

Impact of Monetary Growth and Exchange Rate Fluctuation on Inflation in Nigeria: 1986-2022

Babatope Ademola Awe¹, Uloko Joseph²

Doctoral Candidate, Faculty of Social Sciences, Department of Economics, Nile University of Nigeria,
Airport Road, Abuja (FCT)-Nigeria

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ABSTRACT

The relationship between, monetary growth, exchanger rate fluctuation and inflation in Nigeria is an important one for policy makers. The objective of the paper was to examined the relationship between monetary growth, exchange rate fluctuations and inflation in Nigeria from 1986 to 2022. The research employed the techniques of Dynamic OLS, ARCH and GARCH models to estimate the variables of interest. Based on the empirical findings. It is established that inflation in Nigeria is significantly influenced by such dynamic variables as money supply growth rate, exchange rate and government expenditure growth rate; while real gross domestic product growth rate and interest rate insignificantly influenced the rate of inflation in Nigeria for the period 1986-2022. In line with theoretical assumptions, the findings confirmed that in the long run, inflation in Nigeria is positively related to increase in the monetary aggregate. The findings also established that in the long run fluctuation in the foreign prices negatively affects the level of inflation in Nigeria. Specifically, 1% increase in the monetary aggregate led to about 97% increase in the rate of inflation and 1% increase in exchange rate fluctuation led to about 8% decrease in the rate of inflation in Nigeria. The research also confirmed an inverse relationship between government expenditure growth rate and inflation in Nigeria. That is, a negative relationship exists between government expenditure growth rate and inflation in the model. This implies that a unit percent decrease in government expenditure growth increase the rate of inflation by over one hundred percent. Government should moderate money supply rate and also should endeavor to reduce monetary policy rate to encourage borrowings for SMEs growth in Nigeria.

Keywords: Money supply Growth, Exchange Rate, Inflation Rate ARCH, GARCH, DO

INTRODUCTION

Globally, monetary policy as a tool of macroeconomic administration is utilized for balance of payment equilibrium, economic growth, full employment and price stability. Nevertheless, in developing countries, central bank focus more on monetary aggregate and exchange rate stability because of its positive association with price stability. According to monetary theory. Inflation is caused by excess money supply, that is, increase in the monetary aggregate. In the perspective of balance of payment (BOP), exchange rate is its main concern. High prices of import lead to high inflation rate which are frequently as a result of exchange rate instability, (Ahmed, Muhammad, Noman & Lakhan. 2014).

According to the monetary theory, monetary growth is as a result of expansionary monetary policy. Actions of the monetary authority in a country to increase money supply through any of the instrument of monetary policy lead to increase the monetary base in such economic. The monetary authority of a country is accountable to attain price constancy if the problem of inflation is to be curbed (Khan & Schimmelpfenning 2006). The existence of a relationship between money supply and the price level is well acknowledging in the economic literature (Olorunfemi & Adeleke, 2013; Akinbobola, 2012. A large consensus can be found on the direction of the effect of an increase in the monetary aggregate on prices development. The statement that in equilibrium money policy is neutral hinges on the quantity equation which in turn defines a positive "One-to-one" relationship between monetary and price growth over a long-term horizon (Roffia & Zaghini, 2007). The rapid

growth in monetary aggregate due to the increase in money supply seems to have led to the increase in the general price level. For instance, money supply (M_2) in Nigeria has at least 6.78% annual growth rate in Nigeria between 1986 and 2022. Decade by decade comparison reveals that between 1985 and 1995 M_2 increased from ₦22.30 billion to ₦289.09 billion and between 1995 and 2005 the M_2 increased from ₦289.09 billion to ₦2.64 trillion and before the end of 2022, the M_2 increased to about ₦22,61 trillion in Nigeria (CBN, 2022).

Inflation is a major macroeconomic problem in Nigeria. This problem has been reoccurring. There is no doubt; macroeconomic policy objectives year-in, year-out hand contained reduction of inflationary pressures on the economy. Though inflation rate is not new in the Nigeria economic history, the recent rates of inflation has been a cause of great concern to many. During the period under review (1986-2022), there has been an upsurge in the inflationary rates leading to major economic distortions; these distortions include the reduction in the purchasing power of the currency thereby weakling the currency and too much money in circulation purchasing few goods.

The relationship between monetary growth, exchange rate and inflation has been widely debated in the literature (Canetti & Greene, 200; Bawumia & Abradu-Otoo, 2003; Roffia & Zabhini 2007; Yousfat, 2015). Some studies concluded that a positive relationship exists among the variable (Chiaraah & Nkegbe 2014, Mahamadu & Philip 2003, Roffa & Zaghini 2007, Imimole & Enoma 2011); while others have divergent relationships (Asad, Ahmed & Hussain, 2010; Tule, Obioma, Okparachi, Odeniran & Olaoye, 2015; Bobai & Ubangida, 2013). For instance, Tule *et al* (2015) divided their entire sample into two sub samples with the first one covering the period 1982 to 1996 while the second sub sample covered the period to 2012. The coefficient of money supply was insignificant in the second sub sample meaning that the relationship between inflation and money supply might have weakened in recent years. While, Asad et al (2010) concluded that inflation was not affect by the real effective exchange rate. However, Bobai and Ubangida (2013) concluded that exchange rate fluctuation negatively affects inflation in Nigeria. The broad objective of the study is to examine the effect of monetary growth and exchange rate fluctuation on inflation in Nigeria. Specifically, the study seeks to:-

1. Examine the trend and pattern of monetary growth, exchange rate and inflation in Nigeria.
2. Examine the effect of monetary growth on inflation in Nigeria
3. Examine the effect of exchange rate fluctuation on inflation Nigeria

The following Null Hypotheses are specified: -

1. Monetary growth does not have any significant effect on inflation in Nigeria
2. Exchange rate fluctuation does not have any significant effect on inflation in Nigeria
3. Exchange rate fluctuation does not have any significant effect on inflation in Nigeria.

