fortunes of the international oil market and, to a limited extent, by internal influences. It is therefore imperative to investigate the effectiveness of monetary policy in taming inflation as a means of preventing both external and internal influences of inflation in the Nigerian economy.

The effectiveness of monetary policy in controlling inflation in Nigeria was examined by Ngerebo (2016). Relationship among variables such as inflation, savings rate, monetary policy rate, prime lending rate, maximum lending rate, treasury bill rate, growth of narrow money supply, net domestic credit, growth of broad money supply, net credit to government and credit to private sector were analysed and tested using OLS. Secondary source of data from 1985 to 2012 was collected from the Statistical Bulletin of the Central Bank of Nigeria. The study revealed that monetary policy rate, maximum lending rate, prime lending rate, net domestic credit and treasury bill rate were not statistically significant, while growth of broad money supply, credit to private sector, growth of narrow money supply, savings rate, net credit to government were statistically significant in explaining how they affect inflation in Nigeria. The findings indicated that some monetary policy instruments in Nigeria are effective in managing inflation, while others are not.

3.0 Methodology and Data

This study adoptedex-post facto method to investigate the effect of monetary policy on inflation rate in Nigeria during the 1985-2019. To achieve this, the paper used secondary data on included variables and the techniques of autoregressive distributed lag (ARDL) to carry out the analysis. The data were subjected to various data treatment methods before being used for estimating the model. The estimated model would also be subjected to statistical and econometric tests like t-test, goodness of fit, F-test and Durbin-Watson test to determine its policy implications.

To capture the impact of monetary policy on economic growth in Nigeria, Fisher's (1911) model was applied in this study. The model states that the short-run monetary control is dictated by interest rates, which were sticky, but in the long-run the demand for money influence was real cash balance. Fisher further assumed that the rise in commodity prices would precede the increase in interest rate which was regarded as main channel of the firms operation cost. The model is specified as:

$MV=PT$.....(3.1)

Where M is the actual money stock, V is the transaction velocity of circulation of money, P is the average price level and T is the number of transactions made per the period. Fisher imposed the assumption that the equilibrium values of V and T will be fairly constant in the short-run and invariant with respect to change in the quantity of money.

Given the assumption, equation (3.1) can be re-written as:

$Mv=Pt$.....(3.2)

Where: v and t are constants. Given that M is exogenous, there must be proportional relationship in equilibrium between money supply (M) and the general price level (p).

The quantity theory of money was employed by (okafor, 2009 and Nasko, 2016), with a simple growth model. It is

based on the link between the stock of money (M) and the market value of output that it finances (PY), where P is the price level and Y is the output. M is related to P with a factor of proportionality k, the relationship is given by:

$M=kPY$.....(3.3)

$M/p=KY$.....(3.4)

K is assumed to be constant Equation (3.4) can actually be written as:

$MV=PY$.....(3.5)

Where V= $^1/k$ and this is the income velocity of money, the ratio of money income (nominal GDP) to the number of times the stock of money turns over in a given period in financing the flow of nominal income. Therefore, V is a useful concept in monetary policy making.

Equation (3.3) can be written in growth form as:

$M= P+ Y- V$.....(3.6)

If V is constant then V=0 so that equation (3.6) yields:

$M= P+ Y$.....(3.7)

Given the technical output of the economy in line with the Cobb-Douglas (1928) and Barro (1990) as:

$Y= (AL\alpha K\beta)$.....(3.8)

Where:

Y = Gross Domestic Product (determinant of economic growth)

L = Labour input

K = Capital input

A = Efficiency parameter

α= Contribution of each worker to GDP

β= Contribution of each unit of capital to GDP, and α +β = 1, implying constant return to scale. Or alternatively, total output (Y) is the sum of sectoral output or a function of sectoral input. Therefore:

$Y = P + G$.....(3.9)

That is,

$Y = P (Lp + Kp) + g (Lg + Kg)$.....(3.10)

Similarly:

$Y = LT + KT + G$.....(3.11)

This is the theory upon which the model for this study is built.

