

MONETARY POLICY INSTRUMENTS AND PRICE STABILITY IN NIGERIA: AN ARDL BOUND TESTING APPROACH.

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ABSTRACT

This study examines the impact of monetary policy on price stability in Nigeria from 1986 to 2018. The cash reserve ratio, liquidity ratio, exchange rate, money supply and import of goods and services were the monetary policy variables used while inflation consumer prices was the variable used to measure price stability. For this study, secondary time series data which was obtained from the CBN Statistical Bulletin 2018 and WDI were adopted and the Auto-Regressive Distributed Lag (ARDL) model was employed after conducting a diagnosis test. 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, while import of goods and services was positive though insignificant for the period examined. Based on the results, it is therefore recommended that indirect monetary policy should continue to be used to bring consumer prices to a reasonable low level so as to strengthen the purchasing power of the Naira, which will eventually reduce; unemployment rate, interest rate, inflation rate, arbitrary redistribution of wealth and income, and consequently lead to economic growth and external viability.

Keywords: Monetary Policy, Price Stability, Economic growth, External viability, Auto-Regressive Distributed Lag

Introduction

The impact of monetary policy instruments on economic performance is currently at the core of the policy debate in many countries. The level of development of most countries determines their economic goals and needs. For example, the economic realities of the United States of America may not be the same as that of Tanzania for one is a highly developed nation while the other is an under developed country. The attainments of these goals are consequent upon the formulation of policies which are either monetary or fiscal policy. The recovery of these economies in the light of the global crisis seems to depend on the effectiveness and appropriateness of these policies. Chappelow (2020) affirmed that monetary policy characterizes many nations' apex banks regulatory supply guidelines to achieve macroeconomic goals that promote sustainable economic growth. Essentially, it determines the regulatory virtuosity and quota of monetary and credit facilities; for price stabilization and economic growth (CBN, 2011). Monetary policy is articulated based on exertions gathered from different quarters. Monetary policy however, is the macroeconomic policy set by the central bank. This may require management of money supply, interest rate and the economic policy used by a nation, to realize the microeconomic objectives of liquidity, consumption, inflation and growth (The Economic Times, 2020).

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. According to the European Central Bank (2020), price stability improves price mechanism transparency thereby contributing to increase in economic activity and employment. Price stability, according to the monetary policy department of the CBN in 2012 can be beneficial for the economy in several ways. It promotes high standard of living, reduces uncertainty about general price development, reduces inflation premium risk, helps to avoid unnecessary hedging activities, increases the benefit of holding cash, prevents the arbitrary distribution of wealth and income, contributes to financial stability and contributes to broader economic goals.

Research on impact of monetary policy on economic variables in the Nigerian economy has for long been of interest to economist and policy makers. The main motivation of this study is to assess the impact of monetary policy instruments on price stability in Nigeria and, in particular, whether the shift from direct monetary control to indirect monetary control has had the desirable effect on price stability. There is ample empirical evidence in the literature about monetary policy on economic growth in developed and developing countries (Amiri& Gang 2018; Srithilat& Sun 2017; Hameed, Khaid&Sabit 2012; Agbonlahor 2014; among others). Similarly, there are evidences from Nigeria (Bashir & Sam-Siso 2020; Aderemi, Ogundare, Sejoro&Biodun 2019; Ezeaku, Ibe, Ugwuanyi, Modebe&Agbaeze 2018; Ufoeze; among others). However, emphasis on one of the macro economic objectives that is, price stability, is scarce. The persistent rise in the general level of price in the Nigerian economy prompted the need to find out if the monetary policies implemented by the Central bank have been capable of addressing price instability. This is premised on the fact that price stability is fundamental to economic growth, employment generation, production and investors' investment decisions, implying that there is need to investigate how monetary policy has achieved the desired result.

From a methodological point of view, attention has been devoted to identifying non-linear effects of monetary policy performance on economic growth. Several authors find multiplicative effects of monetary policy mechanism to be significantly higher in economic melt-downs (Bashir & Sam-Siso 2020, Agu 2011, Srithilat & Sun 2017 among others). The main question in this respect is to determine the effect of shift in direct monetary control instruments to indirect monetary control instruments on price stability. In this respect, our study makes an attempt at filling the gap in the literature and presents an analysis of the effect of monetary policy instruments on price stability in Nigeria.

