Impact of Monetary Policy on Exchange Rate in Nigeria: Bound Test and ARDL Approach

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Abstract: The aim of this study is to examine the relationship between monetary policy and exchange rate in Nigeria. The results of past empirical studies have not shown a clear direction about the nature of relationship between these variables in the country and these studies have failed to utilize the methodology in this work, which has created a gap in the literature. Data was collected from the Central Bank of Nigeria Statistical Bulletin from 1990– 2016 and various diagnostic tests such as Unit Roots and Bound Tests were carried out. Consequently, ARDL model was utilized to address the objective of this study. It was discovered in this study that credit reserve requirement and Treasury bill rate have a negative relationship with exchange rate. However, monetary policy rate and broad money supply have a positive relationship with exchange rate in the country. Furthermore, due to these important findings, this paper makes the following vital policy recommendations for the monetary authorities, policy makers, financial institutions regulators and future researchers. Due to the high volatility in exchange rate in Nigeria currently, the monetary authorities should increase the credit reserve requirement of the commercial banks. Also, the Central bank should increase that rate at which it sells Treasury bill to the commercial banks. The multiplier effect of this policy will reduce the level of high powered money and consequently stabilize the exchange rate.

Keywords: Exchange Rate; Monetary Policy Variables; Bound Test; ARDL and Nigeria

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1. Introduction

One of the critical factors that determines the stability or otherwise of external balance of a country is the value of the country's currency vis-à-vis the global

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currency. This value is usually measured through exchange rate mechanism. In Nigeria, a cursory examination of exchange rate history shows that in 1960s, the country adopted a fixed exchange regime by fixing its currency at par with the British pound which was later changed to American dollar. Consequently, the monetary authorities in their own wisdom pegged the country`s currency to a basket of 12 currencies of major trading partners of Nigeria in 1978. However, the implementation of the Structural Adjustment Programme (SAP) in 1986 marked the emergency of a flexible exchange rate in Nigeria. Since then exchange rate has been persistently depreciating in the country. The value of a US dollar was equivalent to 2 naira in 1986. The same dollar in 2018 was averagely valued at 365 naira. This implies that from 1986 to 2018, the country`s currency has been worsened by 18150%. It is worth of note that the multiplier effect of this continuous dwindling of currency value has manifested in the economy in the form of sharp declining in investment, rising in the cost of production, high unemployment rate and persistent fall in the standard of living of the masses in the last decade. Moreover, the various efforts of the Nigerian government to ensure a stable exchange rate in the economy has not been successful in the last few decades. This assertion is further reinforced by the submissions of Benson and Victor, (2012) and Aliyu, (2011) who argued that in spite of different measures adopted by the government of Nigeria to stabilize exchange rate, the currency has lost its value through out 80s to 2010.

However, the exchange rate management is one of the critical macro-economic policy functions of the central monetary authorities championed by the Central Bank of Nigeria. One of the most effective policies of the Central Bank to stabilize any disequilibrium in macroeconomic variables such as interest rate, inflation rate and exchange rate is the monetary policy. The policy is applied based on the discretion of the CBN to regulate the stock of money and the cost of capital in tune with the prevailing economic circumstances of the country with a view to ensuring the stability of the country`s macro-economic variables including exchange rate. It has been established that the monetary policy in Nigeria is primarily geared toward maintaining the stability of price and exchange rate since these variables are very germane to the achievement of sustainable economic growth and external sector competitiveness (Sanusi, 2012). Due to the sensitivity of exchange rate in determining the global competitiveness of economic activities of the country, this has been the issue of concern among the policy makers and scholars in the country.

In the recent time, despite the fact that several attempts have been made to examine the impact of monetary policy on exchange rate stability in Nigeria, the results from the past studies have not shown a clear direction about the relationship between these important variables in the country. See Michael (2010), Nanna (2001), Ullah and Rauf (2013), Ahmed and Rafar (2009). Also, this study is particularly unique in the area of methodology in which the previous studies have failed to explore. Therefore,

this paper will contribute to the existing bulk of studies by examining the impact of monetary policy on exchange rate after the adoption of SAP in Nigeria.

The rest of the paper is organized as follows; in addition to the introductory aspect, the section two addresses relevant theoretical and empirical literature review. Meanwhile, section three presents methodology, empirical results and policy recommendation.

2. Literature Review

The section critically reviewed past studies on nexus between exchange rate and monetary policy.