Following studies by (Quartey and Afful-Mensah, 2014; and Ngerebo, 2016), we modify equation (3.8) as follows:

$A=h (MPR_{t-1}, BMS_{t-1}, FER_{t-1})$.....(3.12)

Where:

MPR= Monetary Policy Rate;

BMS=Broad Money Supply;

FER= Foreign Exchange Reserves;

Then by substituting Equation (3.12) into Equation (3.8), we arrive at the following extended form:

$Yt = f (MPR_{t-1}, BMS_{t-1}, FER_{t-1} Y_{t-1}, L_t)$...(3.13)

Since Cobb-Douglas (1928) model that was adopted in this study is an optimisation model, it is suitable for application in Nigeria. The regression form of the model is stated in a linear form as:

$Y= \beta_0 + \beta_1 MPR_{t-1} + \beta_2 BMS_{t-1} + \beta_3 FER_{t-1} + b_4 Lt + U_t$.....(3.14)

Equation (3.14) was adjusted by dropping labour force (Lt) and replacing output (Yt) by inflation rate (INFt). Thus, the linear model stated in the log form becomes:

$\ln INFt = \beta_0 + \beta_1 \ln MPR_{t-1} + \beta_2 \ln BMS_{t-1} + \beta_3 \ln FER_{t-1} + U_t$.....(3. 15)

Where:

ln= Logarithm;

INFt = Inflation Rate at time t;

MPRt-1= Monetary Policy Rate at time t-1;

BMSt-1=Broad Money Supply at time t-1;

FERt-1= Foreign Exchange Rate at time t-1;

β_0= Intercept of the regression model;

$\beta_1 - \beta_3$ = Coefficients of the explanatory variables to be estimated; and

U = Error term.

It is expected that $\beta_0, \beta_1, \beta_2$, and $\beta_3 > 0$

The data used for this study were from secondary sources- the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), Journals, the internet and other documentary sources. The data which covered the period 1985-2019 were sourced on the relevant variables used in the study as identified in equation (3.15). The reasons for choosing these variables were also adduced earlier in the section, while the choice of the period of the study is due to the fact that it witnessed quite a number of financial sector reforms geared towards the realisation of monetary policy targets. Before estimation, we will determine whether the variables are stationary or not. This will determine the underlying properties of process that

generate our time series data. In addition, the Augmented Dickey-Fuller (ADF) t-test shall be used to determine the order of integration.

Quantitative method of analyses was employed to assess the effectiveness of monetary policy in controlling inflation in Nigeria. Thus, the Augmented Dickey Fuller Unit Root Test was used to determine the stationary state of the data series. Granger Causality Test was employed to determine the causal relationship between monetary policy and inflation, while vector auto regressive (VAR) technique was adopted in carrying out the analysis.

To avoid misleading results, it is important to first determine the stationary state of the data for the study.

The models used for the test of the inflation data series (INF) are in the following forms:

$\Delta INF_t = \partial_{t-1} + U1$ .....(3.16)
$\Delta INF_t = \beta_{1t} + \partial INF_{t-1} + U_{2t}$ .....(3.17)
$\Delta INF_t = \beta_{1t} + \beta_{2t} + \partial INF_{t-1} + U_{3t}$ .....(3.18)
Where, t is the time/trend variable, ∂ is the co-efficient of unit root, Δ is the rate of change in inflation and the U's are the error terms. The difference between equation (3.16) and the other last two equations lies in the inclusion of the constant (intercept) (β_{1t}) and the trend (β_{2t}). Note that the stationary state of the other variables or data series were also tested using similar models. In each case the null hypothesis is that ∂=0, which is the same as saying that there is a unit root.