Our main results reveal that monetary policy instruments influence macroeconomic indicators both positively and negatively, but depending on the existing situation in Nigeria. The cash reserve ratio has a positive relationship with the consumer price which confirms the theoretical knowledge and is significant based on the study. Liquidity ratio, exchange rate and money supply has negative and insignificant relationship with consumer prices while import of goods and services has a positive but insignificant relationship with the consumer prices. It is concluded that the monetary policies put in place by the central bank have not been able to control price level in the economy.

The benefits of this study therefore reveal that in terms of price stability, the government was justified in changing the monetary policy controls from direct to indirect as the indirect tools such as cash reserve, liquidity ratio, exchange rate, money supply and import of goods and services, has the expected effect although only cash reserve ratio is significant. Implying that there are other extraneous factors (fiscal policies, political instability, informal sectors and so on), not captured in the monetary policy tools, but it significantly affect the stability of prices in Nigeria. The bounds test results showed that there is long term relationship among the variables. The paper is structured as follows: Section 2 reviews the importance monetary policy instruments on price stability from a policy and empirical perspective. Section 3 explains the methodology and data used. Section 4 presents the results of the analysis. Concluding remarks are pinpointed in Section 5

2. Literature Review

During the recent financial crisis in Nigeria, policymakers, almost consensually, used monetary instruments to combat inflationary trends. Attention was devoted to indirect instruments as a potential countercyclical tool. Both developed and developing economies incorporated sound monetary policy tools in their price stability stimuli packages. (IMF, 2009). Economic theory of the classical school by David Ricardo (1772 - 1823), is considered a supporter of the money quantitative theory. Since money is understandably a medium of exchange, demonetization of precious metals and paper money in circulation is needed. However, fixed exchange rate should be institutionalized by the monetary authorities in order to avoid the depreciation of money (Smith, 2019). He is concerned that money depreciation, due to the high price of gold was immediately followed by the rising prices and the accumulation of commodities value is a function of regular amount of money in circulation. In this regard, price fluctuation occurs as a result of changes in commodity production manner resulting from labour productivity.

Monetary policy is in relation with interest rates and credit availability. Short-term interest rates and bank reserves through the monetary base are major instruments of monetary policy. For many centuries, there were only two forms of monetary decisions (Bordo & Redish 2013). Firstly, decisions about coinage and secondly, decisions to print paper money to create credit. Interest rates, assumed now as part of monetary authority, were not coordinated with the other forms of monetary policy during this time. S.k. Singh (2009), in his book "Bank Regulations" explained that monetary policy was seen as an executive decision, and was generally in the hands of the authority with seignior age, or the power to coin. The use of credit rationing and statutory liquidity ratios is part of direct monetary policy, which is in turn used to control the amount of money in circulation. In the late of 1970s was the spread of the adoption of indirect monetary instruments leading to the transition of enhanced price signal as a major signal in the economy. In addition, the increasing adoptions of indirect instruments in most economies serve to complement the growing wave of current account convertibility amongst countries. Direct instruments increasingly became ineffective because of increasing openness and subscription to market principles.

Bashir, A. W. and Sam-Siso, E. O (2020) using ARDL questioned if monetary policy stimulates macroeconomic performance during economic downturn in Nigeria. The results revealed that in the short run, lag value of inflation rate, exchange rate appreciation and unexpected appreciation (i.e., shift dummy) could reduce inflation rate while lower MPR and high volume of money in circulation could stimulate inflation rate. The major constraint to inflation rate in the long run is exchange rate appreciation while growth and unemployment is brought to bear by depreciation in Nigeria. Also, money supply has negative effect on GDP growth in Nigeria but it stimulates inflation and unemployment rate. The policy implication is for monetary authorities to minimize pressures on the exchange rate, inflation and foreign reserves through its policy instruments.

