UMYU Journal of Accounting and Finance Research VOL. 1 NO. 2 *June, 2021*
https://doi.org/10.61143/umyu-jafr.1(2)2021.001
Text ISSN: 2795-3831
E-ISSN: 2795-3823

EMPIRICAL ANALYSIS OF THE LONG RUN RELATIONSHIP BETWEEN INFLATION AND SELECTED MONETARY POLICY INSTRUMENTS IN NIGERIA

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ABSTRACT:
This paper examined the relationship between the inflation and the selected monetary policy instruments like money supply and monetary policy rate (MPR), among others in Nigeria relying on time series data spanned from the period of 1980 to 2020 sourced from National Bureau of Statistics (NBS) and World Bank Development Indicator (WDI). Hence, the study utilized Augmented-Dickey Fuller (ADF) and Philips Perron (PP) unit root test frameworks to examine the stochastic properties of the series for the variables under investigation. Subsequent to the results obtained from the unit root tests, the study employed Johansen Cointegration test and error correction model (ECM) as the method of estimation. On this account, the study revealed the presence of long run relationship between inflation rate and monetary policy in Nigeria; while the short run estimate shows that all the examined monetary policy instruments exhibit positive relationship with inflation rate in Nigeria. Implying that inflation rate rises as the examined monetary policy instruments rises. Also, the result form the estimated ECM shows that any deviation from the long run equilibrium in the short run can be restored back to the steady equilibrium state at 47.5% speed of adjustment. The study therefore recommends that: Pragmatic policy framework by the monetary policy authority needs to be drawn to aid the efficient management of exchange rate; MPR as monetary policy instrument must be anchored on efficient operating and monetary targets and; prudent regulation of money supply that is consistent to the prevailing output level in an economy.

Key words: *Inflation rate, Monetary Policy instruments and Error Correction Model.*

1.0 INTRODUCTION

Generally speaking, inflation has been viewed as a continued rise in the general price level of goods and services in an economy over a specified period of time. Though,

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E-ISSN: 2795-3823

this continued rise in general price levels cannot necessarily be said to have an adverse consequence on the economy in as much as the prevailing rates of inflation falls within the thresholds prescribed for the economy (Akarara & Azebi, 2018). Hence, it can be acknowledged that inflation is a common symptom that overturned other macroeconomic variables like unemployment, living standard, general output level and economic growth among others that thus remained the cause of concerns for managers of economy all over the world (Orubu, 2009). This is because price instability due to inflationary tendency does continuously causes uncertainties about future prices, raises business risks for both local and foreign investors, and creates unexpected changes in the distribution of wealth in an economy (Fielding, 2008).

In this view, inflation and price instability generally in West African economies resulting from inconsistence and ineffectiveness in policy direction, overdependence of the region on the imported goods and foreign aids for their growth agenda obstructs the efficient utilization of their productive capacity to its fullest state and resultantly hinders the steady growth of their economies (Jonathan, 2013). For instance, Ghana with history of stable economy and steady GDP growth in West African continent experienced distortions in the early 80s mainly due to foreign intrusion induced by civil unrest which birthed the deficit financing fiscal periods and subsequent rise of inflation rate to 120% of GDP (i.e 116.5% in 1980) and up to recent decade remained above the threshold of a single digit inflation rate of 4-6% at the rate of 17.1 in 2015, 17.46% in 2016 and 12.37% in 2017 (Philip & Eva, 2017). Similarly, overreliance of Nigerian economy on oil product (that is characterised by fluctuation in exchange rate and unstable oil price globally) with no prudent utilization of earnings from oil product since its discovery, over dependent on imported goods and aids from international communities induced price instability and rising inflation rate in Nigeria to 72% in 1991 that still remained high at 12.82% in 2020 (NBS, 2020; Jonathan, 2013). Concisely, it is noteworthy to states that, risks and uncertainties generated by the phenomenon of inflation in Nigeria make planning for both consumers and producers difficult, and by implication, results in inefficiency in the allocation of scarce resources. For instance, a rise in prices above interest rate of savings discouraged savings and this would in turn led to decline in loanable funds for investment that subsequently lead to a fall in potential output and employment (Idoko, Seyi & Rotimi, 2017).

In this regard, price stability especially control of inflation is one among other macroeconomic goals in Nigeria like in other economies of the world that is wholly rested on monetary authority, usually Central Bank of Nigeria who is charged with the responsibility of formulating monetary policy in Nigeria (Emmanuel & Jeremiah, 2020; Akaraka & Azebi, 2018). Therefore, maintenance of bearable inflation rate in

Text ISSN: 2795-3831
E-ISSN: 2795-3823

Nigeria through the application of several monetary and fiscal policies' tools has been among other the set targets which many countries of the world (especially Nigeria) seek to achieved (Akaraka & Azebi, 2018).

