Assessing Exchange Rate Volatility and Economic Growth in Nigeria: A Garch Model Approach

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Abstract: **This study has examined the impact of exchange rate volatility on economic growth in Nigeria from the year 1981 to the year 2020. The study adopted secondary data (i.e. time series) obtained from World Bank National Account data and Central Bank of Nigeria Annual Statistical Bulletins, subjecting them to statistical analysis for relevant inferences to be made. Five variables were used in the study which were Growth rate of Gross Domestic Product (GRGDP), Exchange Rate Volatility (EXRV), Balance of Trade (BOT), Oil Price (OILP) and Inflation (INF) Rate. The variables were subjected to unit root test and they were stationary at different order of I(0) and I(1). Since the Variables were not all stationary at level but a mixed series, the ARDL bound test of cointegration was used to test for cointegration among them. Using the bound test, the variables were found to be cointegrated at 1% level of significance. The ARDL result indicated that; Exchange rate volatility has a significant impact on economic growth, with the impact being negative. In addition, other economic variables such as inflation has a negative and significant impact on economic growth while oil price have a positive and significant impact on economic growth. On the other hand, BOT has a positive effect on growth but the impact was significant at the 10 percent level. From the findings the study recommended that foreign exchange market should be well monitored with a view to ensuring that only ventures that would engender value added production in the real sector and export-oriented businesses should have more access. This will help to increase the value of the naira against major world currencies.**

I. INTRODUCTION

The exchange rate of the Nigerian Naira to the United States Dollar in recent years has experience huge fluctuation and the attendant effect has been enormous in the economy. Also, amidst the variation in exchange rate the real GDP which is a good proxy for economic growth has shrink in recent time causing the nation to experience two recessions within a short interval of 2017 and 2020.

The effects of exchange rate volatility on growth, is seen as a comprehensive measure of the benefits and costs of exchange rate stabilization that can be x-rayed through international trade (imports/exports), foreign direct investment, credit flow, and asymmetric shock, some of the most important transmission channels from exchange rate volatility on growth (Gadanecz and Mehrotra, 2015). Previous research on the impact of exchange rate stability on growth such as Ismaila (2018); Umaru, Niyi, and Osagie (2019) has tended to find weak evidence in favour of a positive impact of exchange rate stability on growth.

Ufoeze, Okuma, Nwakoby and Alajekwu (2018) observed that volatility of exchange rates influences uncertainty in international transactions both in goods and in financial assets. Exchange rates are modeled as forward-looking relative asset prices that reflect unanticipated change in relative demand and supply of domestic and foreign currencies, so exchange rate volatility reflects agents' expectations of changes in determinants of money supplies, interest rates and incomes.

Sequel to the adoption of Structural Adjustment Programme (SAP) in 1986 by Nigeria, the programme considered exchange rate devaluation as the main instrument in resolving the country's economic problems (Okorontah and Odoemena, 2016**)**. As noted by Ubah (2016) the repeated and sustained devaluation of the exchange rate has not transformed the Nigeria's economy, because the devaluation wrongly assumed the structure of the economy was similar to that of the developed economies.

As many developing countries have or are considering implementing changes in their development strategies, now is an opportune time to investigate the issue of whether alteration, in exchange rate arrangement have an effect on economic growth or to what extent would exchange rate volatility be responsible for variation in the rate of economic production. Because such moves are accompanied by increase in the volatility of both, nominal and real exchange rates (Virandra, 2013, Morina et. al, 2020).

Exchange rate volatility has become a macroeconomic variable of serious concern in the management of the Nigerian economy and other countries of the world. Government's inability to provide a lasting solution to this aroused a universal conviction that Exchange Rate Volatility is inevitable and created pessimism that government has no power to stabilize the trend to an end. To address this problem, economic policies, since the attainment of independence in Nigeria and after the adoption of SAP, have been concerned basically with measures aimed at achieving stable exchange rate.

As an open economy that transacts with the global economy, the volatility in exchange rate has serious effects on the nation's macroeconomic outlook. This is because upward and downward swings in exchange rate influences macroeconomic variables directly or indirectly which are of immense importance to a nation's development.

Nevertheless, despite Nigeria exchange rate reforms and the theoretical assumption that it contributes to developmental

efforts of a country, her economy has been characterized by low manufacturing capacity utilization, high level of inflation, heavy debt burden, low savings, low Investment, high interest rate, high unemployment rate, high level of income inequality, poverty to mention but a few (Ojo and Alege, 2018). For instance, within the last three decades, exchange rate has fluctuated widely and the level of volatility affects investment potentials (Ehigiamusoe and Lean, 2019).

The fact that exchange rate has effect on other macroeconomic variables such as Economic growth calls for serious concern. This is because it affects the purchasing power of the local currency due to a rise in the rate of inflation which has attendant effect on domestic Investment, level of employment, government expenditure, Balance of payment and by implication economic growth (Okorontah and Odoemena, 2016**)**. This chain of transmission of the effects of exchange rate on economic growth necessitates an in-depth study on the analysis of the impact of exchange rate volatility on economic growth. In the light of this, the study will make conscious effort to examine the short-run and long-run impact of exchange rate volatility on economic growth in Nigeria.

