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Interest Rate And Exchange Rate In An Oil Dependent Economy: The Case Of Nigeria

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Abstract: We examine the long and short run impact of lending and deposit interest rates on exchange rate in Nigeria using the Autoregressive Distributed Lag (ARDL) model and annual data for the period 1981-2018. In Nigeria, there are two lending rates, i.e., prime and maximum lending rates, thus, we carry out robustness check to find out if the two interest rates have different impact on exchange rate in Nigeria. The result indicates that the relationship between lending interest and exchange rates in Nigeria is not sensitive to the type of lending interest rate used. Our findings reveal that increase in lending rate causes the Naira to depreciate significantly; making other currencies to be expensive against the Naira. However, we find that increase in deposit interest rate insignificantly appreciates the Naira against other currencies. Furthermore, we establish a negative significant relationship between GDP and exchange rate and a positive significant association between money supply and exchange rate in Nigeria. Based on our findings, we conclude that while lending interest rate, economic growth and money supply strongly influence value of the Naira against other currencies, deposit interest rate is weak in determining the rate at which the Naira is exchanged for other currencies.

Keywords: ARDL, Exchange Rate, Deposit Interest Rate, Lending Interest Rate, Nigeria, Interest Rate.

1.0 Introduction

Interest rate has been identified in the modern world, to be a typical policy instrument used by monetary policy authorities to influence the value of a domestic currency vis-à-vis other currencies in particular and to influence the monetary conditions in an economy. The manipulation of interest rate by Central Banks exerts a significant impact on exchange rates [1]. Interest rate rules if properly designed, can be consistent with exchange rate stability [2]. Through an appropriate manipulation of interest rate (interest rate rule as proposed by Taylor) by the Central Bank of a country, the domestic interest rate of the country could be set higher than the foreign interest rate, thus, all else constant, the domestic currency will attract high foreign demand and this is capable of strengthening the domestic currency against foreign currencies. For this and other reasons such as influencing the consumption behaviour of economic agents as well as influencing the monetary condition of an economy, interest rate has attracted the attention of academics, governments, deficit and surplus spending units and economists globally. Interest rate differential between home and abroad is one of the economic fundamentals that determine exchange rate [3]. Higher returns on a domestic currency than on foreign currencies does not only make investment in the domestic currency very attractive to foreigners, but also attracts foreign investment, hence, strengthening the domestic currency vis-à-vis foreign currencies. Besides, high returns on a domestic currency than on foreign currencies discourages investment by the domestic economy in foreign countries and this further strengthens the domestic currency against foreign currencies, *ceteris paribus*. Investors in currencies, both home and abroad, in order to make profit leverage on the difference in home and foreign interest rates via the construction of portfolios whereby they sell low interest rate currency or currencies and buy high interest rate currency or currencies. Based on this, some economists and policy makers have advocated the raise of domestic interest rate in the midst of exchange rate crisis to stabilize and or defend the domestic currency against deterioration. However, recently, there are policy debates on whether a higher interest rate stabilizes the exchange rate. This policy debates over the efficacy of defending exchange rates using the interest rate have spurred a literature [4]. For instance, [1], [4], [6] confirm a positive relationship between exchange and interest rates, while [7], [8] establish an inverse relationship between these variables. The use of interest rate by monetary policy authorities in Nigeria to stabilize exchange rate requires that the policy makers ascertain how these two variables are related. In this study therefore, we focus on the relationship between and exchange rate in Nigeria. Our reason for choosing Nigeria is that the value of the Naira in terms of other currencies has continued to fall since the adoption of the Structural Adjustment Programme (a programme that emphasized increased dependence on market force) in 1986. The recession into which the country went, which lasted from the beginning of 2016 to early 2017 further exacerbated the exchange rate crises and the value of the Naira has remained weak even when the country is out of the recession. One of the measures employed by the Central Bank of Nigeria over time to strengthen and stabilized the

value of the Naira against other currencies is the manipulation of interest rate. Thus, understanding how interest rate impacts on exchange rate in Nigeria is necessary because it will reveal to monetary policy authorities in the country the relationship that exists between the two variables, thereby guiding them on whether or not to use interest rate to strengthen the Naira, and if to use it (interest rate) to strengthen the Naira, our result will as well guide the policy makers on how to use it (interest rate) effectively to achieve the desired macroeconomic objective. We organize other aspects of our study as follows: section two is theoretical underpinning, section three is empirical literature, section four is methodology of the study, section five is results and discursion, section six is summary and conclusion.

