THE IMPACT OF MONETARY POLICY ON PRICE STABILITY IN NIGERIA, (1999 – 2021)

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ABSTRACT

Due to inconclusive and divergent outcomes in the empirical literatures on the impact monetary policy has on price stability over the past years in Nigeria, it is important to ascertain the impact monetary policy have on price stability in lieu of both theoretical and empirical assertions on the nexus between the two variables. Therefore, the objective of this study is to examine the impact of monetary policy on price stability in Nigeria between the periods of 1999 and 2021. This study collected time series data from Central Bank of Nigeria statistical bulletin (2021) and World Development Indicators (2021) on interest rate, money supply and cash reserve ratio as well as consumer price index that cover twenty two (23) years. Thereafter, auto-regressive distributed lag was used to analyse the time series data collected. Finding of this study reveals that interest rate has positive and statistically insignificant impact while money supply at different lag has both positive and negative insignificant impact on price stability. Moreover, cash reserve ratio has negative and significant impact on price stability. Lastly, finding of the study reveals that MS2 Granger Cause CPI and CPI does not Granger Cause MS2. Therefore, the following recommendations are suggested: that monetary policy authority should effectively and continuously apply interest rate (INR) to achieve price stability. More so, monetary policy authority should be caution in applying money supply and cash reserve to achieve price stability. That is to say, that increase or decrease in money supply should base solely on expansionary and contractionary policy targeting at price stability.

Keywords: **Monetary Policy, Price Stability, Interest Rate, Money Supply, Cash Reserve Ratio.**

1. Introduction

Among several macroeconomic objectives of any nation of the world is to achieve price stability in order to control inflation and unemployment. Price is stable in an economy when money retains its value over time. Prices are said to be neither stable if, on average, they neither increase (as in periods of inflation) nor decrease (as in periods of deflation) over time. However, globally two major government policy mixes is commonly in use to achieve price stability. They are monetary and fiscal policies. While fiscal policy focuses on government deliberate actions on revenue mobilization and government expenditure, on the other hand; monetary policy is a set of tools that the monetary policy authority via Central Bank uses to control the volume of money in the circulation and afterward, sustaining economic stability. However, monetary authority uses various monetary policy instruments which include; interest rate, money supply, cash reserve ratio, discount rate, open market operation among other instrument in targeting at controlling volume of money in circulation either directly or indirectly. This is because too much or less of volume of money affects price equilibrium resulting to price instability.

According to Gbadebo, Ogbonna and Adoms (2018) price instability is a major concern for all firms, it has effect on their expenses and income streams. Thereby, making the firms operate under uncertainty. Moreover, according to CBN (2022), economic agents such as firms, households and government are often worried about the impact of prices instability because of its effect on household and firm incomes and the general welfare of the people. However, Nigeria government has been employing monetary policy mechanisms to control price instability. Nevertheless, Alavinasab, (2016) posited that the role of monetary policy in changing aggregate economic activity depends on how monetary policy is conducted and the independence of the central bank to choose the appropriate monetary tools in formulating the monetary policy targeting on price control. According to (Ajibola & Oluwole, 2018) monetary policy are better suited when they are used in targeting macroeconomic challenges such as inflation, exchange rate, unemployment and stimulating growth.

By and large monetary policy of Central Bank of Nigeria most times undertakes for the purpose of contractionary and expansionary measures in achieving the macroeconomic goal in particular, economic growth, reducing unemployment, controlling inflation and sustaining price stability. However, proper understanding of the working of monetary policy vis-a-vis, interest rate, money supply and cash reserve ratio and its implication on price stability is pertinent. This is because of the impact monetary policy via interest rate, money supply and cash reserve ratio variables has on general price level is a controversial issues among the populace and academia. More so, maintenance of price stability is often difficult to attain in the short-run because of its apparent conflicts with other macroeconomic objectives. Subsequently, the Nigerian economy is a highly dynamic and hyper reactive economy. The prices of items easily react to policy implementations of government. Their reactions are easily felt with ordinary rumor even before implementations.

The price fluctuations of items are often predetermined from policy anticipation. Either increases or decreases in general price levels are measured by changes in Consumer Price

Index (CPI). The CPI is a measure of average change in price of basket of goods over time that consumer paid for. That is CPI measure the average change in prices over time that consumers pay for a basket of goods and services. Subsequently, CPI often use as a proxy for general price level (Price Stability), However, the extent to which monetary policy via interest rate, money supply and cash reserve ratio impacts price stability which is been proxy by CPI between the period of 1999 and 2021 is yet to be empirically ascertained. It is against this background that this study attempted to examines the impact of monetary policy via interest rate, money supply and cash reserve ratio on the price stability which is been proxy by CPI in Nigeria between 1999 and 2021.

Statement of the Research Problem

It worth to mentioned that problems creates by persistence price volatility to the entire economy cannot be overemphasis. This is because, recurrent price oscillation, whether persistent increase (inflation) or decrease (deflation), create risks and uncertainties in an economic environment. Not arguable since inception of monetary policy authority in conjunction with Central Bank of Nigeria (CBN) series of monetary policy adjustment has been carried out in particular, targeting on price stability. Despite, the efforts of monetary policy to ensure price stability Nigerian economy is still facing with problems of price instability.