II. LITERATURE REVIEW

2.1 Theoretical Review

This paper will deal on well known theories of exchange rate, the two considered are: The Traditional Flow Model and the purchasing power parity (PPP) theory.

i. The Traditional Flow Model

The traditional flow model is also known as the balance of payment model. The balance of payment model is a theory used to understand how exchange rates are created. In this model, the variations in supply and demand affect the value of foreign currency. The exchange rate adjusts to match the demand on domestic goods with the demand on foreign goods. The theoretical framework is based on two major factors: domestic income and interest rates (Virendra, 2013).

A country with a trade deficit experience decreased foreign reserves, which results in a lower currency value. This makes goods, services, and products less expensive and likely stimulates exports, reduces imports because the foreign goods have become more expensive.

Analysis predicts that a trade deficit should balance at equilibrium and result in more equalized currency rates when the country experiences a trade surplus. A decrease in prices of local goods and services might also induce imports from foreign countries due to lower costs.

This theory stipulates that with free exchange rates, the exchange rate of a country's currency is determined by its balance of payment. A country with a favorable balance of payments will have an increase in the exchange rate, while a country with an unfavorable balance of payments will have a decrease in the exchange rate. This means that the traditional model can overshoot and not substitute between money and financial assets. Monetary approaches attempt to address these issues, but the limitations still persist (Fahrettin, 2013).

2.2 Exchange Rate Volatility Measures

Researchers often use the standard deviation of the moving average of the logarithm of the exchange rate when they measure for exchange rate fluctuations. In Mori et.al (2014) examined the use of a new measure for volatility and noted that there are still find evidence suggesting that a more volatile exchange rate has negative impact on exports.

There are two broad categories of exchange rate volatility. The first category measures the volatility of past, real-time prices; the second category considers future volatility and assumes historical volatility. The definition for exchange rate volatility is the degree in which currency price changes within a given period. It has been calculated by the standard deviation of annualized returns over a particular time period in financial markets (Darrat and Haj, 2002).

Higher volatility may mean the security is more risky, and thus makes an important variable in formulae for option pricing. It is expressed as a percentage coefficient within the option-pricing formulas, arising from daily trading activities. Sometimes, higher volatility may be linked to currency exchange rates and can be calculated as the annualized standard deviation of changes in the daily price.

The volatility of a currency is measured by the study of assessing volatility clustering. The research used the GARCH model and found it to be consistent with other studies, such Kashif et.al (2012) that examined exchange rate volatility.

2.3 Empirical Literature Review

Various empirical literatures on the relationship between exchange rates and macroeconomic performance have been carried out in developing and developed countries. Statistical information, econometrics techniques, and economic performance indicators aside from economic growth have been investigated. The linkage between exchange rate volatility and macroeconomic performance has received considerable attention in previous studies. Due to the varying outcomes of past research, this topic is still worthy of more investigation. Some studies found a negative relationship, some found a positive one, and some showed no significant relationship at all.

Mbuyi, et al., (2022) in their research on Exchange Rate Volatility and Economic Growth in the Democratic Republic of Congo (DRC) using the vector autoregression (VAR) model observed that economic growth is a function of its own innovations, the exchange rate and trade openness. They noted that a depreciation of the domestic currency against the foreign currency hampers economic growth. The finding suggested diversification of economy as it would boost resilience and improve the international competitiveness of the Congolese economy

Oniha (2021) researched on the effect of macroeconomic policy uncertainty on the exchange rate volatility in United

States. Using new measure of monetary policy uncertainty, and some macroeconomic variables, it was observed that higher monetary policy uncertainty surges the volatility in exchange rate. It also reveals that monetary policy uncertainty impacts on the volatility of the exchange rate. Hence, higher the monetary policy uncertainty rises volatility in the exchange rate and lower monetary policy uncertainty lowers volatility in the exchange rate

Kanu & Nwadiubu (2020) using data from 1996-2018, analyzed the impact of exchange rate volatilities on international trade in Nigeria. The finding revealed that there exists evidence of volatility of REER clustering on export and import in Nigeria. Thus, indicating a strong implications exist for growth in Nigeria, as a decrease in the growth of exports may lower the available foreign exchange earnings for use in financing developmental projects. On the other hand, a decrease in imports could affect domestic production and consumption.

Adenekan, Sanni & Itodo (2019) studied the effect of naira-to-dollar exchange rate volatility on naira exchange rate returns in Nigeria. They employed daily percentage exchange rate returns of the naira per US-Dollar, and ARCH(5)-TGARCH (1,1) was utilized in the analyzing. The results shows that exchange rate volatility leads to rise in depreciation. Moreso, there is the existence of asymmetry in the movement of volatility of exchange rate, as negative shocks which leads to depreciation, also leads to fall in volatility by a magnitude higher than the effect of positive shocks of similar size.

Ismaila (2018) examined the economic impacts of exchange rates on the macroeconomic performance. The study adopted the time series econometrics analysis using the error correction model. The study found that long-run factors are more important, but changes in exchange rates can increase inflation rates

Iyeli and Utting (2017) found that Nigeria's GDP is positively associated with oil revenue, exchange rate volatility and inflation. They used Johansen methods to assess the short and long-run relationship between these variables.

Ojo and Alege (2016) explored exchange rate fluctuations and macroeconomic performance in Sub-Saharan Africa (SSA). In their research, the authors employ a dynamic panel data framework to examine the relationships between some variables that are significant to this region. Their conclusion was that diversification of the economy would be an effective way of mitigating some of exchange rate fluctuation and that effective and efficient policies on exchange rate determinants can reduce fluctuations in exchange rate across SSA.