Granger Causality test and impulse response functions was employed by Kelikume, I. and Evans, O.(2015) on inflation targeting as a possible monetary framework for Nigeria. It is proven that inflation is highly sensitive to exchange and interest rate while economic growth is highly sensitive to exchange rate and inflation in Nigeria. Further, exchange rate determines economic growth in Nigeria more than inflation does because the causation from real exchange rate to economic growth is stronger than the causation from inflation to economic growth. Therefore, inflation targeting will be less preferable to exchange rate targeting in Nigeria as a policy alternative, thereby having important implications for monetary policy conduct in Nigeria. By using unit root - ADF, Johansen cointegration, granger causality – VECM, Srithilat, K. and Sun, G. (2017) studied the impact of monetary policy on economic development using evidence from Lao PDR. The findings reveal that in the long run, real GDP per capital is negatively affected by money supply, interest and inflation rate whereas, only the real exchange rate has a positive sign The finding revealed that changing on the stock of money supply would have a negatively effect on the economic development in the long run.

Aderemi, T. A., Ogundare, O. O., Sejoro, M. Z., Balogun, A. S. (2020), illustrating with Autoregressive Distributed Lag (ARDL) model and Error Correction Model (ECM) approach, it revealed that there is a significant negative relationship between exchange rate and

economic growth in the short run but a significantly positive relationship between monetary policy rate and economic growth in the short run. Also, in both short and long run, there is a negative relationship between economic growth and credit reserve ratio, while a positive relationship exist between economic growth and inflation rate. It was reiterated that policy makers in Nigeria should increase the level of broad money supply in the country since both the broad money supply and inflation lead to short and long run economic growth.

3. Methodology

Analytical Framework

The classical monetarists' theory is used in the study to explain the relationship between monetary policies and price level in the economy. Following the quantity theory of money (QTM), they propounded that the quantity of money is the main determinant of the price level, or the value of money, such that any change in the quantity of currency produce can have direct and proportionate variation in the price level. Irving Fisher's equation of exchange on the QTM;

$$MV = PQ \dots\dots\dots (1)$$

Where M stands for the stock of money; V the velocity of circulation of money; Q the volume of transactions which take place within the given period; while P stands for the general price level in the economy. Substituting Y (total amount of goods and services exchanged for money) for Q, the equation of exchange becomes;

$$MV = PY \dots\dots\dots (2)$$

However, P, V and Y are endogenously determined within the system. The variable M is the policy variable, which is exogenously determined by the monetary authorities.

To estimate the parameters of the model the ARDL the Autoregressive Distributive Lags (ARDL) of Pesaran et al. (2011) was used to assess the effects and apply the bounds testing approach to ascertain whether long-run relationship exists between the variables in the model. One of the advantages of the ARDL approach is its usage to model mixture of both I(0) and I(1) in the same specification. Its bounds testing approach is more suitable and provides better results for small sample size. Using this approach, the dynamics of both the short-run and long-run parameters including the speed of adjustment when there is shock are estimated simultaneously within the same framework. Thereby subverting the problem of over parameterization, as robust lag lengths are crucial to this approach although, unable to incorporate I(2) variables in its analysis (Nkwatoh, 2014).

In the study, the dependent variables are the Inflation Consumer prices (INFCP). The explanatory variables are the vector of variables that constitute monetary policy instruments. The instruments considered include: Cash Reserve Ratio (CRR), Liquidity Ratio (LR), Exchange rate (ER), Money Supply (MS) and Import of Goods and Services (IMPC). The functional relationship between monetary policy instruments and the selected macroeconomic variable is specified as follows:

$$INFCP = f(CRR, LR, EXR, MS, IMPC) \dots\dots\dots(3)$$

The above equation can be transformed into an econometric model in a semi log form as follows:

$$INFCP = \beta_0 + \beta_1CRR + \beta_2LR + \beta_3EXR + \beta_4\ln MS + \beta_5\ln IMPC + \mu \dots\dots\dots (4)$$

Where, INFCP is Inflation consumer prices; CRR is Cash reserve ratio; LR is Liquidity ratio; EXR is Exchange rate; MS is Money supply; IMPC is Import of goods and services current (local currency); μ is stochastic variable or error term which must be negative, less than zero and significant sign for causality to exist in the long-run; β_0 is constant term; $\beta_1, \beta_2, \beta_3, \beta_4$ and β_5 are parameters to be estimated for cash reserve ratio, liquidity ratio, exchange rate, money supply and import of goods and services respectively and $\ln$ = Natural Logarithm of the variables used to smoothen possible scholastic effect from variables at level. Furthermore, the ARDL bounds test approach for the long-run relationship was based on the Wald test (Fstatistic), by imposing restrictions on the long-run estimated coefficients of one period lagged level of each of the explanatory variables to be equal to zero, that is, ($H_0: \beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$) for equation (4), the logged variables are MS and IMPC.