LITERATURE REVIEW

This chapter addresses issues that relates to the conceptual literature and theoretical literature which is based on the existing theories of inflation. This chapter also included empirical and methodological literature from various academic journals and publications. The chapter also summaries the literature review and gap to be filled.

Conceptual Literature

Arif and Ali (2012) described inflation as a persistent raise in the general price level of goods as well as services in an economy within a given period of time. It seriously affects government and business as well as individuals. It is regarded generally as significant problem that needs to be solved and the top agendas of policy makers and politicians. To solve the problem of inflation, there is need to know a lot about the factors that cause it. Comman and Pop (2015) asserted that inflation poses to be a serious economic issue in the developing or emerging economy, represented by a generalized increase in prices and a simultaneous decrease in the purchasing power of the national currency. It is a final indicator that shows whether government policies monetary, fiscal and legal are coordinated and lead to stability in consumer prices. According to Jhingan (2010), Inflation is a controversial term which has undergorie modification since it was first defined by the neo-classical economists. They meant by it a galloping rise in prices as a result of the excessive increase in the quantity of money.

Theoretical Literature

Quantity Theory of Money

The quantity theory of money is one of the oldest surviving economic doctrines. Simple stated, it asserts that changes in the general level of general prices are determined primarily by changes in quantity of money in circulation. The quantity theory of money formed the central core of 19th century classical monetary analysis, provided the dominant conceptual framework for interpret in contemporary financial events and formed the intellectual foundation of orthodox policy prescription designed to preserve the gold standard. David Hume (1711-76) provided the first dynamic process analysis of how the impact of a monetary change spread from one sector of the economy to another, altering relative price and quantity in the process. He provided considerable refinement elaboration and extension to the quantity theory of money.

David Ricardo (1772-1823), the most influential of the classical economists, though such disequilibrium effects ephemeral and unimportant in long-run equilibrium analysis. As leader of the Balloonists, Ricardo charged that inflation in Britain was solely the result of the bank of England's irresponsibility over issue of money, when 1797, under the stress of Napoleonic wars; Britain left the gold standard for an inconvertible paper standard.

METHOLOGY

This chapter addresses issue that relates to the methodology of the study with emphasis on the type and sources of data-collection, method of data analysis, and the specification of the model designed to the hypotheses formulated for the study, as well as provides method of analysis. The chapter also specifies the theoretical preposition and a-priori expectation of the study.

Theoretical Framework and Model Specification

The theoretical framework of this study is based on the Monetarist, Keynesian and the Structural theories of inflation. Monetarists believe that the most significant factor influencing inflation is how the money supply grows. The most important for the purpose of this study is the assertion that the significant determinant of aggregate spending is the supply of money. Increase in the money supply is seen as the important causal factor in inflation. The Keynesian theory posited that the aggregate demand comprise consumption, investment and government expenditure. When the value of aggregate demand exceeds the value of aggregate supply at the full employment level. The inflationary gap arises. Also according to the structural theory of inflation, increase in the inflation rate is as a result of foreign exchange bottleneck whereby developing countries face a shortage of foreign exchange for financial needed imports for development.

This study adopted the model of Imimole and Enoma (2011) with some modification. According to Imimole and Emoma (2011), inflation is a function of exchange rate, money supply, government expenditure, real gross domestic product lagged inflation.

$$INFR=f(EXCR, MS, GEXP, RGDP, INF_{t-1}).....(1)$$

Thus, this is mathematically written as:

$$INFR_t=a_0 +a_1INFLR_{t1}+a_2EXCR_t+a_3MS+a_4GEXP_t+a_5RGDP_t+U....(2)$$

Where:

$INFR_t$ =Nigeria Inflation in the Current Period

$INFR_{t-1}$ =One year Lagged Value of Nigeria Inflation Rate

$EXCR_t$ = Nominal Exchange Rate of the Naira in Terms of US Dollar in period t

MS_t = Nominal Money Supply (broadly defined) in period t

$GEXP_t$ = Government Expenditure in the Current Period

$RGDP_t$ = Real GDP in the Current Period

The model of Imimole and Enoma (2011) used exchange rate, money supply, government expenditure, real Gross Domestic Product and lagged inflation as determinant of inflation in Nigeria. To add to the existing body of knowledge, Imimole and Enoma (2011) model is modified such that interest rate is added to the model. The purpose of this modification is to accommodate other variables that can influence inflation in developing countries. Nigeria inclusive. Thus, interest rate is introduced to the model in order to provide a better understanding and also, to add to the existing body of knowledge within the estimated model in Nigeria for the period of 1986-2022. The variable introduced is supported by existing literatures. The introduction of interest rate in the model is supported by Morosan and Zubas (2015). Furthermore, lagged value of inflation rate will be excluded from the model, according to Achan (2001), lagged dependent variables to uniformly indexed, the growth or proportional rate of all the macroeconomics variables will be adopted.

Therefore for this study, equation (1&2) are modified and presented thus:-

$$INFR = f(MSR, EXCR, GEXP, RGDP, INTR_{t-1}) \dots \dots \dots (3)$$

In econometric equation:-

$$INFR_t = a_0 + a_1 MSR_{t1} + a_2 EXR_t + a_3 GER_t + a_4 RGDP_t + a_5 INTR_t + U \dots \dots \dots (4)$$

Where:

$INFR_t$ =Nigeria Inflation in the Current Period

$INFR_{t-1}$ =One year Lagged Value of Nigeria Inflation Rate

$EXCR_t$ = Nominal Exchange Rate of the Naira in Terms of US Dollar in period t

MS_t = Nominal Money Supply (broadly defined) in period t

$GEXP_t$ = Government Expenditure in the Current Period

$RGDP_t$ = Real GDP in the Current Period

$INTR_t$ = Interest rate in the current period

a_0 = Intercept

$a_t - a_5$ = Parameters Estimated

U = Stochastic error term

The a-prior expectations are:

$$a_t > 0; a_2 > 0; a_3 > 0; a_4 < 0; a_5 > 0$$

This means that with the exception of real GDP, all coefficients on the variables are expected to have positive signs.