The Granger technique (Granger, 1969; Gujarati, 2004) has been adopted to determine the direction of causal relationship between monetary policy and inflation in Nigeria. Granger proposed that for a pair of linear covariance stationary time series X and Y; X causes Y if the past values of X can be used to predict Y more accurately than simply using the past values of Y. Formally, X is said to cause Y if $\partial^2_1 (Y_t: Y_{t-j}, X_{t-i}) < \partial^2_2 (Y_t: Y_{t-j})$, where ∂ represents the variance of forecast error and i, j =1,2,3,…,k.

The Granger causality test requires the use of F-statistic to test whether lagged information on a variable say "Y" provides any statistical information about another variable "X"; if not, then, "Y" does not Granger cause "X".

Notably, the vector auto regressive distributed lag (VAR) Technique of regression was used to determine the impact of monetary policy on inflation in Nigeria. Although the VAR analysis deals with the dependence of one variable on other variables, it does not imply causation-that is, it is assumed that the variables in question are not bilaterally related, the independent variables are not collinear, and the disturbance terms are normally distributed and not serially correlated. Thus, the VAR technique is suitable because of its simplicity and the validity of its assumptions.

The unit root result in table 4.1 showed that inflation is stationary at level (0). This is

DATA PRESENTATION AND INTERPRETATION OF RESULTS

Table 4.1: Unit Root Test Result

Variable	ADF Stat.	Critical Values (5%)	Order of Integration
INF	-3.70	-3.59	I(0)
MPRt-1	-5.43	-2.99	I(1)
BMSt-1	-4.24	-2.99	I(1)
FERt-1	-3.31	-2.99	I(1)

Source: Author's computation, 2020,using E-View 10.0

because the ADF statistic (-3.70) in absolute terms is greater than the critical value (-3.59) at 5% level of significance. The result further indicated that MPR, BMS and FER were stationary only after first differencing at 5% level of significance. Therefore, the unit root result suggests that MPR, BMS, and FER have a short-run effect on INF in Nigeria.

Table 4.2: Pairwise Granger Causality Test Result

Null Hypothesis	Obs	F-Statistic	Prob	Decision
MPR does not granger Cause INF	35	0.07919	0.11699	Reject Ho
INF does not Granger Cause MPR	35	2.09381	0.14820	Accept Ho
BMS does not Granger Cause INF	35	0.29150	0.46622	Reject Ho
INF does not Granger Cause BMS	35	2.12826	0.88031	Accept Ho
FER does not Granger Cause INF	35	0.20635	0.63498	Reject Ho
INF does not Granger Cause FER	35	1.90700	0.17338	Accept Ho

Source: Author's computation, 2020, using E-View 10.0;

Note: α=0.05 level of significance, F_{α}=4.28

The Granger causality test result in table 4.2 showed that a uni-directional relationship exists between INF and MPR running from MPR to INF and not from INF to MPR. This implies that monetary policy rate Granger-Cause inflation rate, but inflation rate does not Granger-Cause monetary policy rate in Nigeria within the study period-all at 5% level of significance. However, the result further revealed that independence is suggested between BMS and INF, as well as, between FER and INF at 5% level of significance.

Table 4.3: Ordinary Least Squares Result

Dependent Variable: LOG(INF)
Method: Least Squares
Date: 03/02/20 Time: 10:27AM
Sample: 1985-2019
Included observations: 34
Excluded observations: 1

Variable	Coefficient	Std Error	t- statistic	Prob
C	3.494137	2.674680	1.306376	0.2049
LOG(MPRt-1)	0.050506	0.553355	0.091272	0.9281
LOG(BMSt-1)	0.072683	0.201844	0.360098	0.7222
LOG(FERt-1)	-0.096031	0.285886	-0.335907	0.7401
R-squared	0.342409		Mean dependentvar	2.723447
Adjusted R-squared	0.222847		S.D. dependentvar	0.759643
S.E. of regression	0.669673		Akaike info criterion	2.201522
Sum squared resid	9.866170		Schwarz criterion	2.441492
Log likelihood	-24.72055		F-statistic	2.863860
Durbin-Watson stat	1.345957		Prob(F-statistic)	0.047393

Source: Author's computation, 2020, using E-View 10.0

Using the results in table 4.3, equation becomes:

