

# Assessment of Macroeconomic Indicators on Real Exchange Rate In Nigeria an Empirical Analysis

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## I. INTRODUCTION

A persistent argument over what determines the choice of exchange rate system of a given country has been a subject of debate among scholars on different economies ranging from underdeveloped, developing and developed. Friedman (1953), in his study posits that floating rates and the presence of sticky prices would provide better protection from foreign shocks by allowing relative prices to adjust faster, supported by Mundell (1963), in a real shock scenario floating exchange rate system would be a best option, whereas, in the events of monetary shocks fixed exchange rate system is the best call option.

Thus, in determining the exchange rate system in a country, significant economic policies should be geared towards achieving controlled macroeconomic indicators. Williamson (1994), states that economic policies should be geared in the long run towards achieving real exchange rate at optimal and these are determined by appropriate values of macroeconomic indicators. Incidentally, in 1970s Bretton-Woods system experience a monetary fall and calls for floating exchange rates institution, as such the exchange rate volatility have become somehow extreme without any matching link to changes in the macroeconomic fundamentals.

However, for a country to achieve greater impact on its economic growth, it has to focus on the macroeconomic indicators, like the exchange rate, which is an important indication of a strong economy in the short and long run. Hence, exchange rate volatility and its stability influence the general economic activity of a country in terms of both investment and export (Caballero and combo, 1989). Policy measures with reference to Nigeria comprise creating a reliable long term capital sustainability streams, through a suitable exchange rate control and also determine consistent exchange rate levels and diversified economic prospect, this would weaken reliance on oil revenue source base.

Conversely, for Nigeria to sustain the value of its domestic currency, its key objective should be focusing on maintaining a favorable external reserves position and ensuring internal and external balancing and therefore the overall stability of macroeconomic indicators. Recent events show that the real sector witnessed modest growth during the first half of 2018, as the pulse of activities picked up in other sectors of the Nigerian economy. Moreover, in the second quarter of 2018, the positive move by the government made the GDP

appreciate by 1.73 percent relative to 0.09 percent in 2017 (NBS 2018).

Currently, Nigeria has the highest gross domestic product across Africa as a result of this trend economist projected that by 2050 Nigerian GDP would achieve the highest growth in the world. Supported by city group report 2011, that between 2010 to 2050 Nigeria would achieve a highest average GDP growth in the world all things being equal. There has been an increase in the growth of gross national income for at least 15 years, regrettably, the Nigerian people are yet seeing much of that revenue effect. A majority of the country's population lives in poverty (USN, 2017).

Evident from the projections of the Nigerian gross domestic product by the International Monetary Fund (IMF) over the years, on time interval by the volatile nature of the gross domestic product, exchange rate, and inflation index before 1980, 1 unit of us dollar is equivalent to 1 unit of naira, inflation then stands at 1.3 percent with 58 billion of GDP on purchasing power parity. Despite the increasing gross domestic product over the years Nigeria has experience currency devaluation, by 2000 1 unit us dollar is equivalent 100 units Nigerian naira, this trend continues up to 2017 where a unit of US dollar is 306 equivalent (IMF). However, central banks in emerging markets including Nigeria must respond to the rising exchange rate and inflationary shocks (WEO 2018).

In the year following the global financial crisis, Nigeria amongst have witnessed large volatility and depreciation in their exchange rate, contributing to the concerns of the concerns of the central bank and the government, several factors have contributed to creating pressure on currencies and the central bank are increasingly concerned about the spillover effects of the macroeconomic policies adopted by Nigeria (Kataria, 2018).

### *Overview of Gross Domestic Product (GDP)*

The gross domestic product at a buyer's price is the total gross price of all producers residing in the economy and no taxes on products and less any unrestricted support within the price of the product. They are calculated without deductions for the consumption of phantom assets or for the depletion and degradation of natural resources. GDP may not always be the main framework relevant to the overall economic performance of all countries, especially when production takes place at the expense of the capital stock consumed.

While estimates of economic output (GDP) centered on the production approach are usually reliable from estimates collected through income or expenditure, different countries use different definitions, standards, and methods. However, there are still considerable inconsistencies between international standards and actual practice. Many data management offices, particularly in developing countries, face severe resource, time, training and budget constraints to provide a reliable and comprehensive chain of national accounts statistics.

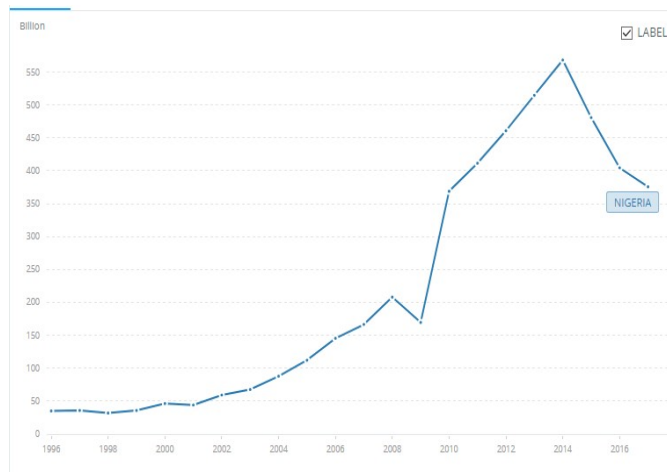


Figure : Shows the current annual GDP data (In billion US dollar).

GDP history

Source: World Bank OECD National Account Data

Analysts and investors believe that the country's GDP is an important macroeconomic indicator when assessing its currency, as well as giving the impression that the existence of debt also leads to higher inflation and possibly devaluation of the currency. Khan, et al, (2012) by using the Eigen test, and found that there is a long-term relationship between the GDP and the exchange rate but the relationship does not work in any direction. The study uses annual data point guides for 29 years to examine the fixed and long-term equilibrium relationship between variables for each model. Ismaila and Imoughele, (2015), use Real GDP to measure the macroeconomic determinants of economic growth in the Federal Republic of Nigeria. The result shows a long-term relationship between variables; at the same time, GDP, FDI, and total government expenditure are the most important determinants of the country's economic output without a fixed inflation rate.

The alternative model exists on GDP and Real rate of exchange called the Balassa Samuelson, this model implies that the growth in real cost reduction appears quicker within the tradable products than the non-tradable, as such cost of the tradable relative to non-tradable fall. This suggests the important worth of the currency would also go on the rise. In his study in Russia, Harberger, (2011), established that it is absolutely difficult to notice a systematic association between the real rate of exchange and economic growth. It was found

that there was no strong presumption that real value reductions would be concentrated primarily within tradable products, his proof does not go in line with the Balassa Samuelson presumptions. Alternatively, Rodrik, (2008), examine the gross domestic product and the real rate of exchange, the study focuses on domestic price index and uses the Balassa Samuelson, the study found that economic growth is said to cause true appreciation on the grounds of Balassa Samuelson result, therefore, use UNDERVAL to control the study.

