DETERMINANT OF EXCHANGE RATE VOLATILITY IN NIGERIAN ECONOMY (1980 – 2017)

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ABSTRACT

The aim of the study is to identify the factors which determine the level and variations in the exchange rate of the Nigerian currency. The study employed secondary data collected mainly from the Central Bank of Nigeria Statistical Bulletin and the World Bank's World Development Indicator (WDI). The Engle-Granger Error Correction Model (ECM) which contains domestic money supply growth rate, inflation, interest rate, openness to trade, international oil price and manufacturing sector performance as the independent variables and exchange rate of naira to the U.S. Dollar as the dependent variable was used as the empirical model. The unit root test result of the variables show that all the variables were 1(1) series and the co-integration results also proved that the variables have a common trend. Estimates from the ECM revealed domestic money supply growth, interest rate level, inflation rate, openness to trade, international oil price and manufacturing sector output are the significant determinants of exchange rate variations in Nigeria economy. It was therefore recommended that the Nigerian government should put in place sound macro-economic policies to improve the performance of these variables in order to reduce volatility in the external value of the domestic currency.

Keywords: Exchange rate, Interest Rate Parity, Purchasing Power Parity, Volatility.

1. INTRODUCTION

The role of exchange rate for international trade and international competiveness is very important. The level of a country's currency relative to the currencies of her trading partners determines how much she earns, buys and sells in the internal market. Over the years, international trade has become a major source of concern to economists. The importance of international trade and trade competiveness stems from the strategic role of trade to economic growth and overall national development. However, before flow of goods and services across

geographical boundaries is the issue of international liquidity or convertibility of the domestic currency. The case with which the local currency is exchanged for another currency, and the level at which the local currency is exchanging for any foreign currency is important for free flow of international trade, overall external and internal macro-economic stability. Therefore, the exchange rate and the concern about its fluctuations are not misplaced. International trade and finance economists have tried to identify the fundamentals which shape and underscore the level and fluctuations in the exchange rate. Many theories have been put forward to explain the factors which determine the level of exchange rate and the influence of the fluctuations in the exchange rate. But none of these theories has been consistent in explaining the swings in exchange rates in all economies and at all times. There are divergent empirical evidence for both the monetary and the purchasing power parity (PPP) models.

Despite the plethora of models and theories, there is no meaningful results or solutions to the incidence of scarcity and volatility of exchange rate in the Nigerian economy or curb the problem of exchange rate. Empirical studies conducted around these models of exchange rate determination yield conflicting results. It is clear that these models and the theories emanating from them cannot explain the dynamics of exchange rate in the Nigerian economy. This situation is dangerous and if unattended to, may plunge the economy into macroeconomic doldrums. Averting this danger requires putting in place effective exchange rate management policies. Exchange rate policy can be effective if it is based on sound assumptions and the first critical step is identifying the factors which influence movement in the exchange rate and therefore, reconstruct the model which explains exchange rate in the Nigerian economy. The problem of this study, therefore, is to empirically identify the macroeconomic variables which determine the exchange rate of the Nigerian Naira in the foreign exchange market.

A study of this nature is significant in Nigerian economy. Specifically the findings will reveal important factors responsible for fluctuation in the exchange rate and policy makers will be well informed in formulating exchange rate policies to mitigate the volatility in the exchange rate. The rest of the paper is organized as follows

Section 2 presented the literature review. Section 3 would explain the method employed in the collection and analysis of the study data. Section 4 presented data available, the empirical results, and discussion of the results. Section 5 was devoted to summary and conclusions of the study.

2. LITERATURE REVIEW

This section presents the theoretical and empirical literature on exchange rate. There are many theories of exchange rate determination. However, the theories can be weaved into two distinctive strands: namely, asset approach, monetary approach, portfolio approach and

purchasing power parity approach. We present a brief review of these theories, and the empirical literature.

2.1 Theoretical Literature

The monetarist approach to exchange rate determination emerged in the 1950s, first as a theory of balance of payment, and later as a Theory of Exchange Rate Determination. The monetarist view of exchange rate determination was popularized by R.A Mundell and H.G. Johnson in the 1970s.

The basic proposition of the monetary theory of exchange rate determination is that exchange rate is a monetary phenomenon and since the exchange rate is the relative price of one currency in terms of another currency, the exchange rate should be expressed from the point of view of the demand and supply of money. As their proponents put it, exchange rate should be determined by the relative supply and demand of money (Frankel and Rose, 1994). Simply put, the more money a country supplies relative to her trading partners, the more her currency depreciates. Thus, the monetary approach to exchange rate determination emphasizes the role of monetary variables in exchange rate determination. Hence, the exchange, as any other price, is subject to the law of demand and supply. The basic assumptions of the monetary approach are:

1. There is perfect capital mobility,
2. Purchasing power parity holds,
3. Uncovered interest rate parity also holds.

Based on these assumptions the Monetary Approach (MA) theorist specified the demand for money in the two countries as

$$M_1 = P_1 + \delta_1 Y_1 - \delta_2 r_1 \quad \text{...} \quad (1)$$
$$M_2 = P_2 + \delta_1 Y_2 - \delta_2 r_2 \quad \text{...} \quad (2)$$