Attah-Obeng, Enu, Osei-Gyimah, & Opoku (2015) conducted a study on Ghana's inflation, GDP growth rate and exchange rate by graphing scatter diagram of the two variables. The study found that undervaluing the exchange rate (high exchange rate) stimulates economic growth in the short run while its depreciation positively impact inflation. However, to stimulate economic growth in the long run, policymakers should stabilize monetary and fiscal policies.

In another study, Ganesh, Moses & Musyoki (2014) examined the nexus between real exchange rate and economic growth in Kenya. The study adopted the Generalized Autoregressive Condition of Heteroscedasticity (GARCH) model and computed the unconditional standard deviation of the changes in exchange rate to measure volatility. This study found that exchange rate volatility has a negative relationship with economic growth and foreign direct investment. However, it also found that the volatility of the exchange rate may have some beneficial attributes like helping with balance of payments adjustments.

Mirchandani (2015) examined the Macroeconomic Determinants of Exchange Rate Volatility in India. The variables used were inflation rate, interest rates, and exchange rates. Different studies on this topic usually use parametric analysis which can be inaccurate because it is sensitive to the shape of distribution. With secondary data, Mirchandani found that exchange rates and inflation were highly correlated with India.

Examining the effect of exchange rate shocks, Berument et al. (2014) found that in Turkey there is no clear relationship between them and macroeconomic performance, but they concluded that macroeconomic performance depended on the sources of the exchange rate shocks

Tarawalie et al. (2014) found that despite being inflationary as a whole, exchange rate volatility has different effects on output growth in countries of the West African Monetary Zone. Specifically, it negatively impacts on output growth in Liberia and Sierra Leone, but positively affects output in other countries. The results seem to be predictable given the differences in their macroeconomic conditions. Generally, higher volatility promotes growth rates in developing countries, but does not affect productivity.

The findings of Gadanecz and Mehrotra (2015) show that real exchange rate volatility, or the variability in currencies, is not only correlated with output volatility in emerging economies, but that it can also help to reduce and limit capitalist output volatility. They claim that too much real exchange rate volatility creates output volatility also.

Holland et.al (2013) studied the impact of exchange rate volatility, or the change in one currency in relation to another, revealed that volatile exchanges prices do not influence macroeconomic variables. This is contrary to a second study which found that an especially less volatile real exchange rate has a positive effect on economic growth and vice versa.

Virendra (2013) examined the effect of currency volatility on macroeconomic performance of Small Island Developing States, it was found that exchange rate volatility impacts negatively on current account balance but positively on the growth rate of these economies.

Ubah (2017) found that in Nigeria, when the exchange rate is volatile, economic growth is negatively responsive in the short-run and there is a negative relationship between the two variables. Findings also recommended greater diversification of the economy with investment in key sectors to guard against this volatility.

Ogiri, Peter and Moon (2015) used the Autoregressive distributed lag (ARDL) to examine the impact of exchange rate on balance of payment in Nigeria. The study found a statistically significant relationship in the long-run and an insignificant one in the short-run. The Marshall-Lerner (ML) condition is also supported by data. Policies should discourage excessive importation and promote export programs with incentives, as well as diversifying Nigeria's economy and entrepreneurship.

Azeez, Kolapo and Ajayi (2014) also examined the effect of exchange rate volatility on macroeconomic performance in Nigeria from 1986 to 2010. The variables used were inflation rate, Exchange Rate (EXR), Balance of Payment (BOP) and Oil Revenue (OREV). The study employed OLS and Johansen cointegration estimation techniques. The result showed that an increase in the exchange rate impacts inflation negatively. The model also showed that, in the long run, an increase in the volatility of exchanges leads to an increase in inflation. It was recommended that monetary authorities should pursue policies that would curb inflation and ensure stability of currency exchange rates.

Similarly, Ngerebo and Ibe (2015) examined Exchange Rate and Macroeconomic Performance in Nigeria. The study used cointegration and granger causality. The study used cointegration and granger causality to show that the exchange rate had an impact on external reserve, BOP and inflation. This suggests that changes in the level of the exchange rate affect financial flows, and lead to changes in the national balance sheet.

Asinya and Nelson (2016) studied exchange rate depreciation and government policy in Nigeria: An empirical evidence The ECM model was adopted and the result showed that real exchange rate in Nigeria is based on other factors such as: capital flow, price level and nominal effective exchange rate. Recommendations for solving this problem are to put in place solutions to the Dutch Disease Syndrome policies and to stabilize inflation.

In a related study, Adeniran, Yusuf and Adeyemi (2016) examined the impact of exchange rate on Nigerian economic growth from 1986 to 2014. Using correlation and regression analysis and OLS method, they found that exchange rate is insignificant in affecting Nigerian economic growth and recommending that government should encourage export promotion strategies in order to maintain a surplus balance of trade and also a conducive environment, adequate security and effective fiscal policy.

In the study by Rasaq (2014), it was found that the exchange rate has a positive correlation with GDP and that Nigeria needs to improve its fiscal situation by increasing the items going out for exports, reducing dependence on oil and importation of non-essentials. Increased production would help create a more stable monetary base.

On the effect of exchange rate on the economic sector output, Ehinomen and Oladipo (2014) examined the impact of exchange rate management on the growth of the manufacturing sector in Nigeria. OLS multiple regression analysis was employed to analyse time series data which spanned between 1986 to 2010. The empirical result of this study showed that depreciation, which is part of SAP, did not have an effect on productivity for the manufacturing sector during examination period. It was observed that in Nigeria, exchange rates that are appreciated have more impact on domestic output and recommended that government should instead direct its exchange rate management policy towards an appreciation to reduce cost for manufacturing sector by reducing input costs. However, there should be importation ban for intermediate goods or other good that can be produced locally for consumers.