In a similar study. Abbas, et al (2012), vital association exist between GDP and the exchange rate, the study demonstrates to investigate the association between GDP, exchange rate, inflation and the real rate of interest. A number of 10 African nations were explored between 1996 to 2010. They found that GDP alone showed a broad relationship with the exchange rate, while the real interest rate and inflation showed an insignificant connection. Correspondingly, Ramasamy and Abar, (2015), made a conclusion on the connection between exchange rate and macroeconomic indicators display opposite sign least to the expectations. They further argue that factors like investors' confidence have a higher weight in the economic variables that determine fluctuation in the rate of exchange.

### Inflation

To measure a country's average price levels of a measure of products and services in a period of time, economist uses the average consumer price index (CPI). Therefore, inflation is a measure of the CPI, i.e. the average percentage change in the consumer price index (WEO 2018). In Nigeria by 2001, as a result of expansion in the public sector fiscal policies, stronger financial policies were made to control the rising inflation. Thus, the effort by the central bank to control the exchange rate became paramount, thereby, stabilizing the rate to the unit of a dollar at 112 naira, this move by the CBN is to control excess government spending, increase the worth of the naira and also made it possible to discount the parallel market rate by 20%.

Additionally, prolonged government spending has resulted in consumer price to rise by 2000, inflation reached 5.6 percent to 6.9 percent in 2001. Thus Nigeria generates 16 billion US dollars on oil receipt twice than that of 1999. This current windfall triggers the state and the local government to demand more, through budget increase which prevents the government to provide substantially for the country's long term goal. In 2016, the BDC charge per unit of the Naira was 60% on top of the official rate. The central bank institutes a releases \$200 million weekly at the official exchange per unit. However, to induce the aid of getting FOREX in the market some firms pay 30% "premium" officers (CBN, 2017).

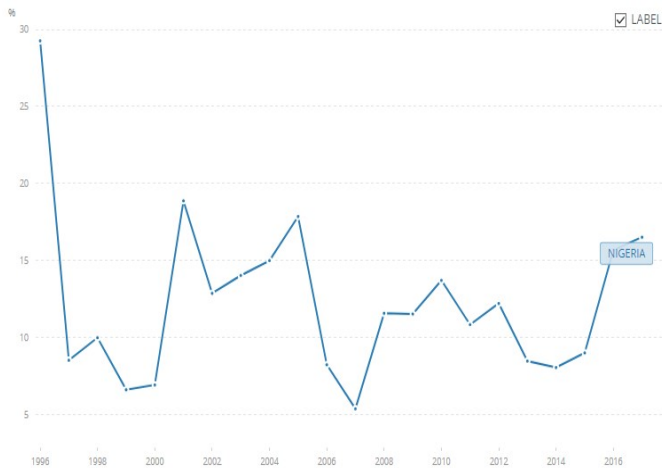


Figure : Shows inflation trends over the years in Nigeria from 1998 to 2017

whereas the rate of lending remains positive in real terms (CBN economic report, 2018).

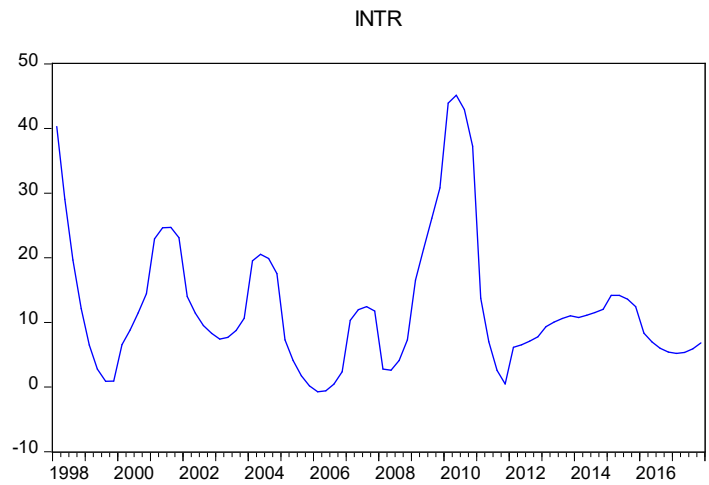


Figure : Shows interest rate trends over the years in Nigeria from 1998 to 2017

### Interest Rate Developments

Movements in money market rates of the banking system reflected the liquidity squeeze in the review period. Consequently, provisional estimates indicated that lending rates trended upward in August 2018, while banks' deposit rates showed mixed developments. The 3-months, 6-months and the over-12 months' deposit rates rose from 9.45 percent, 10.02 percent, and 8.91 percent at July 2018 to 9.60 percent, 10.26 percent, and 8.94 percent, respectively, at end August 2018. The 7 day, 1 month and 12 months' deposit rates, however, drop by 0.05, 0.48 and 0.17 percent point, respectively. There was a drop in average term deposit rate also drops by 0.04 percent to 8.64 percent at August 2018, although the average savings deposit rate remains unaffected at the preceding month's level of 4.07 percent (CBN, 2018).

Furthermore, there is a marginal rise in the weighted average prime and maximum lending rates to 16.90 percent and 31.18 percent at the end of August 2018. Consequently, at the end of August 2018 the range between the mean maximum lending rate and term deposit broadened by 0.14 percent to 22.55 percent points at End-August, 2018. Correspondingly by the end of August 2018 the spread between mean maximum lending and saving deposit rate also expanded to 27.11 percent point from 27.02 of the preceding month (CBN Report, 2018).

The review of the monetary policy rate indicate that short term money market rates generally trended below the weighted mean rate at the interbank call division rose from 4.20 percent in July, 2018 to 6.64 percent (2.44% increase), additionally there was a drop in the weighted mean rate at the open-buy-back division 8.08 per cent at July end, 2018 from 12.13 percent. So also in the review period, a decline in the Nigerian interbank offered rate was reported from 13.23 percent in July to 11.85 percent by August 2018. With the momentous, inflation was estimated at 10.96 percent by August and all rate of deposit in real terms remained negative,

Interest rate play an important role in the economy Gylych, Et al (2016) on interest rates and economic process, explore statistical model for annual data in Nigeria for the period of 32 years (1981 to 2013) testing using econometrics technique to find the long and short run between the variables in the model, the study indicates that a long term association exists between economic growth and interest rate in Nigeria. Therefore, they conclude that economic growth in the country would prevail continuously if the government formulates policies that would aid the performance of this variable and in turn have a positive impact on the GDP.

