

# EFFICACY OF MONETARY POLICY MEASURES ON PRICE AND EXCHANGE RATE STABILTY IN NIGERIA

## *Authors' contributions*

*This research work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

## ABSTRACT

The study investigated the efficacy of monetary policy measures on price and exchange stability in Nigeria using the Ordinary Least Square (OLS), Johansen Co-integration approach and Error Correction Technique on time series data collected from 1981 to 2021. The unit root tests using Augmented Dickey-Fuller (ADF) found that consumer price index and exchange rate are integrated of order zero  $I(0)$  and money supply, lending rate, interest rate and external reserve are stationary at first difference  $I(1)$  and also show that there exist a long-run relationship among the variables. The study revealed that monetary supply (MS2) shows a positive statistical significant to consumer price index and exchange rate. In view of these findings, the study concluded and recommended that the government to ensure a stable economy, there is need for them to diversify the economy so as to channel excessive money supply resulting from deficit financing, different economic yielding ventures that are remote causes of instability in Nigeria economy so as to select the proper monetary policy instrument capable of controlling instability in the economy.

**Keywords:** Money supply, Consumer price index, Exchange rate, Ordinary Least Square, Nigeria.

**JEL Classification:** E12, E31, E51, E52.

## 1. INTRODUCTION

Monetary policy is one of the macroeconomic management tools used to steer the real economy in the right direction. The promotion of stable prices, sustainable production, and employment are the primary aims of monetary policy. Monetary policy is used in macroeconomic policy to impact the actual economy by changing interest rates, which changes the cost of capital and investment in the productive sector. According to Mishkin (2017), monetary policy has an impact on the economy through a range of channels, including interest rates, credit, and bank lending, asset values through exchange rates, equity, and housing prices. Monetary policy refers to the government's use of the central bank to manage money supply in order to achieve broad macroeconomic goals such as price stability, high employment, long-

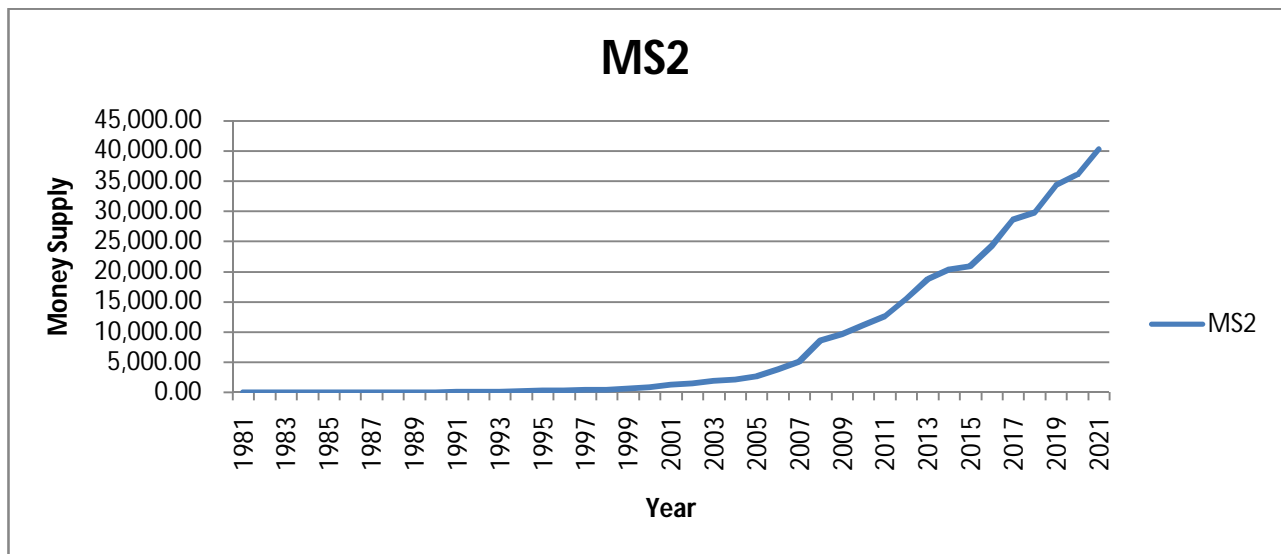
term economic growth, and a balanced budget. This broad goal is achieved by the use of appropriate tools, which are determined by the policy's goal and the economy's stage of development. Since the expositions of the role of monetary policy in influencing objectives such as economic growth, price stability, employment promotion, and balance of payments equilibrium, monetary authorities have made it their responsibility to use monetary policy to develop their economies (Adigwe, Echekeba, and Onyeagba, 2015). In the statement of Folawewo and Osinubi (2006) considers monetary policy to be a mix of measures intended to control the value, supply and cost of money in an economy, in consonance with the expected degree of economic activity.

