# An Empirical Analysis of the Determinants of Exchange Rate in Nigeria

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**Abstract**
This study examined empirically the determinants of exchange rate in Nigeria using the ARDL Bounds test approach to co-integration for the period spanning 1986-2016. The result of the analysis shows that the gross domestic product (GDP), Interest rate (INT) and inflation rate (INF) have positive effect on exchange rate in Nigeria while degree of openness (DOP) recorded a negative effect on exchange rate (EXR) in Nigeria. The Error Correction Mechanism result appeared to be correctly signed and significant. The study therefore concluded that gross domestic product, interest rate and inflation rate are the major determinant of exchange rate in Nigeria under the study period. It is therefore recommended that government should focus more on production of goods and services that can be exported and also introduce policies that can discourage importation of goods into the country. The government must pursue a realistic and pragmatic exchange rate policy in the less free trade areas that would stem capital flight and ensure more investment in the Nigerian economy.

## 1.0 Introduction

Exchange rate is a major variable in the general economic policy making both in developed and developing economies as its appreciation or depreciation affects the performance of other macroeconomic variable and it's attainment of macroeconomic objective cannot be over emphasized. A very strong exchange rate is a reflection of a strong and viable economy while on the other hand, a very weak exchange rate is a reflection of a very weak and vulnerable economy. In the light of its importance, every country pays so much attention to the appropriateness of her foreign exchange policy. As a result, governments, especially in the developing economies over the years have adopted different exchange rate management policies with a view to achieve realistic and stable exchange rate. Thus, most of these countries including Nigeria experienced high exchange rate fluctuation which translates into high degree of uncertainty (Nwude, 2012; Ajao and Igbokoyi, 2013).

The determination of appropriate and sustainable exchange rate in Nigeria has not been an easy task to both the government and policy makers. Before the introduction of the Structural Adjustment Programme (SAP) in 1986, Nigerian currency was said to be overvalued and that was why it was opened to market forces of demand and supply in 1986 to determine its real value. Since the devaluation that followed till date, the Nigeria's exchange rate policies have not yet been appropriate or able to accomplish the desired objectives. It would be recalled that after experimenting with flexible exchange rate policies since 1986 through Second-tier foreign exchange market (SFEM), Dutch Auction System (DAS), Modified Dutch Auction System (MDAS), Weighted Dutch Auction System (WDAS), etc., and punctuated by fixed exchange rate (1994-1998), the monetary authorities found it necessary to revert to fixed exchange rate policy in 2008. It soon neglected that and opted for currency redenomination which was rejected. There was the re-

introduction of the DAS in 2002 as a result of the intensification of the demand pressure in the foreign exchange market and the persistence in the depletion of the country's external reserves. Also, there was the introduction of the wholesale DAS in 2006 which further liberalized the market in an attempt to evolve a realistic exchange rate of the Naira, and finally the managed float exchange rate system which was introduced in June, 2016. The evolution of the foreign exchange market in Nigeria up to its present state was influenced by a number of factors such as the changing pattern of international trade, institutional changes in the economy and structural shifts in production.

Foreign exchange is said to be an important element in the economic growth and development of a developing nation. Foreign exchange policies influence the economic activities and to a large extent, dictate the direction of the macro-economic variables in the country. The mechanism of exchange rate determination are different systems of managing the exchange rate of a nation's currency in terms of other currencies and this should be properly done in a way that will bring about efficient allocation of scarce resources so as to achieve growth and development (Agu, 2002). Jhingan (2005) posited that to maintain both internal and external balance, a country must control its exchange rate. Some economic watchers have attributed the persistent depreciation of the naira to the decline in the nation's foreign exchange reserve. Others argued that the activities of some market speculators and banks are responsible for the recent decline in the value of the naira. It has been argued that the quest for higher profits in the face of the global economic meltdown has led to exchange rate fluctuations and misalignment and these practices continue to negatively affect the economy of Nigeria. Obadan (1994) stated that the factors that that brought about the depreciation of the Nigerian exchange rate include weak production base, import dependent, production structure, fragile export base etc., a realistic and sustainable foreign exchange rate is therefore the backbone of international trade and plays a central role in the economic upliftment of nations (Musa, 1982). A lot of efforts have been made by various researchers in theoretical and empirical forms, in designing and developing appropriate exchange rate system which hitherto has defiled any generalized method of determination because of the differences and peculiarities in the exchange rate system and economic / political climates. From the foregoing discussion, the questions that are raised include: what are the determinants of exchange rate in Nigeria? Secondly, is there a long run relationship between real exchange rate and these determinants? Therefore, the main objective of this study is to find out how some macroeconomic variables which are Gross Domestic Product (GDP), Gross Fixed Capital Formation (GFCF), Import, Export, Money Supply (MS), Interest rate and inflation rate impact on exchange rate in Nigeria using US dollar as a benchmark currency.

