

**EXCHANGE RATE VOLATILITY AND INFLATION IN NIGERIA  
(1986-2016)**

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**ABSTRACT**

*This study assessed the impacts of Exchange Rate Volatility on Inflationary Rate in Nigeria from 1986 to 2016. Secondary data sourced from CBN Statistical Bulletin 2015 was used in this study. The Autoregressive Conditional Heteroskedasticity (ARCH) was developed and applied by the authors where the following macroeconomic variables were used: Exchange Rate (EXR), Inflation Rate (INFR), Broad Money Supply (BMS) and Interest Rate. The ARDL Bound Test was used to assess the long-run relationship between exchange rate volatility and inflation in Nigeria and more so the study employed granger casualty test to identify the causality between exchange rate volatility and inflation in Nigeria. It was however; found out that exchange rate volatility has a negative relationship with inflation. The effect of exchange rate on inflation is very weak and low. Interest rate and Broad money supply also have negative effect on inflation rate in Nigeria, while GDP has a positive effect on inflationary rate in Nigeria. In the same vein the co-integration test shows that, there's a long run relationship between inflation and exchange rate volatility in Nigeria and finally the granger casualty test shows a unidirectional casualty between the two variables inflation and exchange rate volatility, it shows that inflation causes exchange rate and not otherwise. Hence it was recommended that: The government should take a bold step to ensure exchange rate stability so that investors can have confidence in our financial system and the government as a matter of urgency should also diversify the economy in order to boost productivity, revive every sector of the economy that is not so that normalcy and price stability can be achieved in our economy.*

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Key words: Volatility, Inflation, Exchange Rate, Stability, Monetary Policy, Economy, Growth,  
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**1.0 INTRODUCTION**

Exchange Rate remains a significant economic variable that usually dominates the policy-making agendas of every government both in the developed and developing countries. This is so because it has broad impact and implication not only for international trade and balance of payments between two or more countries, but also for the general price level for the conduct of monetary policy and for macroeconomic stability especially for a an import based economy like Nigeria. Exchange rate refers to the rate at which one currency is exchanged for another (Jhingan, 2005). It is the price of a country's

currency expressed in terms of another country's currency. While exchange rate volatility refers to the swings or fluctuations in the exchange rates over a period of time or the deviations from a benchmark or equilibrium exchange rate (Mordi, 2006). Also, it is seen as the risk associated with unexpected movements in the Exchange Rate. Economic fundamentals such as the inflation rate, interest rate and the balance of payments which have become more volatile in the 1980's and early 1990's, by themselves are sources of exchange rate volatility (Ozturk, 2006). Furthermore, governments in many developing countries use exchange rate as a device for ensuring price stability, balance of payment equilibrium and most importantly economic growth and development. This is particularly so for imported commodities and those produced within an economy whose intermediate inputs and raw materials depend heavily on imports (Adelowokan, 2012).

Inflation on the other hand, is also a relevant macroeconomic problem that has been a priority and a challenge over the years to all developed and developing countries globally especially in Nigeria. Inflation which can simply be referred to a sustained rise in the level of prices of general goods and services over a period of time is one of the causes of economic imbalance, depreciated standard of living, economic crisis, devaluation of local currency in terms of domestic and external value (Blanchard, 2009). Inflation has beset the Nigerian economy over the years, or has rather put the Nigerian economy on its knees; because the Nigerian inflation rate has been volatile and mostly double digit (Umo, 2007). Although some economic literatures and theories view inflation as being a monetary phenomenon, but however, a wide range of empirical studies have identified exchange rate volatility as one of the key and major factor that accounts for the variations or increase in the general price level, this is so because fluctuations in exchange rate system for an import based economy like Nigeria leads to lack of confidence in our financial system and discourages foreign direct investments, which in turn transmits into devaluating the local currency and reduce the aggregate purchasing power.