Since the Central Bank of Nigeria (CBN) was assigned the responsibility of creating and executing monetary policies by the Central Bank Act of 1958, monetary policy has been used in Nigeria. This position has aided the growth of an active monetary market, with treasury bills, a financial instrument used for Open Market Operations and government debt raising, increasing in volume and value, becoming notable earning assets for speculators and a source of market balancing liquidity (Adigwe, Echekeba and Onyeagba, 2015). As previously stated, monetary policy objectives include the encouragement of employment, output growth, and long-term development. These goals are critical for achieving internal and external equilibrium, as well as promotion. Price stability and exchange rate management have frequently been the main objectives of monetary policy over the years. These two goals have dominated the CBN's monetary policy, assuming that they are necessary tools for ensuring macroeconomic stability (Ezeanyeji et al, 2021). The amount and direction of money supply, as well as the availability of financial resources in the economy, are used to create and implement monetary policy. According to Owosekun (2010), monetary policy is critical for determining the direction and size of changes in the money supply and credit on output, employment, price stability, and economic growth and development. The Central Bank of Nigeria (CBN) exerts economic control by interfering with the activities and operations of Deposit Money Banks (DBNs). Open market operations, cash reserve ratio, discount rate, stabilization securities, liquidity ratio, and qualitative instruments like moral suasion and selective credit control are all used by the apex monetary authority to restrict commercial banks' reserves. (Ike, 1989; Ajie and Nenbee, 2010). According to Ike (1989), monetary policy is monetary management that involves the management of the money supply in the economy and includes cash management, foreign exchange management, international liquidity, interest rate policy, the full range of monetary policy instruments, the capital market, and indirectly wage and salary management, among other things.

The major goal of monetary policy in 2013 was to maintain the already lowered inflation rates achieved in the first half of the year. The goal was to attain inflation of 8.0 percent by the end of December 2013, down from 8.4 percent in June. In 2014, monetary policy was focused on attaining the goal of price and

exchange rate stability. Inflation stayed throughout single digits in 2014, fluctuating between 7.7 and 8.5 percent, thanks to the combined effect of lower apparel, footwear, and transportation prices. Continuing market expectations of US monetary policy normalization, sluggish global growth, and decreasing crude oil prices in the international market, all of which had a negative influence on foreign exchange reserves and exchange rates, affected the Bank's monetary policy in 2015, 2016 and 2017. The global and local economic and financial environments continued to influence monetary policy in 2018. (CBN, 2018)

**Fig.1. Money Supply (M2) in NBillions**



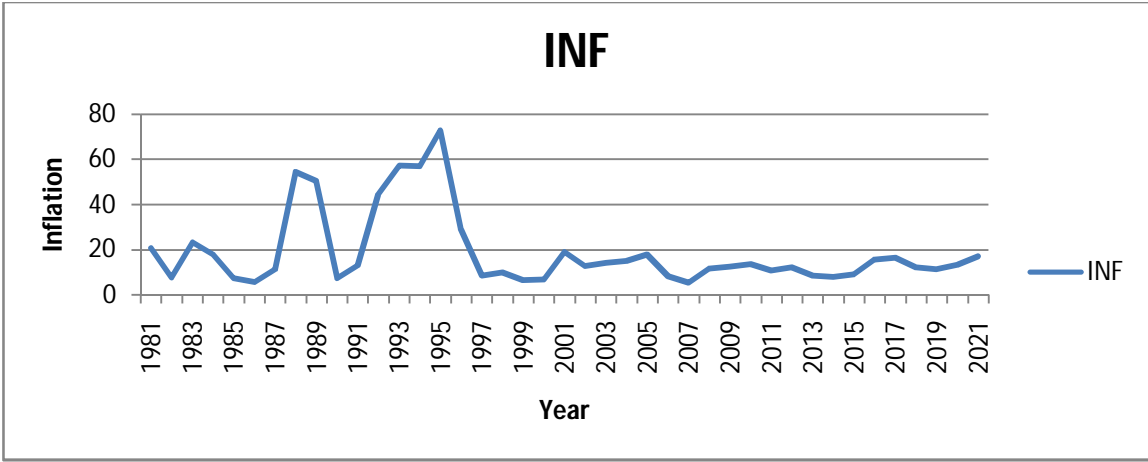
**\*Sources: Author's compilation using CBN data, 2021.**

From the above graph, it can be seen that the money supply increases every year. In 1981 the money supply was N14.47 billion, these increases in 1990 to N47.42 billion which is about 31% increase, in 1995 to 289.09 billion about 16% increase, in 2000 to N878.46 billion about 33%, in 2005 to N2, 637.91 billion which is about 33%, in 2010 to N11, 101.46 billion an increase of about 24%, in 2015 to 20,885.52 billion about 53% increase, in 2017 to N28, 604.47 billion about 73%. In Feb 2019, M2 was N34, 251.70 about 83% increases. Also in 2020 and 2021, it further increase to N36, 038.01 and N40,318.39 respectively about 95% and 89% increases. In order to maintain price stability, the CBN, like other monetary authorities across the world, uses both direct and indirect monetary policy. The price stability strategy maintains the value of money, eliminates cyclical swings, promotes economic stability, reduces income and wealth inequalities, improves social fairness, and promotes economic wellbeing (Jhingan, 2004).