2.0 Theoretical Connection

Difference between domestic and foreign interest rates affects the rate at which the domestic currency is exchanged for foreign currencies. Some economic models have explained how the difference between domestic and foreign interest rates influence the rate at which the domestic currency is exchanged for foreign currencies. For example, Mundell-Fleming model posits that there exists a negative relationship between interest rate and exchange rate. The model assumes that there is perfect capital mobility between or among countries, hence capital moves from countries with low interest rate to countries with high interest rate, thereby weakening the currency of the country with low interest rate against the currencies of countries with high interest rate. According to the model, if on the other hand the domestic interest rate rises above the foreign interest rate, foreign capital flows into the domestic economy and this strengthens the domestic currency against the foreign currencies, all other things constant. Similarly, the portfolio balance model postulates a negative relationship between interest rate and exchange rate. According to this theory, investors' portfolio allocation is influenced by interest rate. If for instance, there are high returns on interest bearing assets of a country, assets of the country become attractive thereby, providing incentives for investors to shift their portfolios to holding assets of that country and this appreciates the currency of the country against other currencies, *ceteris paribus*. If on the other hand the interest-bearing assets of the country attract less interest, assets of such a country become less attractive to investors. Investors in this case will move portfolios of their assets to other countries, as a result, the currency value of the country depreciates.

3.0 Literature Review

Impact of interest rate, economic growth and money supply on exchange rate has been examined by different researchers who, using different methodologies arrive at different conclusions. [9] show that interest rate movement and lagged exchange rate significantly influence exchange rate volatility in Nigeria. They employ annual data from 1981 to 2008, General Autoregressive Conditional Heteroskedasticity (GARCH) and Error Correction Model (ECM). Results of [8] show that exchange rate of ALL/US Dollar increase with US Dollar becoming more expensive when there is an increase in deposit interest rate. He utilizes Ordinary Least Squares (OLS) and monthly data spanning from January 2002 to December 2014 to explain the impact of interest rate on exchange rate fluctuations in Albania. Similarly, [5] find that higher interest rates cause exchange rate to weaken within frequency domain. They seek to determine the efficient level of short-term interest rate on US Dollar exchange rate in Turkey using monthly data from February 2003 to August 2015 and Granger causality. This is corroborated by [10] who establish a positive relationship between interest rate and USD to LKR exchange rate. Their aim is to find the impact of interest rate on exchange rate in Sri Lanka using daily data from 2010 to 2014 and Correlation. Furthermore, [3] investigate the relationship between exchange rate and short-term interest rates using a non-monotonic approach for 80 countries. They use annual data for the period 1974-2009 and find that large increases in interest rate depreciate the currency. [6] who applies OLS to quarterly data for the period 2007 to 2016 corroborates the positive, though insignificant impact of interest rate on exchange. He examines the effects of interest rate and inflation on exchange rate in Kenya. On the other hand, [7] find that monetary policy rate has a negative relationship with the Cedi/US Dollar exchange rate. They analyze the impact of monetary policy rate, inflation, GDP growth rate, current account balance, money supply and quasi money supply per GDP on Cedi to US Dollar Exchange rate in Ghana by applying Partial Least Squares Structural Equation Model to annual data from 1975 to 2014. [3] also reveal that small increases in interest rate appreciate the currency of 80 countries. These results are supported by the findings of [8] who finds that increase in deposit interest rate of ALL appreciate ALL against EUR/ALL exchange rate in Albania. To investigate the causal relationship between money stock and exchange rate, [11] employ Toda and Yamamoto Granger causality test and monthly data from January 1974 to April 2008 in Iran. Their results show that there is bidirectional causality between money stock and market exchange rate in both fixed and floating regime however, they find no significant relationship between money stock and exchange rate when there is no fixed exchange rate policy. Estimating three different monetary models of exchange determination in Nigeria, [12] reveals that a percentage increase in money supply fuels 1.242 percentage increase in nominal exchange rate. He applies Autoregressive Distributed Lag (ARDL) model to annual data that span from 1975 to 2010. In line with this, [7] find that money and quasi money supply per GDP have positive relationships with the Cedi/US Dollar exchange rate. Result of [13] which reveal that money supply depreciates the Khemer Riel/US Dollars exchange rate agrees to the findings of [7]. They use Bayesian Vector Autoregressive (BVAR) and monthly data from October 2009 and April 2018 to study the link among money supply, inflation and exchange rates in Cambodia. On GDP and exchange rate, [7] A find that annual GDP growth rate has positive relationship with Cedi/US Dollar exchange rate. Correspondingly, the result of [14] shows that the USD exchange rate is positively related to real GDP after employing Structural Vector Autoregressive (SVAR) model and annual data for the period 1989-2015 in US. Similarly, [6] finds that Gross Domestic Product (GDP) has a positive but insignificant impact on exchange rate in Kenya. We add to the literature on the relationship between interest rate and exchange rate by investigating the impact of deposit and lending interest rates on exchange rate in Nigeria. Thus, we contribute to the earlier body of knowledge in the following ways: First, we examine the short and long run relationship between lending