In Nigeria, exchange rate policy has undergone different transformation process from the immediate post-independence period when the country maintained a fixed parity with the British pound, through the oil boom of the 1970s, to the floating of the currency in 1986, following the near collapse of the economy between 1982 and 1985 period. This research work was given priority because economic managers in Nigeria have not done justice to our exchange rate system to bring about adequate and substantial stability in Nigeria's economic structure, we have cases, where exchange rates are traded differently in different sectors of the economy ranging up to about 6 rates; for instance the (Official Rate - **305-306**) the (Black Market Rate - **390-400**) (a rate for Muslim pilgrims going to Saudi Arabia – **190**), (a retail rate set

by licensed exchange bureaus – 360) (rate for foreign school fees, BTA and medicals abroad - 375 now at 360) (Eleni G. 2016). It has become so porous that it is no longer news that exchange rate has become the indicator or determinant of virtually the prices of all goods and services in Nigeria, traders, market sellers, cooperate business men and women, merchants and even hawkers have now subscribed to the habit of linking or pegging the price of every good and service to volatility in Exchange Rate system in Nigeria even if they are locally made ones. Hence the focus of this research is to examine exchange rate volatility on inflation in Nigeria, assess the nature of relationship between exchange rate volatility and the casualty between exchange rate volatility and inflation.

## **2.0 LITERATURE REVIEW**

### **Conceptualizing Exchange Rate**

The management of any country’s foreign exchange market is carried out within the ambit of a foreign exchange policy, which according to Obaseki (2001) is the sum total of the institutional framework and measures put in place to gravitate the exchange rate towards desired levels in order to stimulate the productive sectors, curtail inflation, ensure internal balance, improve the level of exports and attract direct foreign investment and other capital inflows. Vergil, (2002) defines Exchange rate simply as the price of foreign currency which clears the foreign exchange market. Therefore, exchange rate of currency is the link between domestic and foreign prices of goods and services. Also, exchange rate can either appreciate or depreciate. Appreciation in the exchange rate occurs if less unit of domestic currency exchanges for a unit of foreign currency while depreciation in exchange rate occurs if more unit of domestic currency exchanges for a unit of foreign currency. Exchange rate is the price of one country’s currency in relation to another country.

According to Elumelu, (2002) The liberalization of the exchange rate regime in 1986 has led to introduction of various techniques with the view of finding the most appropriate method for achieving acceptable exchange rate for the Naira. The frequency with which these measures were introduced and charged is informed by the determined efforts of the monetary authorities to unrelentlessly combat the unbating depreciation and instability of the Naira exchange rate. To ensure effective management of foreign exchange, the fundamental problems of the nation’s economy must be addressed. This evolves an improvement in the state of infrastructure increase, local capacity utilization and a reduction of the cost of doing business in Nigeria. This should be done through the deregulation of the energy sector to enable private investors to participate in the provision of electric and telecommunication, locally produced goods should be encouraged.

## **Exchange Rate Management Policy in Nigeria**

Nigeria adopted Structural Adjustment Programme (SAP) in September, 1986 due to previous failures in macroeconomic policies on the pursuit of a realistic exchange rate. With the introduction of SAP, the second -tier Foreign Exchange Market (SFEM) was established and was expected to produce a market-determined exchange rate that would remove the overvaluation of the naira which persisted in the pre-SAP era. A fixed rate of 22/\$1 was reintroduced after various policies ranging from dual exchange rate to unified exchange rate system were adopted in 1987. Due to inherent abuses and bureaucratic bottlenecks associated with regulation the system short-lived. In 1995, the Autonomous Foreign exchange Market (AFEM) was introduced following the promulgation of foreign exchange decrees 17 of 1995 (monitoring and miscellaneous provisions) and the abolition of exchange control Act of 1962. Under the Autonomous Foreign exchange market, the CBN was to intervene in the market as short notice. (Akabom A. et al 2012) However, the Failure of (AFEM) led to the formation of Inter-bank foreign market (IFEM) whose aim among others, was depending on interbank foreign market as well as having a stable naira exchange rate. Negative developments in IFEM led to its abandonment and the re-introduction of DAS in July 2002 to address the failure of IFEM. DAS was specifically geared towards achieving the following: determination of exchange rate of naira, conserve external reserve position, ensure stability in naira rate etc. Having operated DAS for about three and half years, CBN in 2005 introduced the wholesale Dutch auction system (WDAS) which has since being in existence (Udoayang, Akpanuko and Asuquo, 2009).

## **Main Types of Foreign Exchange Rates**

### **Fixed Exchange Rate System:**

According to Jason, (2010). A fixed exchange rate is when a country's currency doesn't vary according to the FOREX market. The country makes sure that its value against the dollar or other important currencies remains the same. It buys and sells large quantities of its currency, and the other currency, to maintain that fixed value.