Subtracting equation 2 from equation 1, we have

$$M_1 - M_2 = P_1 - P_2 + \delta(Y_1 - Y_2) - \beta_1 (r_1 + r_2) \quad \text{...} (3)$$

Nominal interest rate r is $r_1 + \pi_1^{-e}$ and also $r_2 + \pi_2^{-e}$ ……………………… (4)

r_1 is real interest rate and π^{-e} is expected inflation for country C_1. Hence

$$r_1 - r_2 = \pi_1^e - \pi_2^e \quad \text{..} \quad (5)$$

Also, from the law of purchasing power parity

$P_1 - P_2 = EXR_{12}$ where EXR is the exchange rate of country 1 to country 2.

Equation 3 becomes

$$M_1 - M_2 = EXR_{12} + \delta\,(Y_1 - Y_2) + \delta_2(\pi_1^e - \pi_2^e\,)\dots\dots\dots\dots\dots\dots\dots\dots (7)$$
$$EXR_{12} = (M_1 - M_2) - \delta\,(Y_1 - Y_2) + \delta_2\,(\pi_1^e - \pi_2^e\,)\dots\dots\dots\dots\dots\dots\dots (8).$$

This is the general expression of the monetarist approach to exchange rate determination. The equation expresses the exchange rate between two currencies as a function of relative money supply, income and expected inflation rate.

The short run dynamics of the monetary approach was developed by Frankel (1979). This model incorporates the short run interest rate into the model to capture the influence of short terms interest deferential on exchange rate movement. Frankel opined that the rate of depreciation of the local currency is a positive function of the difference between the current value of the exchange rate and the long run value plus the difference of inflation between the two countries. He showed that the rate of depreciation of the domestic currency is a function of the differences in real interest rate between the two countries. Hence,

$$EXR_1 - EXR_1 = (r_1 - \pi_1) - (r_2 - \pi_2)\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (9)$$

If the foreign real interest rate is higher than the domestic interest, the domestic currency will depreciate. Rearranging equation 9 and substituting into equation 8 we have

$$EXR_1 = \delta_1\,(M_1 - M_2) - \delta_2\,(Y_1 - Y_2) + \delta_3\,(\pi_1 - \pi_2) - \delta_4(r_2 - r_2)\dots\dots\dots\dots\dots (10)$$

Thus, interest rate has been formally added to the exchange rate determination equation. In this short run version of the monetary approach as developed by Frankel, the spot exchange rate is a function of the money supply, income, inflation rate, and interest rate values differential between the two countries.

The purchasing power parity is a theory of exchange rate determination. The main assertion of this theory is that the exchange rate between two countries' currencies at any point in time is determined by price level. This theory places emphasis on changes in price level as the main determinants of exchange rate value. The Sweden economist who popularized the purchasing power parity theory of exchange rate determination observed that the deviation of the exchange rate from its value as determined by the PPP is a consequence of the deviation between actual and expected inflation, barriers to international trade and international capital flows.

There are basically two versions of purchasing power parity theory. They are the absolute and relative purchasing power parity theories. The absolute purchasing power parity holds that the nominal exchange rate between two countries' currencies is a function of the ratio of the domestic price level to the foreign price. Hence,

$$EXR_{12} = \frac{P_1}{P_2} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \ (11)$$

Where EXR_{12} is the exchange rate between the two countries' currencies, P_1 is the domestic price level and P_2 is the foreign price level. If price level increases in the domestic economy faster than in the foreign country then the exchange rate of the domestic currency to the foreign currency will depreciate.

The relative purchasing power parity version asserts that the percentage change in the exchange rate between two countries' currencies is equal to the difference in the rate of inflation between the two countries. Hence,

$$\%\Delta EXR_{12} = \%\Delta P_1 - \%\Delta P_2 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \ (12)$$

The difference between the absolute and relative purchasing power parity is that while the absolute version sees the movement in exchange rate as a function of the absolute inflation level, the relative version sees it as a function of the difference in inflation rate.

In all, the purchasing power parity takes price movement as the main determinant of exchange rate. That is, exchange rate between two countries' currency adjusts to equilibrate purchasing power.

2.2 Empirical Literature

There is large body of empirical literature on the determinants of foreign exchange.

Imed Divine and Christophe Rauld (2003) investigated the major determinant of real exchange rate in the Middle East and North-African countries. The result of their findings indicated that output per capital, government consumption, real interest rate differential and openness to trade affect the real exchange rate.

Ensique, G. and J. Nagayasu (2008) investigated the determinants of parallel exchange rate in Angola. He observed that the major determinants of real exchange rate are the international oil price and interest rate differential. However, the result did not support that monetary growth rate have influence on the real exchange rate. He therefore, recommended the use of flexible exchange rate in Angola. Peterson (2005) examined the factors that affect exchange rate

movement in Sweden, United \kingdom, and Japan from 1995 to 2004. His result indicated that interest rate differential was significant. The influence of money supply, industrial production, and inflation varies between countries.