In view of the theoretical and empirical link between monetary policy and general price level in several literatures, in context of Nigeria, no unanimous conclusion on the impact monetary policy has on general price level. However, it's worthy to note that price instability is harmful to any economy in many dimensions. This include investors speculative motive of holding financial asset, loss of financial stock, demand and supply pull and push inflation, increase in unemployment rate and economic instability.

However, elsewhere and in Nigeria there are many empirical studies like (Bank-Ola, Jemiluyi & Johnson (2020); Oladosu & Oladele (2020); Ahmed & Ibitoye (2016); Bambi & Ying (2020); Anowor & Okorie, (2016); Chipote & Makhetha-Kosi, (2014) on the impact of monetary policy on price stability with divergent outcomes. While some studies found positive and significant impact of monetary policy on price stability other of the opinion that monetary policy has negative and insignificant impact on price stability. Despite this inconclusiveness, the Central Bank of Nigeria, like other central banks in elsewhere seeks to achieve price stability through the management of interest rate, money supply as well as cash reserve ratio. However, the extent to which aforementioned monetary policy tools impact on the price stability in Nigeria is controversial issues which called for empirical research. The broad objective of this study is to examine the impact monetary policy has on price stability in Nigeria between the period of 1999 and 2021.

2. Literature Review

Conceptually, monetary policy have been defined in sum as a policies measures undertaken by monetary authority concerning discretionary control of money supply in order to regulate the stock of money in circulation with a view of achieving economic stability which include price stability. According to Thomas (2022) cited in Investopedea.com (2022) monetary

policy is a set of tools that a nation's central bank use to promote sustainable economic growth and controlling the overall supply of money that is available to the nation's banks, its consumers, and its businesses. Monetary policy is a policy employ by Central Bank of a nation to control the supply of money in circulation (Simon & Elias, 2021). According to Ajibola and Oluwole, (2018) monetary policies consist of those actions designed to influence the behavior of the monetary sector.

Interest rate is the proportion of a loan that is charged as interest to the borrower, typically expressed as an annual percentage of the loan outstanding. Interest refers to the cost of borrowing money or the reward for saving (Banton, (2020) cited in investopedea.com, 2021). Also according to Marco and Hernandez, (2021) an interest rate is the cost of asking for a loan or saving money. It is calculated as a percentage of the amount that was delivered by a bank, financial institution, or individual. An interest rate is a percentage charged on the total amount one borrows or saves. It is the amount charged on top of the principal by a lender to a borrower for the use of the lender's assets (Central Bank of Nigeria, 2020).

According to CBN (2021) money supply comprises narrow and broad money. Narrow money (M1) is defined as currency in circulation with non-bank public and demand deposits or current accounts in the banks. The broad money (M2) includes narrow money plus savings and time deposits, as well as foreign currency denominated deposits. Broad money measures the total volume of money supply in the economy. In the same vein, Cash Reserve Ratio also refers to required reserve ratio, is the percentage of deposits which commercial banks are required to keep as cash according to the directions of the central bank (The Economic Time online.com, 2022). Furthermore, price stability in an economy connotes constant price level over a period of time. In other words, there is no significant level of inflation or deflation as prices are relatively stable (Bank-Ola, Jemiluyi & Johnson, 2020). It is a situation where prices in an economy change slowly, or do not change at all. It also connotes avoiding a prolonged inflation or deflation (Chukwuemeka, 2018). According to European Statistical System (2021) consumer price index (CPI) is used to estimate the average variation between two given periods in the prices of products consumed by households. It is a composite measurement of trends in the prices of products, at constant quality. The Consumer Price Index measures the overall change in consumer prices based on a representative basket of goods and services over time (Fernando, 2022).

Theoretically, there are several monetary theories advanced relating to monetary policy and price stability. The classical school evolved through concerted efforts and contributions of economists like Jean Baptist say, Adam Smith, David Ricardo, Pigou and others who shared the same beliefs. The classical model attempts to explain the determination of savings and investment with respect to money. In the classical system, the main function of money is to act as a medium of exchange. It is to determine the general level of prices at which goods and services will be exchanged. The relationship between money and price level is explained in terms of the quantity theory of money. The classical quantity theory of money states that the price level is a function of the supply of money. In other words, quantity theory of money states that the quantity of money is the main determinant of the price level or the value of

money. That is, any change in the quantity of money produces an exactly proportionate change in the price level. Algebraically, MV =PT where M, V, P and T are the supply of money, velocity of money, price level and the volume of transactions. From the equation, the total money supply (MV) equals total value of outputs (PT) in the economy.

In Keynesian view, they believe that expansionary monetary policy increases the supply of loanable funds available through banking system, causing interest rates to fall. With the lower interest rates, aggregate expenditures on investment and interest-sensitive consumption goods usually increase, causing real gross domestic product to rise. Hence monetary policy affects real gross domestic product indirectly (Nwoko, Ihemeje & Anumadu 2016).