The Arch/Garch Mode

Autoregressive Conditional Heteroskedasticity (ARCH) models are specifically designed to model and forecast conditional variances. The variance of the dependent variable is modeled as a function of past values of the independent or exogenous variables. ARCH models were introduced by Engle (1982) and generalized as GARCH (Generalized ARCH) by Bollerslev (1986). These models are widely used in various branches of econometrics, especially in financial time series analysis.

In developing economies, exchange rate is known to be fluctuating. It may not be sufficient to model it with least square method; least square which is the commonest modeling technique because the basic assumption concerning the means and variance of stochastic term, for which the estimates of this technique will be accepted as robust may not hold (Bobia & Ubangida, 2013). Besides, this problem may also make one to cast doubt on the inferential procedure because it may cause incorrect rejection of the null hypothesis i.e type 1 error. As a result of this, study consider Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model that take into consideration the volatile nature of financial data like exchange rate and inflation into consideration.

The GARCH method is made up of the mean equation (5) and condition variance equation (6) below: GARCH model is the same as the ARCH, except the inclusion of last period's forecast variance (σ^2_{t-1}) in the conditional variance equation. The mean equation of the inflation rate model and conditional variance of inflation rate are therefore specified as follows:-

$$INFR_t = \psi_0 + \psi_1 EXP_{t-1} + u_t \dots\dots\dots(5)$$

$$\pi^2_t \Omega_1 + \Omega_2 u^2_{t-1} + \sigma_1 \pi^2_{t-1} \dots\dots\dots(6)$$

Where $INFR_t$ and EXR_{t-1} are the current inflation rate and previous session of exchange rate. ψ_1 is the coefficient of exchange rate while u_t is the stochastic term of the model. In the conditional variance equation, the news about fluctuation from previous period is denoted by u^2_{t-1} and its coefficient is Ω_2 theoretically, $\psi_1 > 0$

Definition and Measurement of Variables

The need for variables identification is very essential so as to know what method would be put in place to source for such variables. The variable employ includes inflation rate, real GDP growth rate, exchange rate, government expenditure growth rate and interest rate, while money supply growth rate proxies' monetary growth.

Inflation Rate (INFR):- Inflation rate is the percentage rate of change of a price index over time. Inflation rate is widely calculated by calculating the movement or change in price index, inflation is measure as (consumer price index in the current year minus consumer price index in the base year) divided by consumer price index in the base year.

Money Supply Growth Rate (MSR):- Rate of change in money supply over time. Annual money supply growth rate is calculated as (money supply in the current year minus money supply in the base year) divided by money supply in the base year.

Exchange Rate (EXR):- Exchange rate is a price of a country's expressed as a unit price of another country's currency.

Government Expenditure Growth Rate (GER):- Rate of change in government expenditure over time annual government expenditure growth rate is calculated as (government expenditure in the current year minus government expenditure in the base year) divided by government expenditure in the base year.

Real Gross Domestic Product Growth Rate (RGDP):- Rate of change in the real gross domestic product overtime. The annual real gross domestic product growth rate is calculating that (real gross domestic product in the current year minus real gross domestic product in the base year) divided by real gross domestic product in the base year

Interest Rate (INTR): Interest rate is the cost of borrowing and it is expressed as a percentage of its principal. Interest rate is the rate at which the Deposit Money Banks (DMBs) lends to the general public.

Types and Sources of Data

The data in this study were mainly time series secondary data from 1986 to 2022, in Nigeria. Data used in the study were obtained from Central Bank of Nigeria (CBN) annual statistical bulletin. The data needed for the

study are inflation rate, money, supply, government expenditure, real gross domestic product, exchange rate, and interest rate.

Theoretical Proposition of the Model and A-priori Expectations

The theoretical proposition of our expected parameters is discussed as follows. Inflation is expected to have a positive relationship with the exchange rate in the model. An increase in the rate of exchange of a currency in relation to other currency depreciates the value of the home currency thereby increasing the rate of inflation in the economy. Furthermore, increase in the money supply growth rate is theoretically expected to increase the rate inflation in the economy. Thus, money supply growth rate is expected to have a positive relationship with the inflation rate. Theoretically, government expenditure has a significant impact on the rate of inflation. It is expected that government expenditure have a positive relationship with inflation rate in the model. In the same vein, interest rate is expected to be positively related to the inflation rate. It is theoretically expected that the macroeconomic prices (exchange rate and interest rate) move in the same direction. However, it is theoretically expected that real GDP have an inverse relationship on the inflation rate in the model. This is, increase in the real GDP growth rate is expected to reduce the inflation rate in the mod

Data Presentation & Result

This chapter discussion the analysis and interpretation of data collected to investigate the relationship between monetary growth, exchange rate fluctuation and inflation in Nigeria for the period 1986-2022. The analysis intends to examine the econometric relationship between some independent variables; - monetary growth proxied by money supply growth rate (MSR) and exchange ae (EXR) and other control variables; - government expenditure growth rate (GER), real gross domestic product growth rate (RGDP) and interest rate (INTR). Inflation rate is the dependent variable in the models for the period of the study. The student used pre-test; -unit root test and co-integration test are adopted to examine the stationarity and long run relationship between the variables respectively. In addition, the DORS, ARCH and GARCH was applied to established the coefficients or the types of relationship that exist and the degree of the relationship in the models in Nigeria.

