Modeling Exchange Rate Volatility and Economic Growth in Nigeria

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Abstract: The study investigated exchange rate volatility in Nigeria and its effect on economic growth. The date employed in this study comprised of Exchange Rate, Gross Domestic Product, Government Expenditure, External Reserve, and Foreign Direct Investment which was generated from the Central Bank of Nigeria Statistical Bulletin covering the period of 1981-2015. The study employed GARCH (1,1) model in estimating the volatility of exchange rate in Nigeria and found persistence volatility in naira exchange rate with that of US Dollars. The study also employed the Generalized Method of Moments (GMM) in estimating the impact of volatility and economic growth in Nigeria and the result showed that volatility and FDI has negative and significant impact on the growth of the Nigerian economy. Government Expenditure and External Reserve has positive and significant impact on the growth of the Nigerian economy for the period under study. The study recommended that government and monetary authorities should design policies that will stabilize the persistence volatility in naira exchange rate as well as implement laudable economic policies that will help stimulate the domestic economy. The need to stimulate the interest of Nigerians in patronizing domestic products and services as against the current preference for imported products is hereby emphasized.

Keywords: Exchange Rate Volatility, Generalized Method of Moments, Generalized Autoregressive Condition Heteroskedasticity, External Reserve, FDI and Government Expenditure.

1. Introduction

Following the balance of payment deficit experienced by America in 1971 and 1973 respectively resulting to the devaluation of dollar, the collapse of Bretton Woods system, a shift from fixed exchange rate to floating exchange rate system, and later to other forms of managed exchange rate system surfaced. Since then, there has been serious argument by scholars on the impact of exchange rate volatility on trade (Anyanwaokoro, 1999). The choice of exchange rate regime can affect economic growth through its effects on macroeconomic economic variables which are important determinants of growth. Factors such as export, international trade, capital flows are highly affected by the variation of exchange rate. As postulated by balance of payment theory, the exchange rate of the currency of a country depends on its balance of payment position. This is because the demand and supply of foreign exchange is from the debit and credit items in the balance of payments respectively representing what comes into the country (imports) and what goes out(export) of a country. If the demand of foreign exchange is higher than its supply, the price of foreign currency will go up and if the demand of foreign exchange is lesser than its supply, the price of foreign exchange will decline. That is to say, adverse balance of payments leads to exchange rate fluctuation while the favorable balance of payment arising from increase in export over import restores equilibrium rate of exchange (Kanamori and Zhao, 2006).

The exchange rate of a country’s currency is the value of its money for international trade in goods, services and finance and, therefore, very important in determining the financial competitiveness and economic balance of a country among the major currencies of the world. Virtually, all countries of the world have witnessed currency volatility which can arise from market forces or from the Central Bank in various forms sequel to the adoption of various exchange rate regimes like; floating, dirty float, managed, dirty managed, pegged, and fixed, all of which depends on the monetary authorities and the economic goals. Central Bank being the monetary authorities has been given autonomous powers under the relevant
Statutes to decide appropriate foreign exchange rate regime along with its monetary, financial, and economic development policies. The success or failure of a particular exchange rate policy relied on solely depend on the on the direction of the misalignment of the currency. While a persistent exchange rate overvaluation leads to loss in efficiency, higher inflation, and lower GDP growth, exchange rate undervaluation is not helpful to growth (Bhalla, 2008).

Stancik (2007) opined that one of the reasons for establishing the Economic and Monetary Union (EMU) was to promote exchange rate stability among member countries and to encourage trade inside the European Union (EU). Exchange-rate stability is not only a reason for joining the Economic Monetary Union (EMU) but also a fundamental ingredient of stable economic development. Literature shows that the key factors contributing to higher degrees of exchange rate volatility is flexible regimes among other factors. While floating exchange rate exerts higher degree of volatility, fixed exchange rates does not pose a better condition for growth. For instance, Ethiopia maintains a number of foreign exchange restrictions on payments and transfers that are not consistent with international standards, as determined by the International Monetary Fund and exchange control regime.