## 2.0 Literature Review
### 2.1 Theoretical Review
There are four approaches to nominal exchange rate determination which are prominent in literature, they are the traditional model, the monetary model, the portfolio balance approach and the purchasing power parity model. In the traditional model, forces of demand and supply for foreign exchange play vital roles in the determination of the equilibrium rate which emerges at the equality of the demand for and supply of foreign exchange. Capital flows perform important function in maintaining equilibrium in this approach with an outflow moderating current account surplus and an inflow financing current account deficit. In order to prevent excessive changes in the exchange under this approach, attention is usually paid to the determinants of the changes in the current account which are relative prices and income. Accordingly, a situation of current account deficit which tends to depreciate the exchange rate calls for concerted effort at reducing both domestic price level and income while raising interest rate.

The monetary approach is based on the importance of money as a unit of exchange, thus, it visualizes exchange rate as a function of relative shift in money stock, inflation rate and domestic output between a country and a trading partner economy. Frenkel (1978) posits that this model of exchange rate determination attains equilibrium when existing stocks of money in the two countries are willingly held. The monetary approach under the flexible exchange rate can be presented in two forms, the monetary approach or the asset market approach and it emphasized on the role of money and other assets in determining the exchange rate. Obioma (2000) holds the view that asset market or monetary approach attributes variation in exchange rate essentially to income and expected rates of return as well as to other factors that influence the supplies of and demands for the various national income. Therefore, based on the fact that supply and demand for

money is determined by the level of income, the monetary model postulates three basic determinants of exchange rate as relative money supplies, relative income and interest rate differentials. The only disadvantage of this approach is that it assumes unrealistically that the domestic and foreign financial assets are perfect substitutes; this may be a source of persistent disequilibrium under the model.

The Portfolio Balance approach views the exchange rate as resulting from a process of financial equilibrium in the economy. Such financial equilibrium results from a simultaneous equilibrium in the individual financial asset markets, that is, when the amount of each asset desired to be held is the amount that is actually held. Three of such markets are considered very important here, domestic money or monetary base, domestic bonds and foreign bonds. Three equilibrium prices emerge from the attainment of this financial equilibrium: equilibrium price of each asset, the equilibrium interest rate in the country and the equilibrium exchange rate. The exchange rate emerges from this model because any portfolio switches between the domestic assets and the foreign asset necessitates new demand for foreign exchange (Appleyard, Field and Cobb, 1996); (Rogoff 1996). However, Ojo (2001) noted that the approach disregards the fundamentals of trade in its calculations and this may be a source of inexplicable changes in the exchange rate.

The Purchasing Power Parity (PPP) approach to the exchange rate determination was and continues to be a very influential way of thinking about the exchange rate. The PPP posits that the exchange rate between two currencies would be equal to the relative national level prices. The PPP derives from the assumption that in the world there exists the law of one price. This law states that identical goods should be sold at identical prices. The law of one price implies that exchange rate should adjust to compensate for price differentials across countries (Hoontrakul, 1999). Notwithstanding, the infraction to this law often engendered by transportation and handling charges, it is generally believed that the law is plausible. Accordingly, the absolute PPP stipulates that the absolute level of the exchange rate is that which causes traded goods and services to have same price in all countries when measured in the same currency. There is however very little empirical support for the absolute PPP due to the rather strong influence of transportation costs and trade barriers at keeping prices from equalizing across geographical locations, and the effect of the differences in the composition and relative importance of various goods on each country's price level determination (Ogun, 2012).

## 2.2 Empirical Review
There has been various empirical literature carried out on the determinants of exchange rate since the breakdown of the Bretton Woods in 1973 till date. Below are some of the empirical studies which attempt to investigate the determinants of exchange rate in developed countries, developing countries and in Nigeria.

Stancik (2007) investigated the source of exchange rate volatility among the six new European Union member state during the period 1999 to 2004. The study used threshold autoregressive conditional heteroscadasticity (TARCH) model as a technique of analysis. The findings revealed that economic openness, information and flexible exchange rate regimes have positive and statistically significant impact on exchange rate volatility.