The Trend of Monetary Growth, Exchange Rate and Inflation in Nigeria

The study intends to examine the trend of monetary growth, exchange rate in inflation in Nigeria for the period 1986-2022, thus, the trends are presented below:-

Figure 4:1: Trend of Monetary Growth Proxied By Board Money Supply Growth Rate, 1986-2022

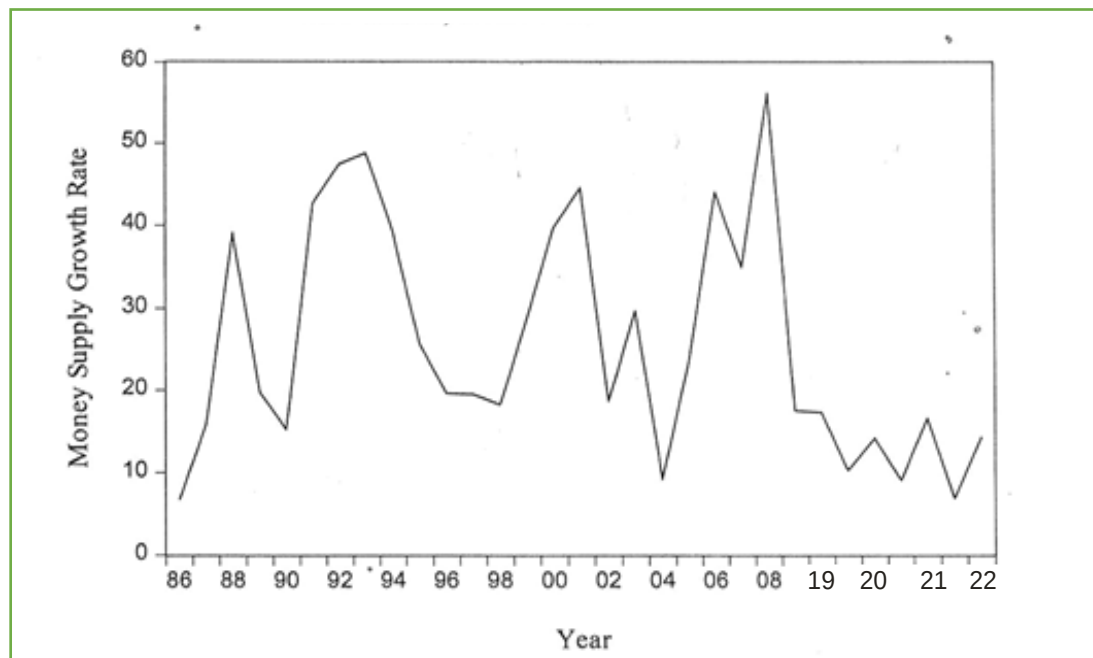


Figure 4.1 established the trend of monetary growth between 1986 and 2022 in Nigeria. It is discovered that between 1986 the annual money supply growth rate (MSR) increased from 6.8% to 39.1% between 1988 and 1990 money supply growth rate reduced from 39.1% to 15.2% between 1990 and 1993 MSR increased steadily from 15.2% to about 49%. But between 1993 and 1998 the MSR reduced from 49% to about 18.2% and between 1998 and 2004 the annual money supply growth rate fluctuates between 44.5% and 9.2% between 2014 and 2008 the MSR increased to about 53% and later decline to about 17% in 2010. Furthermore, between 2011 and 2022 the annual growth rate of money supply varies between 6.9% and about 14.3%. This study thus, reveals sharp increase and decline in the annual growth rate of money supply in Nigeria within the study period.

Figure 4:2: Trend of exchange rate US Dollar/ Naira, 1986-2022

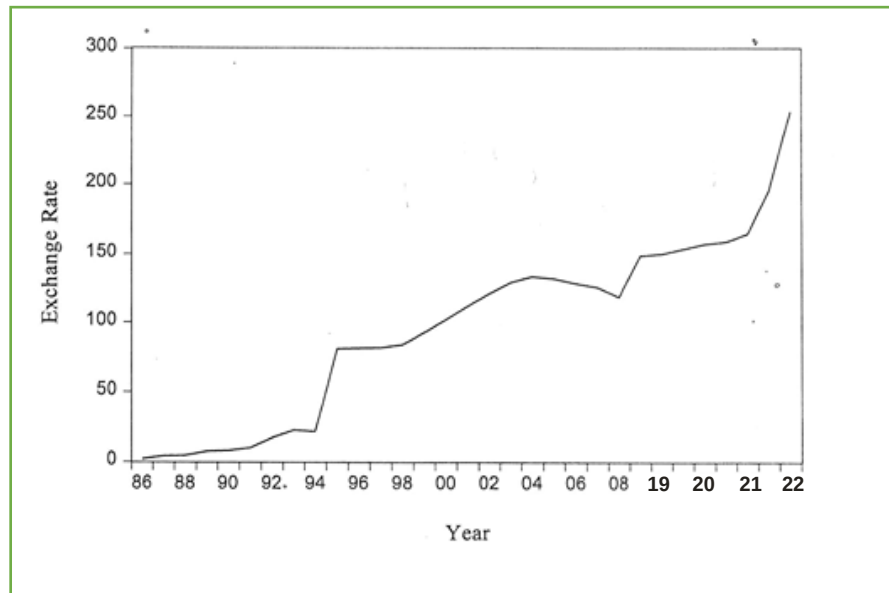


Figure 4:2 shows the trend of exchange rate of the US dollar/Naira between 1986 and 2022, there was an upward slope which implies that exchange rate of naira to a dollar has been depreciating over the years. Between 1986 and 2022 the exchange rate ranges between ₦2.02 and ₦21.90 to a dollar. Between 1995 and 2004 the naira depreciated further from ₦81 to about ₦133.50 to a dollar. Between 2005 and 2008 the naira appreciated a bit but later depreciated between 2009 and 2022 from ₦148.9 to ₦253.5 to a dollar.