Ethiopia birr is not freely convertible because the exchange rates are set by the government. Ethiopia also limits foreign currency inflows and outflows and the amounts that local and foreign individuals and corporations can hold. The outcome of these limitations is foreign exchange rate appreciation, leading to a widening of the current account deficit, suppresses domestic production as the strength of the birr allows for the cheap import of substitute goods, reduces real income, reducing domestic production incentives. The policy of Ethiopian government artificially inflates the value of the birr and hinders investment, economic growth, and development.

Not with standing, exchange rates variations could have both positive and adverse impacts in the short-run and long run of economic activities and living standard of the public depending on the prevailing economic conditions and preference basically because of the international trade and finance involving exchange of currencies of trading partners. As a result, the Central Bank tends to adopt from time to time certain policies to strengthen domestic currency. Nigeria for instance, has experience exchange rate variation over the decade. Since independence in 1960, direct control of exchange rate policy has been used to manage Nigeria’s foreign exchange until 1986 when the country changed from fixed exchange rate to a flexible exchange rate system. Since then, exchange rate was allowed to float and its value determined by market forces of demand and supply.

In 1986, dual exchange rate system; 1st and 2nd Tier (SFEM) was adopted in 1986, but transformed into the Foreign Exchange Market (FEM) in 1987. In 1994 reform, naira exchange rate was pegged again. In 1995 the Foreign Exchange Market was liberalized with the consequent introduction of an Autonomouus Foreign Exchange Market (AFEM) for the sale of foreign exchange to end-users by the monetary authority through selected authorized dealers at market determined exchange rate. In 1999, the Inter-bank Foreign Exchange Market (IFEM) was introduced. The retail Dutch Applied System was introduced which allows end users to bid through authorized dealers who acted as intermediaries in the bidding process. The Dutch Auction System (DAS) was again introduced in 2002 as a result of the intensification of the demand pressure in the foreign exchange market and the persistence incessant depletion of the country’s external reverses. In 2006, the wholesale DAS was introduced at a permitted margin (CBN, 2013).

Between 2015 and 2016 the domestic economy witness an adverse volatility in exchange rate against the US Dollars immediately the All Progressive Congress (APC) government came in to power. These however is partly attributable to the impression created by President Mohammadu Buhari who within the first two years of his assumption of office traveled to more than 8 countries, making speeches that suggests to the international community that Nigerians are systematically corrupt people. This negative impression spurred international investors to divest from Nigerian economy leading to hug withdrawal of foreign currencies from the economy creating a short fall in the demand and supply of foreign currencies in relation to Nigerian naira. The increasing cost of doing business in Nigeria, preference of foreign goods to domestic goods by Nigerians, fall in the international oil price as well as the insecurity in Niger Delta which resulted to significant reduction in crude oil output made it difficult to attract sufficient foreign currencies to meet with the ever increasing demand for foreign currency especially US Dollars. The increasing demand for US Dollars and the devaluation of Nigerian Naira resulted to a total collapse in the value of Naira against US Dollars from N180 per $1 to about N500 per $1. These created untold hardship to Nigerian population as inflation rate enters high double digits, crashing the purchasing power of Naira.

This however necessitated the need for this study to investigate the volatility of exchange rate in Nigeria and its impact on economic growth. The study is structured into five sections, following the this
Introduction is section two which looks at review of related literature, section three looks at the research methodology, section four considered data analysis and interpretation while section five presented the conclusion and policy recommendation.

2. Literature Review

Empirical evidence on the impact of exchange rate volatility on growth is mixed; several studies have found significant adverse effects on growth. Other studies have found that exchange rate volatility have positively affected growth, at least in some developing countries depending on economic priority. Some other researchers empirically studied exchange rate volatility on export with mixed results. For instance, Munyama and Todani (2005) have reported a positive relationship between exchange rate volatility and export performance, Kasman and Kasman (2005) found positive effects of exchange rate volatility on trade whereas, studies by Esquivel and Felipe (2002) and Doganlar (2002) have found a negative relationship between exchange rate volatility and exports. This study focuses on the impact of exchange rate volatility on growth with autoregressive conditional heteroscedasticity (ARCH) and generalized ARCH (GARCH) models of exchange rate volatility.