In this connection, monetary policy is a combination of measures and actions through a set of designated instruments to control the value of money, supply of money and cost of money compatible with the productive capacity of the economy that is free from generating unjustifiable pressure on domestic price and the exchange rate (Manu & Chindo, 2018). According to Iyaji, Success and Success (2012) and; Bătrâncea, Moscviciov and Găban (2012), the Central Bank of Nigeria (CBN) which is by regulation an apex monetary authority in Nigeria charged with the task to implements policies through Deposit Money Banks (DMBs) that assured a logical advancement of the economy through influencing the volume of money supply in an economy. The end result of which is to regulate and maintain inflation at a rate that would not jeopardize the goals of economic growth and employment. In view thereof, this study seeks to examine the relationship between inflation rate and monetary policy instruments in Nigeria.

2.0 LITERATURE REVIEW

This section of paper contained the operational definition of the key concepts in the study, theoretical framework underpinning the study and pertinent empirical studies to the subject of this paper.

2.1 Conceptual Definition of the Key Terms

2.1.1Inflation

In economics generally, inflation is often regarded as a rise in general price level in an economy over a given period of time (Blanchard, 2000; Barro, 1997; Robert & Taylor, 1993). Therefore, Robert and Taylor (1993) define inflation as a situation of sustained rise in general price level that consequently affects the purchasing power per unit of currency occasioned by the loss of real value in the medium of exchange and unit of account within an economy. However, the unanimous understanding of inflation remains that, a long sustained period of inflation is triggered by money supply increasing more rapidly than the rate of economic growth (Mankiw & Reis, 2002). Therefore, inflation rate is commonly measured in terms of annual percentage change in price index usually consumer price index.

2.1.2 Monetary policy

The concept of monetary policy is variedly perceived by different scholars and experts that thus attract different definitions according to the perspectives in which it is being

Text ISSN: 2795-3831
E-ISSN: 2795-3823

applied (Nwoko, Ihemeje & Anumadu, 2016). According to Nwankwo (1991), the term monetary policy is conceptually defined as the macroeconomic tools employed by the monetary authority of a country for effectively managing the economic activities of a country with a view of accomplishing the desired goals for an economy. Similarly, CBN (2008) refers to monetary policy as any policy measure considered by the federal government through its monetary authority to regulate the availability and supply of credit in an economy. This therefore entails the regulation of money supply and interest rate by the country's monetary authority to control the rate of inflation and stabilize the flow of currency in an economy for overall betterment of the economy.

Thus, monetary policy requires those policy actions like indirect control policy regime initiated by the country's monetary authority (says CBN) aimed at inducing the cost and availability of credits in an economy (Wrightsman, 1976). Hence, monetary policy boils down in modifying the supply of money in an economy to achieve some combined goals of inflation and output stabilizations.

2.3 Monetary Policy and Inflation in Nigeria

The monetary policy experiences in Nigeria can be generally classified under two policy regimes; Direct and Indirect policy regimes

i) **The direct policy regime:** The period of direct regime policy started from 19659 and ended in 1985. Under this period, Banks operated passive monetary regime such that the regulation of monetary instrument was partly relaxed to pay attention to development and supervision of a sound currency in the period between 1960 and 1962. Towards ending of 1962 and in the beginning of 1963, the emphasis was redirected to developmental stride with greater attention given to the adequate supply of credit to the economy keeping conscious of the minimal inflationary pressure; while the period between 1966 and 1972, monetary authority redirected policy actions to the lifting of restriction on supply of money to permit the government prosecute civil war (Akinjare, Babajide, Akhnolu & Okafor, 2016). This caused deteriorating balance of payment position and inflationary pressure to the Nigerian economy. However, in a bid to reduce inflation, different policy measures were embraced for the remaining part of the period. The event of increasing oil prices between 1972 and 1976 induced the policy measures to be skewed towards growing overall domestic output and curtailing inflationary pressure. Because of the surplus credit in circulation, selective credit control policy supported by interest rate and exchange rate policies was used with a view to stabilizing the system. Monetary restriction policy continued to be in place

Text ISSN: 2795-3831
E-ISSN: 2795-3823

through 1981 due to surplus credit in the system. However, between 1981 and 1985, major changes were recorded which comprises: marginal upward adjustment of interest rates, loan advances to favour preferred sectors (e.g agriculture and manufacturing) and unchanged cash reserve requirement was in place (CBN, 2008).