Figure 4:3: Trend of Inflation rate in Nigeria, 1986-2022

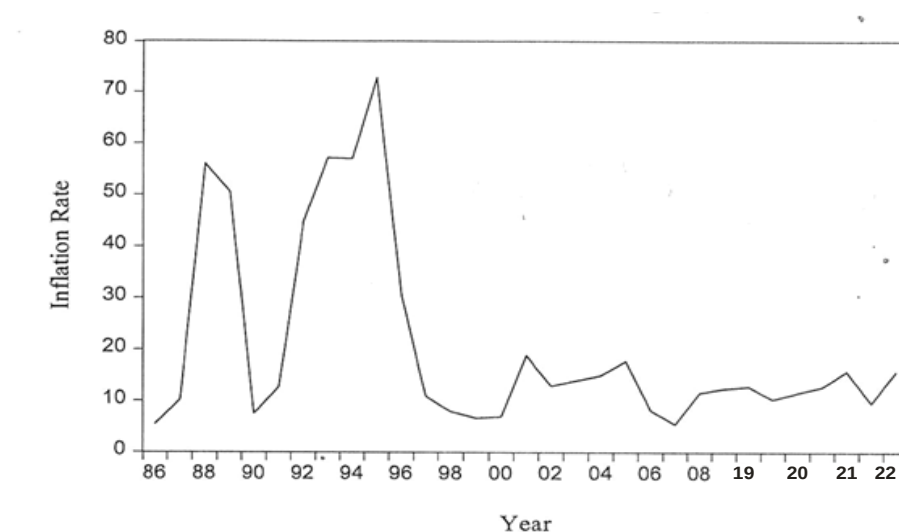


Figure 4.3 shows the trend of inflation for the period 1986 -2022 in Nigeria. There was a sharp increase in the inflation rate between 1986 and 1988 from about 5.4% to about 56% which later reduced to about 7.5% in 1990.

Between 1991 and 1993 inflation rate steadily increased from about 13% to about 73% which later decline to about 6.6% in 1999, between 2000 and 2006 inflation varies between 8.2% and about 17%. The trend shows that in recent times inflation has increased from about 5.4% in 2007 to about 16% in 2022. This shows a persistent increase in the general price level of goods and services over the years in Nigeria. Based on the graphs above, the money supply growth rate and inflation rate have similar trend, this implies that inflation in Nigeria is as a result of annual marginal increase in the monetary aggregated in the economy over the study.

Pre-Test Analyses

The Unit root and co-integration test were carried out as pre-test in this study in order to examine whether the variables were stationary and co-integrated for the period 1986-2022

Test for Stationarity

In order to test for the stationarity of the time series data used in this study, the Augmented Dickey Fuller (ADF) unit root test was employed in this study. The ADF test decision rule is that the ADF test statistic must be greater than or equal to any of its critical values in absolute terms before we can accept stationarity. In this study, 5% critical value is used. The result of the unit root test is presented in table 4.3.1.1 and 4.3.1.2 below:

Table 4.1: test for Unit root at level

Variables	Test statistics	5% Critical Level	Level	Prob	S/NS
INFL	/2.657156/	/2.963972/	1(0)	0.0933	NS
MSR	/3.453146/	/2.963972/	1(0)	0.0168	S
EXR	/0.847609/	/2.963972/	1(0)	0.9932	NS
GER	/7.102640/	/2.963972/	1(0)	0.0000	S
RGDP	/2.794155/	/2.963972/	1(0)	0.0711	NS
INTR	/4.507037/	/2.963972/	1(0)	0.0021	S

Source: Researcher's computations, 2023

Where:

S = Stationary/Significant

NS= Non stationary/Not significant

1(0)= at Level

The result from table 4.1 above reveals that the Money supply growth rate (MSR), Government expenditure growth rate (GER) and interest rate (INTR) were stationary at level; absolute values of the ADF test statistics of MSR, GER and INTR are greater than the 5% critical value (2.96372). The probability values reveal that MSR, GER and INTR are significant because each probability value of MSR, GER and INTR are less than 0.05. However, from the above table, inflation rate (INFL). Exchange rate (EXR) and real GDP growth rate (RGDP) were not stationary at level because the absolute value of test statistics is less than the 5% critical value and the probability values of INFL, EXR and RGDP are greater than 0.05

Table 4.2: Test for Unit Root at 1st Difference

Variables	Test statistics	5% Critical Level	Level	Prob	S/NS
INFL	/4.8.5135/	/2.967767/	1(0)	0.0006	S
EXR	/3.708025/	/2.967767/	1(0)	0.0093	S
RGDP	/6.331493/	/2.967767/	1(0)	0.0000	S

Source: Researcher's computation, 2023

1(1)= 1st Difference

The result form table 4.2 shows that inflation rate (INFL), exchange rate (EXR) and real GDP growth rate were stationary at 1st Difference. This is revealed by comparing the ADF test statistics in absolute terms with the 5% critical values in absolute terms. The probability values reveal that INFL, EXR and RGDP are less than 0.05; this therefore confirms that the variable are significant at 5% level of significance. Thus, there is need to test whether the variables was co-integrated and there is need to verify whether a long run relationship exists between the variables of the model.