Empirically, Orji, Ogbuabor , Ugwu , Anthony-Orji and Nwufo (2022) examine the channels of transmission through which cash reserve ratio impacts on credit to micro-, small and medium-sized enterprises (MSMEs) using vector error correction model The study found that cash reserve ratio indirectly impacts credit to MSMEs through liquidity ratio and lending interest rate as its channels of transmission. Bambi and Ying (2020) analyze the impact of monetary policy on the general prices level in the Democratic Republic of Congo over the period from 2000 to 2016. The study employed linear regression model. Finding of the study showed that the monetary policy of the central bank of Congo did not achieve its objective of stabilizing prices. Bank-Ola, Jemiluyi and Johnson (2020) examines the impact of monetary policy on price stability in Nigeria from 1986 to 2018. The study adopted the Auto-Regressive Distributed Lag (ARDL) model. The results of the analysis showed that of all the monetary policy instruments used; only cash reserve ratio had a positive and significant effect in ensuring price stability. Liquidity ratio, exchange rate, and money supply negatively and insignificantly impacted on price instability.

Oladosu and Oladele (2020) evaluate the effects of monetary policy on price stability in Nigeria for the period 1981-2016. The study employed Auto Regressive Distributive Lag (ARDL). The study result showed that both in the short-run and long-run, exchange rate, money supply, GDP and open market operations have significant effects on price stability in Nigeria while interest rate is significant only in the short-run. Henry and Sabo (2020) examine the impact of monetary policy management on inflation in Nigeria between the periods of 1985- 2019. Autoregressive distributed lag analysis was employed on time series data covering the period. It was found that while monetary policy rate and foreign exchange rate impacted negatively on inflation; broad money supply impact positively on it. Kayode, Isreal and onyuka (2020) examine the impact of money supply on savings and investment in developing countries between the sampled years ranges from 1999-2016. The study employed multiple regression technique. Finding of the study revealed that money supply have significant impact on savings and investment. Both the dependent and independent are highly correlated. None of these studied reviewed the impact of monetary policy on price stability within the sampled period of this paper.

Theoretical Framework
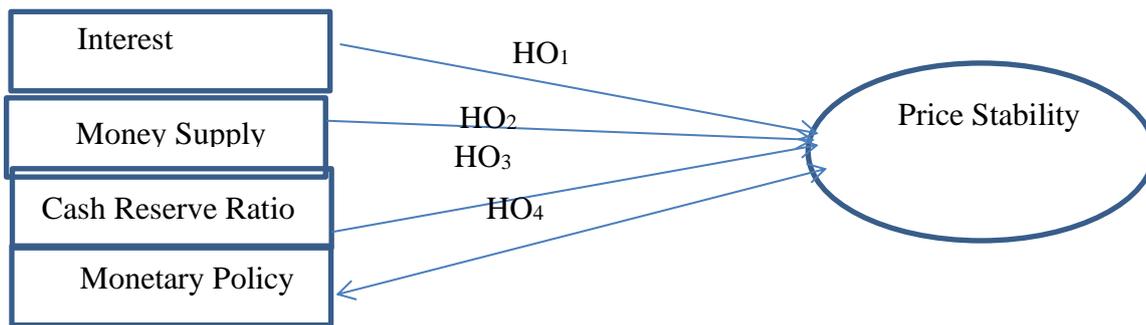
Sources: Olawale Adeleke Adeneye, (2022)

3. Research Methodology

The study employed ex-post factor design. Secondary data (time series data) was employed. Thereafter, econometric techniques analysis which includes; autoregressive distributed lag and granger causality test were adopted in analyzed the data sourced. The researcher subjected the data collected to various diagnosis tests which includes; Augmented Dickey-Fuller Unit Root Test (ADF), Cointegration, and Error Correction test.

Autoregressive Distributed Lag (ARDL) Model Specification

Autoregressive Distributed Lag (ARDL) approach was employed to investigate the impact monetary policies tools which include interest rate (INR), money supply (M2) and cash reserve ratio (CRR) have on price stability in Nigeria between the period of 1999 and 2021. Autoregressive distributed lag (ARDL) model, also known as bounds testing approach to co-integration, was originally developed by Pesaran and Pesaran (1997) and expanded by Pesaran, Shinb and Smith (2001). ARDL models are linear time series models in which both the dependent and independent variables are related not only contemporaneously, but across historical (lagged) values as well. In particular, if y_t is the dependent variable and $x1,\ldots,x_k$ are k explanatory variables, a general ARDL(p,q1,…,qk) model is given by:

$$y_t = a_0 + a_{1t} + \sum_{i=1} \psi_i y_t + \sum_{j=1} \sum_{1=0} \beta_{j1j} X_{j,t-1j} + \varepsilon_t \ \ldots\ldots\ldots\ldots\ldots (1)$$

where ε_t are the usual innovations, a_0 is a constant term, and a_1, ψ_i, and $\beta_{j,lj}$ are respectively the coefficients associated with a linear trend, lags of y_t, and lags of the k regressors (x_{jt}) for $j=1,\ldots k$. Alternatively, let L denote the usual lag operator and define $\psi(L)$ and $\beta j(L)$ as the lag polynomials:

$$\psi(L) = 1 - \sum_{\substack{i=1 \\ p}} \psi_i L_i \ \text{and} \ \beta_j(L) = \sum_{\substack{i=0 \\ q_i}} \beta_j 1_j L_{1j} \ \ldots\ldots\ldots\ldots\ldots(2)$$