While advancing an empirical modeling between monetary policy and exchange rate, Coneri and Ziba (2001) sampled 42 middle-income developing countries. The authors argued that not only monetary policy effects but also open trade policies were necessary condition for the stability of exchange rate. It was further established that demand shocks on crude oil and agricultural exports negatively impacted exchange rate stability. In another work, Ahmed and Rafar (2009) utilized cointegration test, Ordinary Least Square (OLS) and Granger causality test to investigate the determinants of exchange stability in Nigeria from 1990 to 2007. The results from the estimated model indicated that a long-run relationship existed among the selected variables. The influence of money supply and cash reserve ratio was significant on exchange rate in the country. Also, the study asserted that there was an existence of a unidirectional causality between exchange rate and other variables of interest. Similarly, Masha (2011) applied Johansen co-integration technique to estimate the link between monetary policy actions and exchange rate determination in Ghana with the annual data of 1982 to 2009. It was concluded from the study that prompt monetary action resulted into a short-term and long-term stability of exchange rate in the country. Therefore, the paper recommended that the government of the country should employed policy tools like interest rates, liquidity, money supply and cash reserve ratios to stabilize exchange rate. While examining how monetary policy impacts exchange rate and growth in Zambia within the period of 1992 and 2006, Zulu and Paul (2008) used multiple regression model to establish the existence of a direct impact of money supply and liquidity ratio on exchange rate. Meanwhile, reverse was the case of minimum rediscount rate, exports and periodic policy changes on exchange rate. In the same vein, Hameed et al (2012) analyzed the impact of monetary policy on macro-economic variables such as money supply, GDP, exchange rates, interest rates, and inflation with the application of Ordinary least square OLS. The authors submitted that a tight monetary policy (in term of increase interest rate) contributed a significant adverse effect to output. But increase in money supply caused a noticeable direct impact on inflation which consequently

contributed to a negative influence on output. Exchange rate and output had an inverse relationship with each other.

However, Umar (2013) employed Granger causality test and Error Correction Model (ECM) to examine how monetary policy determines exchange rate in Nigeria ranging from 1980 to 2011. The findings that emerged from the paper posited that money supply had a significant direct impact on exchange rate whereas monetary policy rate and liquidity ratio had a reverse effect on exchange rate. Consequently, Chukuigwe and Abili (2008) adopted Ordinary Least Squares technique to investigate the impact of monetary and fiscal policies on non-oil exports in Nigeria between 1974 and 2003. It was discovered from the study that both interest rate and exchange rate exerted a negative impact on non-oil exports. Ditto for fiscal policy. While estimating the connection between exchange rate regimes and international business cycles, Oliver and Thepthida (2005) embraced a general equilibrium model to establish two sources of real exchange rate fluctuations as relative interest rate changes and movement in the relative price of imports across countries. It was further concluded that monetary growth had significant effects on exchange rate. In addition, Zafar and Sabo (2013) utilized multiple regression model to analysis the nexus between monetary policy and exchange rate between 1980 and 2010. The researchers discovered from the estimated model that the effects of money supply, monetary policy rate, Treasury bill rate and cash reserve ratio were negative and significant on exchange rate. The paper submitted that the implementation of monetary policy decisions on timely and effective manner would be the best solution to the issues of exchange rate management. Meanwhile, Ajisafe and Folorunsho (2002) estimated the relative effectiveness of monetary and fiscal policy on macroeconomic variables in Nigeria between 1970 and 1998 with the aid of co-integration and error correction model. The study corroborated that monetary policy exercised greater impact on the Nigerian economic variables than fiscal policy. It was therefore concluded that the past advocacy by the government to embark on fiscal measures has resulted into greater distortion in the economy. Furthermore, Amassoma et al (2011) utilized Ordinary Least Squared approach to evaluate how monetary policy affects macroeconomic variables in Nigeria ranging from 1986 to 2009. The results originated from the work concluded that monetary policy exerted a significant influence on both money supply and exchange rate while reverse was the case on price stability.

Finally, it could be pinpointed from the above reviewed literature that studies on nexus between monetary policy and exchange rate are still on going and there is not yet a consensus about their relationship. Hence, the relevance of this work.

3. Methodology

Secondary data from 1990 to 2016 was utilized for the analysis of this work. Effort was made to extract data on exchange rate, broad money supply, monetary policy rate Treasury bill rate and cash reserve requirement from CBN Statistical Bulletin. Consequently, the paper employed E-Views software to run the data.

3.1. Model Specification

The model for this study can be specified in the general form as follows:

EXR = F (BMS, CRR, MPR, TBR) ……. (I)

Model (I) could be written in an explicit form as follows.