Josifidis et al. (2013) researched the real exchange rate as an adjustment mechanism variable; crisis transmission to the real economy, and foreign exchange intervention as a way of exchange rate management and defense. The study was conducted on six new EU members during the financial crisis.

Benazic and Kersan-Skabic (2016) analyzed the determinants of the nominal exchange rate in Croatia by using the bounds testing (ARDL) approach to co-integration. The results indicated the existence of a stable co-integration relationship between the observed macroeconomic variables and the nominal exchange rate, whereby an increase in the majority of the variables led to an exchange rate appreciation. Thus, the determination of the nominal exchange rate in Croatia primarily depends on the external factors that affect domestic economy. It was however recommended that the results obtained can be useful to policy makers in making monetary policy decisions in keeping the exchange rate stable.

Insah and Chiaraah (2013) empirically investigated the factors affecting real exchange rate in Ghana for the period of 1980 to 2012. The variables used in the study include; government expenditure, money supply, domestic debt and external debt. The study employed the ARDL model to examine the relationship between the variables. The findings revealed that there exist positive relationship between government expenditure

and exchange rate volatility. The study recommended that government should cut down its expenditure in order to control the persistence trends in exchange rate.

Amir et al. (2012) investigated the determinants of exchange rate and its impact on Pakistani economy by evaluating the GDP using data over period of 11 years (2001-2011). The study used multiple regression equation in order to explore the causal relationship between exchange rate with interest rate, inflation rate, current account and GDP. The result showed how these determinants fluctuates exchange rate, inflation differential, current account deficit, public debt and interest rate differential are most important determinants which have major impact on exchange rate and the result is statistically significant in the overall. Also, the studies by Razi et al. (2012) and Saeed et al. (2012) in Pakistan revealed that GDP, inflation, interest rate, current account balance, money stock, foreign reserve and total debt were the major factors influencing exchange rate instability in Pakistan.

Asiama and Kumah (2010) investigated the degree of influences upon which productivity, fiscal balance, current account balance, terms of trade, openness, oil prices, public consumptions, foreign direct investment and foreign aids affects exchange rate variability in African countries over the period of 1980 to 2008. The objective of their study was to investigate whether there is evidence of consistency between the theoretical and empirical framework. The panel co-integration approach was utilized to test the hypothesis. The results of the study revealed that both theoretical and empirical framework were very much consistence, and real exchange rate was strongly influenced by openness, terms of trade and oil prices.

Gelbard and Nagayasu (2004) also investigated the causes of real exchange rate in Angola for the period spanning from 1992 to 2002. Their results proved that oil price and interest rate were the most important sources of exchange rate movement. They recommended that flexible exchange rate policy is more likely to be the right exchange rate policy for Angola than fixed exchange rate policy.

Furthermore, in Nigeria, there seems to be lot of literature on the determinants of exchange rate with various macroeconomic indicators. The empirical evidence on the subject is reviewed below.

Orji (2015) investigated the determinants of real exchange rate in Nigeria by adopting the Ballassa-Samuelson hypothesis. The study employed the Error Correction Model (ECM) technique to perform the data analysis with the use of time series data spanning through 1981 to 2012. The findings revealed that the interest rate differential and oil revenues were major determinants of real exchange rate in Nigeria while productivity differential was not a determinant in influencing real exchange rate. The study therefore suggested that policy makers should consider the effective management and control of interest rate in order to achieve and maintain a stable real exchange rate and also that the economy should be diversified away from oil sector so as to reduce the effect of any shock in the oil sector.

Ajao (2015) examined the determinants of real exchange rate volatility in Nigeria from 1981 through 2008. The volatility of exchange rate was obtained through the GARCH (1, 1) technique and the ECM was used to examine the various determinants of exchange rate volatility in Nigeria and the co-integration analysis reveals the presence of a long term equilibrium relationship between REXRVOL and its various determinants. The empirical analysis further revealed that openness of the economy, government expenditures, interest rate movements as well as the lagged exchange rate were among major significant variables that influenced REXRVOL during the period. The study therefore recommended that the central monetary authority should institute policies that will minimize the magnitude of exchange rate volatility while the federal government exercise control of viable macroeconomic variables which may have direct influence on exchange rate fluctuations.

Alayande (2014) studied the relationship between exchange rate and its potential determinants using the unit root test and granger causality test for the period of 1980 to 2013. The result of the study showed that exchange rate is highly significant, followed by change in oil price, growth in money supply, foreign exchange reserves, interest rate, inflation rate and change in stock market. The study recommended that it will be better for policy researchers to look at other variables before making any future prediction on exchange rate and give proper monitoring if there are any slight changes in other variables to help policy decision makers.