Then, equation (1) above can also be written as:

$$\psi(L)y_t = a_o + a_{1t} + -\sum_{j=1} k \beta_j(L)_{xjt} + \varepsilon_t \ \ldots\ldots\ldots\ldots\ldots\ldots.. (3)$$

Although, ARDL model have been used in econometrics for decades. They have gained popularity in recent years as a method of examining cointegrating relationships. ARDL models are especially advantageous in their ability to handle cointegration with inherent robustness to misspecification of integration orders of relevant variables. This study adopts

the unrestricted autoregressive distributed lag model developed by Pesaran, and Smith (2001). This study model is specified as follows.

$$CPI_t = \beta_0 \sum_{i=1}^{P} + \beta_1 \Delta INR_{t-1} + \beta_2 \Delta MS2_{t-1} + \beta_3 \Delta CRR_{t-1} + \delta_1 INR + \delta_2 MS2 + \delta_3 CRR + \mu_t$$

………..(4)

Where;

CPI is consumer price index,

INR is interest rate,

MS2 is money supply,

CRR is cash reserve ratio,

Δ is a difference operator, t is time, β_0 is an intercept term,

β_1, β_2 and $\beta_3,$ 1 to $\delta3$ are the coefficients of their respective variables and,

ps are the lag lengths while μ_t is random error.

To examine the existence of long-run relationship following Pesaran et al (2001), the study first test, based on Wald test (F-statistics), for the joint significance of the coefficients of the lagged levels of the variables, i.e. Ho: $\delta1 = \delta3 = 0$ and H1: $\delta1 \neq \delta3 \neq 0$. The asymptotic critical values bounds, which are tabulated in Pesaran et al (2001), provide a test for cointegration with the lower values assuming the regressors are I(0), and upper values assuming purely I(1) regressors.

If the calculated F-statistics exceeds the upper critical value, the null hypothesis is rejected, implying that there is cointegration. However, if it is below the lower critical value, the null hypothesis cannot be rejected, indicating lack of cointegration. If the calculated F-statistics falls between the lower and upper critical values, the result is inconclusive. Once cointegration is established, the conditional ARDL long-run model can be estimated as:

$$CPI_t = \beta_0 \sum_{i=1}^{P} + \beta_1 \Delta INR_{t-1} + \beta_2 \Delta MS2_{t-1} + \beta_3 \Delta CRR_{t-1} + \mu_t \text{ ……………..} (5)$$

In the next step, we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. This is specified as follows:

$$CPI_t = \beta_0 \sum_{i=1}^{P} + \beta_1 \Delta INR_{t-1} + \beta_2 \Delta MS2_{t-1} + \beta_3 \Delta CRR_{t-1} + \delta_1 INR + \delta_2 MS2 + \delta_3 CRR + \vartheta ecm + \mu_t$$

…… (6)

Where *ecm* is the error correction representation of equation (6) and ϑ is the speed of adjustment. Where ϑ is the speed of adjustment parameter and ECM is the residuals that are obtained from the estimated co-integration model of equation. Peseran et al., (2001) suggested applying the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) tests whose equation is detailed in Brow, Durbin and Evans (1975) to assess the parameter constancy of the model. The justification for co-integration and error correction model is to add richness, flexibility and versatility to the econometric modeling and to integrate short-run dynamics with long-run equilibrium.

The Apriori Expectation:

$\beta_0 < 0$; β_1, β_2 and $\beta_3 > 0$ and β_1, β_2 and $\beta_3 < 0$; it is expected that monetary policy via interest rate (INR), money supply (M2), Cash Reserve Ration (CRR) will have either positive or negative impact on price stability which have been proxy by consumer price index (CPI) at a given period

This study secondary data was based on times series data sourced from World Bank Development Indicators 2021 on variables which includes; interest rate (INR), money supply (M2), Cash Reserve Ration (CRR) and Price stability proxy by consumer price index (CPI) in Nigeria, between the period of 1999 and 2021. Eview 10 to generate and analyzes descriptive as well as inferential statistics for the study. However, the analysis includes both residual and coefficient diagnostics tests in order to satisfy certain econometric assumptions.