Takamdesa (2006) examined the determinants of real exchange rate in the short and long run in Angola. His result revealed that terms of trade, real interest rate differential, domestic credit expansion, openness to trade and technological progress have long run impact on real exchange rate, while terms of trade, domestic credit expansion, and openness to trade have influence in the short run. Yu Hsing (2006) investigated the determinants of short term real exchange rates in Venezuela. He used secondary data and co-integration method. The result revealed that government deficit contributes to appreciation of exchange rate while increase money supply, interest rate, country risk and expected inflation contribute to exchange rate depreciation. He therefore recommended that the fiscal authority should reduce deficit in order to prevent the appreciation of exchange rate and choke the country's export.

Obi and Gobna (2010) investigated the determinants of exchange rate in Nigeria from 1970 to 2007. They employed cointegration and error correction method using secondary data. Their results indicated that improvement in industrial productivity, investment-GDP ratio, and inflation lead to domestic currency appreciation, while openness to trade, increase in foreign exchange resource, and interest rate differential results in depreciation of the exchange rate. They therefore recommended that policies that encourage productivity growth in the real sector, low inflation rate and interest rate liberalization should be pursued.

Suthar, (2014) examined the determinants of exchange rate in India. He used monthly data from 1996 to 2007, and Ordinary Least Square Regression Method. He observed that monetary policy, interest rate, rate of foreign exchange reserve, and interest rate differential have significant impact on exchange rate. Twarowska, and Kakol (2014) examined the determinants of exchange rate in Poland from 2000 to 2013. They used ordinary least square regression techniques. Their study revealed that inflation rate, market interest rate, and government spending have significant impact, while economic growth was not significant. Khan.and Abbas (2015) investigated the performance of the portfolio balance model in Pakistan from 2001 to 2010. They used autoregressive distributed lag model and bound testing approach to cointegration. Their result revealed that money supply and interest rate differential have significant impact on exchange rate value.

Eric, Mbabasi and Ruhara (2016) investigated the determinants of exchange rate in Rwanda from 2001 to 2015. They used quarterly data, and employed the cointegration and error correction model techniques. Their result supports the long run relationship between money supply,

government external debt, and trade balance. They therefore recommended that monetary authority should regulate the supply of money in order to ensure exchange rate stability.

Hassan, Mikailu and Dantama (2017) examined the determinants of exchange rate volatility in Nigeria. They used quarterly data from 1989 to 2015 and Autoregressive Distributed Log (ARDL) model and Granger causality test to estimate the exchange rate volatility and its determinants. Their result revealed that net foreign asset and interest rate have negative and significant impact on exchange rate volatility, while trade openness and oil price have positive impact on exchange rate volatility. They recommended that government should increase net foreign asset holding and stabilize the interest rate.

Raza and Afsham (2017) examined the determinants of exchange rate in Pakistan by using annual time series data from 1972 to 2013 and autoregressive distributed lag bound testing approach. The result indicated a negative association between terms of trade, trade openness, and economic growth. However, money supply and inflation have positive effect on exchange rate. They recommended the use of both monetary and fiscal policy to reduce volatility in exchange rate.

The empirical literature reviewed above shows that there is no uniformity of the performance of the various exchange rate determination models. Both the monetary and the purchasing power parity models failed to predict the value of the exchange rate and helped in reducing the volatility in the exchange rate value.

Most of the empirical model used in Nigerian economy did not include the influence of oil price on the exchange rate value. Nigeria is an oil exporting country and thus oil is a major source of foreign exchange supply to the foreign exchange market. A model which intends to examine exchange rate value in Nigeria must include the influence of oil income.

The importance of the manufacturing sector output on exchange rate value was equally not considered in the exchange rate determination model of most studies. Empirical studies have shown that manufacturing sector productivity has significant impact on exchange rate value. Thus, excluding it will make the model redundant. The present study will remedy these anomalies by expanding the monetary approach model of exchange rate determination to include the influence of the manufacturing sector productivity, oil revenue and trade openness. Thus, the analytical framework of this study is the Modified Monetary Approach to Exchange Rate Determination (MMAPED).

3.0 METHOD OF THE STUDY

The purpose of this section is to explain the method employed for the collection and analysis of the study data.

3.1 Data Required and Sources

The data required for this study are secondary in nature and consist of annual time series data of the following variables:

i. National Income
ii. Broad Money Supply
iii. Average Annual Interest Rate on 30 day Treasury Bill
iv. Openness to Trade
v. Average Annual Price of Crude Oil per barrel
vi. Manufacturing Sector Output as percentage of the GDP.

All data were collected from 1980 to 2016.