Ngerebo and Ibe (2013) investigated the causal relationship between exchange rate, balance of payment, external debt, external reserves, gross domestic product and inflation rate in Nigeria post Structural Adjustment Programme (SAP) in Nigeria from 1987 to 2011. The Johansen co-integration test, equation estimation and Granger causality tests were applied. The Johansen co-integration result showed that there existed a long run relationship among the indicators and the Granger causality test showed a unidirectional causality from exchange rate to Balance of Payment (BOP), external reserves and GDP growth rate and that there is a causal relationship between exchange rate and the selected macroeconomic variables in Nigeria post SAP era. The study therefore recommended that monetary authorities should come up with a monetary policy framework that compliments the existing exchange rate policy and ensures stability.

Oriavwote and Oyovwi (2012) examined the determinants of the real exchange rate in Nigeria with data covering 1970 – 2010. The parsimonious ECM result showed among others that the ratio of government spending to GDP, terms of trade and technological progress are not important determinants of the real effective exchange rate, also the result showed that capital flow, price level and nominal effective exchange rate are important determinants of the real effective exchange rate in Nigeria. It was thus recommended among others that policies be put in place to stabilize the problem of inflation.

Nwude (2012) investigated the factors that were assumed to be determinants of foreign exchange rate movement in Nigeria using a 52 years annualized data from 1960-2011 and the least square method of analysis was employed. The factors investigated were GDP, BOP, external reserves, inflation rate, deposit rate and lending rate as independent variables while the foreign exchange movement is the dependent variable. The results of the study showed that there is no statistically significant relationship between the dependent and the independent variables. It was recommended that government should set in motion a platform for gauging the power of the domestic currency against the US dollar by increasing the deposit interest rate to encourage citizens keep their money in Nigeria through investments instead of spending such amount abroad.

Aliyu (2011) examined empirically the real exchange rate misalignment in Nigeria based on behavioral equilibrium exchange rate (BEERs) approach. Quarterly time series data were used from 1986Q1 to 2006Q4 and the Johansen co-integration test and error correction model were employed. The variables controlled were net foreign assets, terms of trade and index of crude oil price volatility, government fiscal stance, monetary policy, productivity, trade openness and foreign reserve. The results showed that long-run behavior of real exchange rate was positively influenced by terms of trade, index of crude oil volatility, index of monetary policy performance and net foreign assets; while government spending and foreign reserve were negatively related to real exchange rate behavior. The results also reported that an increase in oil revenue and sound macroeconomic performance could overvalue or undervalue real exchange rate in Nigeria. The study recommended sound and effective monetary policy and reduction of fiscal dominance.

While all the research works reviewed return differing opinions, most of the findings revealed that macroeconomic variables like Balance of Payment (BOP), external debt, external reserve, GDP, terms of trade, production and net foreign assets contribute to the determination of exchange rate though with differing degrees and in different situations. Nwude (2012) revealed that there is no statistically significant relationship between foreign exchange movement and other macroeconomic variables studied which are GDP, BOP, external reserve, Composite Price Index (Inflation rate), deposit rate and lending rate.

As no one policy is best for all countries at all times, therefore a country needs to identify the macroeconomic variables and policy that best fits its economic developmental goals in order to be on a sustainable path of exchange rate policy. What has become clear from the above review is that exchange rate as important as it is in economic development cannot be determined in isolation of other macroeconomic variables. It therefore becomes necessary to determine the relationship of some of these macroeconomic variables especially those that are not frequent in literature and the foreign exchange rate in Nigeria.

### 3.0 Data and Methodology
This paper used annual data spanning 1986 through 2016 for the estimation. The data is obtained from Statistical Bulletin of the Central Bank of Nigeria (CBN). The variables included in the model are the exchange rate, gross domestic product (GDP), degree of openness (DOP), interest rate (INTR) and inflation

rate (INFR). Furthermore, the model expressing the functional relationship between exchange rate and its determinants is given as:

$$EXR = f(GDP, DOP, INTR, INFR) \qquad (3.1)$$

The econometric model is given as:

$$EXR_t = \beta_0 + \beta_1 GDP_t + {}_{\beta2}DOP_t + \beta_3 INTR_t + \beta_4 INFR_t + \text{€}_t \qquad (3.2)$$

## 3.1 Model Specification and Technique

The study adopts Autoregressive Distribute Lag (ARDL) Bounds testing approach developed by Pesaran et al (2001) to estimate equation 3.2. The choice of Bounds testing approach is based on the fact that the model can be applied irrespective of whether the series under investigation are stationary at I(0) or I(1) or mixture of both, and it also provides robust and high quality result even if the sample is large or small.