ii) **Indirect Policy regime:** The indirect control policy regime started in the year 1986 when Structural Adjustment Program (SAP) was launched. The principal aim of SAP was to restructure and diversify the productive base of the economy. More so, SAP was planned to establish a realistic and sustainable exchange rate for naira through trade and payment liberalization, tariff reforms and commercialization as well as privatization of public enterprises. As a direct consequence of the SAP in 1986, monetary policy redeployed to one year perspective. A number of monetary targets and instruments were adopted and this includes Open Market Operation (OMO) conducted solely by using the Nigerian Treasury Bill (NTBs). This continued to be the principal technique of monetary policy. Other instruments include interest rate policy deregulation through practical adjustment of Minimum Rediscount Rate (MRR), discount widow operations, and amalgamation of the official and inter-bank exchange rate in 1999 (Uchendu, 2009).

2.4 Theoretical Framework

Though, the three mainstream schools of economic thoughts (namely; Classical school, Keynesian school and Monetarist school of thoughts) laid premises for understanding nexus between inflation and monetary policy as well as economic growth. Hence, this study is dwelled and hinged solely on the postulation of monetarist view of the link between inflation and monetary policy.

2.4.1 The Monetarist theory of Monetary policy

Monetarist theory of monetary policy often regarded as modern view of monetary policy headed by Milton Friedman (1912-2006) who developed a more explicit and applicable version of the quantity theory of money. In the same direction with other school of thoughts, monetarists stressed that money supply is a key factor affecting the wellbeing of the economy and often regarded as an effective monetary policy tool used to stabilize the economy. Furthermore, the rate of growth of money supply determines the steady growth rate of an economy (Nwoko, Ihemeje & Anumadu, 2016). In the word of Friedman, since the supply of money might be demanded for reasons other than transaction purposes, it can be held in different forms such as liquid money, bonds, equities, physical goods and human capital. Each of this form possesses unique feature of its own and yield differently (Akarara & Azebi, 2018).

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E-ISSN: 2795-3823

Resultantly, this will increase demand for money and output level in an economy. Monetarists therefore admit the fact that the economy may sometimes operate below or above equilibrium level of real GDP. However, monetarists argued that while in the short run, expansionary monetary policy may increase the real GDP by expanding aggregate demand but the economy will in the long run operate at full employment level of real GDP that consequently birth the inflation in an economy. Concisely, the major believe held by monetarists is that quantity theory of money remains a good approximation of the link between the money supply, inflation and the real GDP. This theory therefore provides the basis for explaining the link between inflation rate and monetary policy instruments like money supply.

2.5 Empirical Review

The relationship between inflation and monetary policy instruments has been investigated by plethora of empirical studies. Though, studies differ in their adoption of particular monetary policy instruments in the examination of the relationship between inflation rate and monetary policy instruments in Nigeria, and their methods of analysis. Some of the reviewed studies are:

The empirical study by Ogunmuyiwa (2020) on the examination of managing the inflation problem in Nigeria using Fisco-Monetary approach, the study utilised ARDL regression technique to reveal that broad money supply (M_2) and capital expenditure (CE) positively relates to the rate of inflation in Nigeria both in the short and long run time; whereas exchange rate only endures positive relation to inflation rate in the long run. More so, it is revealed by the study that inflationary situation in Nigeria are instigated by both fiscal and monetary policies in the long run such that both fiscal and monetary policies sustains positive impact on inflation in Nigeria.

Similarly, Manu and Chindo (2018) researched the empirical examination of the effectiveness of monetary policy instruments in achieving price stability in Nigeria. Utilizing OLS as method of estimation, the study reveal that there exist inverse relationship between inflation rate and some of the explanatory variables such as MPR, exchange rate and total credit to private sector; while other explanatory variables such as required reserve (RR) and money supply as a ratio of GDP are direct and positively related to inflation rate in Nigeria.

More so, Akaraka and Azebi (2018) studied the effectiveness of monetary policy in the control of inflation in Nigeria: an ECM approach. The study utilizes Johansen cointegration test and error correction model to respectively reveal the presence of long run relationship between inflation rate and selected monetary policy variables; while the estimated ECM model shows self-equilibrating mechanism of 12%.

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E-ISSN: 2795-3823

Consequently, the study established that Treasury Bills (TRB) is an effective tool in controlling inflation both in the short and long run period; while exchange rate (EXR) and money supply (MS) are very effective monetary policy tools in the controlling inflation in the short run though; monetary policy rate (MPR) is only effective in the long run.