Hammoudeh and Li (2008) found that incorporating exchange rate regime shifts leads to reduction in the estimated volatility persistence. Engle F. R. and Rangel (2008) applied the spline–GARCH model in modeling volatility structural breaks and long memory models. Baille and Morana (2009) used the adaptive FIGARCH model also in modeling volatility structural breaks and long memory models. Many empirical works have used ARCH and GARCH model in different studies. Holland et al. (2011) also assessed the role of real effective exchange rate volatility on long-run economic growth for a set of 82 advanced and emerging economies using a panel data set ranging from 1970 to 2009. The results for the two-step system GMM panel growth models show that a more volatile RER has significant negative impact on economic growth and the results are robust for different model specifications.

Bala and Asemota (2013) examined exchange rate volatility with GARCH models using monthly exchange rate return series for three currencies; from 1985:1 to 2011:7 for Naira/US dollar return and from 2004:1 to 2011:7 for Naira/British Pounds and Naira/Euro returns. The study compare estimates of variants of GARCH models with break in respect of the US dollar rates with exogenously determined break points. Results reveal presence of volatility in the three currencies and equally indicate that most of the asymmetric models rejected the existence of a leverage effect except for models with volatility break. Evaluating the models through standard information criteria, volatility persistence and the log likelihood statistic, showed that results improved with estimation of volatility models with breaks as against those of GARCH models without volatility breaks and that the introduction of volatility breaks reduces the level of persistence in most of the models.

Examining the ARCH effects and series residuals autocorrelation, results indicate that the euro, BPS and USD returns residuals show the presence of ARCH effects. The three currencies show substantial evidence of ARCH effects as further revealed by autocorrelations of the squared residuals. The first order autocorrelation for Euro is 0.937, and they gradually decline to 0.445 after 15 lags. These autocorrelations are not large and were found to be mostly positive. The values are all zeros, thus rejecting the ‘no ARCH’ hypothesis. Similar results were observed for the British Pound Sterling and US Dollar returns. ARCH/GARCH estimation results mean of variance equations further revealed that all coefficients of the ARCH models for USD, BPS and Euro returns are positive, including for the model with volatility breaks thereby satisfying the necessary and sufficient conditions for ARCH family models.

Pokhariyal et al. (2012) equally employed the Generalized Autoregressive Condition of Heteroscedasticity (GARCH) to examine the impact of real exchange rate volatility on economic growth in Kenya. They used the computation of the unconditional standard deviation of changes to measure volatility and Generalized Method Moments (GMM) to assess the impact of the real exchange rate volatility on economic growth with data spanning from 1993-2009. The study found that Real Exchange Rate (RER) was very volatility for the entire study period. Kenya’s RER generally exhibited a appreciating and volatility trend. The RER Volatility reflected a negative impact on economic growth of Kenya. Stancík (2007) employed simpler GARCH model on exchange rate volatility.

Aghion et al. (2009) showed empirical evidence on how flexible an exchange rate system should be if the objective is to maximize long-run productivity growth taking cognizance of a country’s level of financial development. Various measures of exchange rate flexibility, including the volatility of the real effective exchange rate and the exchange rate regime were considered from the most rigid to the most flexible (fix, peg, managed float and float) and comparing the residuals of a productivity growth on a set of variables with the residuals of an exchange rate flexibility regression on the same
variables an adjusted measures of volatility and flexibility that are purged from any collinearity with the standard growth determinants was obtained. They conducted a systematic panel data analysis using a data set for 83 countries over the years 1960-2000. A clear negative relationship between productivity growth and exchange rate flexibility for less financially developed countries was shown. It was revealed consistently that a high degree of exchange rate flexibility leads to lower growth in countries with relatively thin financial markets.

Vieira and MacDonald (2012) investigate the role of real exchange rate on long-run growth for a set of ninety countries using time series data from 1980 to 2004. An estimate panel data model (using fixed and random effects) and panel cointegration methods for the real exchange rate were employed. The variables used in real exchange rate models are: real per capita GDP; net foreign assets; terms of trade and government consumption. The results for the two-step System GMM panel growth models indicate that the coefficients for real exchange rate misalignment are positive for different model specification and samples, which means that a more depreciated (appreciated) real exchange rate helps (harms) long-run growth.