LOG (INF) = 3.494137052 + 0.050505819 86*LOG (MPRt-1) - 0.07268345811*LOG (BMSt-1) - 0.0960311616*LOG(FERt-1) 4.1

This implies that MPR insignificantly impacted positively on INF as a unit increase in MPR would result to a 0.05 increase in INF. This conforms to a priori expectation. Besides, the result showed that BMS impacted positively on INF insignificantly. This negates the proposition of the quantity theorists that an increase in money supply would increase proportionately the level of prices. In addition, the result indicates that FER insignificantly impacts negatively on INF. This does not conform to economic theory as increase in FER is expected to increase inflation.

The co-efficient of determination indicates that only 22.2% change in INF could be attributed to changes in MPR, BMS, and FER, within the study period. This implies that inflation in Nigeria could be attributed to non-monetary forces and variables other than the ones specified in this study. Notably, this corroborates the findings of Ajayi and Awosika (1980). However, the F-statistic reveals that MPR, BMS, and FER, could jointly and significantly impact on INF in Nigeria.

Conclusion and Recommendations

From the study, it is evident that:

- Monetary policy rate impacted positively on inflation;
- Broad money supply impacted positively on inflation; and
- Exchange rate impacted negatively on inflation in Nigeria.

Monetary policy, therefore, is ineffective in taming inflation in Nigeria. This is because the positive impact of monetary policy rate on inflation is insignificant; the growth of money supply does not translate into increase in prices and exchange rate changes tend to affect inflation negatively. More so, this could be due largely to the huge number of poor who are non-bank public in the country.

Based on the findings above, the following recommendations are made:

(i) Monetary authorities should fix the exchange rate at where the value of naira will rise. This will lead to a fall in inflation rate.

(ii) Monetary authorities should reduce monetary policy rate to curtail inflation in the country.

(iii) It is recommended that financial inclusion must be strengthened as a goal by all policy makers as the fight against inflation. To achieve this, more banking institutions should be opened in rural areas to encourage the rural dwellers to cultivate banking habits.

(iv) Policy makers in the government and at the CBN should continue to emphasise the role of the banks, even as it is clear that market failure has arisen in meeting the goal of financial inclusion precisely because of a mismatch of the needs of the formal financial sector and the low income earners.

(v) It is time to look for new non-bank based models that can fill in the gaps.

A complete overhaul of the financial infrastructure, especially in the rural areas is necessary to attract the informal servers of financial services into the formal financial sector. The regulation of policies on financial inclusion that focus on the distribution channels of financial services and retail banking are also necessary to increase access to finance and monetary authority's control of money supply.

References

Adenuga, I. A., Taiwo, B. H., and Efe, E. P (2000),"Is inflation purely a monetary phenomenon? Empirical investigation from Nigeria (1970-2009)", *European Scientific Journal,vol* 4 No. 2, pp. 32-50

Agba, V. A., (1994)."Principles of macroeconomics", Concept Publication Ltd, Lagos

Ahiabor, G. (2013)."The effects of monetary policy on inflation in Ghana",*Developing Country Studies*, vol 3 No. 12, pp. 82-89.

Ajayi, S.I., and Awosika, K., (1980)."Inflation in Nigeria: domestic or imported", Paper commissioned for the Productivity, Prices and Incomes Board, Ibadan, January.

Amarasekara, C. (2009)."The impact of monetary policy on economic growth and inflation in Sri Lanka", *Staff Studies,* 38(1)

Asuquo A., (2012): Inflation accounting and control through monetary policy measures in Nigeria",*Journal of Business and Management,* 53-62.