### Problem Statement

From the financial crisis outcome, there has been a shift in the non-official cross border capital flows which poses macroeconomic and financial stability challenges ranging from currency overvaluation/devaluation and economic overheating, in the case of sub-Saharan Africa there has been an increase on the capital flows. However, these inflows pose macroeconomic vulnerabilities such as the deviation of the real exchange rate (REO, IMF 2018).

Although, economists are uncertain on which macroeconomic basics (inflation, interest rate, gross domestic product, government consumption, trade openness) influences the determination of African real exchange rates, thus, the comparative significance of these macroeconomic indicators and the manner they drive are likely to be different in emerging economies environs, and certainly defer in different parts of the global economies, particularly in sub-Saharan Africa of which Nigeria is part of. Thus, there are few empirical studies centered on real rate of exchange some examples include Ghura and Grennes, (1998). But these studies are limited which does not justify the argument of recent economic scenarios in a relationship between Nigeria and world economies in general.

This study proposes to offer a current investigation of the roles played by the fundamental macroeconomic indicators of the study which are; Gross Domestic Product (GDP), Inflation, interest rate and monetary policy impact in examining the instability of Nigerian real exchange rate, and to determining which of these variables have indicate a more significant dynamic role. This study would further offer empirical structure that can update on Nigerian exchange rate movements policies. Our time series data comprises of annual macroeconomic variables over the period from 1998 to 2017, and supplement it with the rest of the world. This study is designed to be a time series data. This study is based on Nigeria and I choose time series data for 20 years' and the data would be accessed on real rate of exchange, inflation rate, gross domestic product, and interest rate in Nigeria, after which we will estimate if there is an association between Nigeria inflation rate, gross domestic product, and interest rate in relation to real rate of exchange. In this study, yearly time series data would be accessed for the period of 20 years (1998 to 2017).

The exchange rate is measured by its growth rate (%) while inflation is measured by consumer price and we can find the data of inflation and exchange rate in World Bank database and compliment with the data from the central bank of Nigeria, it's also measured gross domestic product and interest rate in Nigeria. Analysis of this data was organized Eviews in order to know the statistical connection between exchange rate, gross domestic product (GDP), inflation and interest rate in Nigeria. Data will be analyzed in Eviews 10+ in order to know the relationship between inflation, GDP, interest rate and exchange rate and also to know if they impact each other. Our estimation model we will use the OLS test in order to know the association between exchange rate, gross domestic product, inflation, and interest rate. In theory, financial investigators recommend that there is a long run connection between those factors under consideration.

#### *Measurements and Pattern of Follow Up*

We will measure Nigerian gross domestic product (GDP), inflation rate and interest rate in relation to the real rate of exchange for 20 years' annual data.

We allow 5% level of significance if the data normally distributed or not.

The strong contributions this study proffers are first, to augment to and update the empirical literature on the association that exists between the real rate exchange, gross domestic product, interest rate and inflation rate for Nigeria, which has been thin because of the less sufficient data. Secondly, we use different estimation and modeling technique like unit root test, cointegration test, OLS estimator to test the significance of our dependent and independent variables, also use heteroscedasticity test and a lot more to make the analysis unique.

#### *Study Objectives*

The broad aim our study is to explore on the effect of macroeconomic indicators (gross domestic product (GDP), inflation rate and interest rate), what role do they play on exchange rate dynamism in Nigeria through the following objectives:

1. To investigate whether the gross domestic product has a significant effect on the real exchange rate in Nigeria.
2. To determine the degree by which inflation affects real exchange rate in Nigeria.
3. To examine the interest rate and its effect on the real exchange rate in Nigeria.
4. To check whether if the exchange rate, gross domestic product, inflation rate, interest rate indicates a long run connection in Nigeria.

#### *Hypothesis*

**H<sub>0</sub>**: the null hypothesis

**H<sub>1</sub>**: an alternative hypothesis

Based on econometric theory of hypothesis and experimental literature on the exchange rate in the nation, we propose the accompanying connections to remain constant in our examination, exchange rate variable isn't a consistent variable, so it generally changes because of some financial, political and social components, and these changes have an effect on a few macroeconomic indicators. They are:

- Inflation rate
- Interest rate.
- Gross domestic product.

Therefore, based on the indicators outlined, the following hypothesis would be tested:

**H01**: There is no relationship between exchange rate and gross domestic product

**H02**: There is no relationship between exchange rate and inflation

**H03**: There is no relationship between the exchange rate and interest rate

**H04**: There is no long-run association between the exchange rate, gross domestic product, inflation and interest rate in Nigeria.

#### *Justification of the Study*

The study would research on the fundamental macroeconomic indicators that benefit the country in preparing for the volatility in the real rate exchange in Nigeria through global challenges of the deterministic finance. Economist maintained that the movement of the rate of exchange can be determined by Gross domestic product (GDP) which in their view seen it as the largest contributor for the economic growth, therefore, to maintain order and stability of the economy in terms of

foreign exchange market should be an important mandate of central bank in the economy, as such Central bank should stay focused on monetary policy measures, active participation in foreign exchange market and foreign exchange regulation.

In Nigeria the body called the development budget allocation committee under the ministry of finance is entrusted with the right for collaborating of government financial institutions to properly harmonize and update financial policies, this study will update such bodies. Also, this study would look at foreign exchange liberalization reforms approved by the Nigerian Central bank to see whether it has emphases on the current economic conditions.

Recently, in the first half of 2018, the domestic economy was affected by a number of developments, including interest rate hike in the United States of America, paired with dollar appreciation and rising inflation concern in the advanced economies. Others were the US-China trade dispute, the Brexit 'no deal' threat and higher crude oil receipts, which boosted external reserves. Consequently, excess liquidity persisted in the banking system, thereby impacting domestic prices and economic activity. Accordingly, the Bank retained a non-expansionary monetary policy stance to rein-in inflation, moderate pressure in the demand for foreign exchange market and stimulate capital inflow. The Bank also through foreign market sustained intervention to retained special Investors' and Exporters' (I&E) window to boost foreign exchange supply from autonomous sources and stabilize the domestic currency (CBN, 2018).