Schnabl (2007) investigates the impact of exchange rate stability on growth for a sample of 41 mostly small open economies at the EMU periphery. Panel estimations reveal a robust negative relationship between exchange rate volatility and growth for countries in the economic catch-up process with open capital accounts. It identifies international trade, international capital flows and macroeconomic stability as important transmission channels from exchange rate stability to more growth. It is argued that fixed exchange rates provide a more stable framework for the adjustment of asset and labour markets of countries in the economic catch-up process thereby accelerating growth.

Etim et al. (2009) examines the determinants of exchange rate instability (volatility of Real Exchange Rate) in a developing economy. The study used ordinary least square (OLS) technique in relation to time series data on exchange rate instability (VRER), current account balance (CABY), import (IMPY), External Reserves (EXTRESS), inflation and economic growth (GDP). Instability of exchange rate is measured by three years moving average of standard deviation of real exchange rate. The paper advocates that a realistic exchange rate capable of accelerating economic growth, reducing import and also stemming the tide of inflation are paramount in a developing economy and should be maintained.

Hau (2002) researched on the openness of an economy and its impact on real exchange rate movements using a small open economy model with a tradable and a non-tradable sector with a sample of 48 countries over a 19-year time period. The results revealed lower real exchange rate volatility for countries with greater openness of the economy. Real exchange rate volatility is measured as the standard deviation for the percentage changes of the effective real exchange rate over intervals of 36 months. The results confirm the impact of an economy’s openness on exchange rate volatility when openness explains almost half of exchange rate variations. He claims that trade integration and real exchange rate volatility is structurally linked and that there is a negative correlation between them.

Mukhtar and Malik (2010) investigated the the impact of exchange rate volatility on growth for three South Asian countries, India, Pakistan and Sri Lanka Using cointegration and vector error correction model (VECM) techniques for the period 1960 to 2007. Findings indicated the presence of a unique cointegrating vector linking real exports, relative export prices, foreign economic activity and real exchange rate volatility in the long run. Real exchange rate volatility exerts significant negative effects on exports both in the short run and the long run. Results also reveal that improvements in the terms of trade (represented by declines in the real exchange rate) and real foreign income exert positive effects on export activity.

Tang (2013) examines the impact of intra-Asia exchange rate volatility on intra-Asia trade in primary goods, intermediate goods, equipment goods and consumption goods from 1980 to 2009. The evidence shows that as intraregional exchange rate volatility increases, intraregional exports in these goods fall for Asian while the impact is more pronounced in the sub region of Association of Southeast Asian Nations (ASEAN) and other ASEAN member countries. Again, the impact magnifies in an even smaller subgroup excluding the smaller ASEAN economies. For South Asia, exchange rate volatility appears to have a positive impact on exports. The results according to Him underline the significant impact of exchange rate volatility on the region’s production networks.

Poon et al. (2005) examines the relationship between exchange rate volatility and exports of the five selected East Asian economies. A measure of the quantitative proxy of the exchange rate risk is constructed, focusing on the role of moving-average in smoothing the persistence of the risk measure. Vector autoregressive (VAR) model, error correction modelling (ECM), and variance decomposition (VD) are applied to characterize the joint dynamics of variables in both the short and long run. The Johansen results indicate a stable long-run relation between exports and exchange rate. Results further
show that a great fluctuation of exchange rate volatility has significantly impacted the volume of exports for the economies concerned. The forecast error VD shows that the innovations of exchange rate volatility have minor impact on export patterns in the study.

A study by Dhakal et al. (2010) on the effect of exchange rate uncertainty on foreign direct investment in some countries that have continued to attract considerable foreign direct investment (FDI) inflows while also experiencing a great deal of volatility in exchange rates revealed that exchange rate volatility has a favorable effect on foreign direct investment.

3. Methodology

The objective of this study is to determine the volatility of exchange rate in Nigeria as well as to establish the effect of this volatility on the economic growth of Nigeria for the period of 1986 to 2016. The study employed Generalised Autoregressive Conditional Heteroscedasticity (GARCH) Models developed by Bollerslev (1986), in determining the volatility of naira exchange rate for the period under study. The choice of the model is based on the fact that the GARCH model is very robust in modelling the volatility in financial data characterized by volatility clustering and heteroscedasticity. Musyoki et al. (2012) noted that GARCH (1, 1) is the most widely used specification in Autoregressive Conditional Heteroscedasticity (ARCH) family. On the other hand, to establish the effect of exchange rate volatility on the economic growth in Nigeria the study adopted Generalized Method of Moment (GMM).