Furthermore, Akinjare, Babajide, Akhanolu and Okafor (2016) studied monetary policy and its effectiveness on economic development in Nigeria. The study utilized multiple linear regressions as an estimation technique and found that exchange rate, interest rate and money supply have significant impacts on economy; while the impact of inflation on economy is statistically insignificant. Also, Gbadebo and Mohammed (2015) examined the effectiveness of monetary policy as an antidote to inflationary pressure in Nigeria. The study utilized cointegration and error correction model techniques to found that interest rate, exchange rate, money supply and oil price are the fundamental causes of inflation in Nigeria. Also revealed by the study, an increased income is in the short run triggered inflation, though such triggered effect of increased income on inflation can be suppressed by efficient utilization of such grown income.

More so, employing simple linear regression as an estimation method, Kumapayi, Nana and Ohwofasa (2012) examined the impact of inflation on monetary policy and economic development in Nigeria. The study found that while fiscal deficit, broad money supply and interest rate are positively related to the inflation rate at its current time, exchange rate and trade openness as well as one lagged period inflation rate are inversely related to the inflation rate at current time. Also, Asuquo (2012) examined inflation accounting and control through monetary policy measures in Nigeria. The study used multiple regression model and OLS estimation techniques to reveal that money supply, interest rate and exchange rate had significant impact on inflation whereas domestic credit bears insignificant impact on inflation in Nigeria. In the same vein, Bakare (2011) examined the determinants of money supply growth and its implications on inflation in Nigeria employing quasi-experimental research design approach, the results of regression indicated that credit expansion to the private sector determines the growth of money supply by the highest magnitude in Nigeria. Also, the findings show that change in money supply is associated with the rate of inflation in Nigeria and thus strongly recommended the need for money supply growth to be regulated in the economy.

Likewise, Chuku (2009) investigated the impact of monetary policy on inflation in Nigeria, employing OLS estimation method in the study; it was found that money supply and exchange rate had a negative impact on inflation. While; exchange rate

Text ISSN: 2795-3831
E-ISSN: 2795-3823

exhibit significant impact in elucidating inflation, the impact of money supply in explaining inflation is insignificant. Admittedly, domestic credit and gross domestic product (GDP) were significantly positive in explaining inflation in Nigeria. Also, Folorunso and Abiola (2000) studied the long-term determinants of inflation in Nigeria. Their study utilises cointegration and error correction mechanism to found that income level, money supply and public sector balance are possible causes of inflation in Nigeria. Also shown in the findings of the study that, in the long run, exchange rate, money supply, income and fiscal balance determines the inflation twisting in Nigeria and therefore advocated that reduction in fiscal deficit, increase in domestic production and a stable exchange rate should be pursue as a veritable tools in controlling inflation in Nigeria. On a similar note, Emmanuel (2000) evaluated the impact of monetary policy on inflation in Nigeria, using OLS as a method of estimating the specified model to reveal that while on one hand, both domestic credit and gross domestic credit are positively related to inflation at a significant level of statistics, and both the money supply and exchange rate on other hand, are negatively related to inflation in Nigeria.

3.0 METHODOLOGY

3.1 Data Sources and Description

This study is designed to investigate the relationship between inflation rate and the selected monetary policy instruments in Nigeria from the period of 1980 to 2020.The study relied on secondary data spanned for the period 1980 to 2020 obtained from annual National Bureau of Statistics (NBS, 2019) and World Bank Development Indicator (WDI, 2018). Based on the theoretical framework underpinning this study, inflation rate is measured by consumer price index in which it is governed by appropriate monetary policy instruments put in place to regulate it in order to stimulate the growth of an economy. Therefore, monetary policy is a key factor that ensures the price stability as a means of stabilizing economy for overall growth of an economy.

3.2 Model Specification

Flowing from the literature particularly, the theoretical frameworks underpinning the work and reviewed empirical studies, the model meant to examine the relationship between inflation rate and monetary policy instruments in Nigeria is specified as:

INF = f(Ms_2, MPR, EXCR)……………………………………………………(3.1)

Where INF = Inflation rate which is the dependent variable;

Ms_2 = the broad money supply;

MPR = Monetary policy rate which is measured by interest rate

EXCR = the exchange rate

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E-ISSN: 2795-3823

Consequently, the econometric model of the equation 3.1 to account for error term in the specified model is thus specified as:

$INF_t = \beta_0 + \beta_1 Ms_{2t} + \beta_2 MPR_t + \beta_3 EXCR_t + \varepsilon_t$ ..... (3.2)

3.3 Model estimation Procedure

Firstly, the study test the stochastic properties of the series employed for the variables specified in the model using complementary test of ADF and PP unit root test frameworks. The PP unit root test is employed to complement ADF for its greater reliability than the ADF due to robustness in the midst of serial correlation and hetersokedasticity (Hamilton, 1994). The unit root test for variables is carried out with both trend and intercept using the following specification:

$\Delta INF_t = \alpha_0 + \beta_1 INF_{t-1} + \beta_2 T + \sum_{i=0}^{n} \varphi\, i\, \Delta INF_{t-i+} \varepsilon_t$ ..... (3.3)

Where, β_0, β_1, β_2 and $\varphi i ... \varphi_n$ are parameters to be estimated, and ε_t is the disturbance error term.