Given the fact that, monetary targeting remained the basis for monetary management, with the monetary policy rate as the main indicator of short term money market rates. This study is also significant looking the recent debates by monetary authorities in Nigeria on how to recover the economy in the financial sector reform which aimed to preserve exchange rate stability. Thus, this study will support Nigeria's economic policy planners in their economic forecast and management. Especially, this study would tend offer thoughtful investigation in the dynamics of the real rate of exchange and most significantly the most important macroeconomic indicators central to the fluctuations of the real exchange rate in Nigeria and it also contribute to the existing literature.

#### *Scope and Limitation of Study*

This study shall cover the period of 1998 to 2017; a sample size of 20 years is pretty enough for time series analysis. The prime choice of this period is largely informed by data availability, and also due to different kinds of the exchange rate that Nigerian economy has experienced and their associated trends in the system within the specified study period and complement beyond.

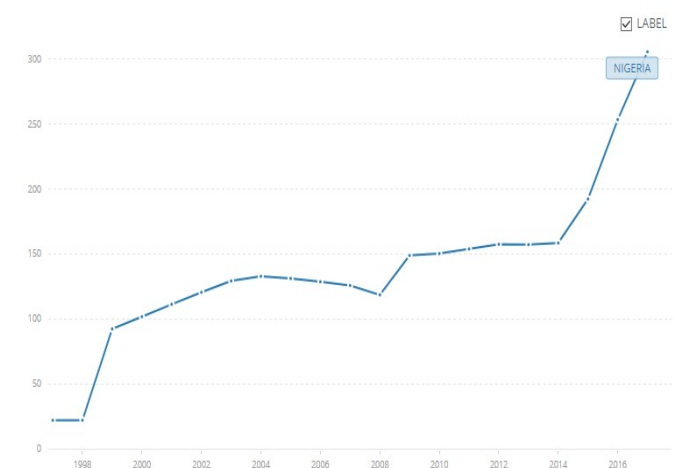
## II. REVIEW OF LITERATURE

Distinctive scholars investigated the association that exists between exchange rate and inflation Bleaney, (1996) indicate that a significant relationship exists between inflation and

exchange rate, his support on this was based on the price level, relative price and expected demand, therefore, impact speculative decisions. Sodersten and Reed, (1994) study 41 developing nations to see whether a relationship exists between the rate of exchange and inflation, they establish an immediate connection between the rate of exchange and inflation. They conclude that inflation significantly brings about currency depreciation, therefore, is a critical variable in the economy that must be watched.

By utilizing vector autoregression Goldfajn and Baig, (1998) directed an exploration in Asian countries expecting to discover the connection between real rate exchange and real interest rate, found that a rise in interest rate positively affect the valuation of the exchange rate. Furman and Stiglitz, (1998) after investigating 9 developing nations found similarly that a rise in the interest rate would trigger depreciation of the rate of exchange.

#### *Exchange Rate Policies and Trend in Nigeria*



#### *Empirical Literature on Real Exchange Rate*

Oriavwote and Eshenake, (2012), investigate the relationship between real exchange rates and Nigeria's inflation rate, found that the exchange rate is exceptionally sensitive to changes from inflation and imports. In another investigation to examine the connection between the interest rate and exchange rate in the United States for 12 years. The study found that exchange rate and interest rate are negatively connected, which came as the magnitude of the inflationary pressures within the study period, and conclude that in 1980s interest rate and dollar value were positively connected (Hakkio, 1996).

Takaendes, (2006), in his study examine the performance and causes of the real rate exchange movement in South Africa found that trade and real interest rate differential have a significant impact on the exchange rate. However, the real exchange rate fluctuations in the real rate of exchange are predominantly based on the real monetary shocks recommend by the study. Sandile and Magnus, (2016). In a similar study found that augmented policy uncertainty reduced the response

of exports to the effective interest rate and had short- and long-term impact on exchange performance.

Assessing how to adjust import prices for exchange rates helps to predict the effects of inflation and monetary policy responses. Aaron (2013), this study found the mean conversion rate to be incomplete. Thus, slowing traffic beneath inflationary targeting was evident. Trails were instituted to fall back with recent exchange rate fluctuations and there is asymmetric evidence, with great feelings for small estimates.

Paul and Muazu (2017), investigates what drives the rate of exchange movement, and what is the fluctuations in the growth rate of each unit on the economy in Ghana, the results indicated a mean-reverting exchange rate shocks, imbalances tend to be terribly slow correction, with consequences in the short term where economic customers re-determine their consumption and their choice of investment. Lawrence and Ismaila (2015), GDP, exchange rate, money supply credit has a major impact on the non-oil.

Nkoro and Aham (2016) investigated the connection between the rate of exchange and inflation volatility and stock volatility in Nigeria, The findings of the study indicate the rate of exchange and inflationary volatility in Nigeria are negatively connected. Nucu, (2011), investigates the link between the exchange rate and key macroeconomic indicators in Romania, specifically the inflation rate, GDP, the interest rate, the money supply and the balance of payments against two strong currencies, the sterling and the euro. One of the main vital findings within the study is that the growth of gross domestic product with one unit determines an increase in the exchange rate, but on average there is a depreciation of Ron against the currency due to inflated imports. Therefore, the USD / RON exchange rate is not related to the gross domestic product, it is a reference association for alternative factors not included in the study list.

Therefore, Economists believe that economic growth and currency exchange rate are negatively linked (Rodrik, 2008). Abdulkadir Et al (2015), examine the impact of Nigerian real exchange rate fluctuations on Nigeria's economic growth, in terms of real exchange rate fluctuations, it shows that the Nigerian monetary unit was generally overvalued by 0.17 percent during the study. the study recommends the continued use of the market-based interest rate provision as the easiest way to ensure that the Nigerian real exchange rate change follows the steps of sustainable balance. This can complement complementary policies applied by the government to stimulate the economic growth within the economy.

Finally, a wide range of assemblage works of literature suggests the existence of a connection between real rate exchange and gross domestic product growth. Nino et al. (2011), explore that real continued consequences exist for depreciation at nominal point view and display concern on the economic output. Another paradigm was suggested by Glzmann, et al. (2012), where a weak exchange rate leads to

increased savings and investment by reducing labor costs and income expense. Therefore, by diverting resources from buyers to monetary compelled companies, a real devaluation will increase reserve funds. Most of the work based on observation has a tendency to confirm a positive relationship between a weak exchange rate and growth. The dollar (1992) shows that overvaluation is detrimental to development, despite Collins (1997), Aguirre and Calderon (2005), and that overvaluation and loss of value are detrimental to development, while lowering the value of high valuation.