The importance of price stability stems from the negative impact of price volatility, which jeopardizes policymakers' capacity to attain other acceptable macroeconomic goals. Domestic price fluctuations, it is widely agreed, undercut the role of money as a store of value and stymie investment and growth. Price stability, according to the CBN (2011), is a desideratum for every nation and has always been a central objective of monetary policy framework, as well as the fact that price stability in goods and services promotes growth, which occurs when there is a sustainable low and stable inflation rate. The polar opposite of price stability is price instability, which occurs as a result of price increases (inflation) in practically every country and poses a danger to a country's economic success, making price stability a top concern for all countries.

Since the 1970s, the world economy in general and the Nigerian economy in particular have seen a continuous rise in the overall price level (Sarcel, 1996). However, the pace of inflation during the previous 10 years has been unconscionably high. 13.7% in 2010; 10.84% in 2011; 12.2% in 2012; 8.5% in 2013; 8.06% in 2014; 9.01% in 2015; 15.68% in 2016; 16.52% in 2017; 12.09% in 2018; 11.04% in 2019; 13.24% in 2020 and 16.95% in 2021 (CBN, 2021).

**Fig.2. Inflation rate in Nigeria**

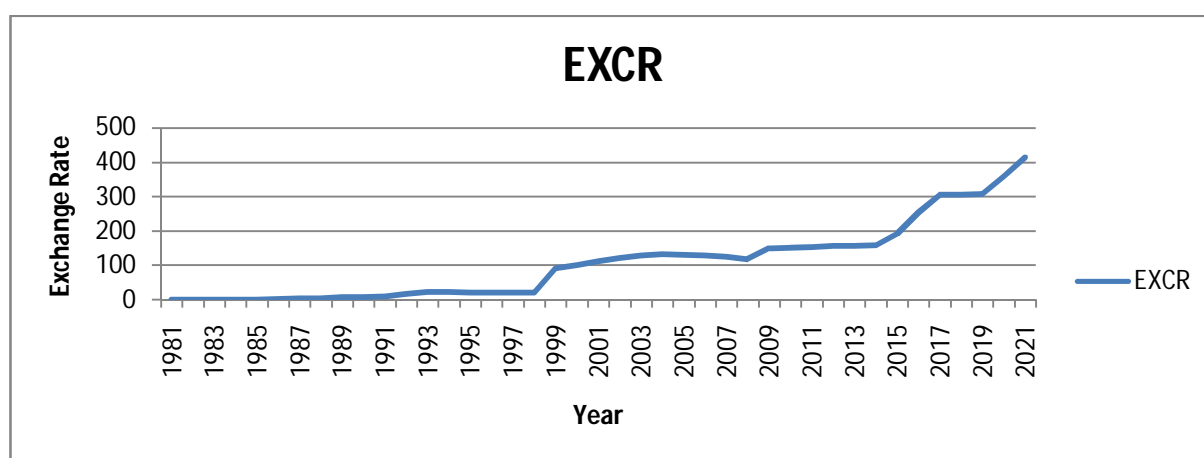


**\*Source: Author’s compilation from CBN, (2021).**

From the above fig 2, it was clearly seen that inflation is fluctuating (rising and falling) in Nigeria which means price is not stable and most of the years inflation are in double digits which are too high to stabilize the economy. . In 2016 the rate was 15.7% and 16.5% in 2017, the rate of inflation is 11.4% in 2019, and the rate of inflation in 2020 and 2021 are 13.24% and 16.95% respectively. The problem is made worse by the recession, which has high unemployment rates.

The exchange rate is a very sensitive variable that influences the speed at which economic activity take place. Apart from being a powerful tool for international trade, the stability of the dollar determines the growth of investment and output in every economy. Export items priced in Naira become more expensive in foreign currency as the exchange rate rises. Inflation and interest rates tend to be pushed lower as a result of this. In addition, a drop in the exchange rate raises the cost of imports, placing upward pressure on demand, inflation, and interest rates (Jason, 2010; Umar and Soliu, 2006). The exchange rate is important for assuring international trade of products and services, as well as obtaining and maintaining international competitiveness and balancing the books.

**Fig.3. Exchange rate**



**\*Source: Author's compilation from CBN data, 2021.**

In fig 3, it can also be seen that exchange rate in Nigeria has been rising continuously which has been a challenge to the Nigeria economy. Between 1980 and 1991, exchange rate was N0.6 and N4 to a US dollar, from 1992 to 1999 the Nigeria exchange start increasing from N17.3 to N92.7 to a dollar. It increase did not stop, between 2000 to 2010 exchange rate rise to N102.1 and 150.3 to one US dollar. Between 2011 and 2015, the exchange rate rises from N153 to a US dollar to N193 to one US dollar. In 2016, it rises again to N253, N305 in 2017 and in 2019 exchange rate of Naira to one US dollar is 306.9 in 2020 and 2021 the exchange rate rises from N358 to 412.99 per dollar.(CBN, 2021).