interest rate and exchange rate in Nigeria. Secondly, we examine the impact of deposit interest rate on exchange rate in Nigeria in the short and long run. Thirdly, we control for money supply and economic growth, which are key variables that influence the value of a country's currency against other currencies.

4.0 Methodology

4.1 Model Specification

The Autoregressive Distributed Lag (ARDL) model developed by [20] is employed for the study. This model allows us to investigate how exchange rate responds to interest rates in Nigeria both in the short and long run. Besides, the model gives more options for appropriate number of lags that we include in the estimation of Equations 1 and 2. Furthermore, the ARDL gives consistent and reliable results [15], allows the analysis of estimates from data with a combination of I(0) and I(1) and addresses the problem of endogeneity [16], [17]. We state the ARDL model as follows:

$$\Delta \ln exr_t = \rho_0 + \sum_{u=1}^{U} \tau_u \Delta \ln exr_{t-u} + \sum_{v=0}^{V} \tau_v \Delta \ln lr_{t-v} + \sum_{w=0}^{W} \tau_w \Delta \ln ms_{t-w} + \sum_{x=0}^{X} \tau_x \Delta \ln gdp_{t-x} + \sum_{y=0}^{Y} \Delta \tau_y \ln dr_{t-y} + \rho_1 exr_{t-1} + \rho_2 \ln lr_{t-1} + \rho_3 \ln ms_{t-1} + \rho_4 \ln gdp_{t-1} + \rho_5 \ln dr + \varepsilon_t \quad (1)$$

where $\ln exr_t$ is the log of exchange rate at time t, $\ln lr_t$ is the log of lending interest at time t, $\ln ms_t$ is the log of money supply at time t, $\ln gdp_t$ is the log of economic growth at time t and $\ln dr_t$ is the log of deposit interest rate at time t. Similarly, U, V, W, X, Y and Δ are optimal lags of exchange rate, lending interest rate, money supply, economic growth, deposit interest rate that we include in the estimation of Equation 1 and the difference operator, respectively. τ_i and ρ_i are respectively, short and long run parameters, while ε_t is the white noise error term. We state the Unrestricted Error Correction (UEC) or short run equation below.

$$\ln \Delta exr_t = \rho_0 + \sum_{u=1}^{U} \tau_u \Delta \ln exr_{t-u} + \sum_{v=0}^{V} \tau_v \Delta \ln lr_{t-v} + \sum_{w=0}^{W} \tau_w \Delta \ln ms_{t-w} + \sum_{x=0}^{X} \tau_x \Delta \ln gdp_{t-x} + \sum_{y=0}^{Y} \Delta \tau_y \ln dr_{t-y} + \Psi ECT_{t-1} + e_t \quad (2)$$

where ECT_{t-1} in Equation 2 is the error correction variable, i.e., the drift component, Ψ is the coefficient of the error correction term which tells how fast the variables adjust to the long run equilibrium after a short run shock or shocks, while e_t is the white noise error term at time t.