A priori specification: the expected signs of the coefficients of the explanatory variables are: $\beta_1 > 0$ (positive effect), $\beta_2 < 0$ (negative effect), $\beta_3 < 0$ (negative effect), $\beta_4 < 0$ (negative effect) and $\beta_5 > 0$ (positive effect); on price stability.

Estimation Technique and Procedures

The processes to this estimation procedure begin with the examination of the stochastic properties of the data in which descriptive statistics and unit root test are performed. The unit root test is necessary in order to avoid a spurious regression that may give a good fit and predict a statistical significance relationship between variables where none really exist (Mahadeva and Robinson, 2014). The variables used for the analysis are subjected to unit root tests so as to determine stationary or non-stationary of the series. The study considers the unit root tests of Augmented Dickey Fuller (ADF) test to determine unexpected shift in time series that can lead to unreliable estimates. In each of these tests performed, the null hypothesis with intercept and trend was considered to determine whether each of the variables in the model being analysed is stationary or not.

Data Description and Sources

The study utilizes time series data on four monetary policy instruments and one macroeconomic indicator. The monetary policy instruments include Cash reserve ratio (CRR), liquidity ratio (LR), Exchange rate (EXR), Money supply (MS) and Import of goods and services (IMPC); while the macroeconomic indicator is Inflation Consumer Prices (INFCP). The entire data set covered the period 1986 to 2018 for which data are available. The data were obtained from two sources: CBN Statistical Bulletin and World Development Indicators (WDI).

4. Empirical Results and Discussion

Preliminary Analysis

Table 1: Descriptive Statistics of the variables

Variables	Mean	Median	Max.	Min.	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Observations
INFCP	19.949	12.555	72.835	5.388	18.279	1.611	4.216	16.307*	33
CRR	15.666	16.080	26.555	3.024	6.248	-0.131	1.945	1.625	33
LR	18.990	17.948	31.650	9.959	3.895	0.928	5.285	11.926*	33
EXR	101.848	118.546	306.084	1.754	85.977	0.662	2.903	2.425	33
LNMS	27.926	28.073	31.045	23.885	2.307	-0.229	1.768	2.377	33
LNIMPC	27.774	28.289	30.749	22.764	2.285	-0.663	2.286	3.120	33

Source: Authors Compilation based on EViews

Table 2: Summary and Decision for Unit Root Test

Variables	ADF Test Statistics (At Levels)	Critical Values @ 5%	ADF Test Statistics (At 1st Diff.)	Critical Values @ 5%	Order of Integration
INFCP	-2.9834	-3.6032	-6.1601	-3.622	I(1)
CRR	-2.1363	-3.5577	-5.4476	-3.5742	I(1)
LR	-4.0742	-3.5742	-6.476	-3.5628	I(0)
EXR	-2.306	-3.5628	-4.1887	-3.5628	I(1)
LNMS	-1.7025	-3.5628	-3.8199	-3.5683	I(1)
LNIMPC	-2.2584	-3.5577	-6.486	-3.5628	I(1)

Source: Authors compilation based on EViews.

Note - The decision is made based on the estimation results with consideration to trend and intercept. I(0) represents stationary of a variable (i.e. significant at level) while I(1) denotes non-stationarity (i.e. significant at first difference)

Table 3: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-524.319	NA	29121933	34.21413	34.49168	34.30460
1	-363.996	248.2420	10032.12	26.19329	28.13611*	26.82660
2	-313.5833	58.54382*	5254.425*	25.26344*	28.87154	26.43959*

*Indicate lag order selected by the criterion (each at 5% level)