III. METHODOLOGY

3.1 Research Design

The research employed the analytical research design using the Autoregressive Conditional Heteroskedasticity (ARCH) and the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model to measure the exchange rate volatility. Multivariate time series analysis was carried out using the Auto-Regressive Distributed Lag (ARDL) Model. The ARDL to establish a long-run and short-run interaction between exchange rate volatility and economic growth. ARDL belongs to a category of multivariate time series model commonly used for data where the underlying variables have a long-run stochastic trend, also known as co- integration. It is a theoretically driven approach useful for estimating both short-term and long-term effect of one time series on another (Poon, 2003). Before specifying the time series regression, there was a need to test and extract the latent exchange rate volatility process. This was done with the use of GARCH model and the realized volatility test.

Time series data from 1981 to 2020 were adopted. The data were obtained from World Bank National Account data and CBN statistical bulletins. The stationarity test (unit root test) was carried out first using the Augmented Dickey Fuller (ADF) test on each variable to test for stationarity so as to avoid spurious regression as suggested by Phillips and Moon (1999). Depending on the stationarity test result, the cointegration test was conducted to determine if the variables have a long-run equilibrium relationship.

3.2 Model Specification

3.2.1 Measuring Exchange rate Volatility

The ARCH process imposes an autoregressive structure on the conditional variance that permits volatility shocks to persist over time. It can therefore allow for volatility clustering (Plante

and Thrum, 2014). The general form of the model, denoted by ARCH(q) begins with the Autoregressive Model;

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-1} + \alpha_3 Y_{t-1} + \cdots + \alpha_P Y_{t-P} + \epsilon_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i Y_{t-i} + \epsilon_t \quad (3.1)$$

Where Y_t is the dependent variable, $\alpha_i$are parameters to estimate and $\epsilon_t$the error term. The lags of the dependent variables can be stack together as X_t and the $\alpha_i's$ as φ which is rewritten as;

$$Y_t = X_t\varphi + \epsilon_t \quad (3.2)$$

Where the error term is assumed to be normally distributed with 0 mean and variance h_t also written as;

$$\epsilon_t \sim N(O, h_t) \quad (3.3)$$

The ARCH(q) model estimated with Maximum Likelihood Procedures is given as;

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \epsilon_{t-1}^2 + V_t \quad (3.4)$$

$$V_t \sim IIN(O, h_t) \quad (3.5)$$

To ensure the conditional variance is positive, an inequality restriction must be imposed on the variance equation :

$$\alpha_0 > 0 \; and \; \alpha_i \geq 0, \forall i$$

To ensure that the process is stationary, it is also required that:

$$\sum_{i=1}^{q} \alpha_i < 1 \quad (3.6)$$

GARCH (p,q) implies the following form of the conditional variance:

$$h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \epsilon_{t-1}^2 + \sum_{j=1}^{p} \beta_i h_{t-j} + V_{t_t} \quad (3.7)$$

Where $\alpha_0$is the constant term, $\epsilon_{t-1}^2$is the ARCH process, h_{t-j} is the GARCH term. To ensure the conditional variance is positive, an inequality restriction must be imposed on the variance equation in (3.8):

$$\alpha_0 > 0 \; and \; \alpha_i \geq 0, \beta_i \geq 0, \forall i,\text{j}$$

The null hypothesis is that, in the absence of ARCH/GARCH components, we have

$$H_0: \alpha_1 = 0 \quad ; \beta_1 = 0 \quad (3.8)$$

The alternative hypothesis is

$$H_1: \alpha_1 \neq 0 \quad ; \beta_1 \neq 0 \quad (3.9)$$

If estimated coefficients δ_1 is significant, them it shows the existence of the GARCH effect. We accepts the null hypothesis, if the probability falls outside the conventional levels of significance. That is, if p>0.05, it accepts the null hypothesis that there is no GARCH effect. Where the reverse is the case, it will reject the null hypothesis.

3.2.2 Multivariate Time Series Model

To accomplish the prime objective of this paper, a linear regression model was adapted from Umaru, Niyi and Osagie (2019). The model is presented as thus:

GRGDP=f (EXCHV, OILP, INFL, BOT)..... (3.l0)

The above was transmogrified into an econometric model, we then have:

GRGDP=b0 + b1EXCHV+ b2OILP + b3INFL + b4BOT+ Ut..... (3.11)

Theoretically, the signs of the coefficients above are expected to be :

b1 <0, b1>0, b2>0, b3>0, b4 >0.

Where: GRGDP = Growth Rate Gross Domestic Product; EXCHV = Exchange Rate Volatility; INFL = Inflation; OILP =Oil Price; BOT =Balance of Trade

b_0 represents the constant ; b1- b_4 represents the coefficients of the regressor variables;

Ut = Error term

Instructively, the ARDL representation of the model is specified below as;

$$\begin{aligned} \Delta GRGDP_t = \alpha_0 &+ \sum_{j=1}^{m} \alpha_{1j} \Delta GRGDP_{t-j} \\ &+ \sum_{j=1}^{m} \alpha_{2j} \Delta EXCHV_{t-j} \\ &+ \sum_{j=1}^{m} \alpha_{3j} \Delta OILP_{t-j} \\ &+ \sum_{j=1}^{m} \alpha_{4j} \Delta INFL_{t-j} + \sum_{j=1}^{m} \alpha_{5j} \Delta BOT_{t-j} \\ &+ \theta_1 GRGDP_{t-1} + \theta_2 EXCHV_{t-1} \\ &+ \theta_3 OILP_{t-1} + \theta_4 INFL_{t-1} + \theta_5 BOT_{t-1} \\ &+ U_t \end{aligned}$$

$\alpha_0 - \alpha_6$ are Coefficients to be estimated,

ε_t Is the Gaussian white noise that is independently and identically distributed random variable.