3.1. Generalised Autoregressive Conditional Heteroscedasticity (GARCH) Models

The GARCH model is an extension of the ARCH model developed by Engle R. F. (1982) which considers the variance of the current error term to be a function of the variances of the previous time period’s error terms. The GARCH process employed in this study was designed to capture the naira exchange rate volatility for the period under review. This involves elucidating the naira exchange rate volatility by postulating a structural relationship between volatility and its determinants.

Meanwhile since it is believed that GARCH model is most appropriate in evaluating volatility clustering, the GARCH model is specified as follows:

\[
\delta_t^2 = \alpha_0 + \beta_1 \delta_{t-1}^2 + \beta_2 \delta_{t-2}^2 + \cdots + \beta_k \delta_{t-k}^2 + \alpha_1 \delta_{t-1}^2 + \alpha_2 \delta_{t-2}^2 + \cdots + \alpha_m \delta_{t-m}^2 \quad \ldots \ldots \quad (1)
\]

where \(\delta_{t-1}^2\) for \(j=1, 2... k\) is the GARCH term representing the last period’s forecast variance.

GARCH models are usually estimated using the method of maximum likelihood estimation (MLE) therefore, the GARCH (1,1) is hereunder stated as follows:

\[
\delta_t^2 = \alpha_0 + \beta_1 \delta_{t-1}^2 + \alpha_1 \varepsilon_{t-1}^2 \quad \ldots \ldots \quad \ldots \ldots \quad \ldots \ldots \quad \ldots \ldots \quad (2)
\]

Where \(\alpha_0\) is the Mean, \(\delta_{t-1}^2\) is the GARCH term and \(\varepsilon_{t-1}^2\) is the ARCH term.

The magnitude of the estimated parameters \(\alpha_1\) and \(\beta_1\) determines the short-run dynamics of the resulting volatility process in the GARCH (1,1) model. And so, if the ARCH error coefficient assumes a larger value, it suggests that volatility react significantly to market movements. On the other volatility is said to be persistent if the coefficient of the GARCH term is large. Similarly, if the coefficient of the ARCH term is higher than that of the GARCH term, it is an indication that the volatility tends to be more extreme.

Bollerslev (1986) identified the necessary and sufficient condition that must hold for the weak stationarity of the GARCH model as:

\[
\sum_{i=1}^{p} \alpha_i + \sum_{j=1}^{q} \beta_j < 1
\]

However, strict stationarity of the GARCH (1, 1) model requires that

\[
E \left( \log(\alpha_1 \varepsilon_{t-1}^2 + \beta_1) \right) < 0
\]
This however permits for $\alpha_1 + \beta_1$ to be equivalent to or somewhat above 1 Nelson (1990). Stationarity of the GARCH model ensures that the behaviour and properties of the estimators do not change over time and that the persistence of shocks is not infinite. The GARCH (1, 1) model is estimated by maximum likelihood estimation (MLE) specifying the density of the error term as a generalized error distribution (GED), Nelson (1990). The GARCH effects in the models are examined using correlograms of the squares of the exchange rate returns. Autocorrelations larger than the critical values give evidence of presence of GARCH effects. The data employed for the volatility test is monthly exchange rate between US Dollars and Nigeria Naira for the period of 1986 to 2016 generated from Central Bank of Nigeria (CBN) statistical Bulletin.

### 3.2. Generalized Method of Moment

This study employed generalized method of moment in establishing the impact of volatility of naira exchange rate on the growth of the Nigerian economy for the period under investigation. Before employing the model, the properties of time series was conducted using both Augmented Dickey Fuller test (ADF) and the Philips-Perron test (PP) to determine the stationarity of the variable. In other words the stationarity tests provided evidence of the order of integration of the variables included in the model, establishing whether the variable is integrated of order zero I(0) or order one I(1). The result of the GMM model and that of the ADF and PP test of stationarity are presented in the appendix 1.