Thus, model used in this study is specified as:

$$LnEXR_t = \beta_0 + \beta_1 LnGDP_t + \beta_2 LnDOP_t + \beta_3 LnINT_t + \beta_4 LnINF_t + \varepsilon_t$$

Where Ln is natural logarithm, $\beta_0$ is the constant term, GDP, DOP, INT, INF where EXR denotes exchange rate, GDP represents gross domestic product, DOP represents degree of openness to trade, INT represents interest rate, INF represents inflation rate and ε is the error term.

## 4.0 Empirical Analysis and Findings

### 4.1 Descriptive Statistics

The descriptive statistics provide information on the statistical properties of the raw data of variables used in the study. Table 4.1 reports the descriptive statistics.

**Table 4.1. Descriptive Statistics**

|  | LNEXR | LNGDP | LNDOP | LNINT | LNINF |
|---|---|---|---|---|---|
| Mean | 1.752809 | 3.858194 | -0.925731 | 1.353034 | 1.159906 |
| Median | 2.048830 | 3.910312 | -0.920819 | 1.350636 | 1.071882 |
| Maximum | 2.484300 | 5.006421 | -0.086186 | 1.557387 | 1.862131 |
| Minimum | 0.305351 | 2.306288 | -2.000000 | 1.079181 | 0.732394 |
| Std. Dev. | 0.587491 | 0.865635 | 0.483165 | 0.088995 | 0.310519 |
| Skewness | -1.081416 | -0.319291 | -0.439209 | -0.399719 | 0.910931 |
| Kurtosis | 2.850844 | 1.824070 | 2.344401 | 4.702575 | 2.697692 |
| Jarque-Bera | 6.070945 | 2.312857 | 1.551844 | 4.569739 | 4.405326 |
| Probability | 0.048052 | 0.314608 | 0.460279 | 0.101787 | 0.110508 |
| Observations | 31 | 31 | 31 | 31 | 31 |

Source: Author's Computation (2018)

The table 4.1 reveals that exchange rate (EXR) has a mean of 1.752809 and varies from a minimum of 0.305351 to a maximum of 2.484300 and a standard deviation of 0.587491 with a probability value of 0.048052. Gross domestic product (GDP) has a mean of 3.858194 and varies from a minimum of 2.306288 to a maximum of 5.006421 and a standard deviation of 0.865635 with a probability value of 0.460279. Degree of openness (DOP) has a mean of -0.925731 and varies from the minimum of -2.000000 to a maximum of -0.086186 with a standard deviation of 0.483165 and probability of 0.460279. Furthermore, interest rate (INT) has a mean of 1.353034 and varies from the minimum of 1.079181 to a maximum of 1.557387 with a standard deviation of 0.483165 and probability value of 0.101787. Lastly, inflation rate (INF) has a mean of 1.159906 and varies from minimum of 0.732394 to a maximum of 1.862131 with a standard deviation of 0.310519 and probability 0.110508. Consequently, exchange rate, gross domestic product, degree of openness and interest rate were negatively skewed while inflation has positive skewness. The Jarque-Bera statistic reported in the table indicates that GDP, DOP, INT and INF variables were normally distributed while EXR is not normally distributed. This follows the decision rule that variables

are normally distributed if JBTAB is greater than JB-CAL at 5% level of significance or if the probability of Jarque-Bera statistics is greater than 0.05.

## 4.2 Augmented Dickey-Fuller (ADF) Unit Root Test

The unit root test is conducted to determine whether the variables are stationary and to determine the order of integration of the variables using the Augmented Dickey-Fuller (ADF) test.