Variables	Sources
National Income	Central Bank of Nigeria Statistical Bulletin (CBN)
Broad Money Supply	Central Bank of Nigeria Statistical Bulletin (CBN)
	World Banks World Development Indicator (WDI)
Inflation Rate	National Bureau of Statistics (NBS), and International Monetary Fund county specific financial statistics
Average return on 360 day Treasury	Central Bank of Nigeria Statistical Bulletin.
Manufacturing Section Output	National Bureau of Statistics (NBS)
	Central Bank of Nigeria Statistical Bulletin (CBN)
Openness to Trade	World Banks World Development Indicator
	United Nation' Conference on Trade and Development UNTAD on the internet
Oil Price	International Energy Agency
	Central Bank of Nigeria Statistical Bulletin (CBN)
	World Banks Word Economics Development (WDI)

Supplementary materials were also collected from text books, research journals, thesis and dissertation of other researchers.

3.2 Model Specification

The purpose of this section is to specify a model of exchange rate and its determinants in Nigerian economy. Following the theoretical and empirical literature reviewed above, we employed a modified multiple-regression model of the monetary theory of exchange rate to express the relationship between exchange rate and some macroeconomic variables as :

EXR = f($Y_1 M_2$, π_1, R_1Mno, OPN, OILP)

The implicit function above is transformed into explicit econometrics model as follows:

$EXR_c = \beta_0 Y^{\beta 1} \beta_0 M^{\beta 2} \beta_0 \pi^{\beta 3} \beta_0 R^{\beta 4} \beta_0 Mno^{\beta 5} \beta_0 OPN^{\beta 6} \beta_0 OILP^{\beta 7} e \dots$ *(13)*

The non linear econometrics model is linearized by converting it into a double log linear model as

$\log EXR_i = \log \beta_0 + \beta_1 \log Y_1 + \beta_2 \log M_2 + \beta_3 \log \pi + \beta_4 \log R + \beta_5 \log Mno + \beta_6 \log OPN + \beta_7 \log OILP + e \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots$ (3.3)

Where:

Y is income level
M is broad money supply
Π is inflation rate
R is Interest rate
Mno is manufacturing sector and as percentage of GDP
OPN is Openness to trade
OILP is the annual average oil price.
B_0 is the model intercepts term
$\beta_1 \dots \beta_7$ are the model parameter estimates, and
e is the error term.

3.3 Choice of Variables

Our choice of variables for the model is influenced by the Frankel Model. Which was modified to accommodate international\oil price and manufacturing sector output. There are two types of variables in the model. They are the independent and the dependent variables.

A. **Dependent Variable**

Exchange Rate: The dependent variable in the model is the exchange rate. The exchange rate is the price of domestic currency in terms of foreign currency or what is called direct quotation, the price of the foreign currency in terms of the domestic currency. Here we used the indirect quotation. The exchange rate here is that of naira to a dollar. The model specifies that the exchange rate of naira to the dollar depends on the independent variables.

B. **Independent Variables**

Income: This is the monetary value of the final output of goods and services produced in a country during a specific period of time, usually one year (Gbosi, 2014). Increase in the national income will lead to appreciation of the many. Therefore, the *apriori* expectation is $B_1 < 0$

Broad Money Supply (M₂): Broad money supply is the sum of currency in circle two plans demand deposit plus smaller value dollar certificate of deposit. (Ezerim, 2004) increase in broad money will lead to higher demand for foreign energydue to high expected depreciation of the domestic energy. Hence, the *apriori* expectation is $\beta_3 > 0$.

Inflation Rate: Inflation is a situation of general and persistent increase in price level. It is measured as annual percentage change in consumer price index. It is hypothesized that high domestic prices will instigate expenditure switching, and therefore the *apriori* for this variable is $\beta_3 > 0$.

Interest Rate: Interest rate is the cost of borrowing capital. It is equally the return on investment. The study used the annual average return on 90 days Treasury bill of the federal government of Nigeria. The higher the return, relative to the US interest rate, the more the naira appreciate due to inflow of short term investment. Hence, $\beta_4 < 0$.

Oil Price: This is the price of crude oil in the international oil market. The higher the oil price, the more the inflow of dollars into Nigerian economy. Thus, the *apriori* expectation is $\beta_5 < 0$.

Openness to Trade: Degree of free flow of goods and services in and out of the economy. It is measured as the sum of export and import divided by the level of GDP. Openness of trade has effect on the exchange rate. Our *apriori* here is $\beta_6 > 0$.

Manufacturing Sector Output: The manufacturing sector out measures the output of the manufacturing sector. It specifically measures the contribution of the manufacturing share of the manufacturing sector. The GDP is taken as a measure of industrialization. The higher the share of manufacturing, more stable the exchange rate. Hence $\beta_7 < 0$.

3.4 Techniques of Data Analysis

The data analysis techniques employed was the Classical Linear Regression Model using the Ordinary Least Square (OLS) approach. The ordinary least square method was adopted because of the statistical properties of its estimates. It has been observed that time series data always have the property of non stationary (Maddala, 2007). Running regression on non-stationary data would lead to spurious regression (Granger & Newbold, 1979) therefore; it is always advised to first; examine the unit root property of the variable data before running regression on them. Hence, we began the analysis of our research data with unit root test.