The capacity to accurately evaluate and comprehend what monetary policy can and cannot achieve is critical for effective policymaking and the selection of various macroeconomic frameworks (Chuku, 2009). According to Altman (2003), the CBN's monetary policy issuance has not been effective in achieving the intended goal. Domestic price fluctuations, according to scholars such as Fasanya, Onakoya, and Agboluaje (2013); Adeoye, Ojapinwa, and Odekunle (2014), are variables that hinder the

effectiveness of monetary policy. Balolgun (2007) revealed that rather than fostering growth, one-time domestic monetary policy was the source of stagnation and chronic inflation in Nigeria after evaluating the premise of monetary policy ineffectiveness. Adedamola (2015) showed that monetary policy has not had a substantial role in maintaining price stability, however Ndubuisi, Uma, and Obidike (2017) found that monetary policy has had a considerable influence on exchange rates. As a result, based on past research, an evaluation of the effectiveness of monetary policy measures on price and exchange rate stability in Nigeria is recommended.

High inflation undermines the economy's ability to generate gains in output, incomes, and employment; for those on fixed income, it wears away the values of their investments, income, and social well-being; and it encourages high speculative deeds in financial markets relative to investments that boost production activities (Ajayi, 2012). Inflation has been one of the most difficult of the several economic difficulties confronting the Nigerian economy to date. Nigeria has used and implemented a variety of monetary policies. Tight monetary policy has been implemented and used at times, while expansionary monetary policy has been enacted and applied at other times, mostly to stabilize prices and maintain a stable exchange rate in the nation. Unfortunately, despite the many types of monetary policies established and implemented, Nigeria has experienced high rates of price and exchange rate volatility (Nwamuo, 2018). Inflation rates tend to rise in response to continuous increases in price levels. Regardless of the numerous regimes that have existed in Nigeria, price volatility continues to represent a serious threat to the engines of economic growth. Nigeria has experienced significant variations in inflation rates since the 1970s. The CBN's main challenge is to control price volatility in the face of other macroeconomic problems

It has been challenging for Nigeria, which is largely reliant on oil export earnings and imports of consumer and industry products, to maintain stable currency rates. The fixed and fluctuating exchange rate regimes have not produced the best results. This is because our economy is characterized by structural rigidities and bottlenecks, and the majority of our imports and exports are considered inelastic on either the demand or supply side, or both. Furthermore, the Central Bank of Nigeria's (CBN) requirements on foreign currency transactions are sometimes cumbersome, producing annoyance among customers and resulting in a high level of patronage for parallel marking. According to World Bank financial data, the actual sectors of Nigeria's economy (agriculture, manufacturing, building and construction, mining and quarrying) have had the worst experience with interest and exchange rate management. External shocks that impact monetary policy via the naira's foreign exchange rate are also a concern. The ability of monetary policy to achieve price stability objectives is often hampered by developments such as a drop in the price of crude oil on the international oil market, which causes

exchange rate depreciation. This is because depreciation of the currency causes an increase in the price of imported items, which leads to an increase in the domestic price level.

To summarize, the early 1980s oil glut created a recession in Nigeria's economy, which manifested itself in the form of inflation, unemployment, and a deficit imbalance (Ike, 1989). In order to achieve other goals, the Nigerian scenario necessitates the compromise of some governmental objectives. Several efforts and programs to ensure price stability and a viable exchange rate for the naira in relation to other world currencies have not yielded the desired results, as Nigerians continue to face price instability (high inflation) and a continuous decline in the Naira's competitiveness among currencies. As a result, this scenario is an issue, and the goal of this research is to discover answers to it. In order to address this issue, this research looks for ways to use monetary policy and the money supply to address pricing and exchange rate volatility. With the latest modifications and addition of data, this study will contribute to the literature by looking at the efficacy of monetary policy on pricing and exchange rate instability in Nigeria. The paper is arranged as follows, with the exception of the introduction: The second section examines the relevant literature. The methodology is presented in Section 3. The data analysis and results are presented in section 4, while the conclusion and policy recommendations are presented in section 5.

## **1.2. Research Objectives**

1. To investigate the efficacy of monetary policy measures on price and exchange rate stability in Nigeria.
2. To determine the direction of causality between monetary policy, price and exchange rate volatility in Nigeria.

## **1.3. Contribution to Knowledge**

Most literatures that studied the efficacy of monetary policy in ensuring stability in exchange rate such as Ndubuisi, Uma and Obidike (2017) found that monetary policy on exchange rate has a positive impact on Nigerian economy both at short run and long run. This study will add to literature as it tries to have a deeper insight on the efficacy of monetary policy on price stability and exchange rate stability in Nigeria with current and recent data on monetary policies, price stability and exchange rate which were not captured on the previous studies making it a revised study from 1981 to 2021. These will show whether monetary policy through money supply has any effect on price and exchange rate stability in Nigeria.