$LEXRt = \beta_1 + \beta_2 LBMSt + \beta_3 CRRt + \beta_4 MPRt + \beta_4 TBRt + \mu_i$ .....(II)

3.2. ARDL Model Specification

The motivation behind the choice of ARDL model for this work is as a result of various diagnostic tests such as unit root test and Bound Test performed on the variables of interest in this paper. Due to different orders of integration of the variables i.e. I(1) and I(0), it is pertinent that the paper considers an autoregressive lag model to address its objective (Pesaran & Pesaran, 1997; Pesaran, Shin & Smith, 2001).

In a general form, ARDL model can be specified as follows:

ARDL (1, 1) model: $Y_t = \mu + \alpha_1 Y_{t-1} + \beta_o X_t + \beta_1 X_{t-1} + U_t$ .....(III)

Meanwhile, Y_t and X_t are stationary variables, and U_t is a white noise.

Therefore, in an explicit way the model to capture the analysis of this work could be stated thus:

$$EXR_t = \alpha_0 + \alpha 1 EXR_{t-1} + \alpha 2 BMS_{t-1} + \alpha 3\, CCR_{t-1} + \alpha 4\, MPR_{t-1} + \alpha 5\, TBR_{t-1} + \varepsilon_{1t} \text{---------- (IV)}$$

$$\Delta EXR_t = \beta_0 + \sum_{i=1}^{p} \beta_1\ \Delta EXR_{t-1} + \sum_{i=0}^{p} \beta_2\, \Delta BMS_{t-1} + \sum_{i=0}^{p} \beta_3 \Delta\, CCR_{t-1} + \sum_{i=0}^{p} \beta_4 \Delta\, MPR_{t-1} + \sum_{i=0}^{p} \beta_5 \Delta\, TBR_{t-1} + \varepsilon_{2t} \text{---------- (4)}$$

Where EXR proxies exchange rate, BMS denotes broad monetary supply, CCR is used to capture cash reserve requirement, MPR is used to represent monetary policy rate, TBR means Treasury bill rate, ε_i is error term. t =1990-2016. Meanwhile, term β_1- β_5 is parameters/ coefficients: $\beta_1\ \beta_2\ \beta_3\ \beta_4\ \beta_5 < 0$

Table 1. Descriptive Statistics of Annual Data Series (1990-2015)

Descriptive Statistics	EXR	BSM	CCR	MPR	TBR
Mean	4.243069	7.471481	7.425662	18.76926	13.19889
Median	4.795544	8.000000	7.577082	12.22000	12.95000
Maximum	5.535333	14.00000	9.980804	72.84000	26.90000
Minimum	2.084156	1.000000	3.967591	5.380000	6.130000
Std. Deviation	1.036382	3.918285	1.872430	17.75316	4.783067
Skewness	-0.755576	-0.211443	-0.222786	1.914774	0.742558
Kurtosis	2.006515	1.764428	1.798574	5.424036	3.776881
Jargue-Bera	3.679418	1.918656	1.847204	23.10906	3.160252
Probability	0.158864	0.383150	0.397086	0.000010	0.205949
Sum	114.5629	201.7300	200.4929	506.7700	356.3700
Sum. Sq. Deviation	27.92630	399.1769	91.15587	8194.537	594.8211
Observation	27	27	27	27	27

Source: Authors` computation (2019)

Before the estimation of the econometric model, an effort was made to examine the statistical features of the selected variables in this paper. However, the table above shows the descriptive statistics with the average values of 4.24%, 7.47%, 7.43%, 18.77%, and 13.19% for exchange rate, broad money supply, cash reserve requirement, monetary policy rate and Treasury bill rate concurrently between 1990 and 2016. The Jarque-Bera estimates indicate that all the variables are fairly distributed across the period because the values of their kurtosis are not far from 3. Also, the mean and median values of the selected variables for the analysis tend to converge which justified the submission of Karmel and Polasek (1980).

Table 2. Unit Root Test

Variables	ADF Test			PP Test		
	Level	1st Diff.	Remarks	Level	1st Diff.	Remarks
EXT	-2.981038**	-2.986225**	I (1)	-2.981038**	-2.986225**	I (1)
BSM	-2.981038**		I(0)	-2.981038**		I(0)
CCR	-2.981038**	-2.986225**	I(1)	-2.981038**	-2.986225**	I(1)
MPR	-2.981038**		I(0)	-2.981038**		I(0)
TBR	-2.981038**	-2.986225**	I (1)	-2.981038**	-2.986225**	I (1)

Source; Authors` Computation (2019)

** %5 level

The table above shows the result of unit root test carried out through the estimation of the standard Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. This test is very pertinent due to the problem of spurious regression which could emanate from the analysis of time series data if such data is not stationary. Succinctly to put, the estimated results in the above table clearly confirmed that the data are a mixture of I (0) and I (1).