Unit Root Test

There are many different types of unit root test in the literature. In this study, the Augmented-Dickey-Fuller (ADF) method was employed (Dickey and Fuller, 1979). There are three main forms of the ADF model. This study adopted the ADF model with constant and deterministic trend. Hence, the model for test was specified as thus;

$$\Delta Y_t = \beta_4 + \beta_1 t_1 + \beta_2 Y_{t-1} + \beta_3 \Delta Y_{e-1} + e_1 \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots \text{(3.4)}$$

The null hypothesis for test is $H_0: \beta_2 = 0$ as against the alternative $H_1: \beta_1 < 0$.

As some authors have observed, it is wrong to proceed to running regression on differenced variables without examining whether a long run relationship exists among on-stationary variables. Long run relationship is not captured by regression on differenced variables. It is only if there is no long run relationship among the variables we should proceed to running regression on difference variables. Hence, it is necessary to examine the variables for co-integration.

Co-integration Test

Co-integration test was conducted to examine the equilibrium relationship among the model variables. The Johansen (1988) Co-integration Approach was employed using both Trace and Maximum Eigen value statistics

Error Correction Model

According to the Engle- Granger Representation Theories, if two or more integrated variables are co-integrated, then they have a valid error correction representation, and their relationship can be expressed as error correction model (ECM).

Therefore, the Error Correction Model of the exchange rate determinants was expressed as:

$$\Delta EXR_6 = \sum_{t=1}^{n} \delta_1 \Delta Y_{e-1} + \sum_{t=1}^{n} \delta_2 \Delta EXR_{t-1} + \sum_{t=1}^{n} \delta_3 \Delta TC_{t-1} + \sum_{t=1}^{n} \delta_4 \Delta R_{t-1} + \sum_{t=1}^{n} \delta_5 \Delta OPN$$
$$+ \sum_{t=1}^{n} \delta_6 \Delta OLP + \sum_{t=1}^{n} \delta_7 \Delta MNO + \Delta ECM_{t-1} + V_1 \ldots \ldots (14)$$

The ECM model was estimated using the One Step Engle-Granger method.

Model Stability Test

The stability of the exchange rate determination function is very important for effective exchange rate policy. The stability of the exchange rate determination function was evaluated using the CUSUM and CUSUMSQ plot test developed by Brown et al. (1975).

Model Diagnostic Test

It is very important in every empirical study to evaluate the model and the parameter estimates for robustness. In order to justify the empirical method and build confidence in the parameter estimates, the following diagnostic tests were carried out on the model and the parameters estimates:

Model Specification Test: The Ramsey RESET statistic was employed for examining the model for specification bias.

Normality Assumption: For normality assumption, the Jacque-Bera (JB) Test was used.

Serial Correlation: To examine serial correlation in the model, the Breusch Godfrey (BG) test was employed

Homoscedasticity: The assumption of Homoscedasticity was tested using ARCH-test statistic

4.2 Co-integration Test Result

TABLE 4.2: Unrestricted Co-integration Rank Test (Trace and Maximum Eigen value)

Hypothesized		Trace			Maximum Eigen Value		
No. of CE(s)	Eigen value	Statistic	5% Critical Value	Prob.**	Statistics	5% critical value	Prob. **
None *	0.938585	366.2640	228.2979	0.0001	94.86352	62.75215	0.0000
At most 1 *	0.858268	271.4004	187.4701	0.0000	66.42969	56.70519	0.0041
At most 2 *	0.818145	204.9708	150.5585	0.0000	57.95450	50.59985	0.0074
At most 3 *	0.729651	147.0163	117.7082	0.0002	44.47342	44.49720	0.0503
At most 4 *	0.623916	102.5428	88.80380	0.0036	33.25001	38.33101	0.1710
At most 5 *	0.569978	69.29283	63.87610	0.0163	28.69326	32.11832	0.1239
At most 6	0.457022	40.59957	42.91525	0.0837	20.76331	25.82321	0.2023
At most 7	0.269109	19.83626	25.87211	0.2343	10.65871	19.38704	0.5488
At most 8	0.236565	9.177543	12.51798	0.1697	9.177543	12.51798	0.1697

Source: E-view computer output: June, 2017.