CBN, 1991 Monetary Policy Department: http://www.cenbank.org.1 Central Bank of Nigeria Statistical Bulletin for several issues: http://www.cenbank.org/

Central Bank of Nigeria (2011): Understanding monetary policy series 1, Abuja, Nigeria

Dagher, J. and Kovanen, A. (2011)."On the Stability of Money Demand in Ghana: A Bounds Testing Approach", IMF Working Paper No. 11/273

Dernburg, T. F.& McDougall, D. (1980), The Rich and the Recession, IMF Working paper, WP/14/225

Faridi, M.Z. (2012). Contribution of Agricultural Exports to Economic Growth in Pakistan, Pak. J. Commer. Soc. Sci. 6(1), 133-146.

Fisher, I (1911). The Purchasing Power of Money: Its Determination and Relation to Credit, Interest and Crises, Augustus M. Kelly, Publisher, London

Goshit, G. G., (2006)."Financial sector's instability: causes and implications for the Nigerian economy", *Jos Journal of Economics,vol.* 3 No.1.pp. 89-103

Gul, H., Mughal, K., and Rahim, S. (2012)."Linkage between Monetary Instruments and Economic Growth",*Universal Journal of Management and Social Sciences*, vol. 2 No. 5,pp. 69-76.

Hameed, I. (2010)."Impact of monetary policy on gross domestic product (GDP)", *Interdisciplinary journal of contemporary research in business,*vol. 3No. 1, pp. 1348-1361.

Jhingan, M. L., (2002)."Macroeconomic theory", 10th Edition, Vrinda Publications Ltd, New Delhi.

Khan, M. S and Schimmelpfennig, A. (2006). Inflation in Pakistan: Money or Wheat? *SBP-Research Bulletin*, 2 (1), 34-50

Lungu, M., Simwaka, K., Chiumia, A., Palamuleni. A., and Jombo, W., (2012)."Money Demand Function for Malawi – Implications for Monetary Policy Conduct", Banks and Bank Systems, 7 (1).

Nasko, A. M. (2016). Impact of Monetary Policy on the Economy of Nigeria,*Pyrex Journal of Business and Finance Management Research*, 2 (10),163-179December, available at: http://www.pyrexjournals.org/pjbfmrl

Mbutor, M.N, (2010)."Can monetary policy enhance remittances for economic growth in Africa? the case of Nigeria". *Journal of Economics and International Finance,*vol.2 No.8. pp.156-163

Ngerebo, A. T. A., (2016).“Monetary Policy and Inflation in Nigeria, *International Journal of Finance and Accounting,*vol.5 No.2, pp. 67-76.

Nwosa, P. I., Olaiya, S.A., and Amassoma, D., (2010).“An appraisal of monetary policy and its effects on macroeconomic stabilization in Nigeria”, *Journal of Emerging Trends in Economics and Management Sciences (JETEMS) vol.*2 No.3,pp. 232-237

Ogunsakin, S., & Awe, A. A., (2014).“Impact of Financial Liberalisation on the Stability of Nigerian Money Demand Function”, *International Journal of Economics, Business and Finance*, vol.2 No.1,pp.1 – 18

Okafor, P. N. (2009). “Monetary Policy Framework in Nigeria: Issues and Challenges,” *CBN Economic and Financial Review,* 33(2).

Oyejide, T.A, (1972).“Deficit financing, inflation and capital formation: an analysis of the Nigerian experience, 1957–1970”,*Nigerian Journal of Economic and Social Studies*, vol.14 No.1,pp. 27–43.

Pesaran, M. H., Yongcheol S., and Smith, R. J., (2001).“Bounds testing approaches to the analysis of level relationships”, *Journal of Applied Econometrics,*vol. 16 No. 3,pp. 289-326.

Quartey, P., and Afful-Mensah, G., (2014).“Financial and monetary policies in Ghana: A review of recent trends”,*Review of Development Finance*, vol.4 No.2, pp. 115-125.

Sanni, M. R., Amusa, N. A., and Agbeyangi, B. A., (2012).“Potency of Monetary and Fiscal Policy Instruments on Economic Activities of Nigeria (1960-2011)”, *Journal of African Macroeconomic Review, vol. 3 No. 1,*www.oanda.com/convert/classic.Accessed on 08/09/18

The Economic Times (2018): Definition of monetary policy,