IV. DATA ANALYSES AND INTERPRETATION OF RESULTS

The data were analysed using Econometric views (E-views) and adopting various econometric techniques to determine the direction of interaction amongst the variables under consideration.

4.1 Descriptive Analysis

Table 4.1: Descriptive Analysis Result

	BOT	EXCH	GRGDP	INFL	OILP
Mean	1198962.	100.8726	3.076250	19.57510	42.73847
Median	213508.0	107.0243	3.700000	12.91100	28.66308
Maximum	6235242.	358.8108	15.33000	76.75887	111.6697
Minimum	-8168416.	0.610025	-13.13000	0.223606	12.71566
Std. Dev.	2627069.	100.7597	5.414674	17.84661	30.37704
Skewness	-0.561460	0.885317	-0.830321	1.724113	1.052129
Kurtosis	5.496606	2.987523	4.646308	5.063801	2.869730
Jarque-Bera	12.48998	5.225496	9.113438	26.91590	7.408120
Probability	0.001940	0.073333	0.010496	0.000001	0.024623
Sum	47958493	4034.904	123.0500	783.0039	1709.539
Sum Sq. Dev.	2.69E+14	395947.8	1143.429	12421.56	35987.83
Observations	40	40	40	40	40

Source: Author's Computation, 2022.

Table 4.1 shows the descriptive statistics of the variables Balance of Trade (BOT); Exchange Rate (EXCH); Growth Rate of Gross Domestic Product (GRGDP); Inflation Rate (INFL) and Oil Price (OILP). It can be shown that the variables contained 40 observations with BOT having the highest mean value followed by EXCH, OILP, INFL and GRGDP respectively. The table also revealed that, only BOT and GRGDP are negatively skewed to the left. EXCH and OILP are platykurtic as the value of their kurtosis are less than three, while BOT, GRGDP and INFL are mesokurtic in nature as the value of their kurtosis are greater than three.

4.3 ARCH/GARCH Analysis

In conducting inferential analysis, the study begins by testing and extracting exchange rate volatility using the Generalized Autoregressive conditionally heteroscedastic (GARCH) model. This is because of the use of many variables in the model. Different orders of GARCH model were estimated to obtain the best fit. Table 4.2 shows the summary of the various GARCH models estimated:

Table 4.2 Summary of Various GARCH models

Table 4.2.: GARCH Test						
Dependent variable: EXCH						
Model	(1)	(1)	(2)	(2)	(3)	(3)
	T-test	AIC	T-test	AIC	T-test	AIC
GARCH (1)	0.0000 ***	8.545476	0.8082	9.472125	0.9916	10.08170
GARCH (2)	0.0000***	8.975743	0.9331	9.915954	0.9385	9.896171

Note: ***= 1per cent level of significance; AIC represents Akaike info criterion

Source: Author's Computation, 2022.

From the result in table 4.2, only GARCH (1,1) and (1,2) are significant from the various GARCH model estimated. However, GARCH (1,1) is superior to GARCH(1,2) and (1,3) since it has a lower AIC of 8.545476 which is lower than 8.975743.Thus, the study chose GARCH(1,1) to test and evaluate volatility clustering in exchange rate.

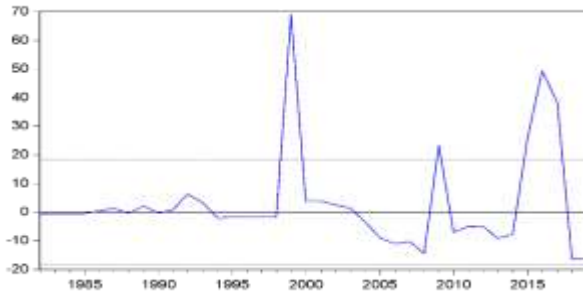
Table 4.3 Estimating GARCH (1, 1)

Dependent Variable: EXCH				
Q = C(3) + C(4)*(Q(-1) - C(3)) + C(5)*(RESID(-1)^2 - GARCH(-1))				
GARCH = Q + C(6) * (RESID(-1)^2 - Q(-1)) + C(7)*(GARCH(-1) - Q(-1))				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	2.404193	7.077303	0.339705	0.7341
EXCH(-1)	1.072010	0.042542	25.19881	0.0000
	Variance Equation			
C(3)	297.3306	142.8565	2.081323	0.0374
C(4)	0.840096	0.212220	3.958616	0.0001
C(5)	0.038780	0.086227	0.449742	0.6529
C(6)	0.086443	0.006898	12.53009	0.0000
C(7)	0.879232	0.125328	7.015437	0.0000

Source: Author's Computation, 2022.