### III. THE METHODOLOGY

#### 3.1 Model of the Study

This study is based on Nigeria and I choose time series data accessible on GDP, inflation and interest rate development in Nigeria, after that I will estimate if there exists an association between exchange rate, inflation, GDP, and interest rate with regards to Nigeria. In this research, annual time series data were utilized for the period 1998 to 2017. GDP is measured by growth rate (%) while inflation is measured by consumer price and we can find the data of inflation and GDP in World Bank data. The interest rate has also measured the growth of the real interest rate in Nigeria. Analysis of this data was organized Eviews 10+ in order to know the relationship between inflation, GDP, interest rate and exchange rate.

#### 3.2 Econometric Model

Year	Y	X1	X2	X3
1998	21.886	9.996	25.28227	32004613750
1999	92.3381	6.618	2.767927	35870792988
2000	101.6973	6.933	10.31976	46386011231
2001	111.2313	18.874	23.83785	44137994252
2002	120.5782	12.877	10.81214	59116847822
2003	129.2224	14.032	8.613594	67655813930
2004	132.888	14.998	19.36914	87845420504
2005	131.2743	17.863	3.340373	1.12248E+11
2006	128.6517	8.24	0.373095	1.4543E+11
2007	125.8081	5.382	11.61433	1.66451E+11
2008	118.546	11.578	4.190484	2.08065E+11
2009	148.9017	11.538	23.7065	1.69481E+11
2010	150.298	13.72	42.31018	3.69062E+11
2011	153.8616	10.84	5.941526	4.11744E+11
2012	157.4994	12.218	6.883106	4.60954E+11
2013	157.3112	8.476	10.24735	5.14966E+11
2014	158.5526	8.062	11.35621	5.68499E+11
2015	192.4403	9.009	13.59583	4.81066E+11
2016	253.492	15.675	6.685325	4.04653E+11
2017	305.7901	16.524	5.816991	3.75771E+11

Source: www.worldbank.com

Y= Exchange rate (USD/NGN)

X1=Inflation rate (%)

X2=Interest rate (%)

X3=Gross domestic product per capital (USD)

**3.3 Model Specification**

In our model, it is multivariate regression model where the exchange rate is the cause or we can say Y is the exchange rate (dependent) and other variables (independent) stands for x such as Inflation rate, Interest rate and GDP in Nigeria. Obtaining data for the analysis I choose to use time series data where my data is annual data it is from 1998 to 2017 in my research topic dynamic of real exchange rate determinants in Nigeria.

Williamson, (1994) argue that optimal real exchange rate is determined by macroeconomic indicators of countries and that the appropriate values of these macroeconomic indicators determine the long-run value of the real exchange, we model the determinant of real rate exchange rate in Nigeria as shown below;

**Econometric Model**

$$y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + u$$

**Specification of Model**

$$EXCR = b_0 + b_1INFR + b_2INTR + b_3GDP + u$$

$$RER = F (GDP, INTR, INFR) \dots\dots\dots (1)$$

Where:

RER = Real Exchange Rate

GDPR = Gross Domestic Product Growth Rate

INTR = Interest rate

INF = Inflation Rate

For this purpose, the above model transform to:

$$RER = \beta_0 + \beta_1 GDP + \beta_2 INTR + \beta_3 INF + \mu \dots\dots (2)$$

$\beta_0$  = Beta the constant term

$\beta_{123}$  = Are the variables to be projected

$\mu$  = Denotes the error term

**3.4 Estimation Procedure**

Ordinary Least Square (OLS) method is used to evaluate the relationships in the appropriate equations. The choice of this method (OLS) it was due to the fact it has been tested on a variety of econometric relationships that yield to significant answers and solutions to a lot of problems facing the world. Additionally, the OLS statistical method is most fitting for solving empirical problems and it has become so standard that its estimates are presented as a point of reference despite other estimation technique result. Thus, OLS reliability lies on its desirability and for the efficiency, unbiased and consistency

of the OLS method of estimation made this kind of study unique. This denotes that OLS error term has equal and minimum variance (Gujarat, 2004).

**3.5 The Unit Root Test**

Generally, assumption guiding econometric models of this kind assumes variables to be stationary to enable the building and testing of an econometric model, but not rarely true. Therefore, we would check for the time series element of the data then estimate our model in equation (3). It is deemed important to do the check evidence from econometricians like Dickey and Fuller, (1981); Enders, (1995), Pindyck and Rubinfeld, (1998), in their observations on the findings on macroeconomics maintained that it can be “Spurious” if the properties of the time series are not examined. Afterward, Augmented Dickey-Fuller (ADF) test and the Engle-Granger co-integration test would be employed. 5% alpha levels are allowed, as such the unit root test would be determined by null hypothesis 0 against the alternative hypothesis 1. If the t statistic is greater than the critical value at 5% level of significance, then the null hypothesis is rejected and it indicates the absence of unit root. From the above assumptions, the model transforms to:

$$\Delta RER = \beta_0 + \beta_1 GDP + \beta_2 INFL + \beta_3 INTR \dots\dots\dots (3)$$

**3.5 Covariance Analysis: Ordinary**

This analysis computes the measures of association between the dependent and independent variables, here the RER would be tested to see if there is a correlation between the RER (dependent variable) and the gross domestic product, inflation rate and interest rate (independent variables) through 5% level of significance.

**3.7 Breusch-Godfrey Serial Correlation Lm Test**

The Breusch–Godfrey serial correlation LM test for autocorrelation of the estimation model. The model made use of residuals regressors in its analysis. Godfrey, (1978), states that the test is based on the null hypothesis which if failed to be rejected indicates no serial correlation of any order up to P, which denotes the absence of serial correlation in the residuals up to the specified order, the statistic has an asymptotic distribution under the null hypothesis. Therefore, our outcomes would reveal if the coefficients are statistically significant or not and also fitted or not. However, OLS standard errors are invalid if found serial correlation and the estimated coefficients will be biased and inconsistent due to the presence of a lagged dependent variable, as such the equation should be re-specified before using it for hypothesis tests and estimation.

**3.8 Heteroscedasticity Test: Arch**

Heteroskedasticity test was extended by Kelejian, (1982) and Doornik, (1995). Heteroscedasticity i.e. violation of homoscedasticity is present when the size of the error terms differs across values of the independent variable that means

the variance of the error term differs across all observations. In a classical econometric model, when the errors have the same scatter regardless of the value of the independent variable its said to be homoscedastic. Therefore, the study would perform a heteroscedastic ARCH test to support the assumption of a good model. Heteroscedasticity has some serious consequences for the OLS estimator, thus, the OLS estimator remains unbiased. In testing heteroscedasticity Basically,  $H_0: Var(e|x_1, x_2, \dots, X_k) = s^2$ , which is correspondent to  $H_0: E(e^2 |x_1, x_2, \dots, X_k) = E(e^2) = s^2$  n If assume the connection between  $e^2$  and  $x_j$  will be linear, can test as a linear restriction n So, for  $e^2 = d_0 + d_1 x_1 + \dots + d_k x_k + v$ ) this means testing  $H_0: d_1 = d_2 = \dots = d_k = 0$ .