4.2 Unit Root Test

Unit root test is carried out to determine the integration order of all the series that we consider for this study. This test is necessary because it ascertains whether the series have constant mean and constant variance, and by extension establishes whether or not, estimates from the series are reliable for policy formulation. Besides, it justifies our choice of the technique of estimation (ARDL model) employed for the study. We conduct the stationarity test using two traditional unit root tests - the ([18], ([19]. Equation 3 specifies the unit root test model.

$$\Delta P_t = \lambda_0 + \lambda_1 T + \pi P_{t-1} + \sum_{t=1}^{Z} \psi \Delta P_{t-1} + \varepsilon_t \quad (3)$$

where P_t is the variable at time t on which we carry out the unit root test, P_{t-1} is the first lag of the variable, Δ is the difference operator, ε_t is the error term which has zero mean, constant variance and is normally distributed, T is time trend, Z is the optimal lag included in carrying out the test. Furthermore, λ_0, λ_1, π and Ψ are parameters. In carrying out the unit root test, we use 1%, 5% and 10% percent levels of significance. Our decision rule is as follows: if the p-value of the test (ADF or PP) statistic is less than 0.01, the series is stationary at 1%, if it is greater than 0.01 but less than 0.05, it is stationary at 5% and if it is greater than 0.05 but less than 0.10, it is stationary at 10%. Any series that fails to meet these conditions (i.e. it has unit root) at level, we difference it however, only one time to make it stationary.

4.3 Cointegration Test

It is necessary that we investigate the existence or otherwise of a long run relationship between exchange rate and interest rates (lending and savings), money supply and economic growth. Thus, we employ the ARDL bounds cointegration test put forward by [20]. The ARDL bounds test is preferred for testing this relationship because the test, when compared to the more traditional methods of testing for cointegration is more flexible ([21]. Besides, the test is applicable to series with a mixture of order of integration; i.e., I(1) and I(0) ([22], [23], [20]. Furthermore, our unit root test result confirms that the series are a mixture of I(0) and I(1), hence, the test is appropriate for the study. From Equation 1, we test the null hypothesis that there exists no cointegration between the regressand and the regresoors of Equation 1 - $H_0 : \rho_1 = \rho_2 = \rho_3 = \rho_4 = \rho_5 = 0$ against the alternative hypothesis - $H_1 : \rho_1 \neq \rho_2 \neq \rho_3 \neq \rho_4 \neq \rho_5 \neq 0$, which states that there is cointegration between the regressand and the regresoors of the equation. The ARDL bounds cointegration test is based on joint F-statistic and if we reject the null hypothesis of the test, i.e., the F-statistic value is greater than the upper bound critical value, it means that exchange rate and money supply, interest rates (lending and savings) and economic growth have a long run or level relationship. If the F-statistic value is less than the lower bound critical value of the test, we accept the null hypothesis; implying that there is no long run relationship

and if the F-statistic value falls within the lower and upper critical bounds values, we declare that the test is indecisive.

4.4 Data

We use annual time series data from 1981-2018 on official Naira/Dollar exchange rate to proxy exchange rate, lending interest, deposit interest rates, money supply proxied with broad money supply (M2) and economic growth proxied with real GDP per capita. Data on lending and deposit interest rates are sourced from the 2018 Central Bank of Nigeria (CBN) statistical bulletin, while data on money supply (M2), official Naira/US Dollar exchange rate and real GDP per capita are obtained from the 2018 World Bank's World Development Indicators (WDI) databank. Our choice of the period for this study is justified by the available data on the variables of interest as well as we consider the sampled period to be large enough for drawing consistent conclusions on the symmetric relationship between exchange rate and interest rate in Nigeria. Other variables included in the study other than lending and deposit interest rates are control variables. We log all the series to enable us interpret our estimates in terms of elasticity, i.e., investigate the short and long run elasticity of exchange rate to a change in interest rate and in other regressors considered our study in Nigeria

5.0 Results and Discussion

Table 1: *Descriptive Statistics*

	Mean	Median	Max.	Min.	Std. Dev.	Skew.	Kurtosis	J-Bera	Obs.
$\ln exr_t$	3.4175	4.5737	5.7239	-0.4817	1.9764	-0.7633	2.2704	4.5332	38
$\ln pri_t$	2.8288	2.8645	3.3945	2.0477	0.2857	-0.7814	3.8140	4.9159*	38
$\ln max_t$	3.0423	3.0654	3.5860	2.3026	0.3076	-0.7746	3.0936	3.8138	38
$\ln sr_t$	1.7606	1.6696	2.9339	0.3440	0.7048	0.0383	2.0072	1.5700	38
$\ln ms_t$	27.3651	27.4702	31.0449	23.4471	2.5970	-0.0810	1.6068	3.1150	38
$\ln gdp_t$	12.4563	12.3573	12.8619	12.2013	0.2383	0.5170	1.6570	4.5488	38