4. Results and Discussion

Table 1

Descriptive Statistics

	CPI	INR	MS2	CRR
Mean	11.89237	5.213043	8.740827	1633.650
Median	12.21778	8.500000	9.308822	910.7000
Maximum	18.87365	23.80000	9.780219	3657.700
Minimum	5.388008	-41.90000	6.444052	118.5000
Std. Dev.	3.603362	13.34437	1.101939	1358.273
Skewness	0.041839	-1.890436	-0.757029	0.301714
Kurtosis	2.314908	8.000328	2.084443	1.265440
Jarque-Bera	0.456505	37.66085	3.000175	3.232290
Probability	0.795923	0.000000	0.223111	0.198663
Sum	273.5244	119.9000	201.0390	37573.95
Sum Sq. Dev.	285.6527	3917.586	26.71393	40587907
Observations	23	23	23	23

Source: Researcher Computation (2022) using (Eview10)

Table 1 presents the descriptive statistics which describes the characteristic of the data used in the study. The study observation is 23. In a normally distributed series the skewness is zero, kurtosis is three (3) and the JB statistics is not expected to exceed the critical value 5.991 at 5%. The skewness which measures the degree of asymmetric of the series shows that consumer price index (CPI) and cash reserve ratio (CRR) is have positive sign that is long-right tail while, interest rate (INR) and money supply (MS2) have negative sign that is long-left tail as well as normal skewness and platykurtic because all the values exception of INR are less than 3 kurtosis, less than 3 is said to be platykurtic. If the kurtosis exceeds 3, the distribution is peaked (leptokurtic) relative to the normal; if the kurtosis is less than 3, the distribution is flat (platykurtic) relative to the normal. The Jarque-Bera test statistic which measure the difference of the skewness and kurtosis of the series with those from the normal distribution show that all the variables understudy were all significant with the probability that

a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null hypothesis - a small probability value leads to the rejection of the null hypothesis of no normal distribution. Thus, it can be concluded that the study data exhibit normal distribution.

4.3.2 Stationary and Non-Stationary Series (Unit Root Test)

The first step to start the time series analysis is to conduct unit root test. If unit root test results show that all variables being analyzed are stationary, then ordinary least square (OLS) or Vector autoregressive model (VAR) method can be used to determine the relationship between the given variables. However, if the reverse is the case, alternative method is applicable such as Johansen test or Autoregressive distributed lag (ARDL) appropriate.

Table 2:

Series of Augmented Dickey-Fuller Test (ADF) Output Results

Coefficients	Critical Values at 5%	ADF Values	Probability	Order of Integration
D(CPI)	-3.052169	-3.454282	0.0233	I(0)
D(INR)	-3.040391	-4.179722	0.0052	I(0)
D(MS2)	-3.012363	-2.233912	0.2010	I(1)
D(CRR)	-3.012363	-3.472973	0.0196	I(0)

Source: *Researcher Computation (2022) using (Eview 10)*

Table 2 present the series of unit root tests of (ADF). The results show that all the variables are not stationary of order I(0) in first differencing, as shown in table there is evidence of mixed unit root test result. D(MS2) is not stationary while, the remaining variables are stationary.Following, evidence of mixed unit root test result Autoregressive distributed lag (ARDL) was employed to analyzes the study data to ascertain both short run and long run estimation.

Co-integration Test

Following stationarity this study conducted cointegration using group statistic of Johansen Cointegration test. Table 3 as follow present the result of cointegration.

Table 3:

Johansen Cointegration Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.864796	88.32317	47.85613	0.0000
At most 1 *	0.723038	46.30276	29.79707	0.0003
At most 2 *	0.461644	19.34141	15.49471	0.0125
At most 3 *	0.260502	6.337456	3.841466	0.0118

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.864796	42.02041	27.58434	0.0004
At most 1 *	0.723038	26.96135	21.13162	0.0067
At most 2	0.461644	13.00395	14.26460	0.0783
At most 3 *	0.260502	6.337456	3.841466	0.0118

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

Source: *Researcher Computation (2022) using (Eview 10)*

Table 3, results above show that Trace test indicates 4 cointegrating eqn(s) at the 0.05 level and Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level.

Figure 2 present cointegration graph of the variables understudy.
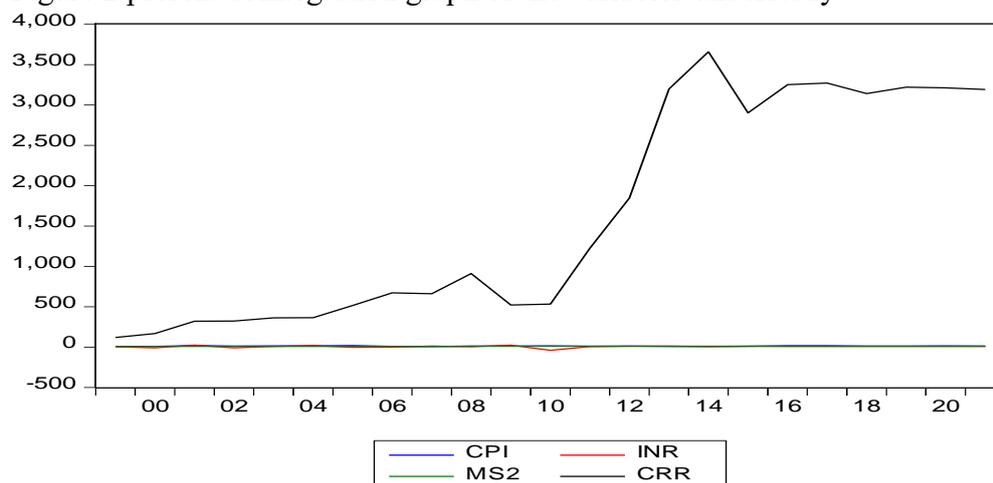
Source: *Researcher Computation (2022) using (Eview 10)*

Figure 2 shows that CPI, INR, MS2 and CRR are been cointegrate. However, the trend show that while CPI, INR, and MS2 are moving in parallel line, CRR is movement exhibit up and down trend. This simply suggests that CRR and CPI are not cointegrate at all times under the sampled periods.