**Table 4.2: Unit Root Test**

| Variables | Test statistics | Critical value | Order of Integration |
|---|---|---|---|
| EXR | -3.168297 | -2.963972 | I(0)** |
| GDP | -3.315875 | -2.963972 | I(0)** |
| DOP | -2.882809 | -2.981038 | I(1)* |
| INT | -4.673317 | -2.963972 | I(0)*** |
| INF | -3.231281 | -2.998064 | I(0)** |

**Note:** * (**) (***) denotes null hypothesis at 10%, 5% and 1% level of significant respectively

*Source:* Author's Computation, (2018)**.**

Table 4.2 shows the result of the Augmented Dickey-Fuller unit root test. From the result, it is shown that exchange rate, gross domestic product, interest rate and inflation rate attained stationarity at level while degree of openness indicated a non-stationary series, but became stationary after first differencing. Exchange rate, gross domestic product and inflation were significant at 5%, degree of openness and interest rate were significant at 10% and 1% level of significance. The economic implication of this is that any shock or disturbance (e.g. government policy) to the variables will not be sustained for a long period of time meaning such shock will die off in a short while. Since there are mixtures of I(0) and I(1) variables. Autoregressive Distributed Lag model (ADRL) will be adopted and bound test will be used to capture the presence of cointegration.

## 4.3    Cointegration Test

Null Hypothesis: No long-run relationships exist
**Table 4.3        ARDL Bound Test Result**

The bounds test was performed to test for the presence of co-integration due to the mix of I(0) and I(1) series in the model. The null hypothesis is that there is no co-integration. Table 4.3 reports the result of the bounds test derived from an Autoregressive Distributed Lag (ARDL) (4,4,4,2,0) model.

| NULL HYPOTHESIS | F - STATISTIC | CRITICAL VALUES BOUNDS | | |
|---|---|---|---|---|
| | | SIGNIFICANCE | LOWER BOUND | UPPER BOUND |
| No long-run relationships exist | 6.412022 | 10% | 2.45 | 3.52 |
| | | 5% | 2.86 | 4.01 |
| | | 2.5% | 3.25 | 4.49 |
| | | 1% | 3.74 | 5.06 |

*Source:* Author's Computation, (2018)

The computed F-stat of 6.412022 is greater than the Upper Bound table value at any % level of significance. The study rejects the null hypothesis. This is interpreted as there is long-run relationship among the variables, that is, the variables co-move on the long run.

## 4.4    Long and Short Run Estimation Coefficients
Having confirmed the existence of long-run relationship among the variables, the study will estimate long run and short run parameters by general to specific procedure ARDL model.
**Table 4.4        Long Run Co-Integrating Coefficients**

| Variables | Coefficient | Standard Error | Probability |
|---|---|---|---|

| | | | |
|---|---|---|---|
| LnEXR | -3.778909 | 1.189679 | 0.0131 |
| LnGDP | 0.698857 | 0.201190 | 0.0084 |
| LnDOP | -1.069952 | 0.362907 | 0.0185 |
| LnINT | 1.656987 | 1.044212 | 0.1512 |
| LnINF | 0.200765 | 0.206423 | 0.3592 |

*Source:* Author's Computation, (2018).

Table 4.4 reports that the coefficient of gross domestic product is positive and statistically significant, this shows the existence of a positive and significant long run relationship between gross domestic product and exchange rate in Nigeria. A percent increase in the gross domestic product increases exchange rate by 69%. The coefficient of the degree of openness depicts a negative and significant effect with exchange rate. Hence, a percentage change in degree of openness will yield to about 10% decrease in exchange rate. The coefficient of interest rate is positive and statistically insignificant, as a result, there is a positive longrun relationship between interest rate and exchange rate in Nigeria. This implies that a unit change in interest will lead to about 16% change in exchange rate. Lastly, the result also revealed the insignificant positive effect of inflation rate on exchange rate with 20% change.

## 4.5 The Short-run Dynamic and the Error Correction Model

**Table 4.5 The Short-run Dynamics and Error Correction Model**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(LNEXR(-1)) | -0.476536 | 0.192743 | -2.472392 | 0.0386 |
| D(LNGDP) | -0.538620 | 0.527385 | -1.021303 | 0.3370 |
| D(LNDOP) | 0.228922 | 0.074701 | 3.064522 | 0.0155 |
| D(LNINT) | 0.446720 | 0.233070 | 1.916676 | 0.0916 |
| D(LNINF) | 0.090925 | 0.083027 | 1.095119 | 0.3053 |
| ECM(-1) | -0.452891 | 0.099858 | -4.535330 | 0.0019 |

*Source:* Author's Computation, (2018).

The result in the table 4.5 indicates that the coefficient of the error correction term ECM(-1) has the correct sign and significant at 5% level. The value of the coefficient is -0.452891 and this means about 45% of the disequilibrium in the level of exchange rate of previous year's shock adjust back to the long run equilibrium in the current year. In another word, the level of exchange rate adjust to equilibrium with lags and only about 45% of the discrepancy between long and short run level of exchange rate in Nigeria is corrected within a year. This is an increasing rate of adjustment.