# **2. LITERATURE REVIEW**

## **2.1 Conceptual and Theoretical Issues**

Both fiscal and monetary policies are significant tools for stabilizing the economy, according to modern economists. Monetarists, led by Milton Friedman (1963), believe that changes in the quantity of money are the fundamental determinants of economic activity and price levels. This is a modern version of classical macroeconomics. They devised a more nuanced and applicable version of the quantity theory of money.

$$MV = PQ \dots\dots\dots (2.1)$$

Where M is the money supply, Q denotes the quantity of national production sold in a particular year, P denotes the average price level, and V denotes the income-velocity of money circulation. As a result, PQ stands for the monetary value of national output sold. MV must equal PQ because it is the total spending on national production. They propose that V is determined completely independent of the money supply in the long run (M). As a result, a change in M has no effect on V but causes a change in the economy's spending (MV). Monetarists argue that, in the long run, monetary policy is a very effective tool for managing aggregate demand (PQ). Monetary policy, according to Keynesians, has a significant impact on economic activity. It claims that changes in money supply can permanently alter variables including interest rates, aggregate demand, and employment, production, and income. Keynes was a firm believer in the existence of an equilibrium between unemployment and employment. This means that expanding the money supply can result in long-term increases in output. Money supply's final impact on price levels is determined by its impact on aggregate demand and the elasticity of aggregate output supply (Nwoko, Ihemeje and Anumadu, 2016)

According to the classical quantity theory of money, the price is a function of the money supply. M, V, P, and T are the supply of money, the velocity of money, the price level, and the volume of transaction, respectively. The total money supply MV equals the total value of output PT in the economy, according to the equation. A change in the money supply (M) induces a corresponding change in the price level, assuming V and T are constant.

Classicists held the belief that the economy was always at full capacity. At the same time, they acknowledged that in the case of downward rigidity in money wages, there would be unemployment. An expansionary monetary policy could help to fix this issue (Jhinghan, 2010). Mundell (1961) and McKinnon (1961) created the Optimal Currency Area (OCA) (1963). This hypothesis focuses on business cycle and trade stabilization. It is based on shock symmetry, openness, and labor market mobility ideas. According to the idea, a fixed exchange rate system can boost trade and economic growth by lowering currency premiums from interest rates, as well as reducing exchange rate uncertainty and hence the cost of hedging.

## 2.2. Empirical Literature

Nwamuo (2018) investigated the impact of Nigerian monetary policy on price stability. Annual data from 1981 to 2015 was used in the study. The researchers employed Johanssen co-integration techniques to confirm the long-run link between the variables, as well as Ordinary least square estimate, and discovered that the money supply and liquidity ratio had a considerable impact on price stability. Itodo, Akadiri, and Ekundayo (2017) used a monthly series data from January 1996 to October 2016 to investigate monetary policy in Nigeria's stability price level. The Vector Autoregressive (VAR) model was used in this investigation. The study's findings reveal that money supply in Nigeria has no meaningful association with price levels. Ahmed and Ibitoye (2016) used annual data from 1970 to 2014 to analyze the impact of monetary policy on price stability in Nigeria. The data for the study came from the Central Bank of Nigeria, and it was analyzed using the Ordinary least square method. The study used the consumer price index (CPI) to proxy general prices and discovered that the exchange rate and money supply both influenced price stability in Nigeria in the short and long run.

Balami, Ahmed, and Yusuf (2016) examined the impact of monetary policy on inflation, exchange rate, and economic growth in Nigeria from 2009 to 2015. They used both primary and secondary data. Some Central Bank of Nigeria (CBN) measures have been criticized, according to the study, because not all monetary policy tools benefit all economic agents. Babatunde and Kehinde (2016) looked at the impact of monetary policy on price stability in Nigeria in a similar study with Adedamola (2015). The study used the ordinary least square regression (OLS) model to analyze secondary data obtained for the Central Bank of Nigeria. The study discovered that the exchange rate and money supply had an impact on price stability in Nigeria in both the short and long run.

Onodugo, Anowor, and Ofoegbu (2018) looked into the effectiveness and failure of monetary policy in addressing inflation and achieving the targeted economic goal. Over the period 1970 to 2015, the study uses an econometric approach to estimate the relationship between the variables. The ordinary least square multiple regression was used in this investigation. If inflation had not been structural, the instruments of monetary policy would have had a bigger impact on it, according to the study's findings. The impact of monetary policy on Nigerian economic growth was re-examined by Anowor and Okerie (2016). With time series data from 1982 to 2013, the study used the Error Correction Model. According to the findings, a one-unit rise in the Cash Reserve Ratio (CRR) resulted in a seven-unit boost in economic growth. The findings are consistent with economic literature, indicating that monetary policy, among other things, is aimed at accomplishing the macroeconomic goal of sustained economic growth and price stability.

Idoko, Seyi, and Rotimi (2017) looked at the impact of monetary policy on price stability in Nigeria. To capture this association, the researchers used the Vector Autoregressive (VAR) model, which includes in-built differencing to account for unit root in time series data. Money supply has no meaningful association with price level in Nigeria, according to the study. Ndubuisi, Uma, and Obidike (2017) investigated the effectiveness of Nigerian monetary policy in maintaining exchange rate stability. Over the period 1981-2014, the study employed secondary data from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics. The study used the multiple regression method and the Error Correction Model (ECM) to discover that there is a strong association between monetary policy and exchange rate, while the ECM discloses the extent to which straying from a stable path leads to reverting to stability.

