

MONETARY POLICY AND INFLATION CONTROL IN NIGERIA.**DAVIES, N.****DEPARTMENT OF FINANCE AND BANKING, UNIVERSITY OF PORT HARCOURT,
PORT HARCOURT, NIGERIA.****IFIONU, E.P.****DEPARTMENT OF FINANCE AND BANKING, UNIVERSITY OF PORT HARCOURT,
PORT HARCOURT, NIGERIA.****AND****OGUNBIYI, S. S.****DEPARTMENT OF FINANCE AND BANKING, UNIVERSITY OF PORT HARCOURT,
PORT HARCOURT, NIGERIA.****Abstract**

The study investigated the nexus between monetary policy and inflationary phenomenon in Nigeria. An historical data sourced from the Apex bank of Nigeria is used in this study and it covers the periods 1980 to 2020. The study selected six indices of Monetary Policy and they include Money Supply, Cash Reserve ratio, Monetary Policy rate, Liquidity ratio, Exchange rate, Treasury bill rate while Inflation rate is the explained variable. Due to the mixed stationary nature of the data, we employed the ARDL methodology alongside various diagnostic tests. It was found that of the six measures of MP indicated in the study, only one (Treasury bill rate) significantly respond to inflationary pressure in Nigeria. The study thus concludes that in the Nigerian context, monetary policy variables had no significant impact on inflation. As such, we recommend that to bring inflation under control, government needs to pay attention to other matters heating up the economy.

Keywords: Money Supply, Cash Reserve ratio, Monetary Policy rate, Liquidity ratio, Exchange rate, Inflation rate, Auto Regressive Distributed Lag (ARDL).

Introduction

Monetary Policy is the totality of economic measures crafted by the Central Bank to manage microeconomic variables in the economy. Its objectives are to achieve price stability, rapid economic growth, balance of payment equilibrium and a higher standard of living (Onoh, 2013). From the CBN perspective, monetary policy committee is saddle with the responsibility of regulating money supply and it cost towards ensuring the targeted objectives.

Domestic monetary policy instruments used by the CBN include; Open Market Operation, Monetary Policy Rate, Cash Reserve Ratio, Liquidity Ratio, moral suasion and control of non-bank financial

Institutions (Onoh, 2007). Anyanwu, (1993), identified monetary policy as a major economic stabilization weapon. He specifies the measures to include the regulation and control of the volume, cost, availability and direction of money and credit. While the objectives of monetary policy may vary from country to country, two main views are identified, 1) price stability Price and 2) price stability and macroeconomic objectives (CBN, 2006). However monetary stability has been construed as the main objectives of monetary policy (Henry and Sabo, 2020, Mbutor, 2010)

Inflation is the continuous rise in general price level of goods and services in an economy. Inflation is a macroeconomic

problem that affects the microeconomic objective of price stability. By corroding the value of money, inflation reduces the standard of living. Money has no value of itself. Its value is measured in what it can purchase. Money is a store of value, a medium of exchange and a unit of account. As Mankiw & Taylor (2008) opined, its value is measured by the quantity of goods and service a unit of money can be exchanged for. The monetary policy objective of price stability is to maintain a relative stability in the purchasing power of money, which is price stability. A rising inflation erodes the purchasing power. Because rising prices of goods and services exert inflationary pressures on the economy, the key monetary policy objective is to mitigate it and sustain stable prices (Orubu, 2009).

Two crucial factors identified as determinants of inflation in an economy are the level of money supply and the stock of goods and services in an economy. According to Mankiw & Taylor, (2008), while the activities of the private sector determines the volume of commodities in the economy, government, the Central Bank and other financial intermediaries determine the volume of money the economy. Thus to tackle inflation, the amount of money in circulation and the stock of goods and services should be the target (Gbadebo & Mohammed, 2015).

But Soludo, (2009) opines that it is a monetary phenomenon. He argues that increase in money supply fuels inflation and that rising domestic prices occur when money supply exceeds the absorptive capacity of the economy.