Johansen Co-integration Test, DOLS Model

Going by the result of the ADF unit root test, some of the variables were not stationary at level. Hence, it is necessary to verify whether the regression residuals are co-integrated, that is, to test if there is any long run relationship(s) between the response and explanatory variables in the estimated within the models. For this, the study applied by Johansen Co-integration test using Trace and Maximum Eigenvalue statistics by comparing their values' with the critical values at 5% significance level. If the values of the trace and maximum Eigen value were greater than the critical value, when we conclude that there existed a long run equilibrium relationship otherwise the regression residual is not co-integrated. Thus, this is shown below: -

Table 4.3: Empirical Results of Unrestricted Co-Integration Rank Test (Trace)

Variables	Test statistics	0.05 Critical value	Eigen Value	Hypothesized No. of CE(S)	Prob**
INFL	154.5539	95.75366	0.889709	None *	0.0000
MSR	88.41483	69.81889	0.675708	At most 1*	0.0008
EXR	54.63153	47.851613	0.573373	At most 2*	0.0101
GER	29.07616	29.79707	0.430206	At most 3*	0.0604
RGDP	12.20172	15.49471	0.315428	At most 4*	0.1475
INTR	0.832898	3.841466	0.027381	At most 5*	0.3614

Source: Researcher's computations, 2023

Trace test indicates 3 co-integrating equations at the 0.05 level

* denoted rejection of the hypothesis at the 0.005 level

** Mackinnon Haug-michelis (1999) p-values.

Table 4.4: Empirical Results of Unrestricted Co-Integration Rank Test (Max- Eigen Value)

Variables	Maximum Eigenvalue Statistics	0.05 Critical value	Eigen Value	Hypothesized No. of CE(S)	Prob**
INFL	66.13911	40.07757	0.889709	None *	0.0000
MSR	33.78330	33.87687	0.675708	At most 1	0.0513
EXR	25.55537	27.58434	0.573373	At most 2	0.0889
GER	16.87444	24.13162	0.430206	At most 3	0.1780
RGDP	11.36882	14.26460	0.315428	At most 4	0.1367
INTR	0.832898	3.841466	0.027381	At most 5	0.3614

Source: Researcher's computations, 2023

Maximum Eigenvalue test indicate 1 co-integrating equations at the 0.05 level

*denoted rejection of the hypothesis at the 0.005 level

**Mackinnon Haug-michelis (1999) p-values.

The table 4.3 and 4.4 above reveal that monetary growth, exchange rate and inflation were co-integrated in the model using the unrestricted co-integration test. Trace and maximum Eigenvalue test, with the values of unrestricted co-integration test, trace and maximum Eigenvalue were greater than the value of the critical value at 5% level of significance. The test statistics indicate that the Hypothesis of no co-integration among the variables can be rejected. The finding implies that there is a long run relationship between inflation, monetary growth, exchange rate, government expenditure growth rate, real GDP growth rate and interest rate within the estimated model in Nigeria. The test result suggests that a long run relationship exists among the variables in the model. Thus, the study proceeds to estimate the long run parameters of the models.

Jonansen Co-Integration Test: ARCH/GARCH Model

Table 4.5: Empirical Results of Unrestricted Co-Integration Rank Test (Trace)

Variables	Maximum eigenvalue Statistics	0.05 Critical value	Eigen Value	Hypothesized No. of CE(S)	Prob**
INFL	19.13652	15.49471	0.466249	None *	0.0135
EXR	0.301747	3.841466	0.010008	At most 1	0.5828

Source: Reas]5232searcher's computations, 2023

Trace test indicate 1 co-integrating equations at the 0.05 level

*denoted rejection of the hypothesis at the 0.005 level

**Mackinnon Haug-michelis (1999) p-values.

Table 4.6 Empirical results of unrestricted co-integration ranks text (Max-Eigen Value)

Variables	Maximum Eigenvalue Statistics	0.05 Critical value	Eigen Value	Hypothesized No. of CE(S)	Prob**
INFL	18.83477	14.26460	0.466249	None *	0.0088
EXR	0.31747	3.847466	0.01008	At most 1	0.5828

Source: Researcher's computations, 2023

Trace test indicate 1 co-integrating equations at the 0.05 level

*denoted rejection of the hypothesis at the 0.005 level

**Mackinnon Haug-michelis (1999) p-values.

Table 4:6 Empirical Results of Unrestricted Co-Integration Rank Rest

Variables	Maximum Eigenvalue Statistics	0.05 Critical value	Eigen Value	Hypothesized No. of CE(S)	Prob**
INFL	18.83477	14.26460	0.466249	None *	0.00088
EXR	0.301747	3.841466	0.010008	At most 1	0.5828

Source: Researcher's computations, 2023

Maximum Eigenvalue test indicate 1 co-integrating equations at the 0.05 level

*denoted rejection of the hypothesis at the 0.005 level

**Mackinnon Haug-michelis (1999) p-values.

Analysis and Interpretation of DOLS Regression Result.

The equation of the effect of monetary growth proxied by board money supply growth rate on inflation in Nigeria is estimated using Dynamic ordinary least square (DOLS) model technique applied to the time series data for the period of 1986-2022

Table 4.7 The empirical result of dynamic ordinary least square Depend variable: INFL

Model: Dynamic least square (DOLS)

Variables	Coefficients	Std. Error	t-statistics	Prob**
MSR	0.973625	0.367080	2.652350	0.0328
EXR	-0.401358	0.159206	-2.520988	0.0398
GER	-1.679415	0.378266	-4.439769	0.0030
RGDP	-2.268361	1.727461	-1.313119	0.2305
INTR	1.684025	2.358882	0.713908	0.4984
C	54.48642	54.13050	1.006575	0.3477
R-Squared0.843293				

Source: Researcher's computations, 2023

The result of DOLS estimation technique with Newey West Heteroskedasticity and Autocorrelation Consistent Covariance (HAC) procedure, to correct for serial autocorrelation is presented in table 4.7. table 4.7 reveals that the coefficient of monetary growth proxied by money supply growth rate (MSR) at 0.973625 on inflation rate in the model. Findings show that a unit percent (1%) increase in monetary growth led to about ninety-seven percent (97%) increase in the inflation rate in Nigeria. Hence, it is statistically significant at 5% level of significance at 0.0328 probability value. This result suggests a direct significant relationship exists between monetary growth and inflation in the Nigeria economy. Also, exchange rate (EXR) shows a negative relationship with inflation in the model contrary to the *a priori* expectation of the model the result prove that a unit percent increase in the rate of exchange brings about forty percent (40%) decrease in inflation in Nigeria. This result is in agreement with Akinbobola (2012) which stated that exchange rate have significant inverse effect on inflationary pressure.