Source: Authors computation based on Eviews

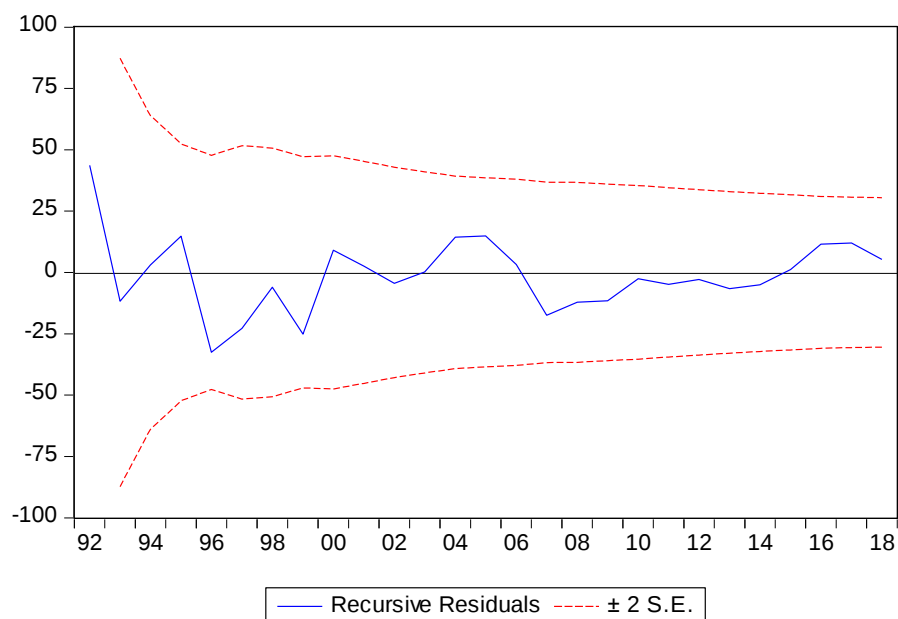


Figure 1: Recursive Residual
 Source: Author's compilation based on EViews

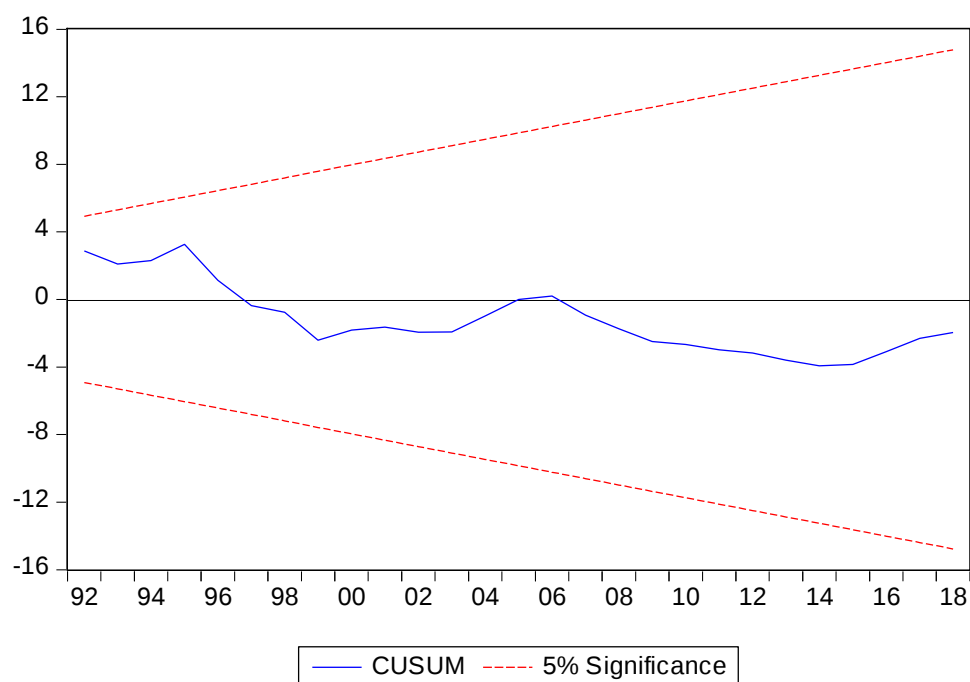


Figure 2: Cumulative Sum of Recursive Residual
 Source: Author's compilation based on EViews