Inflation is measured using three indices, the direct measures (period to period changes): the Consumer Price Index (CPI) and the producer price index (PPI), and the gross national product (GNP) implicit deflator.

There are three approaches to measure inflation rate. According to CBN (1991), in Nigeria the CPI is used due to availability of monthly, quarterly and annual data.

As a result of the capacity of inflation to negatively impact economic growth and wealth creation in an economy, it has been identified as an economic variable of primary concern (Muhammed and Mubarak, 2013). It is suggested by theorists that an economy with relatively stable prices will better foster rapid economic growth than one with excessive inflationary pressure. Negative consequences of persistent inflation include growth in speculative activities and reduction in productive activities, fall in real income levels, drop in standard of living, impaired capital formation, reduction in exports and increase in importation with the resultant balance of payment challenges (Onoh, 2013). The IMF observes that for over two decades, inflation rate are at double digits or more in sub-Saharan Africa (IMF, 2019). This study aims to find out whether or not a stable and predictable relationship exists between inflation and monetary policy instruments in Nigeria.

Theoretical Framework

The quantity theory of money propounded by Fisher (1911) forms the theoretical underpinning of this study. Fisher's equation of exchange is used to explain the classical money theory $MV = PT$ (1) Where: M = Supply of money V = Velocity of money in circulation P = Price of goods and services and T = the transaction (output). It proposes 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.

It is based on the assumption that at the state of full employment, national output

and velocity is constant. This theory states that changes in the stock of money supply will translate into a proportionate change in general price levels (inflation). Thus it attributes price inflation to excessive growth in quantity of money in circulation. Since the velocity of money circulation is assumed to be constant what determines the total money value of transaction in the economy at any given period is money supply (Jhingan, 2005). Thus, when money supply increases and there is no proportionate increase in goods and services, more money will chase the existing goods. The effect is a rise in general prices levels (inflation). Leaning on the quantity theory of money, the Modern quantity theorist led by Milton Friedman opines, that a rapid expansion in quantity of money is always the reason for inflation everywhere rather than increase in total output.

Empirical Review

Numerous scholars have undertaken the study of inflation and the effectiveness or otherwise of monetary policy tools of Central Banks in curbing or managing inflation and keeping it within the desired range. While there appears to have been more success in developed countries with more developed financial systems, the opposite is the case for emerging economies with less sophisticated financial systems. These studies have also attempted to determine the short and long run relationships between inflation rate and its determinants in various countries. In this section we review and summarize some of these studies; identifying their methodologies and findings.

Olayinka (2021) examined data from 2000-2019 to determine interrelationship between inflation and interest rate in Nigeria. Monetary policy rate, deposit rate and maximum lending rate were used to proxy monetary policy. Also, the period under

review were disaggregated into two sections, 2000-2007 and 2009-2019. The author used the structural analysis as a tool of estimation, a long span nexus was identified while in the short run, a week form nature prevailed as the direction of association between inflation and rate of interest are weak. The study covers a period of 34 years respectively where the ARDL methodology was used.

Henry & Sabo (2020) found that while monetary policy rate and foreign exchange rate impacted negatively on inflation; broad money supply impact positively on it.

Principal Component analysis was employed by Agya, Abudul, & Raze (2019) to identify factors responsible for inflationary pressure in Nigeria. The study spanned second quarter 2015 to first quarter 2018. It was found that 19 items correlated at least 0.4 with other factors and sample is adequate. The first three PCs explained 94.30 percent of the total variability in inflation. The first component explained 53.59 percent; second component 27.79 percent of the variance while third component account for 10.92 percent of the variance. Component 1 is denoted as Food crop factor, Component 2 is energy factor while component 3 is denoted as Cash crop factors. They concluded that in the period under reviewed, inflation in Nigeria was driven by increase in food crops price, energy prices and cash crop prices. To curb the persisting inflation challenge, the researchers identified the need for Government to enable the processes that would increase food production, drop energy rates and intensify efforts to boost production of petroleum products in Nigeria.