Moreover, the result shows that a negative relationship exists between government expenditure growth rate and inflation in the model. The coefficient of government expenditure growth rate is negative (-1.679412) on inflation in Nigeria and this implies that a unit percent decrease in government expenditure growth increase the rate of inflation by over one hundred percent within the study period at 5% level of significance in the model. Again, a negative relationship exists between real gross domestic product growth rate and inflation in Nigeria for the period of 1986-2022. The result is in (2011) which states that real gross domestics product has negative effect on the rate of inflation. Also, the result of the estimated model shows a positive relationship between interest rate and inflation in Nigeria. The coefficient of interest rate is positive (1.684025), this implies that a unit increase in the rate of interest led to cover one hundred percent increase in their rate of inflation in the model. Also, if all the explanatory variables are excluded from the model, the constant value is positive at 54.48642. this means that the intercept value (α_0) is still positive in the model over the estimated years 1986 to 2022.

Standard Error Test

The standard error test is summarized in table 4.4.2 below

Table 4.8 The Empirical Result of Standard Error Test

Variables	Coefficients	½ Coefficient	Std. Error	Decision
MSR	0.973625	0.486813	0.367080	Accept H_1
EXR	-0.401358	0.200679	0.159206	Accept H_1

GER	-1.679412	0.839706	0.378266	Accept H_1
RGDP	-2.268361	1.134181	1.727461	Accept H_0
INTR	1.684025	0.842013	2.358882	Accept H_0
C	54.48642	27.24321	54.13050	Accept H_0

Source: Research's computation, 2023

From table 4.8 above, half of each coefficient of the variables are compared with its standard error in absolute terms, it was found that the standard error of monetary growth proxied by broad money supply growth rate, exchange rate, exchange rate and government expenditure growth rate are less than half of its corresponding coefficient, hence they are significant in the model while real gross domestic product growth rate and interest rate are insignificant in the model. Thus, the key variable (broad money supply growth rate) and two other variable (exchange rate and government expenditure growth rate) significantly affect inflation in Nigeria.

The Student in Nigeria

To further establish the empirical validity and statistical significance of the model, or otherwise, of the stand hypothesis, the student t-test is used. This is summarized in. table 4.9 blow

Table 4.9: Empirical Result of Student t-Test

Variables	Parameters	t-statistics	$t_{0.05}$	Decision
MSR	a_1	2.652350	1.967	Accept H_1
EXR	a_2	-2.520988	1.967	Accept H_1
GER	a_3	-4.439769	1.967	Accept H_1
RGDP	a_4	-1.313119	1.967	Accept H_0
INTR	a_5	0.713908	1.967	Accept H_0
C	a_6	1.006575	1.967	Accept H_0

Source: Research's computation, 2023

Table 4.9 above shows similar conclusion with the standard error test. In summary, the t-test values are greater than the theoretical value of t-test at 5% degree of freedom critical values for the estimate a_1 a_2 and a_3 for of monetary growth proxied by broad money supply growth rate, exchange rate and government expenditure growth rate using dynamic ordinary least square technique. The finding therefore suggests that broad money supply growth rate, exchange rate and government expenditure growth rate have significant effect on inflation in Nigeria for the period 1986-2022. This reject the Null hypothesis which states that "Monetary growth does not have significant effect in inflation in Nigeria." Therefore, the Alternative Hypothesis, which state that that Monetary growth have significant effect on inflation in Nigeria" is accepted.

Test for goodness of the model (coefficient of determination, R^2)

The R-square (R^2) shows the predicative power of a model and it is derived to be 0.843293, using the dynamic ordinary least square approach, this implies that monetary growth proxied by broad money supply growth rate, exchange rate, government expenditure growth rate, real gross domestic product growth rate and interest rate explain about 84% systematic variation on inflation rate in Nigeria for the period of 1986-2022 while the random stochastic term accounts for the remaining 16% variation in inflation outside the estimate model.

Analysis and Interpretation of ARCH/GRACH Regression Result

The equation of the effect of exchange fluctuation on inflation in Nigeria is estimate using the autoregressive conditional Heteroskedasticity (ARCH)/Generalized Autoregressive Conditional Heteroskedasticity (GRACH)

model technique applied to the time series data for the period of 1986-2022. The empirical result of the autoregressive conditional heteroscedasticity and generalized autoregressive conditional Heteoreskedasticity is pretended in table 4.10 below:

Table 4.10: the empirical result of the atuogressive conditional heteroscedasticity/generalized autoregressive conditional heteroscedasticity

Dependent variables: INFL

Method: ARCH/GRACH

Variables	coefficient	Std. Error	t-Statistic	Prob.
Mean Equation				
C	24.20725	3.078439	7.863482	0.0000
EXR(-1)	-0.076101	0.018150	-4.193014	0.0000
Variance Equation				
C	6.997492	9.513377	0.735542	0.4620
RESID(-1)^2	1.36226	0.987845	1.379029	0.1679
GARCH (-1)	-0.046743	0.27681	-0.16885	0.8659
Durbin_Watson stat 0.920505				

Source: Researcher's Computation, 2023

Table 4.10 above shows the result of the ARCH and GARCH model. The result of the estimation indicates that exchange rate during the previous period have significant effects on inflation rate in Nigeria at 5% level of significance. The coefficient of the exchange rate during the previous period in the mean equation is negative (-0.076101), that is, a unit percent change in the exchange rate would lead to about 8% change in the rate of inflation. This implies that exchange rate fluctuation have a negative effect on in inflation in Nigeria from 1986 to 2022. Furthermore, the R-square (R_2) reveals the predictor powered of a model and it is derived to be 0.185340. this implies that exchange rate in previous year explain about 19 percent systematic variation on rate of inflation in Nigeria for the period 1986-2022.