With annual data from the Central Bank of Nigeria covering 1981 to 2014, Ndubuisi, Uma, and Obidike (2017) evaluated the efficacy of monetary policy in ensuring exchange rate stability in Nigeria. The multiple least square regression method was used to analyze the data in this study. The findings show that monetary policy has a major impact on exchange rates, while ECM reveals the extent to which deviations from a stable path can be reverted to stability. In Ghana, Ofori, Danquah, and Zhang (2017) investigated the effect of money supply on inflation. From 1967 to 2015, secondary data was used in the study. It also used a simple regression model based on ordinary least squares. The study's findings show that money supply and inflation have a long-term beneficial relationship.

In Kenya, Mutwiri (2017) looked at the relationship between monetary policy tools and inflation. The study used secondary data from 2000 to 2012. Inflation and monetary supply are positively associated, according to the study, and the general level of prices rises as the money supply rises. According to the findings of the study, Treasury bill rates have an impact on inflation levels.

This study fills a gap by examining the efficacy of monetary policy on price stability and exchange rate stability in Nigeria using current and recent data on monetary policies, price stability, and exchange rate stability that were not included in previous studies, resulting in a revised study from 1980 to 2019. These will demonstrate if monetary policy, as measured by money supply, has influenced price and exchange rate stability in Nigeria, as well as contribute to the literature.

### **3. METHODOLOGY**

The theoretical framework is hinged on the classical theory of monetary policy developed by Robert Lucas and Thomas Sargent (1979). Money's primary role in the classical system is to serve as a medium of exchange. Its purpose is to establish the general price level at which products and services will be

traded. The quantity theory of money is used to explain the relationship between money and pricing. The Cambridge version of the classical theory of money suggests the following quantity equation of exchange:

$$PY = MV \dots\dots\dots (3.1)$$

Where M is the money supply, V denotes the money velocity (which is considered constant), P denotes the price level, and Y denotes the real income or production. V would be relatively steady, and Y would always tend to full employment, according to classical economists. It's questionable if MV can explain changes in PY or PY explains changes in MV.

OLS regression is a statistical approach for estimating the connection between one or more independent variables and dependent variables. OLS will be used in this study in the context of a multivariate model with two or more independent variables. The following is an example of a multiple regression model.

$$Y_t = \beta_1 X_{1t} + \beta_2 X_{2t} + \beta_3 X_{3t} + \dots \beta_k X_{kt} + \mu_t \dots\dots\dots (3.2)$$

Where  $\beta$  is a  $k \times 1$  vector of unknown parameters; the  $\mu_t$  are unobserved scalar random variables (errors) which account for influences upon the responses  $Y_{it}$  from sources other than explanators  $X_{it}$  and  $X_{it}$  is a column vector of the  $i$ th observations of all the explanatory variables.

### 3.1. Model Specification

Following the discussions in the theoretical framework, the study adopts with modifications the classical theory of monetary policy developed by Robert Lucas and Thomas Sargent (1979). Furthermore,

**To Investigate the effect of monetary policy on price stability in Nigeria. The study adopts consumer price index as a proxy of price as a function of the specified explanatory variables, we specify the empirical model thus:**

$$CPI_t = f(\beta_1 + \beta_2 MS2_t + \beta_3 INR_t + \beta_4 LR_t + \beta_5 ER_t + \beta_6 EXR_t + \mu \dots\dots\dots (3.3)$$

Where CPI = Consumer Price Index

MS2 = Broad Money supply

INR = Interest rate

LR = Liquidity Ratio

ER = External reserve

EXR = Exchange rate

Where the  $\beta_1 \beta_2 \beta_3 \beta_4 \beta_5 \beta_6$  are parameters for estimate and  $\mu$  is the stochastic error term.

**To Investigate the effect of monetary policy on exchange rate stability in Nigeria. The study adopts exchange rate as a function of the specified explanatory variables, we specify the empirical model thus:**

$$EXR_t = f(\beta_1 + \beta_2 MS2_t + \beta_3 INR_t + \beta_4 LR_t + \beta_5 ER_t + \beta_6 INF_t + \mu_t) \dots \dots \dots (3.4)$$

Where EXR = Exchange rate

MS2 = Broad Money supply a proxy of Monetary Policy

INR = Interest rate

LR = Liquidity ratio

ER = External reserve

INF = Inflation

Where the  $\beta_1 \beta_2 \beta_3 \beta_4 \beta_5 \beta_6$  are parameters for estimate and  $\mu$  is the stochastic error term.