From table 4.3, the variance equation showed the presence of ARCH/GARCH effect since the ARCH/GARCH parameters C(6) and C(7) as depicted by the probability value of 0.0000 respectively which is lower than 0.05 (5 percent level of significance). This shows that volatility exists in exchange rate from 1981to 2020. The ARCH/GARCH model is stable as the coefficient of ARCH/GARCH parameter sum up to less than one (0.086443+0.879232). Also the GARCH parameter of 0.879232 indicate a persistent volatility in exchange rate. This is result is similar to previous studies such as Ismialia (2018) and Ojo and Alege (2016) who also identified persistent volatility in exchange rate series in Nigeria. From the variance equations, exchange rate volatility was extracted as depicted graphically below:

Figure 2.0: Exchange Rate Volatility



Source: Author's Computation, 2022.

Figure 2.0 above indicates exchange rate volatility from (1981-2020). In 2008, 2013 and 2019 exchange rate volatility were negative with minimum value of -18 in 2019. The diagram shows that between 1981 to 1990, exchange rate volatility was minimal. In total exchange rate volatility ranges from -20 to 70 over the reference period indicating a wide oscillation in volatility. The excessive exchange rate volatility is expected to have impacted macroeconomic performance over the period under review.

4.4 Unit Root Tests

Table 4.3: Unit Root Test Result

ADF Unit-Root Test Statistics (At Level)									
Variables	**With Constant**			**With Constant & Trend**			**Without Constant & Trend**		
	t-statistic	**Prob.**	**Level**	**t-statistic**	**Prob.**	**Level**	**t-statistic**	**Prob.**	**Level**
BOT	-1.2459	**0.6439**	NS	-3.1853	**0.1058**	NS	-1.0213	**0.2707**	NS
EXCHV	-4.9295	**0.0003**	I(0)	-4.8647	**0.0019**	I(0)	-5.0043	**0.0000**	I(0)
GRGDP	-3.0923	**0.0356**	I(0)	-2.6033	**0.2811**	NS	-1.9653	**0.0484**	I(0)
INFL	-3.2512	**0.0244**	I(0)	-4.0611	**0.0148**	I(0)	-2.071	**0.0382**	I(0)
OILP	-4.4202	**0.0015**	I(0)	-3.6314	**0.0433**	I(0)	-0.9647	**0.2934**	NS

ADF Unit-Root Test Statistics (At First Difference)									
	t-statistic	**Prob.**	**Level**	**t-statistic**	**Prob.**	**Level**	**t-statistic**	**Prob.**	**Level**
D(BOT)	-9.1412	**0.0000**	I(1)	-9.1508	**0.0000**	I(1)	-9.3146	**0.0000**	I(1)
D(EXCHV)	-5.9281	**0.0000**	I(0)	-5.8239	**0.0000**	I(0)	-6.0209	**0.0000**	I(0)
D(GRGDP)	-10.1913	**0.0000**	I(0)	-10.4878	**0.0000**	I(0)	-10.2776	**0.0000**	I(0)
D(INFL)	-5.8939	**0.0000**	I(0)	-3.1163	**0.1197**	NS	-5.995	**0.0000**	I(0)
D(OILP)	-4.7664	**0.0004**	I(0)	-2.2244	**0.4593**	NS	-4.8476	**0.0000**	I(0)

Source: Author's Computation, 2022.

Table 4.3 depicts the unit root test result using ADF unit root test at it constant, constant and trend and without constant and trend forms. The table revealed that GRGDP, EXCH, INFL and OLP are stationary at level. At first difference, BOT became stationary. Hence, given the mixture of the level of integration of the variables, we adopts the autoregressive distributive lag (ARDL) bounds testing approach developed by Pesaran et al. (2001) to test whether short-run/long-run relationship exist between the variables

4.4 Empirical Analysis and Interpretation

4.4.1 ARDL Bound Test Approach to Cointegration

The bound test approach to cointegration seeks to confirm if there is long run relationship among the variables in the model. This is done by testing if their coefficients are equal to zero in our estimated model or not. The F-Statistic value from the bound test and the critical value bounds as revealed by the regression result using E-views 10 is presented in the table 4.4;

Table 4.4: ARDL Bounds Test Result

Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	K
F-statistic	7.978535	4
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Author's computation 2022.

ARDL bounds F test results as reported in Table 4.4 shows that the result confirms the presence of a long run relationship between GRGDP, EXCHV, BOT, INFL and OILP for the period under consideration in Nigeria. This is because the calculated F statistic is 7.978535 is greater than upper critical values at 10% and 5% significance level, and thus, inferring that there exists a co-integrating relationship among the time series in the level form, without considering whether they are I(0) or I(1). In other words, the Null hypothesis of no cointegration can be rejected at the 5% and 10% significance levels because F test statistic is greater than the critical upper bounds value I(1).

4.4.2 Short Run Dynamics and Error Correction Representation of ARDL Cointegrating

After confirming the existence of a long-run relationship among the gross domestic product growth rate and its explanatory variables in the study, it is pertinent to estimate both the error correction mechanism form of the model together with its long run form. Error correction model was first used by Sargan (1964) and after this popularized by Engle and Granger (1987).