### 3.9 Techniques of Results Evaluation

Basically, this study would tend to utilize different criteria in its evaluation, ranging from econometric criteria, statistical criteria, and economic criteria. Therefore, to evaluate the result of the study the first criteria i.e. the econometric technique involves testing multicollinearity and serial correlation to see the level of association between the variables and test for the presence or absence of serial correlation. Secondly, statistical criteria would tend to test statistics see the significance of the variables at 5% alpha levels of the overall regression. Finally, economics criteria would refer to economics theories to see the behavior of these variables, thus, giving us insight on how to tackle the prevailing economic problems.

### 3.10 Sources of Data Collection

The data obtained and used for this study are time series in nature, clearly secondary data would be utilized for our analysis obtained from World Bank database and compliment it with that of the central bank of Nigeria database statistics to have an overview of the data preparation.

### 3.11 Econometric Software

The choice of software is basically on the reliability of the result is provided, as indicated in different part of this study EViews has been one of the trusted software for econometric and financial computations for its sophistication and reliability. Therefore, for the said background EViews10+ statistical software is used for the analysis, begins by downloading data in Excel format from the database and import it into the software for the analysis.

## IV. EMPIRICAL ANALYSIS AND FINDINGS

### 4.1 Descriptive

Table 1

	EXCR	INFL	GDP	INTR
Mean	144.6134	11.67265	2.38E+11	12.35320
Median	132.0812	11.55800	1.68E+11	10.28356
Maximum	305.7901	18.87400	5.68E+11	42.31018
Minimum	21.88600	5.382000	3.20E+10	0.373095
Observations	20	20	20	20

On average the exchange rate to a unit of dollar has been N144.61 during all the period of observation, gross domestic product (GDP) also has shown 238 billion US dollars on average, average inflation during the study period was 11.67% and interest rate averaged 12.35%, throughout the period of the study maximum exchange rate reach was N305.79 and the minimum was N21.886, moreover, In the period of the study gross domestic product has a maximum reach of 568 billion US dollars and a minimum of 32 billion US dollars, inflation has reached 18.87% maximum and 5.38% minimum while the interest rate has risen to 42.31% and go down as much 0.37%

### 4.2 Group Unit Root Test

Table 2

Group unit root test: Summary

Series: EXCR, GDP, INFL, INTR

Sample: 1998 2017

Exogenous variables: Individual effects

User-specified lags: 2

Balanced observations for each test

Method	Statistic	Prob.	Cross-sections	Obs
<b>Null: Unit root (assumes common unit root process)</b>				
Levin, Lin & Chu t*	-2.924	0.0017	4	75
<b>Null: Unit root (assumes individual unit root process)</b>				
Im, Pesaran and Shin W-stat	-2.914	0.0018	4	75
ADF - Fisher Chi-square	49.53	0.0000	4	76
PP - Fisher Chi-square	17.53	0.0633	4	77

From the table 2 above, we tend to utilized the group unit root test, to test our hypothesis whether the data across all variables have unit root or not, the model displays four method across the observations, from the first Levin, Lin, and Chu (2002), the assumption is that null hypothesis has unit root versus alternative that does not have a unit root, as such, from the table it displays from the (p) values of 0.0017 (5% significant levels) that our variables across has no unit root failing to accept the null hypothesis. However, Im, Pesaran, and Shin (2003), also indicate a (p) value of 0.0018 less than the significant levels and support their assumption of the absence of unit root. So also at ADF test, Wu (1999) and Choi (2001), also have the same assumption on null has unit root against the alternative hypothesis that does not have unit root thus, the ADF confirm also the stationarity of the variables. We can conclude that based on the above evidence real



exchange, GDP, Inflation, the interest rate are stationary, note that the variables are said to be stationary if the observed p-value is less than the chosen alpha values, which is in this study at 5% level of significance.

### 4.3 Cointegration Test

Table 3

Trend assumption: Linear deterministic trend

Series: EXCR INFL GDP INTR

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.932744	77.62079	47.85613	0.0000
At most 1	0.673907	29.03427	29.79707	0.0610
At most 2	0.387118	8.863970	15.49471	0.3781
At most 3	0.002856	0.051486	3.841466	0.8205

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

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

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.932744	48.58651	27.58434	0.0000
At most 1	0.673907	20.17030	21.13162	0.0677
At most 2	0.387118	8.812484	14.26460	0.3021
At most 3	0.002856	0.051486	3.841466	0.8205

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

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

From Table 3 above, the upper part represents the trace cointegration test and from the base is the maximum eigenvalue cointegration test. From the trace cointegration test, we either reject our null hypothesis or fail to reject it. Therefore, from the first p-value of the trace test of 0.00 indicate a rejection of null hypothesis because is less than the 5% level of significance which denotes the t statistics is greater than the critical values. At most one cointegrating vector indicates that we cannot reject our null hypothesis as the p-value of 0.06 is greater than the 5% level of

significance, thus the t statistics is less than the critical value. At most two cointegrating vectors also show that we cannot reject our null hypothesis evident from 0.378 p values which are greater than the provided level of significance. At most three cointegrating vectors also fail to reject the null hypothesis of there is no cointegration with 0.82 p-values which is greater than the 5% level of significance. The maximum eigenvalue test also shows a similar trend as the trace test, therefore, either of the tests can be used for the analysis, hence we can conclude that there is at least one cointegration equation as evidenced from the model, this means that there is a long run relationship between the variables.

### 4.4 Test of Multicollinearity

Gujarati, (2004), poist that two or more variables are said to be multicollinear if their correlation coefficient is greater than 0.8. in the correlation table that is used to test for multicollinearity among the variables. Thus, generally the correlation coefficient between 0.1 and 0.29 indicates a small association, coefficient between 0.30 and 0.49 indicates medium association and coefficient of 0.50 and above indicates a large relationship.