### 4. Analysis and Interpretation of Results

The data employed in this analysis which was sourced from Central Bank of Nigeria statistical Bulletin includes; Real Exchange Rate (RER), Foreign Direct Investment (FDI), Government Expenditure (GOVE), and Gross Domestic Product (GDP). In order to determine volatility, GARCH model was used on quarterly RER to generate the Volatility of exchange rate series (VOLEX), and the average of the quarterly GARCH series was selected as the volatility variable (VOLEX). The analysis began with the test for stationarity of the variables included in the model. The order of integration in the variables was determine using ADF and PP test as presented in the table 1 below.

#### 4.1. Result of Stationarity Test

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF PROB</th>
<th>REMK</th>
<th>ADF PROB</th>
<th>REMK</th>
<th>PP PROB</th>
<th>REMK</th>
<th>PP PROB</th>
<th>REMK</th>
</tr>
</thead>
<tbody>
<tr>
<td>EX_RES</td>
<td>-0.025</td>
<td>0.949</td>
<td>-4.62</td>
<td>0.000</td>
<td>I(1)</td>
<td>-0.51</td>
<td>0.876</td>
<td>I(1)</td>
</tr>
<tr>
<td>FDI</td>
<td>-1.109</td>
<td>0.701</td>
<td>-7.23</td>
<td>0.000</td>
<td>I(1)</td>
<td>-1.18</td>
<td>0.670</td>
<td>I(1)</td>
</tr>
<tr>
<td>LGDP</td>
<td>-0.398</td>
<td>0.898</td>
<td>-3.08</td>
<td>0.038</td>
<td>I(1)</td>
<td>-0.38</td>
<td>0.901</td>
<td>I(1)</td>
</tr>
<tr>
<td>GOVE</td>
<td>-0.167</td>
<td>0.997</td>
<td>-4.44</td>
<td>0.007</td>
<td>I(1)</td>
<td>-0.82</td>
<td>0.954</td>
<td>I(1)</td>
</tr>
<tr>
<td>VOLEX</td>
<td>-2.657</td>
<td>0.092</td>
<td>-5.47</td>
<td>0.001</td>
<td>I(1)</td>
<td>-2.26</td>
<td>0.191</td>
<td>I(1)</td>
</tr>
</tbody>
</table>

Source: Authors Eview Result (*UR = Unit Root)

The result of the ADF test indicates that all the variables are unit root at level but after the first differencing the variables became integrated of the same order one I(1). This result is in consonance with that of the PP test which also reviles that all the variables are unit root at level but are stationary after the first differencing I(1).

#### 4.2. Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>GDP</th>
<th>EX_RES</th>
<th>FDI</th>
<th>GOVE</th>
<th>VOLEX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>20133.50</td>
<td>2007.620</td>
<td>326.5200</td>
<td>1421.473</td>
<td>21.88178</td>
</tr>
<tr>
<td>Median</td>
<td>4588.990</td>
<td>197.2000</td>
<td>110.5000</td>
<td>487.1100</td>
<td>12.92281</td>
</tr>
<tr>
<td>Maximum</td>
<td>94144.96</td>
<td>6903.300</td>
<td>1360.300</td>
<td>5185.320</td>
<td>117.1796</td>
</tr>
<tr>
<td>Minimum</td>
<td>144.8300</td>
<td>0.200000</td>
<td>0.300000</td>
<td>9.640000</td>
<td>0.150000</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>28608.18</td>
<td>2625.366</td>
<td>422.5545</td>
<td>1768.144</td>
<td>25.52436</td>
</tr>
<tr>
<td>Skewness</td>
<td>1.398183</td>
<td>0.830374</td>
<td>1.093155</td>
<td>1.047195</td>
<td>2.242423</td>
</tr>
</tbody>
</table>

Table 2.
The result of the descriptive statistics as shown in tables 4.2 indicates that the mean of GDP for the period under study is 20133.50 while the mean value of EX_RES is 2007.620. It also indicates that the mean values of FDI GOVEX and VOLEXR for the period under study are 326.52, 1421.473 and 21.88178 respectively. The maximum and minimum values of GDP for the period under consideration are 94144.96 and 144.83 respectively. EX_RES for the period under study also has a maximum value of 6903.3 and a minimum value of 0.200. Similarly the maximum and minimum values of FDI are 1360.30 and 0.300 respectively. GOVEX also has a maximum value of 5185.32 and a minimum value of 9.640. The maximum and minimum values of VOLEXR for the period under considerations are 117.1796 and 0.150 respectively. The result of Skewness shows that all the variables in the model are positively skewed. The result also showed that all the variables have a value greater than one for Kurtosis. On the other hand, the result of the descriptive statistics indicates that GDP has the highest variability among other variables given the value of standard deviation of 28608.18 which is larger than the standard deviation of the rest variables included in the model. The result of the Jarque-Bera test indicates that all the variables included in the model are normally distributed.