The unit root test is followed by the test of cointegration using the Johansen (1988, 1991) framework. The renowned Johanson's (1998) cointegration method is used to confirm the long-run relationship among the specified variables in the model. The Johansen Cointegration is one that modelled time series as reduced rank regression in which it computed the maximum likelihood estimates in the multivariate Cointegation model with Gaussian error terms. Thus, the Cointegration model is specified as:

$\Delta Z_t = \sum_{i=1}^{p-1} \mu + \Gamma_i \Delta Z_{t-k} + \Pi Z_{t-1} + \delta_t$ .....(3.4)

Where Z_t is an (n x1) column vector of p variables; μ is an (n x1) vector of constant terms and Π represent coefficient matrices; Δ is a difference operator; k denotes the lag length and; $\varepsilon_t \sim N(0, \Sigma)$. The coefficient matrix Π is known as the impact matrix, and it contains information about the long-run relationships. The estimation of Johansen Cointegration specified in equation (3.4) follows that the residuals are used to compute two likelihood ratio test statistics: the trace test and maximal eigenvalue (λ – max) test. The trace test considers the hypothesis that the rank of Π is less than or equal to r cointegrating vectors (i.e there are at most r cointegrating vector), and it is expressed as:

$Trace = -T \sum_{i=r+1}^{n} In(1-\boldsymbol{\lambda})$ .....(3.5a)

Alternatively, the maximal eigenvalue test (λ – max) computes the null hypothesis that there are exactly r cointegrating vectors in the system and it is given as:

$\lambda - \max = TIn(1-\boldsymbol{\lambda}_r)$.....(3.5b)

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E-ISSN: 2795-3823

The distributions for these tests are not given by the usual chi-square distributions. The asymptotic critical values for the two likelihood ratio tests are calculated via numerical simulations. The null hypothesis is rejected when the estimated likelihood ratio tests statistics exceeds critical values. Since each of the two tests have their strength and limitations, it is preferable to make inference using both tests.

Consequently, the establishment of long-run equilibrium relationship among the variables under the study shall connote that the cointegrating vector shall be re-parameterized into dynamic model often regarded as ECM (error correction model). This implies that, the tendency of deviation of explanatory variables either jointly or independently from the established long-run equilibrium state by variable(s) shall be corrected by the degree of adjustment and such degree of adjustment is captured by the short-run equilibrium dynamic model otherwise referred to as ECM (error correction model) (Emeka & Aham, 2016). Therefore, the ECM model is specified as;

$$\Delta INF_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \, \Delta Ms2_{\,t-1} + \sum_{i=1}^{n} \beta_2 \, \Delta MPR_{t-1} + \sum_{i=1}^{n} \beta_3 \, \Delta EXCR_{t-1} + \pi_1 ECT_{t-1} + \varepsilon_{1t} \quad \ldots\ldots (3.7)$$

Where;

INF = Inflation rate;

Ms_2 = Broad money supply;

MPR = Monetary policy rate;

EXCR = Exchange rate

3.4 Post Estimation Tests

To ensure that, the estimated result is free from such problem that leads to spurious regression, the following diagnostic tests shall be conducted; Breusch-Pagan-Godfrey test for Heteroskedasticity; stability test using cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of the recursive of residuals (CUSUMSQ) and; Durbin-Watson for autocorrelation.

4. RESULT AND DISCUSSION OF FINDINGS

4.1: Pre-estimation Results

The results of complementary tests using ADF and PP unit root conducted at pre-estimation stage is shown in table 4.1 which reveals that in the case of PP test framework, all the variables are non-stationary series since they are all integrated at order one (i.e I/1) and that at order one (I/1) they are stationary at 1% level of statistical

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E-ISSN: 2795-3823

significance. But in the case of ADF test framework, all variables became stationary and at 1% level of significance after taking the first difference (i.e I/1) for each series except inflation rate (INF) which is stationary at level (I/0) and at 5% level of statistical significance. Hence, this study adopts the result of PP unit root test due to its greater reliability in the midst of serial correlation and hetroskedasticity than the ADF.