*Note: * signifies statistically significant at 10% level.*

We start our analysis with the descriptive statistics of all the variables reported in Table 1. Based on the evidence in the table, money supply has the greatest mean value; it has a value of 27.3651 followed by economic growth with mean value of 12.4563, while deposit interest rate has the smallest average (1.7606). Money supply and deposit interest rate, respectively have the largest and the least maximum values - their respective maximum values are 31.0449 and 2.9339. Among all the variables as confirmed by Table 1, exchange rate and money supply have the least and the greatest minimum values, respectively. The table further reveals that money supply with a standard deviation value of 2.5970 is the most unstable followed by exchange rate with a standard deviation value of 1.9764. This is confirmed by the respective differences between the minimum and the maximum values of these variables. All the other variables are somewhat stable; their standard deviation values are less than 1. With regard to skewness of the series, all the variables, but economic growth and deposit interest rate are negatively skewed. The Jacque-Bera statistic reveals that among all the variables, only prime lending rate (pri) is not normally distributed. While the peakedness of the variables shows that maximum (max) and prime lending (pri) rates are leptokurtic; it reveals that exchange rate, deposit interest rate, money supply and economic growth are platykurtic; suggesting that none of the variables is naturally peaked.

Table 2: *Unit Root Test Result*

	Augmented Dickey-Fuller (ADF)			Phillips-Peron (PP)			KPSS		
Variable	Level	Fist Difference	I(d)	Level	First difference	I(d)	Level	First difference	
$\ln exr_t$	-1.9886^{p}	-5.5257***^{q}	I(1)	-2.1219^{p}	-5.7135***^{q}	I(1)	0.6930***^{p}	0.3176^{p}	I(1)
$\ln pri_t$	-3.5446**^{p}	-		-3.249**^{p}	-	I(0)	0.2295^{p}	-	I(0)
$\ln \max_t$	-2.6861*^{p}	-		-2.8550*^{q}	-	I(0)	0.4411**^{p}	0.1610^{p}	I(1)
$\ln sr_t$	-2.0574^{q}	-5.6671***^{p}	I(1)	-2.2345^{q}	-5.6903***^{p}	I(1)	0.1106^{q}	-	I(0)
$\ln ms_t$	-2.3049^{q}	-3.5380*^{q}	I(1)	-1.5938^{q}	-3.0166**^{p}	I(1)	0.1070^{q}	-	I(0)
$\ln gdp_t$	-1.5105^{q}	-3.8263***^{p}	I(1)	-3.1724^{q}	-3.8263***^{p}	I(1)	0.7245**^{p}	0.1905^{q}	I(1)

*Note: *, ** and *** denote statically significant at 10%, 5% and 1% level of significant respectively, while ^{p} and ^{q} denote test with only constant and with constant and trend respectively.*

The unit root test is based on t-statistic and its probability value. For the ADF and PP test, the null hypothesis is there is unit root in the series while the alternative hypothesis is there is no unit root in the series. Rejecting the null hypothesis, therefore, indicates accepting the alternative hypothesis, i.e., there is no unit root in the series**.** On the other hand, null hypothesis of KPSS test is the antithesis of that of the ADF and PP tests; i.e., there is no unit root in the series. If we

reject the null hypothesis of the test our conclusion is that the series is not stationary. Table 2 shows that in both the ADF and PP tests, the null hypothesis is rejected at level for lending interest rates (maximum and prime); i.e., the t-statistic value of the test is statically significant. However, as confirmed by the table, all the series that are not stationary at level in all the three tests (ADF, PP and the KPSS) became stationary after we difference them one time; making result of the test a mixture of I(0) and I(1). This result therefore, requires us to carry out cointegration test, the result which is reported in Table 3.