4.3. The Result of Arch Effect

The result of the test for ARCH effect indicates that there is ARCH effect in the variable. This was made clear from the result of ARCH LM test as well as the result of the Autocorrelation (AC), Partial Autocorrelation (PAC) and Q-stat as presented in table 3 and 4. The ARCH LM test result showed the rejection of the null hypothesis of no ARCH effect with a probability Chi-Square value greater than 0.05. On the other hand the result of AC, PAC and Q-stat showed that the probability values are all zeros indicating the rejection of “no ARCH” hypothesis.

<table>
<thead>
<tr>
<th>Kurtosis</th>
<th>3.630695</th>
<th>1.911896</th>
<th>2.812098</th>
<th>2.560264</th>
<th>7.940048</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jarque-Bera</td>
<td>11.98377</td>
<td>5.748824</td>
<td>7.02254</td>
<td>6.678928</td>
<td>64.92197</td>
</tr>
<tr>
<td>Probability</td>
<td>0.002499</td>
<td>0.056449</td>
<td>0.029863</td>
<td>0.035456</td>
<td>0.000000</td>
</tr>
<tr>
<td>Observations</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
</tbody>
</table>

**Table 3. ARCH LM Test**

<table>
<thead>
<tr>
<th>F-statistic</th>
<th>1.382413</th>
<th>Prob. F(1,137)</th>
<th>0.2417</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obs*R-squared</td>
<td>1.388582</td>
<td>Prob. Chi-Square(1)</td>
<td>0.2386</td>
</tr>
</tbody>
</table>

**Table 4. Correlogram Q-statistics**

<table>
<thead>
<tr>
<th></th>
<th>AC</th>
<th>PAC</th>
<th>Q-Stat</th>
<th>Prob*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.896</td>
<td>0.896</td>
<td>114.73</td>
<td>0.000</td>
</tr>
<tr>
<td>2</td>
<td>0.859</td>
<td>0.287</td>
<td>221.00</td>
<td>0.000</td>
</tr>
<tr>
<td>3</td>
<td>0.837</td>
<td>0.175</td>
<td>322.73</td>
<td>0.000</td>
</tr>
<tr>
<td>4</td>
<td>0.819</td>
<td>0.108</td>
<td>420.74</td>
<td>0.000</td>
</tr>
<tr>
<td>5</td>
<td>0.787</td>
<td>-0.014</td>
<td>512.00</td>
<td>0.000</td>
</tr>
<tr>
<td>6</td>
<td>0.763</td>
<td>0.010</td>
<td>598.28</td>
<td>0.000</td>
</tr>
<tr>
<td>7</td>
<td>0.732</td>
<td>-0.041</td>
<td>678.32</td>
<td>0.000</td>
</tr>
<tr>
<td>8</td>
<td>0.711</td>
<td>0.018</td>
<td>754.39</td>
<td>0.000</td>
</tr>
<tr>
<td>9</td>
<td>0.680</td>
<td>-0.037</td>
<td>824.66</td>
<td>0.000</td>
</tr>
<tr>
<td>10</td>
<td>0.639</td>
<td>-0.099</td>
<td>887.20</td>
<td>0.000</td>
</tr>
<tr>
<td>11</td>
<td>0.611</td>
<td>-0.015</td>
<td>944.64</td>
<td>0.000</td>
</tr>
<tr>
<td>12</td>
<td>0.590</td>
<td>0.029</td>
<td>998.76</td>
<td>0.000</td>
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<tr>
<td>13</td>
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<td>-0.005</td>
<td>1048.4</td>
<td>0.000</td>
</tr>
<tr>
<td>14</td>
<td>0.530</td>
<td>-0.036</td>
<td>1092.7</td>
<td>0.000</td>
</tr>
<tr>
<td>15</td>
<td>0.500</td>
<td>-0.025</td>
<td>1132.4</td>
<td>0.000</td>
</tr>
</tbody>
</table>