In a more recent study, Okotori & Gbalam (2020) explore the implication of monetary policy on the management of inflation in Nigeria using an historical data between the periods 2008 to 2018. The structural analysis of VECM, co-integration

test and reliability test were used in the paper. Due to the presence of long run association as reported by the co-integration test, the VECM estimation tool was introduced and report show that all the indicators of MP presented in the study significantly influence inflation rate in Nigeria. As such, it was further submitted that the inflationary pressure in Nigeria is been stabilized by monetary policy measure.

In another study, Ebipre & Amaegberi (2020) submitted that money supply and inflation are directly link such that when the volume of money in the society increase, inflationary pressure is bound to spur. However, their study further submitted that excessive government borrowing will shout up inflationary pressure in Nigeria. Their study employed historical data sourced from the apex bank bulletin for a period of 44 using the least square method. The study aim is to analyze the implication of money supply on inflation pressure in Nigeria. They summarized by submitting that money supply and inflation rate move in the same direct as rise in one will directly affect the other accordingly.

Using the co-integration approach on Nigeria Data, Okotori (2019) used two model in investigating the direction of causation between instrument of monetary policy (MP) and inflation. The first model identified five measures of MP using the index of consumer price as the explained variable while the second model used inflationary pressure. It was reported that in the first model, MP instruments automatically adjust to inflationary pressure to the tune of 5.2% while consumer price index will rise by 9.4% whenever the MP decision is not favorable. The authors conclude that irrespective of the policy, self-equilibrium mechanism prevail in the economy.

Opeyemi (2018) contributed to the argument in literature by submitting that MP as a tool of economic stability can only work in an economy where systemic problems do not exist. The study further contributed to the debate by submitting that Nigeria is a country with a systemic problem and until this issue is critically addressed by the authority, no volume of policy will transform the economy either MP o FP. The study empiricallyinvestigates into the benefit of MP and its implication on inflation where historical data were generated from the apex bank over a period of thirty years.

Outside the shore of Nigeria, Van Wyngard, Meyer & De Jongh, (2018) used a data set gathered from the South African apex bank to analyze the connection between some selected macroeconomic indices and MP. The authors considered the ARDL mechanism and it was gathered that in south Africa, all macroeconomic indices related in the long period although, the inflationary structure and cost push effect significantly sculpt the MP effect. In the same vein, Ogunmuyiwa & Babatunde (2017) using the ARDL mechanism examined the link between inflation and MP using historical data for a period of six years. The study used the monthly data which give a total of 72 observations. The study submitted that both in the long run and short, the three indices of MP have direct and significant impact on inflation.

Due to absence of co-integration among the study series, Itodo, Adesuwa, & Lambert (2017) used the VAR methodology in analyzing the extent to which the economy can be stabilized with the help of MP. The study takes a different dimension as emphasis was on the working indicators of MP and they are lending rate, price index and its rate. The study reported that the economy can only be stabilized when the appropriate

policy is introduced into the system considering the present nature of the problem at hand. The authors briefed that overtime; policy mix-match was witnessed as the introduced policy those not seem to help solve the problem on ground. Hence, they concluded that ensuring economic stability is good, but monitoring the state of the economic situation is the optimal as it will help in ascertaining massive stability.

The work of Asuquo (2012) investigated the impact of monetary policy on price stability in Nigeria using Structural VAR to estimate the model. The study period commenced from December 2006 (when Monetary policy rate, MPR) was introduced, to February 2012. 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. 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.

Knowledge Gap Identified

From the reviews literature, several gaps were identified. First most of the reviewed studies ended their investigation using 2019 data set. Therefore, this study set out to contribute to the literature by introducing more recent data thereby filling the above gap. Secondly, none of the reviewed literature subjected their result to diagnostic test to ascertain the efficacy of their result. As such, this study fill this gap by subjected all empirical result to rigorous diagnostic test to justify the implication of monetary policy on inflationary pressure in Nigeria. Lastly, more recent empirical position regarding the implication of monetary policy on inflationary pressure will

be presented to enrich the literature accordingly.