Max-Eigen value test indicates 3 cointegrating eqn(s) at the 0.05 level

Trace test indicates 6 cointegrating eqn(s) at the 0.05 level and

* denotes rejection of the hypothesis at the 0.05 level

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

EMPIRICAL RESULTS AND DISCUSSION

4.1 Unit Root Test

TABLE 4.1: RESULT OF UNIT ROOT TEST

	ADF			PP		
Variables	Level	1st difference	Order of Integration	Levels	1st difference	Order of Integration
EXR	-1.4865	-3.9627*	1(1)	0.82414	-3.9241*	1(1)
GDP	-2.4086	-3.6080*	1(1)	-1.9271	-8.4123*	1(1)
INF	-3.3843	-5.6559*	1(1)	-2.1126	-12.9281*	1(1)
INR	-3.0892	-6.0960*	1(1)	-1.9273	-9.7251*	1(1)
M_2	-1.9534	-1.7650*	1(1)	-0.1985	-6.3184*	1(1)
OPN	-13.7974	-5.1670*	1(!)	-0.3927	-5.4618*	1(1)
IMP	-1.8218	-4.2113*	1(1)	-0.8461	-3.9729*	1(1)
OIL	-2.1686	-5.5209*	1(1)	-1.6214	-4.2510*	1(1)
MOTP	-1.0165	-5.8998*	!(1)	-0.2174	-3.5924*	1(1)
	1% 4.2528		5% 3.5484		10% 3.2152	

*Both test examined the null hypothesis of unit root the test are the Augumented Dickey-Fuller, 1979 (ADF) and the Philiips-Peron 1999 (PP). *Indicates Statistical, significance at 5% levels.*

The result presented above in Table 4.1 shows that all the variables were not stationary at level. However, they all became stationary after 1st differencing. Thus, the variables are integrated of order one or 1(1) as indicated above in the last column. Hence, we examined the integrated variables for co-integration to see whether long run equilibrium relationship exist among the variables. Johansen (1988) technique was employed for the co-integration analysis. The results are summarized in Table 4.2.

4.2 Co-integration Test Result

TABLE 4.2: Unrestricted Co-integration Rank Test (Trace and Maximum Eigen value)

Hypothesized		Trace			Maximum Eigen Value		
No. of CE(s)	Eigen value	Statistic	5% Critical Value	Prob.**	Statistics	5% critical value	Prob. **
None *	0.938585	366.2640	228.2979	0.0001	94.86352	62.75215	0.0000
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At most 8	0.236565	9.177543	12.51798	0.1697	9.177543	12.51798	0.1697

Source: E-view computer output: Max-Eigen value test indicates 3 cointegrating eqn(s) at the 0.05 level
*Trace test indicates 6 cointegrating eqn(s) at the 0.05 level and * denotes rejection of the hypothesis at the 0.05 level*
**MacKinnon-Haug-Michelis (1999) p-values

The co-integration results presented above shows that the variables are co-integrated. But Trace and the Maximum Eigen value indicated the existence of co-integrating equations among variables. The Trace statistic indicated 6co-integration, while the maximum Eigen value statistics indicated at most 3 co-integration equations at 5% level of significance. Thus, we conclude that there is a long run equilibrium relationship between the variables

Error Correction Model Results

The results of the ECM model are presented in Table 4.3 below.

4.3 Parsimonious ECM

Table 4.3: Result of Parsimonious Error Correction Model
Dependent Variable: DLOG (EXR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(EXR(-1))	0.854375	0.164498	5.193842	0.0003
DLOG(GDP(-1))	10.33507	2.030327	5.090347	0.0003
DLOG(GDP(-2))	-3.965475	1.479531	-2.680224	0.0214
D(INF)	0.006121	0.002936	2.084868	0.0612
D(INF(-2))	0.017668	0.004413	4.003322	0.0021
D(INR)	0.050043	0.012429	4.026429	0.0020
D(INR(-1))	-0.078492	0.018465	-4.250789	0.0014
D(INR(-2))	-0.066732	0.015528	-4.297573	0.0013
DLOG(M2)	1.889650	0.418728	4.512830	0.0009
DLOG(M2(-1))	0.655501	0.401214	1.633793	0.1306
DLOG(M2(-2))	-3.020208	0.526883	-5.732218	0.0001
DLOG(OILP)	0.253589	0.159654	1.588364	0.1405
DLOG(OILP(-1))	-0.568655	0.203375	-2.796086	0.0174
DLOG(MOTP)	-0.352079	0.287090	-1.226375	0.2457
DLOG(MOTP(-1))	-1.297638	0.469466	-2.764071	0.0184
DLOG(MOTP(-2))	0.800825	0.433098	1.849063	0.0915
D(OPN)	1.838098	0.458090	4.012524	0.0020
D(OPN(-1))	0.385376	0.442111	0.871674	0.4020
ECM(-1)	-0.94899	0.222998	-5.358342	0.0002
C	-0.060947	0.093382	-0.652666	0.5274

R-squared	0.923126
Adjusted R-squared	0.776366
F-statistic	6.290046
Prob(F-statistic)	0.001583

Source: E-view computer output..

The parsimonious error correction result presented above shows the relationship between exchange rate and its determinants in the short run.

The relationship between income growth rate and exchange rate is negative. This is in conformity with the monetary approach to exchange rate determination, and also with the Frankel Model. Specifically, increase in economic growth of the domestic economy relative to the foreign economy will lead to appreciation of the domestic currency

The influence of domestic inflation rate on exchange is positive and statistically significant. This means that increase in domestic price level will lead to depreciation of the domestic currency. The real interest rate coefficient is negative and statistically significant. This implies that

increase in domestic real interest rate will lead to appreciation of the domestic currency. It is in line with the finding of Obi and Gobna (2010) who found negative relationship between interest rate and exchange rate in Nigeria. The effect of money supply growth rate on exchange is positive as expected and statistically significant. Thus, increase in domestic money supply growth rate faster than her trading partners will lead to depreciation of the domestic currency against her trading partners' currency.