Table 3. ARDL Bounds Test

Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	k
F-statistic	2.644090	4
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
5%	2.86	4.01

Due to the mixture of stationarity and non-stationarity of the adopted data for this work, it is expedient to examine the existence or otherwise of the long run equilibrium relationship among these variables with the application of Bound Test. (Pesaran & Pesaran, 1997; Pesaran, Shin & Smith, 2001). Therefore, the result presented in the above table indicates that the Null hypothesis of no long run relationship could not be rejected because the upper and lower Critical Value Bounds at all level of significance is greater than the value of F-Statistic. Hence, there is no presence of cointegrating relationship among the variables in the model. The outcome of this test warrantees the estimation of short run relationship with adoption of ARDL model.

Table 4. Short Run Relationship

Dependent Variable:

Selected Model: ARDL(1, 1, 0, 1, 1)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LEXR(-1)	0.645359	0.147948	4.362055	0.0004
MPR	0.010524	0.035242	0.298635	0.7688
MPR(-1)	0.141363	0.055125	2.564436	0.0201
LBMS	0.261780	0.112112	2.334992	0.0321
CRR	0.069700	0.032137	2.168821	0.0446
CRR(-1)	-0.062878	0.034440	1.825725	0.0855
TBR	0.034811	0.028329	1.228798	0.2359
TBR(-1)	-0.113073	0.039487	2.863579	0.0108
C	-1.452117	0.842309	1.723973	0.1028
R-squared	0.955189			
Adjusted R-squared	0.934101			
Durbin-Watson stat	2.011637			

Source: Authors` computation (2019)

The ARDL result of the short run relationship between monetary policy and exchange rate in Nigeria is presented in the above table. The estimated result shows that monetary policy rate has a significant positive impact on exchange rate in the short run. This result is line with the submission of Michael (2010) despite the

adoption of different methodology. But it contradicts the argument of Umar (2013) with Nigerian data and Zulu and Paul (2008) with Zambian data. Similarly, broad money supply has a positive and significant impact on exchange rate. This finding corroborates the assertions of Umar (2013) and Zulu and Paul (2008), meanwhile Paul, Kalu and Paul (2017) found opposite result. Credit reserve requirement at lag 1 has an insignificant negative impact on exchange rate. This result is line with Zafar and Sabo (2013). However, Treasury bill rate at lag 1 has a negative and significant relationship with exchange rate. This result confirms the propositions of Zafar and Sabo (2013), Ahmed and Rafar (2009), Zulu and Paul (2008). But Paul, Kalu and Paul (2017) reported an insignificant result. Consequently, it is worth of note to pinpoint that credit reserve requirement and Treasury bill rate have expected relationship with exchange rate in this study.

Furthermore, the monetary policy variables explained about 96% of total variation exchange rate in Nigeria. This means the model for this work is good.is influenced by the monetary policy variables. This implies a good fit. In the same vein, the DW statistic is approximated to 2. This shows there is absence of both serial and auto correlation in the model.

3.4. Conclusion and Recommendations

This paper has examined the relationship between monetary policy variables and exchange rate in Nigeria between the periods of 1990 and 2016 using Bound Test and ARDL model. The findings originated from this work could be summarized as follows: credit reserve requirement and Treasury bill rate have a negative relationship with exchange rate. Conversely, monetary policy rate and broad money supply have a positive relationship with exchange rate in the country. The implication of this result is that when exchange rate stability is the target of policy makers in Nigeria, manipulating the monetary policy variables will induce exchange rate accordingly in the short run. However, due to this important findings, this paper makes the following vital policy recommendations for the monetary authorities, policy makers, financial institutions regulators and future researchers.

1. Due to the high volatility in exchange rate in Nigeria currently, it is a matter of urgency that the monetary authorities should increase the credit reserve requirement of the commercial banks. Also, the Central bank should increase that rate at which it sells Treasury bill to the commercial banks. The multiplier effect of this policy will reduce the level of high powered money and consequently stabilize the exchange rate in the short run.

2. The monetary authorities should embark on contractionary monetary policy. This will cause declining in the level of broad money supply and monetary policy rate and eventually lower exchange rate depreciation in the country.

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