For example, China maintains a fixed rate. It pegs its currency (the Yuan), to a targeted value against the dollar. As of June 19, 2017, one dollar was worth 6.806 Chinese Yuan. Since February 7, 2003, U.S. dollar has weakened against the Yuan. One U.S. dollar could be exchanged for 8.28 Yuan at that time. The U.S. dollar has weakened because it can buy fewer Yuan today, than it could in 2003.

That's because the U.S. government pressured the Chinese government to let the Yuan rise in value. This allows U.S. exports to be more competitively priced in China. It also makes Chinese exports to the United States, more expensive. On August 11, 2015, China modified its policy to allow the Yuan more flexibility. China wants to reduce its reliance on the dollar. It also wants the Yuan to be more widely traded.

### **Flexible Exchange Rates**

Most exchange rates are determined by the foreign exchange market, or FOREX. That's called a flexible exchange rate. For this reason, exchange rates fluctuate on a moment-by-moment basis.

The flexible rates follow what FOREX traders think the currency is worth. Those judgments depend on a lot of economic factors. The three most important are central bank's interest rates, the country's debt levels and the strength of its economy. The United States allows its FOREX market to determine the U.S. dollar's value. The U.S. dollar strengthened against most currencies during the 2008 financial crisis. When stock markets fell worldwide, traders flocked to the relative safety of the dollar. But, why was the dollar safe? After all, the crisis started in the United States. Here's more on why the dollar is so strong right now. Despite this, most investors trusted that the U.S. Treasury would guarantee the safety of the world's global currency. The dollar took on that role when it replaced the gold standard during the 1944 Bretton Woods agreement. Here's more about the underlying reasons behind the power of the U.S. dollar. (Sanusi, 2010).

### **Exchange Rate and Inflation**

As a general rule, a country with a consistently lower inflation rate exhibits a rising currency value, as its purchasing power increases relative to other currencies. During the last half of the twentieth century, the countries with low inflation included Japan, Germany and Switzerland, while the U.S. and Canada achieved low inflation only later. Those countries with higher inflation typically see depreciation in their currency in relation to the currencies of their trading partners. This is also usually accompanied by higher interest rates (Jason, 2010).

### **Theoretical framework**

#### **Purchasing Power Parity Theory (PPP)**

According to this theory, the difference in the rate of interest in two countries should be able to explain the exchange value of the currencies of the two countries. Thus, if a country is experiencing high interest rate regime, there is a strong tendency for the exchange rate of its domestic currency to be high as well, depicting that the domestic currency has depreciated in value against foreign ones. Therefore, there exists

some form of linear relationship between the interest and the exchange rate operatives in any domestic economy which also translates to inflation or general price level. If interest rates are low, the exchange value of the domestic currency vis-a-vis foreign ones will be low (an appreciation) while the reverse will be the case if interest rates are high (a depreciated local currency results). In effect, differences in the interest rate structure between two economies will give an indication of what their exchange rates would be like. The interest rate parity theory is arguing that the rate of exchange is an important factor influencing the rate of interest rate of a local currency vis-a-vis a foreign one (Idika, 1998). Nonetheless, the main argument against the interest rate parity theory is for its non-arbitrage condition; which says that the returns from borrowing in one currency, exchanging that currency for another currency and investing in interest-bearing instruments of the second currency, while simultaneously purchasing futures contracts to convert the currency back at the end of the holding period, should be equal to the returns from purchasing and holding similar interest-bearing instruments of the first currency. If the returns are different, an arbitrage transaction could, in theory, produce a risk-free return (Odunsanya and Atanda, 2010). Upon all these, the theory could still be adopted to have an insight about the possible relation between interest and exchange rates.

### **Empirical Literature**

Maku and Adelowokan (2013) in their work using annual data from 1970 to 2011 examined monetary policy and inflation in Nigeria by employing the partial adjustment model. The result indicated that interest rate and exchange rate exert decelerating pressure on dynamics of inflation rate in Nigeria. While, other macroeconomic indicators such as real output growth rate, broad money supply growth rate, and previous level of inflation rate found to be significant positive determinants of inflation rate in Nigeria during the period.