Table 3: *Cointegration Test Result*

Model	f-statistic	K	Critical Bounds		
Model 1	6.6097***	4	Significance level	Lower (0)	Upper (1)
Model 2	6.1318***	4	1%	3.29	4.37
H_0: no Levels Relationship			5%	2.56	3.59
			10%	2.2	3.09

*Note: *** signifies statistically significant at 1%. Models 1 and 2 are the main in which prime and maximum lending rates are used respectively.*

We conduct cointegration test on all the variables and Table 3 reports the result. Rule guiding the ARDL bounds cointegration test stipulates that if the F-statistic of the test is greater than the upper critical bound value of the test, the null hypothesis of the test is rejected; implying existence of a long run relationship between the dependent and independent variables ([20]. If the F-statistic is less than the lower critical bound value of the test, the null hypothesis is accepted; indicating that there is no evidence of a long run relationship ([24]. In a case where the F-statistic lies between the lower and the upper bounds, we declare that the test is inclusive. Result in Table 3 reveals that the F-statistic value of the test for both the main and the robustness check models are greater than the upper bound value at 1% level of significance; thus, we reject the null hypothesis of no long run or level relationship between the explained and the explanatory variables of Equation 1. This suggests an evidence of a long run relationship between exchange rate and lending interest rate, deposit interest rate, economic growth and money supply. Additionally, it means that a shock or shocks to the equilibrium of the variables is/are temporary; with time the variables return to their level relationship.

Table 4: *Short and Long Run ARDL Estimates*

Main Result				Robustness Result			
Variable	Coefficient	Variable	Coefficient	Variable	Coefficient	Variable	Coefficient
Constant	3.9151 (4.1220)	Constant	8.9241 (9.3094)	Constant	5.9001 (4.1763)	Constant	19.4031 (13.4022)
$\ln \Delta lr_t$	0.8791*** (0.2631)	$\ln lr_t$	2.0038*** (0.5187)	$\ln \Delta lr_t$	0.7855*** (0.2555)	$\ln lr_t$	2.5833** (1.0060)
$\ln \Delta gdp_t$	-1.1625** (0.4770)	$\ln gdp_t$	-2.6499*** (0.8656)	$\ln \Delta gdp_t$	-0.9921** (0.4824)	$\ln gdp_t$	-3.2626** (1.2305)
$\ln \Delta sr_t$	-0.0420 (0.1294)	$\ln sr_t$	-0.0957 (0.2969)	$\ln \Delta sr_t$	-0.1089 (0.1463)	$\ln sr_t$	-0.3580 (0.5093)
$\ln \Delta ms_t$	0.3558*** (0.1166)	$\ln ms_t$	0.8110*** (9.3094)	$\ln \Delta ms_t$	0.1977* (0.1145)	$\ln ms_t$	0.6502*** (0.2232)
ECT_{t-1}	-0.4387*** (0.1149)			ECT_{t-1}	-0.3041*** (0.0997)		
Adj. R^2	0.9836			Adj. R^2	0.9829		
F-stat.		431.7994 [0.0000]		F-stat.	414.0154 [0.0000]		
Post Estimation Test							
Test	Statistic	P-value		Statistic	P-value		
Normality	13.6281	0.0011		17.2806	0.0002		
Serial Correlation	0.5448	0.5858		0.8002	0.4589		
Heteroskedasticity	1.0797	0.3061		0.7902	0.3803		
Functional Form	0.6715	0.5071		0.0150	0.9034		

*Note: *, ** and *** denote statistically significant at 10%, 5% and 1% level respectively; (.) and [.] are respectively standard error and p-values.*

Table 4 confirms the existence of a long run stability among all the variables. The table reveals that in the presence of a shock or shocks in the previous year, the variables of our model move to their long run equilibrium at the speed of 43.87% in the present period. This confirms our ARDL bounds cointegration test result reported in Table 3. Table 4 indicates that in the short run, lending interest rate has positive and significant impact on exchange rate. This suggests that if domestic lending interest rate rises, the value of the Naira against other currencies depreciates, i.e., more units of the Naira are required to purchase a unit of a foreign currency. Similarly, in the long run, exchange rate and lending interest rate are positively and strongly associated; signifying that if lending interest rate rises, the Naira deteriorates (becomes weak) against foreign currencies. That is to say, with increase in the lending rate in Nigeria, more