### **3.3 Diagnostic Tests**

#### **Unit Root Test**

The Augmented Dickey Fuller (ADF) test for order of stationarity will be used to assess the time series properties of the variables. This is done to avoid the issue of erroneous regression estimations. The following regression equation has to be estimated as part of the test.

$$\Delta X_t = \alpha + \beta_1 X_t + \beta_2 \Delta X_{t-1} + \dots + \epsilon_t \dots \dots \dots (3.5)$$

Where X is the variable under consideration. Thus the ADF unit root test states that

Ho:  $\beta = 0$  and Hi:  $\beta < 0$ , where the ADF statistic was compared either the observed Mackinno critical values, A series that exhibits a stochastic trend will not be stationary and cannot be forecast far in the future.

#### **Co-integration Test**

Testing for co-integration is an important step in determining whether your model has empirically meaningful interactions. If variables have various trend processes, they cannot remain in a stable long-run relationship with each other, meaning that one cannot predict the long-run and that standard distribution is no longer applicable.

There are various co-integration tests available. The simplest basic test is the Johansen test. One of the first co-integration tests was developed by Engel and Granger (1987). This test has the advantage of being simple and intuitive to use. The Johansen approach will be used to test for co-integration among the variables; this ensures that the dependent and explanatory variables have an underlying long-run stationary steady state relationship. As a result, the co-integrated equation is as follows:

$$Z_t = A_1 Z_{t-1} + A_2 Z_{t-2} + A_3 Z_{t-3} + U_t \dots \dots \dots (3.6)$$

**Autocorrelation Test**

In a time series context, autocorrelation is most likely to occur. When data is arranged chronologically, an inaccuracy in one period may have an impact on the error in the next (or other) era (s). The traditional linear regression approach implies that there is no autocorrelation in the disturbances  $U_{i,t}$

$$\text{cov}(u_i, u_j / x_i, x_j) = E(u_i, u_j) = 0 \dots \dots \dots (3.7)$$

Nevertheless, if there is such a dependence, we have autocorrelation.

$$E(u_i, u_j) \neq 0 \dots \dots \dots (3.8)$$

To test for the presence of serial correlation of the error terms in the model, The Breusch-Godfrey (BG) statistic will be adopted.

**Error correction model (ECM)**

An error correction model is a type of multiple time series model that is most typically used with data that has a long-run stochastic trend, also known as co-integration. ECMs are a theoretically-based method for assessing both the short- and long-term effects of one time series on another.

If  $Y_t$  and  $X_t$  are co-integrated, then  $I$  must be co-integrated (0). As a result, we can use an ECM specification to represent the relationship between  $Y_t$  and  $X_t$  as follows:

$$\Delta Y_t = a_0 + b_1 \Delta X_t - \Pi u_{t-1} + Y_t \dots \dots \dots (3.9)$$

**4. DATA ANALYSIS AND DISCUSSION OF RESULTS**

**TABLE 4.1: Unit Root Test**

The below table will shows the Augmented Dickey Fuller unit root test and will carried by 5%.

Table 4.1

Varaibles	ADF				
	Test Critical Value @ 5%	Level	1 <sup>st</sup> Diff	Diff Prob	Order of Diff
CPI	-3.540328	-3.962293*		0.0193	I(0)
MS2	-3.536601	2.228257	-4.757827*	0.0026	I(1)
EXR	-3.540328	-1.916805	-4.537895*	0.0047	I(1)
LR	-3.540328	-3.373207	-6.333442*	0.0000	I(1)
INR	-3.536601	-7.396542*		0.0000	I(0)
ER	-3.540328	-2.390696	-4.643740*	0.0036	I(1)

The results of unit root tests in the levels of money supply, real exchange rate, liquidity ratio, and external reserve indicate the presence of a unit root. After initially differencing the series, the results strongly refute the null hypothesis of the presence of a unit root, implying that the series are of order one I(1). While the results at the levels of the consumer price index and the interest rate plainly indicate to the absence of a unit root, the null hypothesis is rejected at these levels. As a result, the series appear to be integrated of order zero I. (0).

**TABLE 4.2: Johansen Co-Integration Analysis**

Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	0.05 Critical Value	Prob**
$r_0$	0.822238	166.1980	95.75366	0.0000
$r_1$	0.787454	105.7422	69.81889	0.0000
$r_2$	0.449744	51.54126	47.85613	0.0216
$r_3$	0.335608	30.63326	29.79707	0.0400
$r_4$	0.292969	16.32233	15.49471	0.0375
$r_5$	0.112788	4.188500	3.841466	0.0407

Trace test indicates six (6) co-integration equations at 5% level. This is evidence from the result presented above, which shows that up to 6, the trace statistic values are less than 5% critical value. Thus, to further confirm this result, the maximum eigenvalue statistic result is presented. Unrestricted Co-Integration

Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistics	0.05 Critical Value	Prob**
$r_0$	0.822238	60.45582	40.07757	0.0001
$r_1$	0.787454	54.20092	33.87687	0.0001
$r_2$	0.449744	20.90800	27.58434	0.2818
$r_3$	0.335608	14.31093	21.13162	0.3400
$r_4$	0.292969	12.13383	14.26460	0.1057
$r_5$	0.112788	4.188500	3.841466	0.0407

The Max-Eigenvalue test also indicates 3 co-integrating equation at the 5% significance level. The normalized co-integrating coefficients indicated further that the three co-integrating variable is Broad Money supply (MS), Price stability proxy by Consumer price index (CPI), Exchange rate (EXR). Therefore, this shows that there will be long run relationship among the variables.