Table 4.1: The Result of Unit Root Test

Variables	F-Statistics		Prob.	Decision Rules
	ADF	PP		
INF	I(0)	I(1)	0.00	Stationary
	-3.76**	-11.83*		
$InMs_2$	I(1)	I(1)	0.00	Stationary
	-4.82*	-4.78*		
MPR	I(1)	I(1)	0.00	Stationary
	-6.31*	-8.40*		
EXCR	I(1)	I(1)	0.00	Stationary
	-4.60*	-4.60*		

Source: Authour's Computation

4.1.1 Lag Length Selection

As shown in the table 4.2, the optimal lag length chosen for all the examined variables specified in the model is two (2) lag periods. Though, there is variation among the lag length selection test frameworks in the selection of lag period; while likelihood ratio (LR), final prediction error (FPE) and Akaike Information Criterion choses two (2) lag periods, the Schwarz Information Criterion (SC) and Hannan-Quin Information Criterion choses one (1) lag period.

4.2: Lag Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-530.5348	NA	19422634	28.13341	28.30579	28.19474
1	-371.9423	275.4501	10755.50	20.62854	21.49043*	20.93519*
2	-351.7314	30.84824*	8884.617*	20.40691*	21.95831	20.95889

Source: Author's computation

Text ISSN: 2795-3831
E-ISSN: 2795-3823

Hence, since those three lag length selection tests framework that choses two (2) lag periods dominates the two lag length selection tests framework that choses one lag period, the study therefore adopts the two (2) lag periods selected by three tests frameworks as the optimal lag period.

4.2 Estimation of the Results

4.2.1 The results of Johansen Cointegration Test

The results shown in both table 4.3 (a) and 4.3 (b) reported the results of both trace statistics and maximum eigenvalue of Johansen Cointegration tests respectively. The table 4.3 (a) shows the results of Trace statistics where it is revealed that, there is only one (1) cointegrating equation at 0.05 levels of significance between inflation rate and the selected monetary policy instruments in Nigeria; whereas, the table 4.3 (b) shows the results of max-eigenvalue statistics where it is revealed that, there is presence of only one (1) cointegrating equation at 0.05 level of statistical significance. This implies that, there exist long relationship between inflation rate and the selected monetary policy instruments in Nigeria. This is consistent to the finding of Akaraka and Azebi (2018) that there is long run relationship between inflation rate and monetary policy variables in Nigeria.

4.3 (a): Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value (0.05)	Prob.**
None*	0.639366	70.13625	54.07904	0.0010
At most 1	0.433590	32.40030	35.19275	0.0971
At most 2	0.180877	11.36810	20.26184	0.5070
At most 3	0.102125	3.985806	9.164546	0.4142

Trace test indicates 1 cointegrating equation at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

4.3 (b): Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized	Max-Eigen

Text ISSN: 2795-3831
E-ISSN: 2795-3823

No. of CE(s)	Eigenvalue	Statistic	Critical Value (0.05)	Prob.**
None *	0.639366	37.73596	28.58808	0.0026
At most 1	0.433590	21.03219	22.29962	0.0744
At most 2	0.180877	7.382297	15.89210	0.6227
At most 3	0.102125	3.985806	9.164546	0.4142

Max-eigenvalue test indicates 1 cointegration equation at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source: Authors' Computation

4.2.1 The Result of Error Correction Model

The table 4.4 shows the results of short-run estimates where it is revealed that money supply is positively related to the rate of inflation in Nigeria. This finding is consistent to the findings in study by Ogunmuyiwa (2020); Manu and Chindo (2018); Gbadebo and Mohammed (2015); Asuquo (2012); Bakare (2011); Folorunso and Abiola (2000) that money supply has positive impacts on inflation rate in Nigeria. This imply that increase in money supply without corresponding increase in output level in an economy will mean increase in the liquidity of money in the hands of individuals in an economy which would induced the expenditure habit of individuals that thus exerts pressure on the non-increased output level and demand, consequently results in rise in inflation rate. Conversely, this finding is in variant to the finding by Emmanuel (2000) that money supply and exchange rate had a negative influence on inflation rate.

Also, the study found that monetary policy rate (MPR) has positive impact on inflation rate in Nigeria. Meaning that, as MPR rises, there is corresponding rise in the rate of inflation in Nigeria. This finding is consistent to the finding by Kumapayi, Nana and Ohwofasa (2012); Asuquo (2012); Folorunso and Abiola (2000) that monetary policy rate impact positively on inflation. This is so, because increase in monetary policy rate results in increase in the rate at which the funds is loaned to the key players in the real sector of the economy and by implication raises the cost of production that consequently results to increase in the price of commodities and hence, the rising inflation rate in an economy.