Naira is needed for a unit of other currencies in the long run. This result contradicts the portfolio and Mundell-Fleming models which postulate that all other things constant, a rise in domestic interest rate strengthens the value of the domestic currency vis-à-vis other currencies. The contradiction could be attributed to the fact that if the domestic lending interest rate rises, investors' expectations of returns on lent money in the country in the next period is that it will fall. This expectation of investors of next period fall in the yields of lent money as well as the risk of default in payment of the lent money at maturity on the part of borrowers will force investor to invest less in the Naira or event shift their portfolios of investment to other currencies, thereby weakening the Naira against other currencies. *Ceteris paribus*, Table 4 shows that if domestic lending rate rises by 1%, the Naira deteriorates against other currencies by 0.8791% and 2.0038% in the short and long run, respectively; both being statistically significant at 1% level of significance. This relationship between lending interest rate and exchange rate supports the findings of [3] that establish a positive relationship between interest rate and exchange rate in 80 countries. Our result however, contradicts [7] that find an inverse relationship between exchange rate and interest rate in Ghana. Evidence in Table 4 reveals that exchange rate and saving interest rate are negatively, but insignificantly related in both the short and long run. Though insignificant, this finding is in conformity with the Mundell-Fleming and the portfolio balance models which suggest that a rise in returns on a currency appreciates the currency against other currencies, all else equal. Furthermore, the finding conforms to [8] which finds that a rise in deposit interest rate appreciates the ALL against the Euro in Albania**.** Our result in Table 4 reports that all else equal, a percentage rise in deposit interest rate in Nigeria is accompanied by 0.0420% and 0.0957% appreciation of the Naira against other currencies in the short and long run, respectively. This inverse relationship between deposit interest rate and exchange rate is expected because all else constant, a rise in deposit interest rate encourages savings, and this in turn, reduces pressure on goods and services (imported goods and services included), hence, improving the value of the Naira vis-à-vis the value of other currencies. Furthermore, if deposit interest rate rises, foreign investors find it somewhat profitable to invest in the Naira through keeping their wealth in the Naira. This increases the demand for the Naira, thereby improving the value of the Naira. In both the short and long run, Table 4 reports that economic growth and exchange rate are negatively and significantly related; implying that if the economy of Nigeria experiences growth, the rate at which the Naira is exchanged for a unit of foreign currency improves significantly in the short and long run. Our evidence suggests that if the economy of Nigeria witnesses 1% growth, the Naira becomes stronger against other currencies by 1.1625% and 2.6499% in the short and long run, correspondingly and are statistically significant. This means that the growth of the Nigerian economy is indispensable for an improvement in the rate at which the Naira is exchanged for a unit of a foreign currency. This result is the antithesis of [7], [14], [6] which find a direct relationship between economic growth and exchange rate in Cambodia, US and Ghana, respectively. Similarly, we find money supply to exert strong positive influence on exchange rate in both the short and long run, the result which corroborates [12], [7], [13]. Our respective short and long run coefficients of money supply reveal that the Naira exchange rate weakens by 0.3558% and 0.8110% (both being statistically significant at 1% significance level) if money supply grows by 1%; suggesting that growth of money supply is highly detrimental to the strength of the Naira against other currencies. The adjusted R^2 and the F-statistic values suggest that economic growth, money supply, lending and deposit interest rates have strong influence on exchange rate in Nigeria. Value of the adjusted R^2 suggests that economic growth, money supply, lending and deposit interest rates explain about 98.36% of the total variation in the rate at which the Naira is exchanged for other currencies. We further conduct robustness test in which we use the maximum lending rate to establish the robustness of our findings, i.e., to investigate whether the response of exchange rate to lending interest rate in Nigeria is sensitive to the type of lending interest rate (prime or maximum) used. Table 4 reports result of the robustness check. The robustness check result conforms to our main findings. The result affirms that lending interest rate is positive and significantly related to exchange rate in both the short and long run. Similarly, the result corroborates the short and long run negative insignificant relationship between deposit interest rate and exchange rate. Also, it validates the short and long run inverse significant relationship between economic growth and exchange rate as well as the short and long run positive significant impact on exchange rate of money supply in Nigeria. Furthermore, the result reveals that the joint impact of economic growth, money supply, lending and deposit interest rates on exchange rate is strong and the variable jointly account for about 98.29% of the total variation in the rate at which the Naira is exchange for other currencies. We conduct four important post-diagnostic tests on both the main and the robustness check estimates to ascertain the reliability of our ARDL estimates. These tests are the normality, serial correlation, hetroskedasticity and the functional form tests using the Jarque-Bera, Breusch-Godfrey serial correlation LM, the ARCH and the Ramsey RESSET tests, respectively and Table 4 reports the results. The results reveal that in both the main and the robustness check estimates, the null hypotheses of all the tests, but normality are not rejected at any level of significance. This indicates that the error terms of the series are not serially correlated, i.e., the estimates do not suffer from serial correlation, variance of the error terms is homoskedastic and the model is correctly specified – there is no specification error. This further indicates that our estimates are valid. We further test for stability of the ARDL estimates using the CUSUM test advanced by [25] and Figure 1 reports the result.