Methodology

This study will use Secondary data sourced from CBN Statistical Bulletin, 2020. The data obtained for all the variables will be obtained from the 2020 CBN Statistical Bulletin. The study will cover the period 1980 to 2020. The table of the serial data can be seen in appendix 1.

Model Specification

The following are the variables specified for this study.

Inflation Rate is the dependent variable. We intend to establish the impact of the independent variables, which proxy monetary policy, on inflation rate and establish the relationships, if any with inflation rate.

The independent variables are;

1. Cash Reserve Ratio (CRR)
2. Money supply (as a percentage of GDP),(MS)
3. Monetary policy rate (MPR)
4. Treasury bill rate, (TBR)
5. Liquidity ratio (LR)
6. Exchange rate(EXR)

The model that seeks to examine the effects of monetary policy on Inflation is written as follows:

$$INF = f(CRR, MS, MPR, TBR, LQR, EXCHR) \dots\dots\dots (4.1)$$

The model (equation 4.1), is re-specified as:

$$INFR = \alpha + \alpha_1 CRR + \alpha_2 MS + \alpha_3 MPR + \alpha_4 TBR + \alpha_5 LQR + \alpha_6 EXCHR + \mu \dots\dots\dots (4.2)$$

Where;

INF = Inflation rate

CRR = Cash Reserve ratio

MS = Broad money supply (% of GDP)

MPR = Monetary policy rate

TBR = Treasury bill rate

LR = Liquidity ratio

EXR = Exchange rate

α_0 = Constant $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ and α_6 = Parameters. μ = Error term.

It is expected that $\alpha_0 > 0, \alpha_1 < 0, \alpha_2 > 0, \alpha_3 < 0, \alpha_4 < 0, \alpha_5 < 0$ and $\alpha_6 > 0$

Data Analysis Technique

The study adopts econometric tools to analyze the data. The process begins with

Table 1 Presentation of Summary of Descriptive Statistics

	INFR	CRR	MPR	M2	LQDR	TBR	EXCHR
Mean	17.39075	8.984875	13.03750	15.23321	48.05635	13.08342	106.6451
Median	11.94000	7.900000	13.25000	12.64095	46.09236	12.95083	106.8005
Maximum	76.80000	22.50000	26.00000	24.89526	81.42032	26.90000	356.4267
Minimum	0.000000	1.000000	6.000000	8.464230	26.39276	4.500000	0.610000
Std. Dev.	18.43573	6.849233	4.002223	5.284174	12.50524	4.820416	97.24682
Skewness	1.781806	0.884626	0.702213	0.614716	0.678421	0.307782	0.837485
Kurtosis	5.322685	2.686468	4.437047	1.731911	3.216043	3.146735	3.107352
Jarque-Bera	30.15700	5.380929	6.729197	5.199253	3.146155	0.667417	4.695081
Observations	40	40	40	40	40	40	40

Source: Extract from E-views computation

The table above presents the characteristics of the variables. The mean and median show the central tendency of the variables. The average inflation rate within the period was 17.39%, while the highest inflation figure is 76.8% which as in 1994. The average money supply as a percentage of GDP is 15.23%, the highest being 24.89% in 2017. The inflation rate in 2017 was 15.4%. The maximum exchange rate in period was 356.42 while the minimum was 0.61. The

the determination of the stationary of the variables. The results determine the appropriate steps thereafter. The presence of co-integration or otherwise will be determined and then the short run and long run estimates will be carried out depending on the co-integration result

Results and Discussion

Descriptive Statistics

The summary descriptive statistics of the test variables are presented below.