Another important determinant of exchange rate value in the model is crude oil price in the international market, the coefficient of this variable is negative and significant. The sign of this coefficient is in agreement with the *apriori* expectation and the findings of Jun Nagayasu (2004) who observed that oil price has negative impact on exchange rate in Angola. The influence of manufacturing sector output on exchange rate is significant. The manufacturing sector output variable has a negative coefficient as expected. The sign of the coefficient of the manufacturing sector output is in line with the findings of Obi and Gobna (2004), and Takaondesa (2006) in Nigeria and Angola respectively. Trade Openness has positive and significant effect on exchange rate value. The positive influence of trade openness indicates that trade openness has depreciating effect on the domestic currency. The result comforms with the findings of Hassan, et al (2017), Imed Divine and Christope Rauff (2003), Yu Hsing (2006).

The model R^2 value of 0.9231 means that independent variables accounted for about 92% variation in the exchange rate level during the period under review. The empirical f-statistic value of 6.2900 with probability value of 0.00158 indicates that the model is statistically significant at 0.05 level. This means that the model employed for the analysis was` significant .The ECM-I coefficient is negative and significant at 0.05 level. The ECM-I coefficient of 0-9448 means that the speed of adjustment to disequilibrium is about 95%.

4.4 Stability Test

The stability of the relationship between exchange rate and its determinants was examined by plotting of the residual eliminative Dum (decision) and the emulative sum of square (CUSUMSQ). If the plot remains with the 5% critical line through the period of the study, then the model is stable otherwise, the model is unstable. The CUSUM and CUSUMSQ plots are presented as figure 4.1 a and b. The residual CUSUM and the CUSUMSQ plot remained within the 5% critical lines. Hence, the model was statistically stable throughout the period of the study

STABILITY TEST PLOT
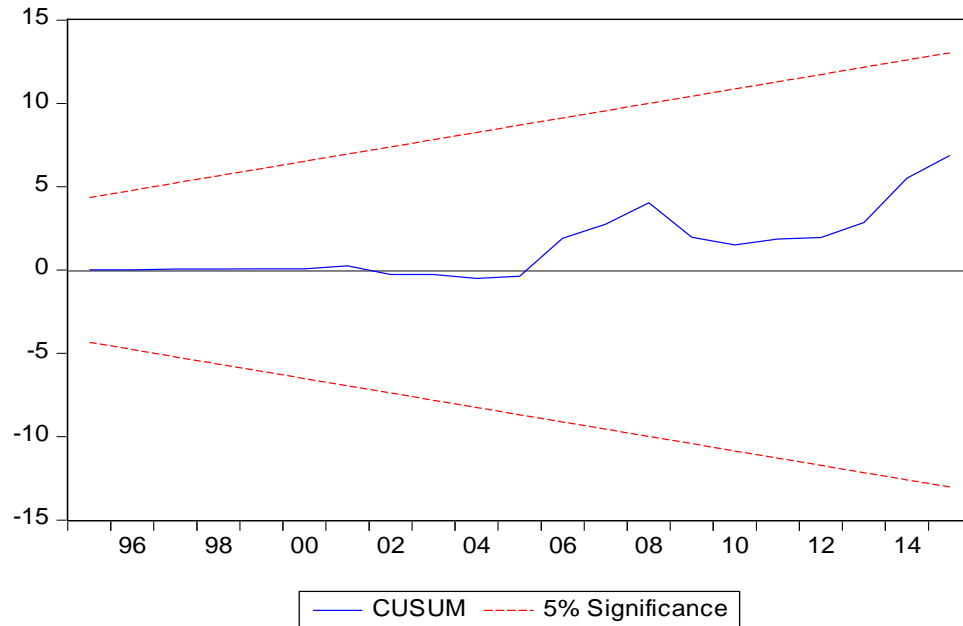
Figure 4.1a
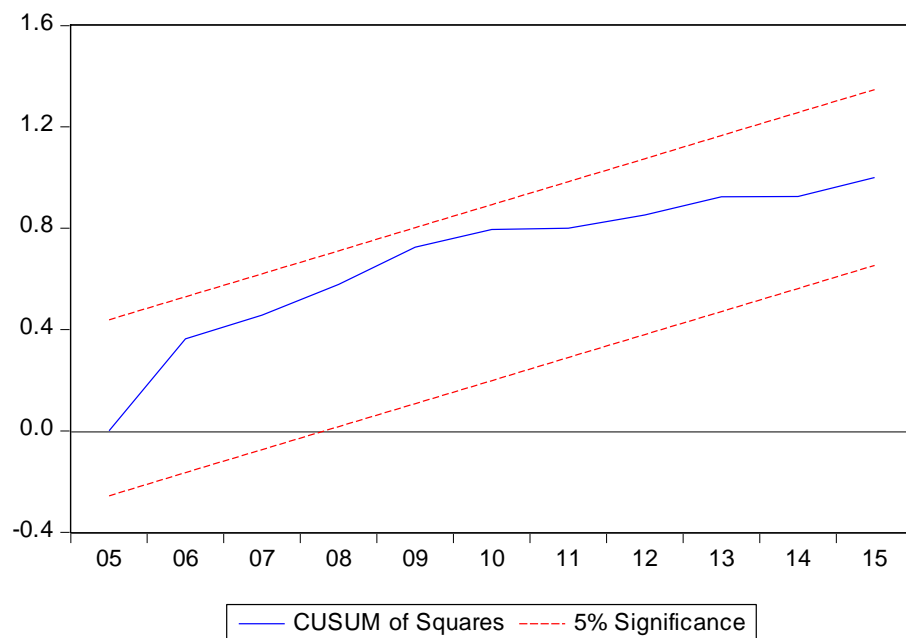
Figure 4.1b