Ogundipe (2013) adopted a structural Vector autoregressive model to estimate the pass-through effect of exchange rate changes to consumer prices in Nigeria. Evidence from the analysis, covering the period of 1970 to 2008, revealed that exchange rate pass through to consumer prices is substantial in Nigeria and has a negative relationship with inflation. This further suggests that exchange rate is very important in explaining inflation in Nigeria.

Omotor (2008) examined the inflationary consequences of exchange rate reforms in Nigeria using data covering the period between 1970 to 2003. The results showed that exchange rate policy reforms are important in the determination of inflation in Nigeria. Similarly, Oyejide(1989) studied the stability of

Nigeria's exchange rate and revealed that exchange rate depreciation often leads to increases in cost of imported inputs and final goods through the channel of cost-push inflation.

Egwaikhide, Chete and Falokun (1994) examined the quantitative effects of exchange rate depreciation on inflation, and money supply in Nigeria. Employing cointegration and error correction techniques, the results revealed that domestic money supply, real output, the shadow price of exchange rate, the parallel market exchange rate and the official exchange rate, cannot be ignored in evaluating the proximate causes of inflation in Nigeria.

Imimole and Enoma (2011) examined the impact of exchange rate depreciation on inflation in Nigeria for the period 1986-2008 using Auto Regressive Distributed Lag (ARDL) co-integration Procedure. The research found amongst other things, that Naira depreciation has negative and significant long-run effect on inflation in Nigeria. This implies that exchange rate depreciation can bring about an increase in inflation rate.

Aliaa (2012) investigated the relationship between exchange rate changes and inflation using two indicators of inflation: Consumer Price Index (CPI) and Wholesale Price Index (WPI). Employing the Granger causality test for monthly data in Egypt during the period of 1990-2008, the results showed a strong relationship between exchange rate changes and inflation. Both indicators of inflation succeeded in reflecting a clear Exchange Rate- Pass through (ERPT) Phenomenon, but WPI showed a faster response to exchange rate changes than CPI. This is due to the distortions of CPI.

Kamin and Khan (2003), examined the linkage between inflation and exchange rate in a multi-country comparison involving Asian and Latin American countries. Their study revealed that there exist a long run relationship between inflation rate and real exchange rate in most Asian and Latin American countries. Furthermore, they found that the influence of exchange rate changes on inflation rate is higher in Latin American countries than those in Asia and industrialized countries.

Oriovwote and Eshenake (2012) assessed the relationship between the real exchange rate and inflation in Nigeria. Using data covering the period between 1970 and 2010, the co-integration test result shows a long run relationship between inflation and the real exchange rate.

Ndungu (1997) studied the Price and Exchange rate dynamics in Kenya using data for the period 1970-1993. The results of the Granger Non- causality test showed that the level of inflation and changes in exchange rates affect each other.

### **3.0 METHODOLOGY**

This section explained the data source and the method used in analyzing the data in this study. Data for the study was obtained from the Central Bank of Nigeria (CBN). The study used nominal figures and it employed monthly Nigeria data for the period **1986 – 2016**. The data frequency selected shall be yearly.

**Model specification**

This study measured volatility using the descriptive statistics in order to examine the changes that have occurred within the period under study and more importantly, the Autoregressive Conditional Heteroskedasticity(ARCH) developed by Bollerslev (1986). The choice of the method is because exchange rate best follows the ARCH process (Mchenzie, 1999), given the fact that the ARCH model captures the variations or fluctuations that is commonly experienced in exchange rate system. This also follows the work allowing the exchange rate to depend on its previous value for the mean equation. Therefore, the study in generalizing this, the standard ARCH (p,q) specification is depicted as in Equation [1]

$$y_t = \gamma + \sum_{k=0}^n \eta_k X_{t-k} + e_t \text{-----1}$$

Where  $\gamma$  is the mean with other exogeneous variables assumed to be zero,  $x_{t-1}$  the exogenous variables and  $e_t$  the error term. The  $e_t$  is explained as in Equation (2)

$$e_t = \sigma_t \epsilon_t \text{-----2}$$

The  $\sigma_t^2$  which explained the conditional variance of the error term in Equation (2) is further expressed as in Equation (3)

$$\sigma_t^2 = \omega + \sum_{i=1}^q \alpha_i e_{t-i}^2 + \sum_{j=1}^p \beta_j \sigma_{t-j}^2 \text{-----3}$$

Where  $\sigma_t^2$  is the period ahead forecast based on past information or the conditional variance,  $\omega$  is the constant taken as mean with other exogenous variables assume to be zero and  $\gamma$  is the previous period volatility the ARCH term and  $\beta$  the coefficient of the forecast variance of the GARCH term respectively.