Furthermore, the study discovered that exchange rate (EXCR) positively impacted on inflation rate in Nigeria. This finding corroborates the findings by Ogunmuyiwa

Text ISSN: 2795-3831
E-ISSN: 2795-3823

(2020); Tonprebofa (2019); Akinjare, Babajide, Akhanolu and Okafor (2016); Gbadebo and Mohammed (2015); Asuquo (2012) where it is revealed in the aforementioned studies that exchange rate had a positive impact on inflation rate. Impliedly, increase in the rate of exchanging one currency for another particularly, as it is in the case of naira exchange rate presently, leads to increasing cost of importing goods from foreign countries that consequently results in increase in inflation rate. In other words, it is a case of cost-push inflation. Conversely, this finding is in variant to the findings by Chuku (2009); Emmanuel (2000) where it is revealed that exchange rate and money supply negatively influences inflation rate in Nigeria, and this also negate the theory upon which this study is built.

Nonetheless, the table 4.4 also shows that, the obtained result of error correction model (ECM) associated with the long-run estimates is -0.475059 with p-value 0.0020 showing the statistical significance of the estimated short-run dynamic of the long-run estimated model, which is consistent and fulfils the conditions of the ECM. The error correction term represents the speed of adjustment from the initial level of disequilibrium in the short run to a long run equilibrium path. This implies that, any disequilibrium of inflation rate (INF) resulting from instability in either of the variables specified in the estimated model in the preceding year, would be corrected by 47.5 per cent speed of correction in the following year to attain equilibrium level in the long run. Theoretically, the error correction model (ECM) lies between zero (0) and negative integers. Consequently, the negative coefficient depicted in the table 4.4 simply means that the convergence or ECM is oscillatory, in which case monetary policy measures using its instruments selected in this study may take a relatively shorter period to achieve the steady state in the long run.

4.4: The Result of ECM

Variables	Coefficient	Std. Error	T-Statistics	Probability
D($InMs_2$)	3.383633	9.008364	0.375610	0.7095
D(MPR)	1.240333	1.103592	1.123905	0.2687
D(EXCR)	0.010583	0.097364	0.108691	0.9141
CointEq (-1)	-0.475059	0.142283	-3.38822	0.0020

Source: Authour's Computation

4.3 The Results of Residual Diagnostics Tests

The R^2-adjusted shows that any variation from regression line is captured by 0.446% error term (since the R^2-adjusted is 0.554) as shown in the table 4.4; while the result

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E-ISSN: 2795-3823

of Durbin-Watson statistics (D.W) is 1.85 (which is approximately 2.0) indicates that there is absence of autocorrelation in the regression equation since the computed D.W statistics is both farther from both zero (0) and four (4). More so, the result of hetroskedasticity shows that the estimated model is free from such problem as multi-colinearity that lead to spurious regression that thus amount to weak regression result obtained from the estimated model since the p-value is greater than 0.05. Lastly, the stability test is presented in Fig. 1 and 2.

4.5: The Result of Residual Diagnostics Tests

R^2 adjusted	0.5535136
D.W	1.85 ≈2.00
Hetroskedasticity- BPG	2.411625 (P-0.0571)

Source: Author's Computation

4.3.1 Stability Test

The cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) tests were utilised to define the stability of the coefficients of the calculated model. Both the CUSUM and CUSUMSQ plots do not cross the 5% critical lines, implying that over the entire sample period of investigation, there exist stability of the estimated coefficients, so that the regression coefficients are reliable and suitable for policy formulation.

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Fig. 1: Cumulative Sum (CUSUM)