Also, the diagnostic tests are examined from the unrestricted error correction (bounds test) model. These include Lagrange multiplier test of residual serial correlation, Ramsey's RESET test using the square of the fitted values for correct functional form (no mis-specification), Jarque-Bera normality test based on the skewness and kurtosis measures of the residuals and Breusch-Godfrey heteroscedasticity test based on the regression of squared residuals on the original regressors of the model. The results are presented in the table below:

Table 4.5 Estimated Short Run Dynamics and Error Correction

Representation of ARDL (1, 2, 2, 2) Selected based on Akaike info criterion (AIC)				
Dependent variable is GDPGR				
Regressor	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
D(GRGDP(-1))	-0.263514	0.152443	-1.728611	0.1075
D(EXCHV)	-0.119233	0.043940	-2.713543	0.0177**
D(EXCHV(-1))	-0.004423	0.040899	-0.108140	0.9155
D(EXCHV(-2))	-0.097684	0.039234	-2.489797	0.0271**

D(EXCHV(-3))	-0.040013	0.044898	-0.891210	0.3890
D(BOT)	-0.000001	0.000001	-0.562821	0.5831
D(BOT(-1))	0.000001	0.000002	0.449256	0.6606
D(BOT(-2))	-0.000000	0.000002	-0.139434	0.8912
D(BOT(-3))	-0.000003	0.000002	-2.051524	0.0609*
D(INFL)	-0.079311	0.036123	-2.195568	0.0469**
D(INFL(-1))	-0.059569	0.045112	-1.320456	0.2095
D(INFL(-2))	0.117605	0.039537	2.974541	0.0108**
D(OILP)	0.073325	0.078222	0.937397	0.3656
D(OILP(-1))	-0.032522	0.075841	-0.428814	0.6751
D(OILP(-2))	0.009602	0.104540	0.091848	0.9282
D(OILP(-3))	0.141829	0.070374	2.015369	0.0650*
CointEq(-1)	-0.908406	0.236223	-3.845546	0.0020***
Diagnostic Tests				
Test Statistics		**LM Version**		
A. Serial Correlation		X^2_{auto} = 0.305871 (0.9181)		
B. Functional Form (Ramsey Reset)		X^2_{RESET} = 1.320081 (0.1231)		
C. Normality		X^2_{Norm} = 1.090121 (0.5791)		
D. Heteroscedasticity		X^2_{Het} = 9.156371 (0.4230)		

Author's computation from E-Views 10.0, 2022.

Note: ***, ** and * indicate significance at 1% and 5% level of significances. Figures in parenthesis are probability values. A is Breusch-Godfrey Serial Correlation LM Test, B is Ramsey's RESET test, C is Normality Test, D is Heteroscedasticity test.

The result presented in table 4.6 suggests that the sign of the coefficient associated with each variable do not differ in the long and in the short-run. The result indicated that a unit increase in EXCHV will lead to 0.119233 decrease in economic growth in the short run. This result is significant as indicated by the probability value of 0.0177. This result is in line with previous studies such as (e.g. Iyeli & Utting 2017, Yakubu et.al, 2017; Victoria 2019). However other studies such as Omorokunwa and Ikponmwosa (2014); Dickson (2012) have observed a positive relationship between exchange rate volatility and economic growth.

Furthermore, unit increase in BOT will lead to 0.00001 decrease in economic growth in the short run. This result is insignificant as indicated by the probability value of 0.5831. A unit increase in INFL export will lead to 0.079311 decrease in economic growth in the short run. This result is significant as indicated by the probability value of 0.0469. A unit increase in OILP export will lead to 0.073325 decrease in economic growth in the short run. This result is insignificant as indicated by the probability value of 0.3652.

Also, the outcome of this result tested using some diagnostic tests such Breusch-Godfrey Serial Correlation LM Test, Ramsey's RESET test, Normality Test and Heteroscedasticity test is not different from what is recorded in the long run estimation. The result of these tests as presented in table 4.6 shows that, the model passes all the diagnostic tests. The diagnostic tests applied to the model point out that there is no evidence of serial correlation, heteroscedasticity, the RESET test implies the correctly specified ARDL model and the result of the normality test showed that the residuals are normally distributed.

Considering specifically the short run dynamics, it is shown that economic growth is positively influenced by the previous year increase in growth rate of gross domestic product and the independent variables. The estimated coefficient of the error correction term is highly significant, thus confirming the previous results that there is a long-run relationship between the variables. Furthermore, the magnitude of the estimated coefficient of the error correction term suggests a relatively high speed of adjustment to any disequilibrium in the short run. In other words, the estimated ECT_{t-1} is equal to 0.90 which states that the departure from the equilibrium is adjusted by 90% per year.

4.4.2 Estimated ARDL Model

The ARDL long run estimation of the impact of exchange rate volatility on growth rate of gross domestic product (GDPGR) is presented in table 4.6:

Table 4.6 Estimated Long Run Coefficients M Using the ARDL Approach

Estimated Long Run Coefficients Using the ARDL Approach ARDL (1, 1, 2, 2, 2) Selected based on Akaike info criterion (AIC)				
Dependent variable is LGDPGR				
Regressor	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
EXCHV	-0.038834	0.010298	-3.770801	0.0022***
BOT	0.000004	0.000002	2.065753	0.0594*
INFL	-0.218068	0.060435	-3.608286	0.0032***
OILP	0.275312	0.099513	2.766601	0.0160**
C	15.465190	2.910297	5.313955	0.0001***
R Squared	0.845620			
Adjusted R-Squared	0.596237			
S.E. of Regression	2.467358			
F-statistic (Prob.)	3.390845 (0.013661)			
Diagnostic Tests				
Test Statistics	**LM Version**			
A. Serial Correlation	X^2_{auto} = 0.305871 (0.9181)			
B. Functional Form (Ramsey Reset)	X^2_{RESET} = 1.320081 (0.1231)			
C. Normality	X^2_{Norm} = 1.090121 (0.5791)			
D. Heteroscedasticity	X^2_{Het} = 9.156371 (0.4230)			

Author's computation from E-Views 10.0, 2022.