Pairwise Granger Causality Test

Following the unit root tests of (ADF) and cointegration test outcomes, Pairwise granger causality test was performed as presents in Table 4.

Table 4
Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
INR does not Granger Cause CPI	21	0.02377	0.9765
CPI does not Granger Cause INR		0.70868	0.5071
MS2 does not Granger Cause CPI	21	8.86785	0.0026
CPI does not Granger Cause MS2		2.28175	0.1343
CRR does not Granger Cause CPI	21	2.21526	0.1415
CPI does not Granger Cause CRR		0.10504	0.9009

Source: *Researcher Computation (2022) using (Eview 10)*

Table 4 presents granger causality test result. The foregoing result suggests that the null hypothesis that stated that INR does not Granger Cause CPI and that CPI does not Granger Cause INR cannot be rejected given the p-values of 0.9765 and 0.5071 greater than 0.05 levels of significant. The p-value is near to 1 (i.e. 98% and 51% respectively), therefore the null hypothesis $X = f(Y)$, Y Granger causes X, cannot be rejected. However, the null hypothesis that stated that MS2 does not Granger Cause CPI is been rejected given the p-value of 0.00 less than 0.05 levels of significant. The p-value is very small, thus the null hypothesis $Y = f(X)$, X Granger causes Y, is rejected. In other words, MS2 Granger Cause CPI. On the other side the null hypothesis that stated CPI does not Granger Cause MS2 cannot be rejected given the p-value of 0.16 greater than 0.05 levels of significant.

Lastly, the null hypothesis that stated that CRR does not Granger Cause CPI and CPI does not Granger Cause CRR cannot be rejected given the p-values of 0.1415 and 0.9009 greater than 0.05 levels of significant. The p-value is near to 1 (i.e. 14% and 90% respectively), therefore the null hypothesis $X = f(Y)$, Y Granger causes X, cannot be rejected.

Subsequent to the unit root test result which produced mixed unit root the autoregressive distributed Lag regression (ARDL) was adopted to ascertain the short run and long run relationship.

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Table 5

Autoregressive Distributed Lag Estimate.

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
CPI(-1)	-0.008536	0.180945	-0.047175	0.9631
CPI(-2)	-0.606068	0.155176	-3.905680	0.0021
INR	0.053225	0.046275	1.150188	0.2725
MS2	-5.395423	5.808258	-0.928923	0.3712
MS2(-1)	-24.03860	8.899179	-2.701215	0.0193

MS2(-2)	27.80192	6.386009	4.353567	0.0009
CRR	-0.002414	0.001009	-2.392490	0.0340
C	43.01179	10.26587	4.189786	0.0013

R-squared	0.733742	Mean dependent var	12.38545
Adjusted R-squared	0.578424	S.D. dependent var	3.465961
S.E. of regression	2.250409	Akaike info criterion	4.749275
Sum squared resid	60.77208	Schwarz criterion	5.147568
Log likelihood	-39.49275	Hannan-Quinn criter.	4.827026
F-statistic	4.724144	Durbin-Watson stat	2.135381
Prob(F-statistic)	0.009327		

*Note: p-values and any subsequent tests do not account for model selection.

Source: Researcher Computation (2022) using (Eview10)

Table 5 presents, ARDL regression estimation, the first part of the output gives a summary of the settings used during estimation. The result shows that automatic selection (using the Akaike Information Criterion) was used with a maximum of 2 lags of both the dependent variable and the regressor. Out of the 54 models evaluated, the procedure has selected an ARDL (2,0,2,0) including observation of 20 after adjustment.

However, the coefficient of consumer price index CPI(-1) and CPI(-2) at period of lag 1 and 2 are -0.01 and -0.61 a proxy for price stability respectively are very relatively low. However, with probability of 0.96 and 0.00 respectively, CPI is statistically insignificant at period of lag 1 because the probability value is greater than 0.05 levels of significance and statistically significant at period of lag 2 because the probability value is less than 0.05 levels of significance. This implies that holding other independent variables constant, a one percent increase in consumer price index CPI(-1) and CPI(-2) period of lagged 1 and 2 translate to approximately -1% and -61% respectively decline in its present value. However, with negative sign associated with the coefficient of consumer price index CPI(-1) and CPI(-2) at period of lagged 1 and 2 implies that consumer price index CPI(-1) and CPI(-2) at period of lagged 1 and 2 are moving in opposite direction with its present value.