However, in other to measure exchange rate volatility and inflation in Nigeria, the study employed these key variables:

Implicit function:

$$INFR = f(EXCHR, INTR, BMS, GDP) \text{-----} 4$$

Explicit function:

$$INFR = \alpha_0 + \alpha_1 EXCHR + \alpha_2 INTR + \alpha_3 BMS + \alpha_4 GDP \text{-----} 5$$

Where *INFR* is Inflation Rate, *EXCHR* is Exchange Rate, *INTR* is Interest Rate, *BMS* is Broad Money Supply, *GDP* is Gross Domestic Product and  $\epsilon_t$  is a white noise error term. All the variables for estimation in Equation [1] are estimated in their natural logs form as denoted by *L* in the model.

**Data Analysis:**

Preliminary test like Descriptive Statistics and stationary test were accomplished to scrutinize the data characteristics. This preliminary was done to make sure that the estimation technique of ARCH chosen is appropriate for the data in the model.

Descriptive statistics tests were performed to observe if *INF* and *EXCHR* exhibit time varying volatility and leptokurtosis characteristics. The two vital variables of the study are carefully investigated and given more priority because these variables determine the estimation technique for the study.

**Description of the variables used in the model**

The main technique of data analysis in this study is the Multiple Regression Model, but it is pertinent to provide an understanding of the trend and distribution of the variables of the study. This is to help in the determination of the most appropriate regression estimation techniques and more importantly to trace the variations or changes that had occurred overtime, given the fact that, the research topic deals with exchange rate volatility. To fulfill this obligation, the descriptive statistics of all the variables covering the same sample size of 30 observations were computed as contained in the table below.

**Table 4.1 Descriptive Statistics**

	LINF	LEXRV	LGDP	LIR	LM2
<b>Mean</b>	2.695750	3.878231	13.38930	2.564264	8.184698
<b>Maximum</b>	4.288265	5.721033	18.04996	3.258097	11.32132
<b>Minimum</b>	1.682688	0.703394	12.22982	1.813195	4.594109
<b>Std. Dev.</b>	0.750711	1.381039	1.613580	0.297820	2.217739
<b>Skewness</b>	0.834670	-0.718030	2.332531	-0.304834	-0.197097
<b>Kurtosis</b>	2.527801	2.233401	7.162857	3.433606	1.718679
<b>Jarque-Bera</b>	3.887492	3.422840	50.49406	0.722958	2.321347
<b>Probability</b>	0.143167	0.180609	0.000000	0.696645	0.313275

<b>Sum</b>	83.56825	120.2252	415.0682	79.49219	253.7256
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**Source: Authors Computation Using E-Views-9**

The result above shows that, the average values of Inflation Rate (**INFR**), Exchange Rate Volatility (**EXRV**), Interest Rate (**INTR**), Broad Money Supply (**M2**) and Gross Domestic Product (**GDP**) over the period under study are 2.695750, 3.878231, 13.38930, 2.564264 and 8.184698 respectively. There is a wide difference between the maximum and the minimum values of all the variables employed.

Although, the standard deviations are not so large given the fact that they are (less than two) except for Broad money supply which is greater than two, but however, the wide range is an indication that, significant changes have occurred on the variables over the period under study, and this implies that the essence of this research work is justified. The Skewness, Kurtosis and Jacque-Bera statistics are used for the examination of the nature of distribution of the variables; these determine best estimation technique for the variables. The result shows that the distributions of INF, GDP are positively skewed, while those of EXCHRV, INTR and M2 are negatively skewed. In relation to kurtosis, GDP and INTR are leptokurtic (i.e. evidence of fatter tail than the normal distribution) while INFR, EXCHR and M2 are platykurtic (i.e. evidence of thinner tail than the normal distribution). The distribution of a series is leptokurtic when the kurtosis is greater than three (3) and it is platykurtic when the kurtosis is less than three. The Jaque-Bera statistics of all the variables are statistically insignificant at 5% (i.e their probability values of the statistics are greater than 5%), except for GDP with probability value of 0.000000. This denotes that all the variables are abnormally distributed, hence the use of Autoregressive Conditional heteroskedasticity.