**Source:** Authors Eviews Result.
4.4. The Result of the Volatility Model

The result of the GARCH (1,1) test as shown in table 5 indicates that there is a high persistent of shock in the volatility of the variable at 5 percent level of significant. The coefficients of ARCH and GARCH term are positive while their sum was slightly above 1. The coefficient of ARCH term is higher than that of the GARCH term indicating that volatility in the exchange rate for the period under consideration tends to be more extreme. The implication of the positive and significant values of the coefficient of ARCH and GARCH term is that previous months exchange information (ARCH) can influence the present month’s naira exchange rate volatility with respect to the US Dollars. On the other hand the significant GARCH term also means that the previous month’s exchange rate volatility can influence the present month volatility.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>z-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>7.526497</td>
<td>0.451149</td>
<td>16.68295</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Table 5. GARCH Equation

4.5. Result of the Growth Model

The result of the Generalized Method of Moments (GMM) indicates that EX_RES and GOVEX have positive and significant impact on the growth of the Nigerian economy proxied by GDP. Similarly the result of the FDI and VOLEXR has negative and significant impact on the growth of the Nigerian Economy proxied by GDP. This however implies that exchange rate volatility exerts negative impact on the growth of the Nigerian economy for the period under consideration. In other word a unit increase in the volatility of naira exchange rate in favour of US Dollars leads to 21.04 decreases in Nigerian GDP. Similarly the result indicates that FDI an increase in FDI leads to a decrease in GDP. On the other hand the result EX_RES and GOVEX are statistically significant at 5% level of significant which reviles that an increase in the variables leads to 0.943 and 20.635 increase in GDP respectively for the period under consideration. The result of the R-square is 0.97 (97%) indicating that the model is properly fitted. The Durbin-Watson stat is approximately 2 which indicate the absence of autocorrelation in the GMM model.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EX_RES</td>
<td>0.943044</td>
<td>0.330312</td>
<td>2.855013</td>
<td>0.0076</td>
</tr>
<tr>
<td>FDI</td>
<td>-29.24327</td>
<td>6.039630</td>
<td>-4.841897</td>
<td>0.0000</td>
</tr>
<tr>
<td>GOVEX</td>
<td>20.63488</td>
<td>1.821347</td>
<td>11.32947</td>
<td>0.0000</td>
</tr>
<tr>
<td>VOLEXR</td>
<td>-21.03837</td>
<td>10.53610</td>
<td>-1.996789</td>
<td>0.0547</td>
</tr>
</tbody>
</table>

Table 6. GMM Result

5. Conclusion and Policy Recommendations

The result of the unit root test indicates that all the variables are integrated of order one I(1). The test for volatility conducted using GARCH model showed that there is persistent volatility in the Naira exchange rate with that of the US Dollars for the period under consideration. This result is in consonance with the findings of Bala and Asemota (2013), Musyoki et al. (2012), and Otieno (2014).

The result of the GMM indicates a negative and significant relationship between exchange rate volatility and economic growth in Nigeria proxied by GDP. FDI was also found to have negative and significant impact on growth. The result of the GMM model also reviles that external reserve and government expenditure has positive and significant impact on the growth of the Nigerian economy for the period under consideration. This however implies that an increase in the external reserve and government expenditure will lead to an increase in the growth of the Nigerian economy. This result corroborated the findings of Musyoki et al. (2012), Doukas et al. (2003), Kiyota and Urata (2004), and
Bala and Asemota (2013) who also found persistence volatility in exchange rate with negative and significant impact on economic growth. The study therefor recommended that the government and monetary authorities should design policies and program that will enhance the stability of naira in relation to other currencies especially that of US Dollars. Similarly effort should be made to implement most of the government laudable program like economic diversification away from oil so as to stimulate the domestic economy of Nigeria. The National Orientation Agency (NOA) should do more in creating positive mental attitude of Nigerians as it concerns patronizing domestic product and over dependency in foreign goods.

References