The result shows that degree of openness and interest rate have positive effect on exchange rate, this implies that the degree of openness and interest rate will bring about 22% and 44% changes to exchange rate determinant in Nigeria. Degree of openness and interest rate are significant at 5% and 10% respectively. More so, inflation reveals an insignificant positive effect on exchange rate with about 9% increase. Gross domestic product has a negative and insignificant effect on exchange rate in Nigeria with about 53% decrease effect.

## 4.6 Autocorrelation Test
**Table 4.6 Breusch-Godfrey Serial Correlation LM Test**

| | | | |
|---|---|---|---|
| F-statistic | 0.166957 | Prob. F(2,6) | 0.8500 |
| Obs*R-squared | 1.423399 | Prob. Chi-Square(2) | 0.4908 |

*Source:* Author's Computation, (2018).

The probability of the chi-square statistics in the result of the autocorrelation test has a value of 0.4908 (49.08%) which is greater than 5% level of significance, hence the null hypothesis of no autocorrelation is accepted, hence the result of this analysis is reliable and free from serial error correlation.

## 4.7 Heteroscedasticity Test (ARCH)

**Table 4.7: Heteroscedasticity Test (ARCH)**

| F-statistic | 3.648047 | Prob. F(1,24) | 0.0682 |
|---|---|---|---|
| Obs*R-squared | 3.430594 | Prob. Chi-Square(1) | 0.0640 |

*Source:* Author's Computation, (2018).

The probability of the chi-square statistics in the result of the heteroscedasticity test has a value of 0.0640 (6.40%) which is greater than 5% level of significance, hence the null hypothesis of homoscedasticity is accepted, therefore the result of this analysis is reliable and free non constant variance.

**4.8    Stability Test**

**Table 4.8:    Ramsey RESET Test**

| Null hypothesis | Probability |
|---|---|
| The model is fit | 0.5239 |

*Source:* Author's Computation, (2018).

The F-statistics in the result has a probability value of 0.5239 (52.39%) which is greater than 5% level of significance, hence the null hypothesis that the regression model fit the data well is accepted, hence the parameter estimate in this model are stable over time.

**4.9    Normality Test**

**Figure 1: Normality Test**
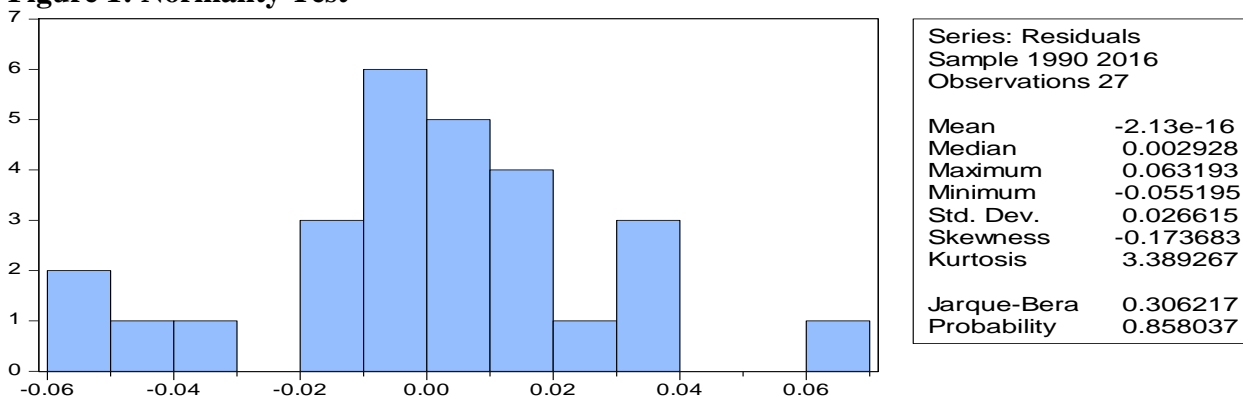


Source: Authors Regression Output

The assumption of the OLS estimate and statistical inferences of the ARDL methodology adopted in this study is based on normality. Violation of the normality assumption may render the outcome of the regression analysis invalid. The normality assumption is tested for using the residual from the regression result. The probability value of the Jarque-Bera statistics in the Figure 1 has the value of 0.858037 (85.80%) which is greater than 5% level of significance, hence the null hypothesis of normality is accepted, and therefore the residual of this analysis is normally distributed.