Jarque-Bera statistic indicates that all the variables have a normal distribution. M2 and CRR are Platykurtic while all the others are Leptokurtic. The standard deviation indicates the samples spread, dispersion, from the mean.

Test of Stationarity

The augmented Dickey-Fuller test was used to determine the stationarity of the variables. The null hypothesis is that the variable has a unit root. The null is rejected if

the t-statistic, in its absolute form, is higher than Test Critical values at the 5% significance level and the Prob. Values is lower than

0.05%, that it is, it is significant. The summary of the test results for the dependent and independent variables are presented below.

Table 2. Summary Unit Root Test Result using the Augmented Dickey-Fuller Test

Variable	t-Statistic	Test Critical Value at 5%	Prob. Value	Order of integration
INFR	4.4669710	3.568379	0.0067	I(0)
CRR	2.987148	1.951000	0.0040	I(1)
M2	5.618466	1.949856	0.0000	I(1)
MPR	3.302339	2.938987	0.0216	I(0)
TBR	3.069662	2.938987	0.0373	I(0)
LQDR	7.417638	1.949856	0.0000	I(1)
EXCHR	3.566282	1.949856	0.0007	I(1)

Source: extract from e-views computation

The result above indicates that the variables are stationary at levels and at 1st difference. That is they are integrated at levels, I(0) while others are integrated at order I(1). As a result of this mixture we will proceed to estimate the variables using the

Auto Regressive Distributed Lag (ARDL) method. We will also utilize the ARDL long run form Bounds Test to ascertain if there is any long run co-integration between the variables used in the model. (Gujarati & Porter, 2008, p. 762)

Determination of optimal lag length

Table 3. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-889.5788	NA	2.63e+12	48.46372	48.76849	48.57117
1	-718.4636	*	*	*	*	*
2	-676.8452	49.49225	7.53e+09	42.26190	46.83342	43.87358
3	-620.6453	45.56746	1.28e+10	41.87272	48.57762	44.23651

Source: E-views 10 result.

The result of the lag length selection test indicates that all the information criteria picked a one lag length. Our preferred information criterion is Akaike Information Criterion (AIC).

ARDL Long Run and Bounds Test

We now investigate whether the series are co-integrated and have a long run equilibrium

relationship. The ARDL long run bounds test, proposed by Pagaran, Shin & Smith (2001), will be used to investigate the existence or otherwise of co-integration. The Null hypothesis of the test is that there is no co-integration between the variables. The decision rule is to reject the null if the calculated F-statistic is higher than the Test critical value at the upper bound I(1)

Table 4. Result of ARDL long run form and Bounds Test Null Hypothesis: No levels relationship

Test Statistic	Value	Significance	I(0)	I(1)
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F-statistic	3.022368	5%	2.27	3.28
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Source: E-views 10 Output

At 5% significance level, the F-Statistic of 3.02 falls below the 3.28 Of the I(1) bounds thus we cannot reject the null. The figure falls between the two bounds indicating that test

is inconclusive. The result above indicates that there is no long run relationship between the variables. We will thus proceed to run the ARDL and obtain the short run relationships.

Table 5. ARDL Estimation Result

Method: ARDL

Dependent Variable: INFR

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
INFR(-1)	0.385874	0.160870	2.398666	0.0231
CRR	-0.874676	0.632446	-1.383005	0.1772
M2	1.174043	0.833601	1.408399	0.1696
MPR	0.428602	1.134423	0.377815	0.7083
TBR	-0.243301	0.934978	-0.260221	0.7965
TBR(-1)	1.761809	0.669128	2.632992	0.0134
LQDR	-0.023298	0.219105	-0.106334	0.9160
EXCHR	0.131988	0.150449	0.877294	0.3875
EXCHR(-1)	-0.200157	0.152655	-1.311176	0.2001
C	-17.71420	18.16572	-0.975144	0.3376