Table 4

Correlation				
Probability	EXCR	GDP	INFL	INTR
<b>EXCR</b>	1.000000			
	-----			
<b>GDP</b>	0.616714	1.000000		
	0.0000	-----		
<b>INFL</b>	0.319191	0.101773	1.000000	
	0.0039	0.3690	-----	
<b>INTR</b>	-0.228108	-0.047461	0.202819	1.000000
	0.0418	0.6759	0.0712	-----

From table 4 it shows that there is no multicollinearity since order correlation coefficient of the variables is less than 0.8. Thus, there is statistical relationship or connection between the dependent variable, exchange rate and independent variables gross domestic product (GDP), and inflation while the interest rate is negatively correlated to exchange rate in Nigeria.

### 4.5 OLS Test

Table 5

Dependent Variable: EXCR

Method: Least Squares

Sample: 1998 2017

Variable	Coefficient	Std. Error	t-Statistic	Prob.
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C	36.12091	32.19897	1.121803	0.2785
GDP	2.05E-10	4.79E-11	4.271983	0.0006
INFL	6.737360	2.349126	2.868029	0.0112
INTR	-1.526963	0.899765	-1.697068	0.1090
R-squared	0.622471	Mean dependent var	144.6134	
Adjusted R-squared	0.551685	S.D. dependent var	58.01384	
S.E. of regression	38.84396	Akaike info criterion	10.33384	
Sum squared resid	24141.65	Schwarz criterion	10.53298	
Log likelihood	-99.33838	Hannan-Quinn criter.	10.37271	
F-statistic	8.793627	Durbin-Watson stat	1.574216	
Prob(F-statistic)	0.001123			

$$EXCR = \beta_0 + \beta_1 GDP + \beta_2 INFL + \beta_3 INTR$$

$$= 36.12 + 2.05 GDP + 6.74 INFL + (-1.52) INTR$$

*(0.0006)*
*(0.0112)*
*(0.10)*

From table after running the regression analysis, we can see that the predictor variables GDP, inflation is significant because their p-values are less than common alpha levels of 5% which indicate that they are statistically significant, thereby fail to accept the null hypothesis. The result shows that an increase in GDP has a direct significant relationship with real exchange rate because if GDP increase by 1 dollar its causes the exchange rate to increase by 2.05, the positive signs display by real gross domestic product shows that its meet economic a priority expectation. This is because a country seeking to acquire domestic assets will attract investment through strong economic growth. Therefore, when a domestic product is highly demanded, the demand for domestic currency would increase and in turn becomes competing currency in the market, shreds of evidence from empirical studies supports the hypothesis.

Inflation also has a direct significant relationship with the real exchange rate, evident from table 1% rise in inflation will lead to 6.74% rise in the real exchange rate in Nigeria. The fact that inflation is statistically significant in determining real rate of exchange the study suggests Nigeria focus on the importance of controlled inflation in the determination of real exchange rate, because Nigerians devise a lot of patronage on abroad product which in turn would make using a lot of foreign currency at the expense of the naira, the case of China and Nigeria transmits its impact through changes in the exchange rate and other countries.

The negative sign displayed by interest rate does not meet economic priority expectation since differentials in the rate of interest affect the equilibrium rate of exchange. Thus, a rise in

the Nigerian rate of interest relative to other countries rates will cause investors to shift from their denominations to take advantage of the rising Naira rates in the market, and without government control, the net result will be a devaluation of the Nigerian Naira without which is happening currently in the country. However, the result indicates that Interest rate is part of the determinant of the real exchange rate in Nigeria as shown by its t-values of -3.91 and 0.109 which are statistically insignificant but have a relationship.

The R2 is 0.622 indicates that 62% of the variation in the dependent variable exchange rate is explained by the independent variables GDP, inflation and interest rate. The other parts of about 38% are extra elements which are not incorporated in the model. DW is pretty ok from 1.5 - 2.5 which indicate the absence of autocorrelation.

#### 4.6 Heteroskedasticity Test

Table 6

Heteroskedasticity Test: ARCH

F-statistic	0.222145	Prob. F	0.6434
Obs*R-squared	0.245077	Prob. Chi-Square(1)	0.6206

Test Equation:

Dependent Variable: RESID^2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	910.6633	649.2770	1.402581	0.1787
RESID^2	0.274468	0.582335	0.471323	0.6434
Log likelihood	-168.9187			
F-statistic	0.222145			
Prob(F-statistic)	0.643402			

From table 6 we assume homoskedasticity because the p-values of the residuals 0.64 are bigger than 5% level of significance, we accept our null hypothesis. Finally, I can assume that the model is a good model when we look the heteroscedasticity arch test which is larger than 0.05 and as long as the model displays homoskedasticity the model is said to be good.

#### 4.7 Breusch-Godfrey Serial Correlation Lm Test

Table 7

Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.349259	Prob. F	0.7112
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Obs. R-squared	0.950460	Prob. Chi-Square	0.6217
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Test Equation:

Dependent Variable: RESID

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.28396	42.63097	0.358518	0.7253
GDP	-6.73E-14	5.12E-11	-0.001313	0.9990
INFL	-1.029748	3.210095	-0.320784	0.7531
INTR	-0.174787	0.967596	-0.180640	0.8592
RESID(-1)	0.310941	0.410531	0.757412	0.4614
RESID(-2)	-0.048732	0.403187	-0.120868	0.9055

From table 7 we accept the null hypothesis that there is no serial correlation because the p-value of 0.62 is bigger than 5% level of significance, as such the model is confirmed to be statistically a good model for the absence of autocorrelation.

## V. SUMMARY, CONCLUSION AND POLICY RECOMMENDATION

### 5.1 Summary and Conclusion

This study investigates on dynamics of real exchange rate focusing on its key determinants gross GDP, inflation rate and interest rate in Nigeria, an empirical analysis was carried out through the period of 20 years, 1998 to 2017, with 20 observations which are pretty enough in improving the analysis. 20 observations have been studied to see the dynamic fluctuations of the real rate of the exchange rate with regards to trends of its determinants (gross domestic product, inflation, interest rate). Based on this background, we formulate an extensive review of literature to support our argument, we reviewed the literature starting with the dependent variable exchange rate and supplement it with the independent variables (GDP, inflation and interest rate) and we noticed diverse scholarly conclusion on different economies, using different kind of analysis across the globe.

The dependent variable exchange rates it's measured with its key determinants. Gross domestic product (GDP) is perceived generally as a single determinant of a country's total economic activity. Nigeria's GDP represents the total dollar value of all goods and services produced during a specified period of time. The interest rate is an installment from a Brower from financial usage of the sum above reimbursement of the essential total. Inflation is measured by consumer price index (CPI), the inflation rate is the change in the average CPI percentage.