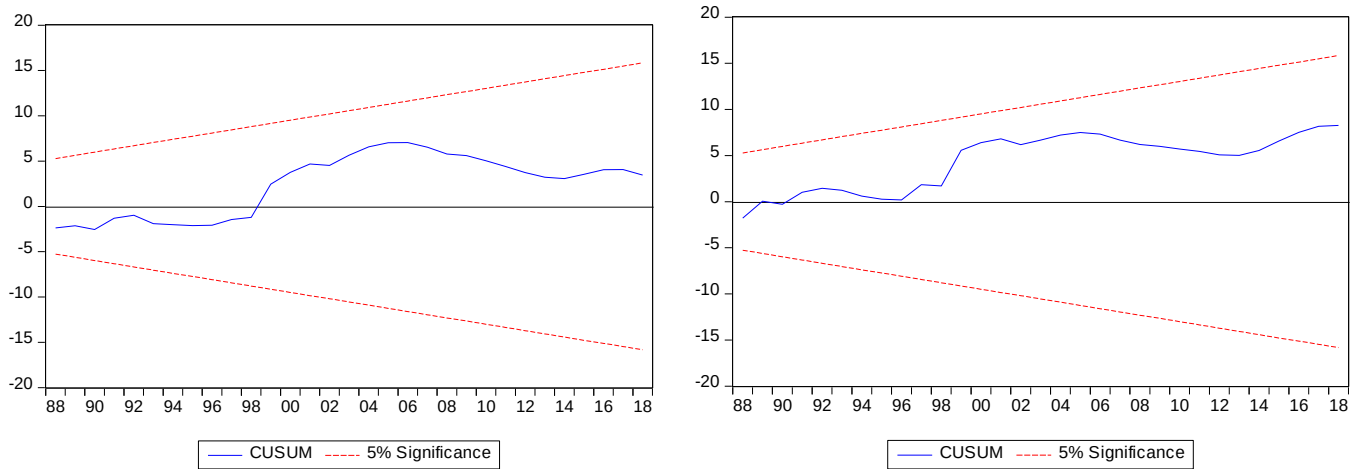

Figure 1. *CUSUM Test Result*

Rule of this test stipulates that if the CUSUM plot statistic remains within 5% level of significance, the estimated coefficients are stable. Therefore, based on Figure 1, we conclude that the parameters of our ARDL estimates are sufficiently stable - the CUSUM plot moves within the 5% level boundaries.

6.0 Summary and Conclusion

In this study we examine the impact of interest rate on exchange rate in Nigeria using annual data from 1981-2018. We use the nominal Naira/US Dollar exchange rate as a proxy for exchange rate, nominal lending and deposit interest rates. We also include economic growth, proxied with GDP per capita and money supply as control variables. After a reliability test, our findings reveal that lending interest rate has positive and significant impact on the rate at which the Naira is exchanged for other currencies in the short and long run. However, the findings reveal that saving interest rate exerts negatively but insignificant impact on exchange rate in both the short and long. In addition, we establish that while money supply weakens the Naira significantly against other currencies in the short and long run, economic growth strongly strengthens the Naira against other currencies in both the short and long run. Based on our findings, we conclude that while lending interest rate, economic growth and money supply are strong factors that influence the value of the Naira vis-à-vis the value of other currencies, deposit interest rate is weak in determining the strength of the Naira.

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