Also, the coefficient of the interest rate at current level period is 0.05 with the probability value of 0.27 which is greater than 0.05 levels of significance indicates that at current level period interest rate has positive and statistically insignificant impact on consumer price index (CPI) a proxy for price stability under the period sampled. This result suggests that one percent increase in interest rate causes about 5% increase in consumer price index (CPI) a proxy for price stability. Furthermore, the result indicates that both interest rate and price stability are moving in the same direction. That is an increase in one lead to increase in other vice-viser.

More so, the coefficients of the money supply (MS2), MS2(-1) and MS2(-2) at current level, period of lag 1 and 2 are -5.39, -24.04 and 27.80 with probability values of 0.37, 0.02 and 0.00 indicate that money supply (MS2) at current level period is statistical insignificant with

probability value greater than 0.05 levels of significance while, money supply MS2(-1) and MS2(-2) at period of lag 1 and 2 are statistical significant with probability values less than 0.05 levels of significance. This suggests that holding other independent variables constant, a one percent decrease in money supply (MS2) and MS2(-1) at current level and period of lag 1 leads to -539 and -24 percent respectively increase in consumers price index (CPI) a proxy for price stability. On the other hand, a one percent increase in money supply MS2(-2) at period of lag 2 leads to 278 percent increase in consumers price index (CPI) a proxy for price stability. However, with negative and positive sign suggests that money supply have both impact on CPI at different period. That is to say, that at current level and period of lag 1 money supply and CPI moves in opposite direction while, at period of lag 2 money supply and CPI moves in the same direction. The foregoing suggests increase or decrease in money supply could alter the price stability level.

In addition, the coefficients of the cash reserve ratio (CRR) at current level period, is -0.002 with probability values of 0.03 which is less than 0.05 level of significance suggest that cash reserve ratio (CRR) at current level period has negative and statistically significant impact on consumers price index (CPI) a proxy for price stability. That is, one percent increase in cash reserve ratio (CRR) at current level period effect an approximately, -0.2% decrease in (CPI) a proxy for price stability. This result indicate that both cash reserve ratio (CRR) and (CPI) a proxy for price stability move in the opposite direction, which suggest that an increase in one effects an decrease in other vice viser.

 This foregoing result is in conformity with the study apriori expectation, which earlier postulates that interest rate (INR), money supply (MS2) and cash reserve ratio are expected to have both negative and positive sign at different periods. Theoretically, monetary policy instruments like interest rate, money supply and cash reserve ratio are aimed at stimulate the economy through contractionary and expansionary policy. Either by increase or decrease cash liquidity in circulation thereby increases economic activities or slow down recession and subsequently price stability. However, increase in interest rate and cash reserve ratio is expected to limit the stock of money in the economy in order to control inflation and achieve price stability while increase in money supply aimed at increase the volume of stock of money in the circulation. On the other hand, decrease in interest rate and cash reserve ratio is expected to increase the stock of money in the economy in order to stimulate economic activities in the economy and achieve price stability while decrease in money supply is aimed at reducing the volume of stock of money in the circulation thereby stabilize the economy. However, the three aforementioned variables could either increase or reduces household purchasing power.

The Coefficient of fixed variable, that is, constant (C) also known as the intercept, is the value of (CPI) a proxy for price stability when other independent variables have a value of zero is 43.0 with probability value of 0.00 less than 0.05 level of significance is statistically significant. This result simply suggests that increase in CPI in Nigeria within the sampled period is associated with other factors which are not explained by any of the explanatory variables stated in the model. More so, the R-Square often refers as the coefficient of

determination also known as a measures of the goodness-of-fit, is 0.73, approximately 73%. This means that 73% of the changes in (CPI) a proxy for price stability at time t, are explained by the changes in the explanatory variables while, the remaining 27% could be explained by factors outside this model represented by error term. Adjusted R-squared value is 57% variation in the dependent variable which is explained by only those independent variables that, in reality, affect the dependent variable. More so, Durbin-Watson statistic (DW) is 2.1 approximately 2 shows there is no serial autocorrelation. Furthermore, the F-statistic coefficient which measure the overall goodness fit of the study model is 4.72 with probability value of 0.00 indicates that the model is statistically significant and competent to estimate the impact of independent variables on the dependent variable.

Next is the autoregressive distributed lag (ARDL) long-run model estimation. The procedure starts by conducting the bounds test for the null hypothesis of no co-integration. The asymptotic critical values bounds, which were tabulated in Pesaran, Shin, and Smith, (2001), provide a test for cointegration with the lower values assuming the regressors are I(0), and upper values assuming I(1) regressors. If the calculated F-statistics exceeds the upper critical value, the null hypothesis is rejected, implying that there is cointegration. However, if it is below the lower critical value, the null hypothesis cannot be rejected, indicating lack of cointegration. If the calculated F-statistics falls between the lower and upper critical values, the result is inconclusive. Once cointegration is established, the conditional ARDL long-run model can be estimated. Table 6 below presented ARDL Long Run Form and Bounds Test on which decision to conduct ARDL Error Correction Regression is based

Table 6

ARDL Long Run Form and Bounds Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Significance.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	13.10476	10%	2.37	3.2
K	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	20	Finite Sample: n=30		
		10%	2.676	3.586
		5%	3.272	4.306
		1%	4.614	5.966

Source: *Researcher Computation (2022) using (Eview10)*

Furthermore, error correction model mechanism regression in table 5 presents the speed of error adjustment. ECM is a category of multiple time series model that directly estimates the speed at which a dependent variable returns to equilibrium after a change in an independent

variable. ECM incorporates the long-run equilibrium in the dynamic adjustment (that is the short-run model). The ECM is also closely bound up with the concept of co-integration.