#### 4.3 To investigate the effect of monetary policy on price stability in Nigeria.

**Table 4.3: Dependent Variable: CPI**

##### **ERROR CORRECTION MODEL FOR MODEL ONE**

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	26.50530	12.41615	2.134744	0.0411
Log(MS2)	6.815700	2.103327	3.240437	0.0029
INR	-0.906525	0.182842	-4.957973	0.0000
LR	-0187716	0.171695	-1.093308	0.2830
Log(ER)	-10.28229	2.181872	-4.712601	0.0001
EXR	-0.063677	0.047421	-1.342796	0.1894
UHAT(-1)	0.345973	0.160992	2.149001	0.0398
Adjusted R <sup>2</sup>	0.730018			
F-Statistic	17.22374			
DW	1.996995			

From the result, it was seen that money supply (MS2) shows a positive statistical significant to consumer price (CPI) index while interest rate (INR) and external reserve (ER) shows a negative statistical significant to consumer price index (CPI). Also other variables like liquidity ratio and exchange rate are statistically insignificant to consumer price index (CPI). From the estimation above, one percent change in money supply (MS2) brought a 6% positive change (increase) in consumer price index (CPI). Also a percentage change in interest rate (INR) brought 90% negative change (decrease) in consumer price index

(CPI) while a percentage change in external reserve (ER) brought 10% negative change (decrease) to consumer price index. The overall result which is the R-Square adjusted shows about 73% goodness of fit and the F-statistic shows a significant result of 17.22374.

#### 4.4 To investigate the effect of monetary policy on exchange rate stability in Nigeria.

**Table 4.4 Dependent variable: EXR  
ERROR CORRECTION MODEL FOR MODEL TWO**

Variable	Coefficient	Std. Error	t-Statistic	Prob
C	-135.2830	26.31716	-5.140484	0.0000
Log(MS2)	41.92597	3.294446	12.72626	0.0000
INR	-0.106320	0.589312	-0.180414	0.8580
LR	0.822926	0.400898	2.052709	0.0489
Log(ER)	-21.16807	6.023925	-3.513999	0.0014
INF	-0.842530	0.398475	-2.064552	0.0477
UHAT(-1)	0.842530	0.130223	6.469908	0.0000
R <sup>2</sup>	0.936126			
F-Statistic	88.93561			
DW	1.830914			

From the result, it was seen that money supply (MS2) and liquidity ratio (LR) shows a positive statistical significant to exchange rate (EXR) while inflation (INF) and external reserve (ER) shows a negative statistical significant to exchange rate (EXR). Also interest rate (INT) is statistically insignificant to exchange rate (EXR). From the estimation above, one percent change in money supply (MS2) will bring about a 41% positive change (increase) in exchange rate (EXR) and a percentage change in liquidity ratio (LR) brought about 82% positive change (increase) in exchange rate (EXR). Also a percentage change in inflation (INF) brought about 82% negative change (decrease) in exchange rate (EXR) while a percentage change in external reserve (ER) brought 21% negative change (decrease) in exchange rate. The overall result which is the R-Square adjusted shows about 93% goodness of fit and the F-statistic shows a significant result of 88.93561

## 5. Conclusion and Policy Recommendation

In order to investigate the efficacy of monetary policy measures proxies with broad money supply on price stability and exchange rate stability in objectives one and two, the study used the Ordinary Least Square (OLS) method. The study's data came from the Central Bank of Nigeria (CBN, 2021), National

bureau of statistics (NBS, 2020) and World bank, 2021 and it covered the years 1981 to 2019. Each target was modelled differently with the help of Ordinary Least Squares for successful estimate (OLS).

Based on the findings, it was discovered that monetary policy and price stability have a positive and statistically significant link. It means that the monetary policy proxy of broad money supply (MS2) and price stability in Nigeria have a positive and significant association. It was also shown that monetary policy affects exchange rate stability in Nigeria in a positive and statistically significant way. That is to say, as monetary policy tightens, the exchange rate tightens as well.

Base on the findings, the study recommends that;

- (1) For the government to ensure a stable economy there is need for them to diversify the economy so as to channel excessive money supply resulting from deficit financing different economic yielding vestures.
- (2) For the government to quickly identity remote causes of instability in Nigeria economy so as to select the proper monetary policy instrument capable controlling instability in the economy.
- (3) The Central Bank of Nigeria (CBN) needs to avoid policy irregularity to actually determine its policy impact before contemplating a change.
- (4) Monetary policy should create a favourable investment environment by facilitating the emergence of market based interest rate and exchange rate regimes which could attract domestic and foreign investment.
- (5) Government should push sound, effective and more coordinated monetary policy.

## **COMPETING INTEREST**

Authors have declared that no competing interests exist.

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