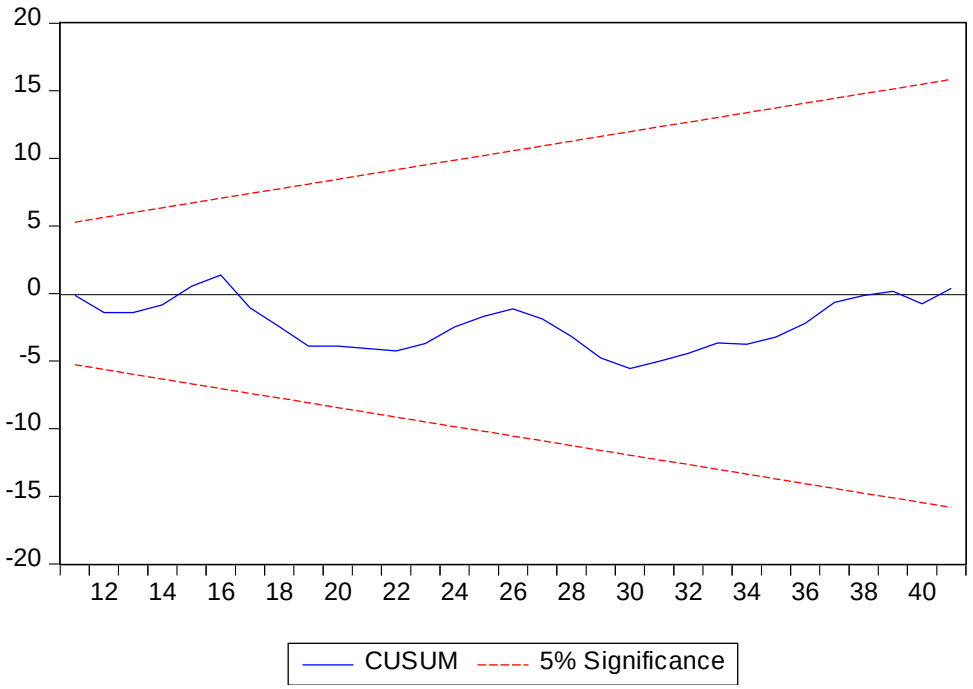
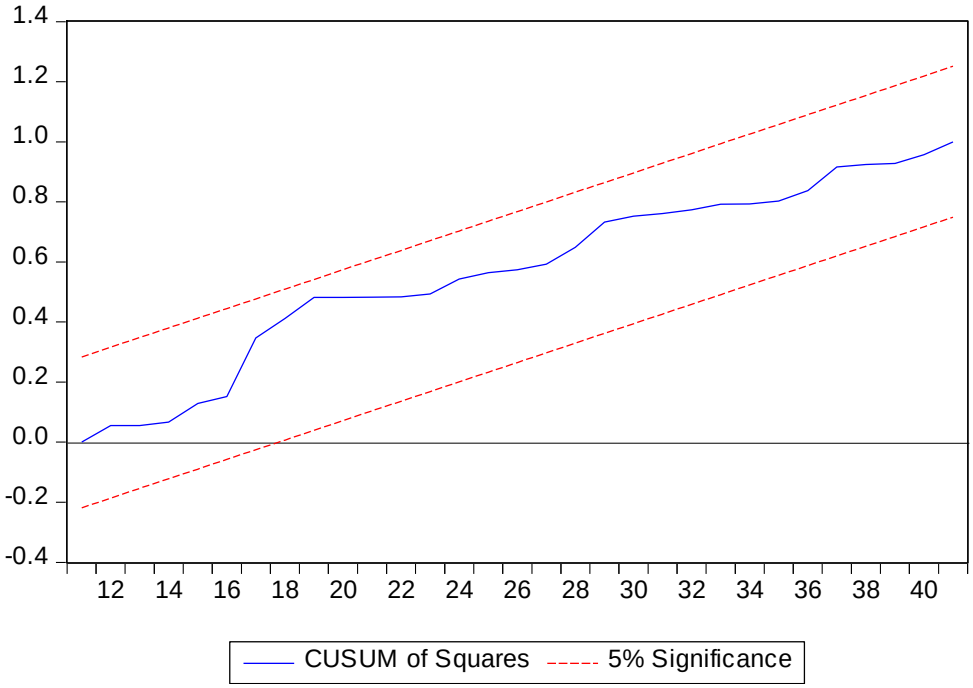


Fig. 2: Cumulative Sum of Squares (CUSUMSQ)



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E-ISSN: 2795-3823

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Importantly, inflation and monetary policy instruments like money supply, monetary policy rate (MPR) and exchange rate (EXCR) have been identified as critical factors for stabilizing the economy in order to ensure the sustained economic growth and development. This study examined some selected monetary policy instruments and inflation in Nigeria from 1980 to 2020. As such, the study employed Johansen Cointegration test and error correction model test framework as methods of estimation. Emerging from the findings of this study, it is established that there is evidence of presence of long run relationship between inflation and monetary policy in Nigeria; whereas, the result of short run model revealed that all the employed monetary policy instruments in the study are positively related to and impacted positively on inflation rate in Nigeria, though at insignificant statistical level, and that ECM shows any disequilibrium in the estimated long run model can be adjusted back to the long run equilibrium path at 47.5% speed of correction.

5.2 Recommendations

In view of the policy implications of the findings presented and discussed in this study, the following recommendations are hereby proposed:

i. Pragmatic policy framework by the monetary policy authority in Nigeria needs to be drawn to aid the efficient management of exchange rate so as to reduce the overburden effects of exchange rate disequilibrium on the local economy that most of times necessitates rising inflation rate in the country.
ii. To sustain effectiveness of MPR as monetary policy instrument, it needs to be anchored on efficient operating and monetary targets in order to stimulate sustained short run growth in an economy.
iii. Prudent regulation of money supply that is consistent to the prevailing output level in an economy in order not to induce expenditure tendency beyond the productive capacity in an economy.

Text ISSN: 2795-3831
E-ISSN: 2795-3823

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