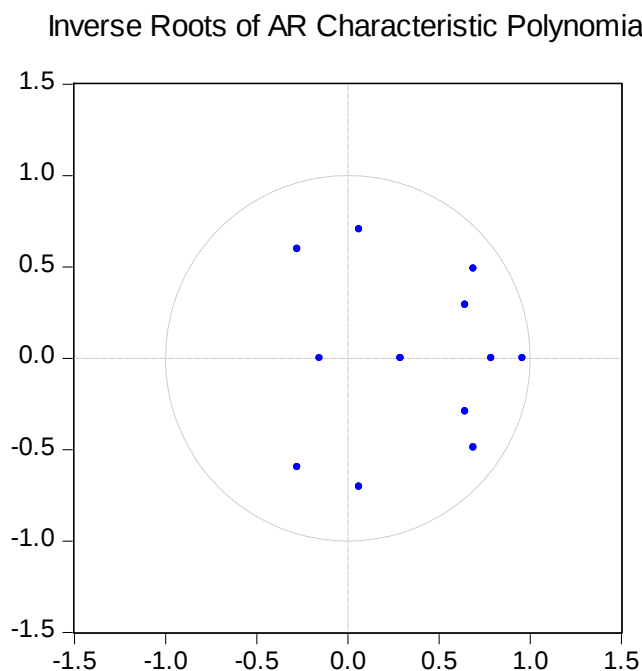


Figure 3: Inverse Roots of AR Characteristics Polynomial

Source: Author's compilation based on EViews

Table 4: ADRL Bound Test for Co-integration Analysis

Inflation

Wald F-statistic: 16.90781; K = 5

Dependent variable

F-statistic	Lower bound	Upper bound
Bounds level	I(0)	I(1)
10% critical bounds value	2.26	3.35
5% critical bounds value	2.62	3.79
2.5% critical bounds value	2.96	4.18
1% critical bounds value	3.41	4.68

Source: Author's compilation based on EViews

Table 5: Short Run Coefficient of ARDL (2, 1, 2, 0, 2, 1)

R-squared	0.907279	Mean dependent var	20.68803
Adjusted R-squared	0.836374	S.D. dependent var	18.61742
S.E. of regression	7.530882	Akaike info criterion	7.178353
Sum squared resid	964.141	Schwarz criterion	7.82596
Log likelihood	-97.26447	Hannan-Quinn criter.	7.389457

F-statistic	12.79575	Durbin-Watson stat	1.772826
Prob(F-statistic)	0.000003		

Source: Author's compilation based on EViews

Table 6: Long Run Coefficient of ARDL (2,1, 2, 0, 2, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CRR	1.648	0.366	4.501	0.0003
LR	-0.271	0.638	-0.424	0.6771
EXR	-0.017	0.042	-0.415	0.6832
LNMS	-8.057	6.618	-1.217	0.2401
LNIMPC	2.578	6.201	0.416	0.6828
C	147.957	54.899	2.695	0.0153

Source: Author's compilation based on EViews

Table 1 reports the summary statistics for each of the variables used in the model for the period (1986-2018). The statistics presented include the mean, median, maximum, minimum, standard deviation, skewness, kurtosis and Jarque-Bera. As it is observed, the standard deviations of EXR are relatively higher than the other variables. This implies that this monetary policy instruments is more volatile and unpredictable compared to others. The skewness test which measures the asymmetry of the distribution of the series shows positive skew values for INFCP, LR and EXR variables. This indicates that the variables are skewed to the right and that the right tails are longer. Whereas, CRR, MS and IMPC are negatively skewed to the left. The result of kurtosis statistics which measures the peakedness or flatness of the distribution of the series indicates that LR and INFCP is highly leptokurtic as its kurtosis statistics is greater than 3. However, the distribution of EXR, IMPC, CRR and MS are highly platykurtic relative to the normal. The calculated Jarque-Bera statistics and p-values in Table 1 are used to test the null hypothesis for normal distribution. Given this, the p-values indicate that the null hypothesis of normality is accepted for CRR, EXR, MS and IMPC while it is rejected for INFCP and LR variable. This connotes that these variables apart from INFCP and LR are normally distributed.

Unit Root Tests

In testing the time series properties of the variables in the model, this paper performed a univariate regression analysis using conventional unit root tests in order to ascertain whether each of these variables has unit root (non-stationary) or does not have unit root (stationary series). Following the summary results of the unit root tests presented in Table 2, it is clearly shown that the variables considered are a mixture of stationary I(0) and non-stationary I(1) series. Given this scenario, there is therefore a need for long-run relationship among the variables in each of the models, which the use of ARDL is capable of capturing.

The optimal lag length of the variables included in the ARDL model was selected based on the LR, FPE, AIC and HQ, indicated an optimal lag length of two (2) as seen in table 3.