**4.10    Discussion of Findings**

According to the empirical findings, the Augmented Dickey-Fuller (ADF) unit root test reveal that exchange rate, gross domestic product, interest rate and inflation rate contain a unit root series while degree of openness was stationary in nature. Due to the mixture of the I(1) and I(0) series, the condition to adopt Johansen cointegration test technique was violated and Pesaran ARDL bound test was used to test for the presence of cointegration among the variables as it suit this study and the result showed an evidence of long run relationship among the variables.

The Bound test explores that there is long-run relationship among the variables, that is, the variables co-move on the long run. The ARDL result indicates that gross domestic product has positive and significant effect on exchange rate in Nigeria. The study connotes the findings of Razi et al. (2012) and Saeed et al. (2012) who revealed that among other thing that GDP is one major factors influencing exchange rate instability. Interest rate and inflation rate have positive with an insignificant effect on exchange rate. The

result is in consonance with Nwude (2012) who found an insignificant relationship between interest rate, inflation rate and exchange rate. Conversely, degree of openness has negative and significant effect on exchange rate. The result disagrees with Asiama and Kumah (2010) which opined that trade openness influences exchange rate. Based on the aforementioned, the study outlined that variables as gross domestic product, interest rate and inflation rate are the major determinants of exchange rate in Nigeria.

Also, there was evidence that disequilibrium in exchange rate is restored back to equilibrium within a year if there is any short run fluctuation in the explanatory variables because the coefficient of the ECM was significant with the correctness of its sign and with a large magnitude. Diagnostic tests revealed that the model used in this study passed the test of autocorrelation, heteroscedasticity, instability and normality. This signifies that the result from the findings can be used by the researcher and the policy makers for recommendation and forecasting. The study is in consistence with the study of Izilein, Chukwuma and Odjegba (2013) who found that inflation rate, interest rate and gross domestic product play vital role in determining exchange rate variations in Nigeria.

## 5.0 Conclusion and Recommendations

The exchange rate is a measure of the competitiveness of an economy to international trade, and when an exchange rate is overvalued, it increases the price of domestic goods abroad leading to lower demands for exports of such country. Since the adoption of the Structural Adjustment Programme (SAP) in 1986, Nigeria has experienced various types of regimes of exchange rate system. One major gain from this adoption was the liberalization of the foreign exchange market, in which the determination of the exchange rate has been largely dictated by the market forces of demand and supply. This has helped to enhance efficiency in the allocation and utilization of foreign exchange resources. However, in the early 1990's, the real effective exchange rate of Nigeria did not follow the trend of the nominal exchange rate and maintaining a realistic exchange rate for the Naira is very crucial given the structure of the Nigerian economy. This therefore, forms the basis of the investigation of the determinants of exchange rate in Nigeria using data covering 1986 to 2016. The variables tested in the study include the exchange rate (EXR) as the dependent variable and Gross Domestic Product (GDP), Degree of openness (DOP), Interest rate (INTR) and Inflation rate (INFR) as independent variables using the Auto-Regressive Distributed Lag (ARDL) bounds testing approach to co-integration in determining the relationship between the variables.

The longrun regression techniques of analysis revealed that inflation rate, interest rate and gross domestic product play vital roles in determining exchange rate variations in Nigeria and hence, affect economic growth. However, for the domestic economy to create wealth and generate employment for its citizens, it has to produce more, import less, export more and buy more locally made goods in the home country. All these and in particular, the exchange rate determinants cited in this study if properly harnessed, will bring about the right exchange rate which will in turn, facilitate the optimal performance of the Nigerian economy as part of the new integrated global village. The strive by central monetary authority to ensure a stable exchange rate regime and policy will continue to exist as there continue to be openness of Nigerian economy to foreign trade especially as an import dependent economy.

It is recommended that Government should restructuring the economy to ensure diversification of the production base in order to increase output productivity thereby, lowering inflation. The government should ensure fiscal balances and effective monetary policy, this is usually done by contractionary fiscal and monetary policies to guarantee exchange rate stability. There is the need to guide trade liberalization policy. Here, the government must pursue a realistic and pragmatic exchange rate policy in the less free trade areas that would stem capital flight and ensure more investment in the Nigerian economy. This is necessary so as to prevent the fluctuations in the exchange rate. More so, the government should stabilizing the earnings from crude oil upon which the economy depends heavily, through the stabilization of the crude oil earnings, over-dependence on importation would be reduced, thereby, strengthening the export base to include the non-oil export earnings. Lastly, there is need for reducing the excess demand for foreign exchange, this will result to the overvaluation of the local currency especially under the fixed exchange rate.

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