R-squared	0.619421	Mean dependent var	17.83667
Adjusted R-squared	0.501310	S.D. dependent var	18.45690
S.E. of regression	13.03389	Akaike info criterion	8.189537
Sum squared resid	4926.585	Schwarz criterion	8.616092
Log likelihood	-149.6960	Hannan-Quinn criter.	8.342581
F-statistic	5.244408	Durbin-Watson stat	1.826072
Prob(F-statistic)	0.000292		

Source: Eviews 10 Output

The ARDL result is given above. The P-value of the F-statistic, at 0.000292, is significant and thus confirms the overall significance of the model. The result tells us the relationship between the independent variables in the study and inflation. It also enables us to test the hypothesis. The results indicate that the coefficients of CRR (-0.87)

and LQDR (-0.02) are negative thus agreeing with our apriori expectation. A policy reduction in Cash Reserve Ratio and Liquidity Ratio can potentially increase money supply as banks can create more credit. Their relationships however are not significant. Treasury Bills rate (TBR) indicates a negative impact on Inflation with a coefficient of -0.24.

Treasury bills are viewed as risk free investment therefore a more appealing rate will attract more investments thus taking funds away from the banks and also limiting their ability to create credit that would boost money supply.

Money supply, M2, has the expected positive relationship with inflation rate, INFR, meaning that an increase in money supply can fuel inflation. But again the result shows that

it is not significant. Overall the result suggests that we cannot reject the null of the hypotheses tested. Monetary Policy rate (MPR) showed a positive impact with a coefficient of 0.42 and no significance. Exchange rate exhibited a positive impact, as expected, though not significant. The one period lag of Treasury bill rate had a positive and significant effect on inflation rate.

Diagnostic Tests

Heteroskedasticity Test

Table 6. Result of Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.427528	Prob. F(6,33)	0.8552
Obs*R-squared	2.885035	Prob. Chi-Square(6)	0.8231
Scaled explained SS	6.615847	Prob. Chi-Square(6)	0.3578

Source: Eviews 10 Output.

The null hypothesis is “the model is homoskedastic”. The result above indicates that the P-value of the F-Statistic is not significant at 5%, thus we cannot reject the null. We conclude that this model has no heteroskedasticity problem.

Serial Correlation Test

Table: 7. Result of Serial Correlation Test

F-statistic	0.408109	Prob. F(1,28)	0.5281
Obs*R-squared	0.560272	Prob. Chi-Square(1)	0.4542

Source: Eviews 10 Output

This result indicates that there is no serial correlation problem in the model.

Linearity Test

The linear nexus among the study indices is the essence of this test. The Ramsey

This test checks whether the error terms are temporarily independent. That is they are not serially correlated. The null hypothesis states that “There is no Serial correlation problem in the model”. The null is rejected if the P-value of the F-statistic is significant.

RESET is employed for this test. The null hypothesis is “a linear nexus was found between the studies variables. That is, the model under consideration is correctly specified. The null is rejected if the P-value of the F-Statistic is significant at 5%.

Table 8. Result of Ramsey RESET Linearity Test

	Value	df	Probability
t-statistic	1.913056	28	0.0660

F-statistic	3.659783	(1, 28)	0.0660
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Source: E-views 10 Output

From the result the P-value of the F-Statistic is not significant thus we cannot reject the null. We thus conclude that the model is correctly specified.

Stability Test

This test is deployed to determine the appropriateness and the stability of the

model. The CUSUM (cumulative sum) and CUSUM SQ (cumulative sum of squares) tests are used to determine if the model is stable and is suitable for making long run decision. The decision rule is that if the plot of the CUSUM and CUSUM SQ stay with the 5% critical bound, the null hypothesis that all parameters are stable cannot be rejected.