**Presentation of Unit Root Test**

The stationarity test is used to find out whether or not variables have a Unit Root from **1986-2016**, using Augmented-Dickey Fuller unit root test and more importantly to explore options that would make the variables stationary, in case they are not, otherwise the results would be spurious and unreliable. The result is presented in the table below.

<b>VARIABLES</b>	<b>ADF</b>	<b>5% CRITICAL LEVEL</b>	<b>(ADF) Order of Integration</b>
<b>LINFL Prob.</b>	-2.967107 0.0497	-2.963972	I (0)
<b>LEXCHV Prob.</b>	-5.326488 0.0002	-2.967767	I (1)
<b>LINTR Prob.s</b>	-6.762090 0,0000	-2.967767	I (1)
<b>LBMS<sub>2</sub> Prob.</b>	-8.516504 0.0000	-2.967767	I (1)
<b>LGDP Prob.</b>	-5.353220 0.0001	-2.967767	I (0)

**Source: Authors Computation Using E-Views-9**

Time series data for all the variables in this study are trended and therefore most likely to be non-stationary. The problem with non-stationary or trended data is that, employing the standard OLS regression procedures can easily result to biased and inconsistent estimates leading to incorrect and misleading policy inferences. It is essential therefore, to perform unit root test in order to avoid such spurious regression results and also to confirm the order of integration of the series of the variables involved in a model. Regression becomes spurious when both the dependent and independent variable (s) are not stationary at level. A spurious regression usually has a very high  $R^2$ , insignificant probability values and t-statistics that appear to provide significant estimates, but the results may be intuitively meaningless misleading. This is because the OLS estimates may not be consistent, and therefore the tests of statistical inference are invalid. To avoid the aforementioned problems, Augmented Dickey Fuller (ADF) unit root test was conducted in this study and the result is presented in the table below.

The result test (ADF) revealed that, EXCH V, INTR, BMS2 have unit root at level but stationary at first difference i.e integrated order of one I (1). This means the variables had to be differenced once to become stationary. On the other hand, INFR and GDP are stationary at level, i.e I (0). This shows that the independent variables of the model except GDP estimated in this study are not stationary at level, while the dependent variable (INFL) is stationary at level. The stationarity of the variables at I (0) and I (1) could indicate the presence of long-run relationship. Hence, co-integration test becomes necessary in this study to examine the existence or otherwise of a long-run relationship between the variables in the models. The co-integration test is presented in the table below.

**Analysis of Co-integration Test (Bound Testing Approach)**

<b>ARDL Bounds Test</b>		
Date: 11/17/17 Time: 02:46		
Sample: 1987 2016		
Included observations: 30		
Null Hypothesis: No long-run relationships exist		
<b>Test Statistic</b>	<b>Value</b>	<b>K</b>
<b>F-statistic</b>	6.460492	1

Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	4.04	4.78

*Source: Authors computation (2017) using Eviews-9*

Given the result of the unit root tests which shows that all the variables are not stationary at level, but instead a combination of I (1) and I (0) series, therefore the most appropriate test of co-integration is the Autoregressive Distributive Lag (ARDL) Bound test of co-integration. This is employed for the model in this study. The result is presented in table 4.3. The null hypothesis indicates that, there is no long-run relationship between the dependant and independent variables. The decision rule is to reject null hypothesis when F-statistics of the test is greater than the Critical Value of Upper Bound at a chosen level of significance i.e (5% for this study). On the other hand, the null hypothesis is accepted when the F-statistics is less than that of the Critical Value of the Lower Bound. When the F-statistics falls between the upper and the lower bound, it then means that the test is considered inconclusive.

However, the result of the test above indicates that the F-statistics of the variables is **6.460492** with 5% Critical Values of the Lower Bound **4.94** and the Upper Bound **5.73** respectively. This shows that the F-statistics **6.460492** is greater than the Critical Values of both the lower and the Upper Bounds in the model. This implies the rejection of the null hypothesis, while alternative hypothesis is accepted. Hence, the test shows that there is co-integration (long-run relationship) between the Exchange Rate Volatility and Inflation rate in Nigeria. And most importantly this implies that objective two has been achieved and the null hypothesis is rejected. This agrees with the findings of Alia (2012), Kanim and Khan (2003), and Onovuote and Eheken (2012) who posit that there is a co-integration between exchange rate volatility and inflation.