4.5 Diagnostic Test Result

As pointed out in section 3.4 above, it is always important in empirical study to evaluate the empirical estimates to ensure that they have desirable statistical properties. Hence, we present the result of the diagnostic test of the empirical estimate as follows:

Table 4.5: Results of Model diagnostic Test

Hypothesis	Test statistics	Empirical Value	Remarks
Residual normality	Jacque-Bera (JB)	0.9400 (0.6500)	Accepted
No serial correlation	Breush-Godfrey (BJ)	2.4632 (0.2918)	Accepted
Homoskedasticity	(ARCH)	0.1017	Accepted

Source: E-view computer output; June 2017.

In parenthesis are the empirical probability values

The model diagnostic tests results revealed that there is no evidence of the incidence of serial correlation or heteroskedasticity and the residuals are normality distributed. Involving the Guas-monkeys theories, conclude that the estimates hence the property of the Best Linear Unbiased and efficient estimates (BLUE) and therefore are reliable.

In summary, the major determinants of exchange rate level of the Nigerian naira are the level of the national income growth rate, the supply of money in the economy, the domestic inflation rate reactive to the world inflation the domestic real interest rate level, the price of crude oil, (supply of dollar), the manufacturing sector output, and openness to trade. These are the variables responsible for the variation in the external value of the Nigerian naira.

5. SUMMARY AND CONCLUSION

The study was concerned with identifying the factors which determine the external value of the Nigerian naira from 1980 to 2016. The empirical analysis aimed at determining the nature of the functional relationship between the exchange rate of the Nigerian naira to the United States' dollars and national income, money supply, inflation, real interest rate, price of oil, openness to trade , and manufacturing sector output . the study used Secondary data collected from the World Bank's World Economic Development Indicators (WDI) on the internet, International Monetary Fund's Country Specific Financial Statistics, National Bureau of Statistics and the Central Bank of Nigeria Statistical Bulletin The Johansen co-integration approach was used to examine the long run relationship while the short run adjustment dynamics was specified and estimated using the Engle-Granger Error Correction Model. From the empirical results, the findings could be summarized as follows:

i.   There was a significant relation between income growth rate and exchange rate level in Nigeria during the period under review.

ii.   There was significant relationship between money supply and exchange rate in Nigeria during the year under study.

iii.   There was a direct and significant relationship between domestic inflation rate and exchange rate in Nigeria during the period of the study.

iv.   There existed direct and significant relationship between real interest rate and exchange rate in Nigeria.

v.   There was a direct and significant relationship between international oil price and the exchange rate level in Nigeria during the period under review.

vi.   There was a significant relationship between manufacturing sector output and exchange rate in Nigeria during the years of the study.

vii.   There was a significant relationship between trade openness and exchange rate value in Nigeria during the period of the study.

viii. It was observed that income money supply, inflation real interest rate, manufacturing sector output, openness to trade, oil price, accounted for about 93% variation in the level of exchange rate during the period of the study.

ix.   The relationship between exchange and its determinants was stable throughout the period of the study, and

From the findings of the study, it was clear that income growth rate, money supply, inflation rate, real interest rate, international oil price, openness to trade, and manufacturing sector performance are the significant determinants of foreign exchange rate in the Nigerian economy. The poor conditions of these macro-economic variable and the volatility oil price in the last three decades underscores the depreciation and the volatility of the Nigerian naira.

Monetary and fiscal authorities have important role to play in the stability of the domestic currency. The relationship between exchange rate, money supply, Inflation and interest rate points to the critical importance of macro-economic policies to the stability of the domestic currency. The achievement of a stable exchange rate hinges on addressing the macro-economic challenges of Nigerian economy with the appropriate, and effective fiscal, monetary, and commercial policies. To address the problem of exchange rate instability in Nigerian economy, the manufacturing sector should be strengthened in addition to strengthening monetary policy effectiveness.

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