Diagram. (a) CUSUM Stability Test Result

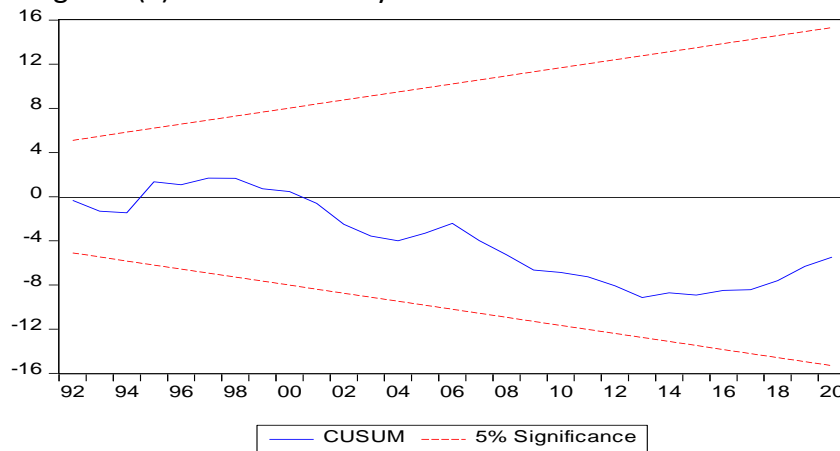
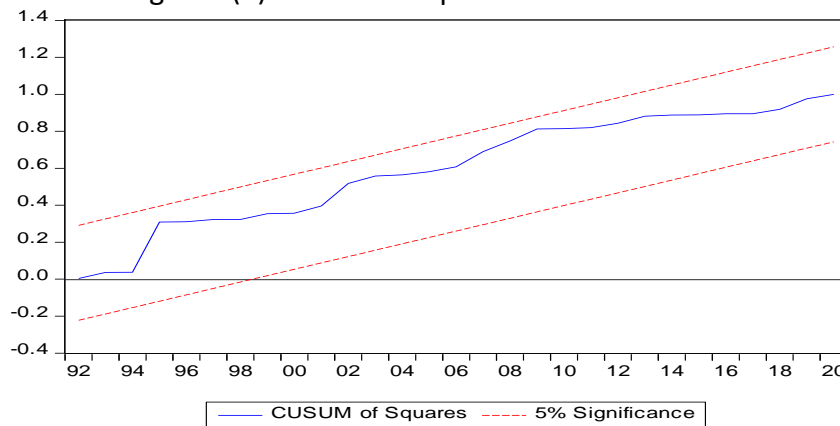


Diagram (b) CUSUM of Squares Test Result



In the two diagrams above the plot stays within the red line (that is the 5% significance) thus we safely conclude that the model is stable.

Conclusion and Recommendation

The main purpose of this study was to test the impact of monetary policy on the inflation phenomenon in Nigeria. The study

was built on the quantity theory of money. The effect of monetary policy on level of money supply in the economy and its effect on inflation was investigated. The results

indicated that monetary policy variables had no significant impact on inflation in Nigeria. The impact of lagged value of variables seems to suggest the time frame within which monetary policy begins to impact on the economy and macroeconomic variables.

These test results agree with a number empirical works that monetary policy has no firm grip on inflation in Nigeria. Examples include; Ujuju and Etele(2006), Ezeanyej, Obi, Chika&Ejefobihi (2021). According to Asuquo(2012), expected changes in inflation cannot be guaranteed by variation in monetary policy rate. Others found a weak link between money supply and inflation (Ogbonna, 2008, Osuji& Akujuobi, 2012). Itodo, et al (2017) concluded that money supply has no significant impact on price levels in Nigeria due to the large volumes of money in circulation in the informal sector.

Agya et al (2017) found that inflation was driven by other factors like food crop prices and energy cost rather than a monetary phenomenon. Though money supply growth dropped from 30.99 in 4th quarter 2020 to 15.67 in 3rdquarter 2021 through CRR debits and sale of government securities, inflation has not abated. Government spending, insecurity, higher energy cost, exchange rate pass through and seasonality issues seem likely cuprite's for Nigeria's persisting inflation at present (Proshare,2021). To bring inflation under control, government needs to pay attention to other matters heating up the economy.

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