The arch and GARCH coefficients components test

Table 4.11: The Empirical Result of ARCH and GRACH coefficient components

Variable	Parameter	Coefficient
C	Ω_1	6.997492
RESID(-1)	Ω_2	1.362266
GARCH(-1)	σ_1	-0.046743
	$\Omega_2 + \sigma_1 = 1.315523$	

Source: Researcher's Computation, 2023

As shown in table 4.11, the summation of the coefficients of the ARCH and GARCH components (1.362266 and -0.046743) in the conditional variance equation is approximately equal to one at 1.315523. This implies that exchange rate fluctuation is persistent in Nigeria. We therefore say the exchange rate fluctuation is persistent in Nigeria. This rejects the Null hypothesis which states that "exchange rate fluctuation was not been persistent in Nigeria. "Therefore, the Alternative Hypothesis, which states that "exchange rate fluctuation was persistent in Nigeria", is accepted.

Standard Error Test

The standard error test of the ARCH and GRACH model is summarized in table 4.11 below.

Table 4.12: The Empirical Result of Standard Error Test

Variables	Coefficient	$\frac{1}{2}$ Coefficient	Std. Error	Prob.	Decision
Mean Equation					
C	24.20725	12.103625	3.078439	0.0000	Accept H_1
EXR(-1)	-0.076101	0.0380505	0.018150	0.0000	Accept H_1

Source: Researcher's computation, 2023

The Z-Statistic Test

Table 4.13: The Empirical Result of Z-Statistic Test

Variables	Parameter	z-statistic	$Z_{0.05}$	Decision
Mean Equation				
C	Ψ_0	7.863482	2.58	Accept H_1
EXR(-1)	Ψ_1	-4.193014	2.58	Accept H_1

Source: Researcher's computation, 2018

The same conclusion can be reached with the standard error and z-statistic tests have shown in table 4.12 and 4.13 above. Half of each coefficient of the variable was compared with its standard error in absolute terms: it was found that the standard error to the constant and variable in the mean equation are significant at 5% level. Also, the value of the estimated z-statistics is greater than the critical value of the z-statistics in the means equation at 5% significant level, hence, the null hypothesis is rejected. This rejects the null hypothesis which states that "Exchange rate fluctuation does not have any significant effect on inflation in Nigeria". Therefore, the Alternative Hypothesis, which states that "Exchange rate fluctuation have significant effect on inflation in Nigeria" is accepted.

Test for Auto-Correlation Using Durbin-Watson Test

Durbin-Watson test can be used in detecting the presence of auto-correlation in regression analysis. Durbin-Watson statistic is derived to be 0.920505 in the estimated model. The study therefore concludes that there is absence of auto-correlation in the estimated model at one percent level of significance. From the Durbin-Watson table, with 1% level of significance, n=31 observations, and k=5. The estimated Durbin-Watson (0.920505) lies between the Durbin-Watson upper and lower limits. $dL < d^* < dU$: $0.90 < 0.92 < 1.60$. Hence, the parameter estimate is statistically significant as determinant of the rate of inflation in Nigeria over the study period.

CONCLUSION & POLICY RECOMMENDATIONS

Conclusions

The relationship between, monetary growth, exchanger rate fluctuation and inflation in Nigeria is an important one for policy makers. Based on the empirical findings. It is established that inflation in Nigeria is significantly influenced by such dynamic variables as money supply growth rate, exchange rate and government expenditure growth rate; while real gross domestic product growth rate and interest rate insignificantly influenced the rate of inflation in Nigeria for the period 1986-2022. In line with theoretical assumptions, the findings confirmed that in the long run, inflation in Nigeria is positively related to increase in the monetary aggregate. The findings also established that in the long run fluctuation in the foreign prices negatively affects the level of inflation in Nigeria. Specifically, 1% increase in the monetary aggregate led to about 97% increase in the rate of inflation and 1% increase in exchange rate fluctuation led to about 8% decrease in the rate of inflation in Nigeria.

The study also confirmed an inverse relationship between government expenditure growth rate and inflation in Nigeria. That is, a negative relationship exists between government expenditure growth rate and inflation in the

model. This implies that a unit percent decrease in government expenditure growth increase the rate of inflation by over one hundred percent.

The empirical finding in the estimated model are in conformity with the stand of the Central Bank of Nigeria's policy of using monetary instruments as in inflation targeting. It is clear from the above that an increase in money supply above output growth can be inflationary, so the Central Bank Nigeria should monitor the money supply growth rate as it is strongly linked to the price formation in Nigeria.

The central opinion of this study is that inflation can be significantly reduce through adopting appropriate monetary measures that is necessary to reduced monetary expansion by reducing the money supply growth rate in the Nigeria economy.

Recommendations

The major objective of any monetary authority in any economy is the formulation and implementation of monetary policy, with the overriding objective of maintaining price stability through appropriate monetary actions in the economy. Based on the findings of the study, the following recommendations are made:

- i) It is clear from the findings that an increase in money supply above output growth can be inflationary, so the Central Bank of Nigeria should monitor the money supply growth rate as it is strongly linked to the price of formation in Nigeria. If this is done, it can lead to stable and how inflation and sustainable economic growth in Nigeria.
- ii) For effective inflation control in Nigeria, monetary policy must be well coordinated to percent excessive monetary expansion. Though exchange rate may not be the most important factor in inflation determination in Nigeria, exchange rate stability is a necessary condition for stable domestic prices.
- iii) Based on the findings of the study, positive relationship exists between interest and inflation in Nigeria. Therefore, the prime lending rate should be reduced so as to boost the credit facilities in order to improve the productivity level in the country. Reducing the interest rate will encourage borrowing by the business sector thereby mopping up idle resources in the economy.

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