Stability Test

The Recursive Residuals and CUSUM test results in figure 1 and 2 respectively indicated no break in the regression coefficients and the departure of the parameters from the constancy is within the straight line that represents critical band at 5% significant level respectively. The inverse roots of AR characteristics Polynomial in figure 3 also shows the points are within the circle.

Bound Test

To determine the existence of long-run relationship or trend between macroeconomic variable (INFCP) in the model and selected monetary policy instruments (CRR, LR, EXR, MS and IMPC), a co-integration analysis is performed using ARDL bounds test. In the case, the null hypothesis of no co-integration, ($H_0; \beta_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$) is tested. In the model (Inflation Consumer prices), the results in Table 4 depict that the Wald F-statistic of 16.91 fall above both the upper and lower critical bounds of 2.62 and 3.79 at 5% level of significance as established by Pesaran et al. (2001). Based on this, we reject the null hypothesis and conclude that there is long-run relationship between the variables between 1986 and 2018.

Short Run Analysis

The co-efficient of determination (R^2) in table 5, shows the total variation in the dependent variable, inflation consumer prices that is accounted for by the independent variables included in the model. The five independent variables explain about 90.73% variation in consumer prices. The adjusted co-efficient of determination (R^2) is 0.836374, it implies that the explanatory variables are able to explain 83.63% of the total variable in the dependent variable. The value of the F-statistic is 12.7957 with the probability value of 0.000003%. The P-value of F-statistic is less than 0.05%. This means that all the independent variables have a jointly significant influence on the dependent variable. We reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1). The value of Durbin-waston statistics is 1.772826. It implies that there is no auto-correlation.

Long Run Analysis

Table 6 displays the long run impact of INFCP. It showed that CRR reduces/increases the impact of the INFCP in Nigeria. The coefficient of CRR is positive and statistically significant, which implies a percentage increase in CRR increases INFCP by 1.65 percent and percentage decrease in CRR decreases INFCP in Nigeria. This conforms to the apriori expectations. The main reason for this result is that majority of businesses in Nigeria as a developing economy are between the medium and small scale, who depend largely on loans from banks to thrive and improved their businesses. An increase in cash reserve ratio sends a signal to the businesses which affects consumer prices. CRR is therefore a strong determinant for INFCP in Nigeria.

The coefficients of LR, EXR and MS showed a negative relationship with INFCP though statistically insignificant. This implies that one percentage increase in LR, EXR and MS decreases INFCP by 0.27 percent, 0.01 percent and 8.06 percent respectively conforming to the apriori expectations. Liquidity ratio, exchange rate and money supply affects money in circulation.

Import of goods and services co-efficient showed a positive relationship with INFCP but statistically insignificant. This implies that a percentage increase in IMPC increases INFCP by 2.58percent and the reverse also hold. When imported goods and services increases, this will lead to competition as traders want more customers, thereby selling at competitive prices which in turn improved price stability in Nigeria. Prices of products available in the market would be relatively stable as a result of increased volume.

5. Conclusion and Policy Recommendations

This study analysed the relationship between monetary policy instruments and price stability in Nigeria relying on annual data spanning 1986 to 2018. Exploiting techniques from the time series literature, our results revealed that in the long run, firstly, the cash reserve ratio has a positive relationship with the consumer price which confirms the theoretical knowledge, and is significant. Secondly, the liquidity ratio, exchange rate and money supply has a negative and insignificant relationship on the consumer prices. Lastly, import of goods and services has a positive but also insignificant relationship with the consumer prices. From the instruments used to measure the relationship between monetary policy and price stability, it is concluded that the monetary policies put in place by the central bank have not been able to control the price level of the economy since it was only the cash reserve ratio among the five that could have a significant effect on consumer prices. Based on the results of the study, it shows that in terms of price stability, the government was justified in changing the monetary policy controls from direct to indirect as the indirect tools of cash reserve, has the expected effect although it can be more effective. The bounds test results showed that there is long term relationship among the variables.

Given this, monetary authority with the aid of monetary policy instruments must be as supportive so as to ensure price stability, reduce unemployment rate and consequently brings about economic growth. It is necessary that the monetary authority designs its monetary policy instruments to be aligned with the other aspects of the Federal Government's macroeconomic programme. Such alignment would deploy liquidity management tools to reduce inflationary pressure and stimulate economic growth.

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