Table 7

ARDL Error Correction Regression
Dependent Variable: D(CPI)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CPI(-1))	0.605309	0.126417	4.788209	0.0004
D(MS2)	-5.343514	3.869612	-1.380891	0.1906
D(MS2(-1))	-27.78590	4.204153	-6.609156	0.0000
CointEq(-1)*	-1.615129	0.167700	-9.631052	0.0000
R-squared	0.856663	Mean dependent var		0.253836
Adjusted R-squared	0.831368	S.D. dependent var		4.606974
S.E. of regression	1.891848	Akaike info criterion		4.282628
Sum squared resid	60.84449	Schwarz criterion		4.481585
Log likelihood	-40.96760	Hannan-Quinn criter.		4.325807
Durbin-Watson stat	2.239038			

* p-value incompatible with t-Bounds distribution.
Source: *Researcher Computation (2022) using (Eview10)*

Table 7 present, ARDL ECM regression estimation, in this context the estimated parameters were subjected to test based on economic theory so as to ascertain whether they agree with expected sign. In other words, the model sought to relate the changes in consumer price index (CPI) a proxy for price stability in Nigeria to its explanatory variables which include interest rate (INR), money supply (MS2), and cash reserve ratio (CRR) to ascertain the conformation with 'a priori' expectation underlying each variable.

The result shows that, the CointEq(-1) coefficient of the error correction term which measures the speed of adjustment towards long-run equilibrium is negative and statistically significant at 5% level. The ECM has the expected negative sign which stands at -1.62. This implies that the rate at which changes in CPI at time t, adjusts to the single long-run co-integrating relationship is different from zero. In other words, the equation of CPI at time t, contains information about the long run relationship, the reason why co-integrating equation enter the model automatically. The coefficient of the ECM revealed that the speed with which changes in CPI at time t, adjusts respond to regressors is about -162% in the short-run. This is in conformity with this study aprior expectation.

Furthermore, the R-Square often refers as the coefficient of determination also known as a measures of the goodness-of-fit, is 0.86, approximately 86%. This means that 86% of the changes in CPI at time t, are explained by the changes in the explanatory variables while, the remaining 14% could be explained by factors outside this model represented by error term.

Adjusted R-squared, value is about 83% variation in the dependent variable is explained by only those independent variables that, in reality, affect the dependent variable. More so, Durbin-Watson statistic (DW) is 2. shows there is no serial autocorrelation.

5. Conclusion and Recommendations

In conclusion this study examined the impact monetary policy which include, interest rate (INR), money supply (MS2) and cash reserve ratio (CRR) has on price stability (CPI) between the period spanning 1999 and 2020 using econometric technique of ARDL to ascertain both short run and long run relationship between the dependent (price stability) and independent (interest rate (INR), money supply (MS2) and cash reserve ratio (CRR)) variables. Also, this study applied Granger causality test to determine the causal effect between the two understudy variables. Findings of this study leads to these following conclusions;

This study concludes that consumer price index at different lagged are moving in opposite direction with its present value. This study concludes that interest rate has positive relationship with price stability. That is, an increase in one leads to increase in other side vice-viser but, its impact is statistically insignificant. This study concludes that money supply at current level and period of lag 1, money supply and CPI moves in the opposite direction while, at period of lag 2 money supply and CPI move in same direction. However, money supply has statistically insignificant impact on CPI This study also concludes, that both cash reserve ratio (CRR) and (CPI) a proxy for price stability move in the opposite direction, which suggest that an increase in one effects an decrease in other vice viser. Nevertheless, cash reserve ratio (CRR) has statistically significant impact on CPI. Moreover, this study concludes that the speed with which changes in CPI at time t, adjusts respond to regressors is about -16% in the short-run. Lastly, f this study concludes that MS2 Granger Cause CPI and CPI does not Granger Cause MS2

As manifested from the findings of this study, the following recommendations are suggested: first, that monetary policy authority should ensure that policy target at price stability which has been measure by CPI should not solely depend on price instability of the past lagged. This because past lags and present value is moving in opposite direction. Second, since interest rate has positive impact on price stability, it is therefore suggests that monetary policy authority should effectively and continuously apply interest rate (INR) to achieve price stability. Third, since money supply has both negative and positive impact on price stability, this study recommends that monetary policy authority should be caution in applying money supply to achieve price stability. That is to say, that increase or decrease in money supply should base on expansionary and contractionary policy targeting at price stability. Four, since cash reserve ratio has negative impact on price stability, it is therefore suggests that monetary policy authority should effectively and cautiously apply cash reserve ratio to achieve price stability. Lastly, since money supply granger causes CPI, monetary policy authority should mindful on when increase or decrease in MS2 should be apply.

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