### Heteroskedasticity Test

Null Hypothesis: No Heteroskedasticity Exists

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.260239	Prob. F(5,24)	0.0031
Obs*R-squared	6.238561	Prob. Chi-Square(5)	0.0037

From the table above, the statistic labeled “obs\*R-squared is the ARCH test of heteroskedacity in the squared residuals. The P-value (0.0037) indicates that there is presence of heteroskedacity in the residuals. This also implies that ARCH technique is suitable for the estimation.

## ARCH Test Result

Dependent Variable: LINF  
Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)  
Date: 11/17/17 Time: 03:42  
Sample: 1986 –2016  
Included observations: 31

Variable	Coefficient	Std. Error	z-Statistic	Prob.
LEXRV	-0.011854	0.058248	-0.203504	0.0387
LIR	-0.201972	0.040941	-4.933196	0.0000
LM2	-0.189465	0.007204	-26.29999	0.0000
LGDP	0.057839	0.030862	1.874108	0.0609
C	4.210042	0.004543	926.8093	0.0000

R-squared 0.798277  
Adjusted R-squared 0.667388  
Durbin-Watson stat 1.902444

The ARCH result largely determines the rates at which changes in the conditional mean of the variables especially exchange rate volatility are associated with changes in Inflation. However, from the result above Exchange Rate has a negative relationship with inflationary rate in Nigeria, given the coefficient sign of **(-0.011854)**. Thus, a percentage increase in exchange rate decreases inflation rate by approximately 0.01 percent and it is statistically significant given the **0.0039** probability value which is less than 5%, this shows that Naira volatility has a very weak but positive impact on Inflation. An increase in exchange rate will cause a very small decrease in Inflation. This is also an indication that these two subject variables have a negative relationship and this is in line with our a-priori expectation and theoretical stand point, particularly the purchasing power theory, which was also adopted in this work. This result is also in line with the findings of Maku and Adelowokan (2013), Omotor (2008), Ogunidipe (2013). But on the contrary it disagrees with the findings of Inomole & Enoma (2011) and Egwaikhide & Falokun (1994), who assert that Exchange rate volatility has a positive relationship with Inflation in Nigeria. However, a practical example of this in relation to our economic environment was the crash of global crude oil prices, from about \$110 to about \$34 per barrel, which led to monumental devaluation of our currency and exchange rate volatility in 2015 to 2016 given the fact that, Nigeria as a

country practice a monoculture economy, neglecting other sectors of the economy completely and as a result of this, the overall prices of goods and services started rising rapidly from about **8.06** inflation rate in 2014 to **9.02** in **2015** and eventually to **15.7** in 2016, a trend the government has been battling with to reverse by ensuring stability in our Exchange Rate System.

The coefficient of Interest rate can also be clearly seen to be negatively related to inflation rate given the (-0.201972) value and statistically significant given the **(0.0000)** probability value which is less than 5%. This is also in line with a-priori expectations and theoretical standpoint, for example the quantity theory of money which postulates that, the total money in circulation is the major determinant of general price level and therefore a reduction in interest rate i.e (Expansionary Monetary Policy) leads a corresponding increase in inflation and vice versa. Thus a percentage increase in interest rate leads to a corresponding 0.20% decrease in inflation rate in Nigeria. This also goes with the findings of Maku and Adelowoken (2013) and Hameed et al (2012) but disagreed with the findings of and Iya & Aminu (2014) whose finding exerts that Interest rate has a positive relationship with inflation.