In order to determine these relationships, we start our modeling on the 20 observations by computing descriptive statistics, we found that the average exchange rate in Nigeria over the period was N144.61, the maximum reach was

N305.79 and the minimum reach was N21.89 to a dollar. On GDP the average during the period was 238 billion US dollar, the maximum reach was 568 billion US dollar and the minimum reach was 32 billion US dollars. The mean inflation during the period was 11.67%, maximum inflation experience during the period of observation was 18.87% and the minimum was 5.38%. The interest rate also averaged 12.35% during the period with the apex reach of 42.31% and the base reach of 0.37%.

Furthermore, to determine the stationary of the time series characteristics unit root test and cointegration was employed. We noticed that all the variables are not stationary but at ADF differencing it was, thus Johnsen cointegration test confirm the association between real exchange rate and GDP, inflation and interest rate, that mean real rate of exchange is subject to perpetual variations as the independent variables fluctuates and finally the trace test indicates a long-run relationship between real exchange rate and GDP, inflation rate and interest rate in Nigeria.

Moreover, we use OLS to test also our hypothesis in the study, the observed outcome shows on the first hypothesis, the real rate of exchange has a positive and significant relationship with the gross domestic product. The result suggests that the value of GDP is a determinant of the real exchange rate in Nigeria, in comparison with Abbas, et al (2012), in their study on 10 African nations found that GDP alone showed a broad relationship with the exchange rate, while the real interest rate and inflation showed an insignificant connection. On the second hypothesis, Correspondingly, Inflation rate also indicates a positive relationship with the real exchange rate, this was supported by Bleaney (1996) Oriavwote and Eshenake (2012), there exists a powerful relationship between exchange rate and inflation. Though some studies are of the view that inflation is not a significant element in determining a country's real exchange rate, these studies are not applicable to all countries. Therefore, this study found that in Nigeria inflation and real exchange rate are significantly and positively related by the scope of the study.

On the third hypothesis, though negative sign displayed by the interest rate that does not meet economic priority expectation since interest rate differentials affect the equilibrium exchange rate, interest has a negative relationship with the real exchange rate in Nigeria in contrary with Peter Takaendesa (2006), that found interest rate differential, has long run relationship with real exchange rate. Thus, Hakkio, (1996) supported these findings that exchange rate and interest rate are negatively connected, which came as the magnitude of the inflationary pressures. Lastly, on the fourth hypothesis, the outcome obtained from the analysis indicates the proof of a long-run association between real exchange rate, GDP, inflation and interest rate.

Another interesting parameter is we found the fitness of the model using heteroscedasticity arch test that confirms that the

model is good because of the absence of heteroscedasticity and also looking at the DW there was no autocorrelation. In a nutshell we fail to accept the null hypotheses and empirically prove the association between real rate of exchange and the GDP, Inflation and Interest rate, that is to say, the real exchange rate has a significant relationship with GDP, interest rate and inflation.

### 5.2 Policy Recommendation for Nigeria

This study explores macroeconomic indicators that benefit the country in preparing for the exchange rate volatility from the global challenges of finance especially in sub-Saharan Africa. Gross domestic product and inflation from the study are the macroeconomic indicators that contribute to the movement of the real rate of exchange in Nigeria, therefore, the central bank of Nigeria has to concentrate on different policy measures to maintain the steadiness and command of the foreign exchange market through the following:

These areas include but are not limited to the following:

- Active participation in the foreign exchange market to study the market volatility of Nigerian currency in relation to other currencies in the market.
- Effective monetary policy measure to control money supply thereby aiming at increasing the value of Nigerian naira.
- Regulation of foreign exchange.
- Portfolio balance approach to have a broader outlook on Nigeria's financial asset which would attract investors to naira denominated assets.

The government of Nigeria through its coordinating body federal ministry finance in collaboration with the central bank in properly harmonizing monetary policies. Also, this study is significant to inform the federation to look at improvements on foreign exchange control by the CBN which aim at being responsive to prevailing economic situations. Though there is a rise in the GDP over the years, but recent years also has shown a fall which it's not enough to control the exchange rate volatility, more efforts should be done to expand domestic production to contest on the global platform of strong currency nations since Analyst and investor considers a country's GDP as one of the important macroeconomic indicators when evaluating its currency.

The study shows that real exchange rate responds positively to interest rates. Interest rate is central to diverse issue of economic policy such as economic price which is directly related to the cost of capital or opportunity cost of funds therefore, it is crucial for the monetary authority in Nigeria to pursue interest rate stability as fluctuations in interest rate will have effect in maintaining stability in real rate of exchange. Hence, we suggest that the rate of exchange has to be competitive, in order to attract foreign investors in Nigeria. That is, the exchange rate should undeniably, redirect the realities of the market thus, stimulating competence in resource allocation and growth in productivity. Therefore,

amongst the mandate of CBN should be to maintain a stable and realistic exchange rate regime through effective monetary policy.

Nigerian government should try to formulate monetary policies so as to maintain the strength of the naira in terms of controlling not only price levels but also money supply in curbing the effect of inflation. Thus, inflation and economic output are positively related, a large gross domestic product growth in a country may pulse a dangerous effect on the economy leading to higher inflation. Therefore, to help determine a suitable exchange rate value in Nigeria, the central bank should incorporate foreign exchange control policies that will go a long way in strengthening the naira to compete with other foreign currencies in the market.

In conclusion, adopting a particular exchange rate regime demands a particular kind of consideration. If the economy is competent enough to perform in a rational fashion, free floating is the best policy choice, but if the economy sporadically produces irrational and inefficient outcomes, managed floating might be a suitable policy choice. The type of exchange rate regime chosen by a country has a significant influence on the economy. Thus most developing countries fail to follow a prearranged exchange rate regime due to external shocks. Investor sentiment and market perception risk made Nigeria and many other emerging economies subject to these external shocks.

### 5.3 Limitations and Future Directions

Further studies should be conducted to look at the overall Nigeria financial asset to improve its domestic outlook to attract foreign investments and boost the value of naira. Moreover, when there is an increase in population, the demand for foreign currency increases, as a lot of people would demand for foreign currency to make their individual transactions which would add more pressure in the market, therefore, directions in the future should be geared towards looking at the population growth as a social indicator that causes shortage of foreign currency in emerging economies (like Nigeria) which in turn tend to rises the value of foreign currency at the detriment of domestic currency (plus other factors not captured), these should be looked into especial in economies that heavily rely on imports. However, the limitations of the study are basically on the thin literatures that conjointly explore more about macroeconomic variables, based on other models of exchange rate determination that would assist in having a broader perspective on the scope of the study.

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