Broad Money Supply on the other side depicts a negative relationship with inflation rate in Nigeria; unfortunately this is against the backdrop of our a-priori expectation, as the amount of money in circulation is expected to have a corresponding positive relationship with inflation, although when Money Supply is channeled towards production against consumption, the relationship of money and inflation can be said to be negative. Meanwhile a percentage increase in Broad Money Supply leads to a corresponding 0.18% decrease in inflations rate. However, this negates the findings of Maku and Adelowokan (2013) who posits that broad Money Supply has a positive relationship with Inflation in Nigeria. Finally, GDP is positively related to inflation in Nigeria given the fact that, the co-efficient is (0.057839) which indicates a positive value and that means a percentage increase in GDP has a corresponding 5.7 increase in inflation in Nigeria and the variable is also statistically significant given the less than 5% probability value. More importantly, the ARCH result above depicts reliable estimates given that the R<sup>2</sup> is about 79% and the adjusted R<sup>2</sup> is about 66% which indicates that, the model has a good fit and the independent variables used can best explain the variations or changes in inflation which is the dependent variables. Moreover the Durbin-Watson Statistic is approximately 2 and all the variables are statistically significant which is good enough to forecast policies.

### Causality Test

Pairwise Granger Causality Tests

Date: 11/17/17 Time: 02:56

Sample: 1986 2016

Lags: 2

Null Hypothesis:	Obs	FStatistic	Prob.
LINF does not Granger Cause LEXRV	29	4.17814	0.0277
LEXRV does not Granger Cause LINF	29	2.85231	0.0774

**Source: Authors computation (2017) using Eviews- 9**

In other to determine whether Exchange Rate Volatility causes inflation or otherwise or to know if the both variables cause each other or otherwise, so as to know the causal relationship between the two aforementioned variables in Nigeria's economy, particularly, the granger causality test is important in two areas, namely: identification of relevant variables in the causality relationship and the depth and intensity (effect) of the relationship which is also important, that's why we employed the granger casualty test, however from the result above it can be clearly seen that inflation granger cause exchange rate considering the **(0.0277)** Probability value of inflation which is less than 5% and its statistically significant, in this case the null hypothesis is rejected and the alternative is accepted. However exchange rate volatility does not granger cause inflation given the **(0.07740)** probability value which is greater than 5% and that implies that is statistically insignificant. This also implies that the two variables have a unidirectional relationship given the one way directional effect. However, this result has justified the third objective in chapter one and the null hypothesis in respect to this is rejected. This however, disagrees with the findings of Ndung (1997), who posits that Exchange Rate and Inflation have a bi-directional relationship.

**Conclusion**

This research work was embarked on to assess the impacts of exchange rate volatility on inflation in Nigeria, from the period 1986 to 2016; secondary data was used for the analyses which were sourced from CBN statistical bulletin 2016. The variables used were Inflation Rate, Exchange Rate, Broad money Supply, Interest Rate and Gross Domestic Product. However, some major statistical analyses were used such as: Descriptive statistics, Stationarity test, co-integration Bound test, Heteroskedasticity test, Arch test, Q-statistic Test and granger casualty test. These were all employed in order to contain any sense of spurious estimates to ensure an efficient and a reliable result.

However, from the findings, exchange rate volatility has a negative impact on inflation given the negative estimates of the co-efficient, but given the (-0.01185) magnitude of impact we conclude that exchange rate has a very poor effect on inflation rate in Nigeria, it was also revealed from the estimates that, Interest rate and Broad money supply have negative effect on inflation rate in Nigeria, while GDP has a

positive effect on inflationary rate in Nigeria. In the same vein the co-integration test shows that, there's a long run relationship between inflation and exchange rate volatility in Nigeria and finally the granger casualty test shows a unidirectional casualty between the two variables inflation and exchange rate volatility, it shows that inflation causes exchange rate and not otherwise.

### **Policy Recommendations**

Based on the findings of this research work, the researchers recommend that:

1. The government should take a bold step to ensure exchange rate stability so that investors can have confidence in our financial system.
2. The government as a matter of urgency should diversify the economy in order to boost productivity revives every sector of the economy that is left idle so that normalcy and price stability can be achieved.
3. Interest rate should also be given attention given the enormous impact it has on inflationary trend in Nigeria, the rate should be reduced to motivate potential investors and entrepreneurs to boost productivity and stabilize the general price level.
4. The government should reconcile and harmonize our multiple exchange rate system and stop the manipulation of our exchange rate system by influential people and politicians to build trust and in our financial system, so that proper economic activities, projecting, planning and budgeting can be made viable and reliable.
5. Nigerians should patronize home made goods to boost our local productivity, so that our currency can add value and regain its purchasing power both locally and internationally.



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