Note: ***, ** and * indicate significance at 1% , 5% and 10% level of significances. Figures in parenthesis are probability values. A is Breusch-Godfrey Serial Correlation LM Test, B is Ramsey's RESET test, C is Normality Test, D is Heteroscedasticity test.

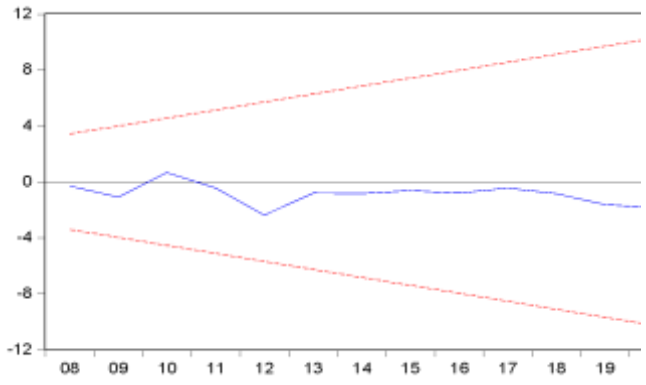
The result presented in table 4.6 shows the estimated long run model of the impact of exchange rate volatility on economic growth in Nigeria. From the result, a unit increase in EXCHV on the average will lead to 0.038834 decrease in GRGDP holding other variables constant. This finding is in line with previous studies such as Ismialia (2018) and Ojo and Alege (2016). A unit increase in BOT on the average will lead to 0.000004 increase in GRGDP holding other variables constant. A unit increase in INFL on the average will lead to 0.218068 decrease in GRGDP holding other variables constant. Finally, a unit increase in OILP on the average will lead to 0.275312 increase in GRGDP holding other variables constant. All the independent variables are statistically significant at 5 percent level of significance except BOT as indicated by their low probability values. BOT is significant at 10 percent level.

In the same vein, the coefficient of determination (R^2) shows that 84% of the variations in economic growth is explained by the explanatory variables in the model which is above 50% and even after taking into consideration the degree of freedom, the adjusted coefficient of determination (adjusted R^2) still shows that, 59% variation in the economic growth is explained by the explanatory variables. The F-statistic 3.390845 (0.013661) confirmed the fitness of the coefficient of model and shows an overall significant level of the explanatory variables jointly in explaining economic growth.

Also, the outcome of this result was tested using some diagnostic tests such Breusch-Godfrey Serial Correlation LM Test, Ramsey's RESET test, Normality Test and Heteroscedasticity test. The result of these tests as presented in table 4.6 shows that, the model passes all the diagnostic tests. The diagnostic tests applied to the model point out that there is no evidence of serial correlation, heteroscedasticity, while the RESET test confirmed a well specified model and the result of the normality test showed that the residuals are normally distributed.

The stability of the regression coefficients is tested using the cumulative sum (CUSUM) and CUSUM of Squares of the recursive residual test for structural stability. Plots of the CUSUM and CUSUM of Square show that the regression equation seems stable given that the CUSUM tests statistics did not exceed the 5% level of significance boundary.

Figure 4.3: Stability (CUSUM) Tests



Source: Author's Computation, 2022.

V. CONCLUSION AND RECOMMENDATION

The empirical results show that exchange rate volatility has a significant impact on economic performance in Nigeria. This result indicated that exchange rate volatility discourages

economic growth, which supports many previous studies. This finding also suggests that the volatility of exchange rate has played an important role in the fluctuations of macroeconomic performance in Nigeria over the years. In addition, other economic variables such as inflation has a negative and significant impact on economic growth while oil price have a positive and significant impact on economic growth. On the other hand BOT has a positive on growth but the impact was significant at the 10 percent level. Overall, the result supported theoretical postulations specifically the balance of trade theory and a priori expectations that posits that exchange rate fluctuations impact on the economic growth of a country.

In conclusion, it is pertinent to note that defective exchange rate management is one of the major macroeconomic problems that confront the Nigerian economy today. Attempts by the government to control this exchange rate fluctuation using the traditional monetary and fiscal policies have not provided a long-lasting solution. Therefore, the knowledge of the exchange rate relationship with macroeconomic variables in Nigeria is the prerequisite to evolving a long-term solution. In this study, it was discovered that the macroeconomic uncertainties that are associated with exchange rate in Nigeria have serious effects on macroeconomic performance such as the level of trade and balance of trade. This reveals some important facts about the general impact of exchange rate volatility on the Nigerian economy.

Finally, it is interesting to note that findings in this study suggest that exchange rate volatility has played an important role in determining macroeconomic performance in Nigeria over the years. In addition, the results also suggest that exchange rate volatility adversely affects economic growth.

VI. RECOMMENDATIONS

From the findings so far, the study recommended that:

In order to mitigate the menace of exchange volatility against economic growth, foreign exchange market should be well monitored with a view to ensuring that only ventures that would engender value added production in the real sector and export-oriented businesses should have more access. This will help to increase the value of the naira against major world currencies.

Again, since inflation rate impact negatively on economic growth, government should pursue with vigour, policies that will ensure low inflation through monetary policy measures such as monetary policy rate, discount rate (interest rate) and open market operations (OMO).

Also, in order to sustain the positive impact of BoT on economic growth, Government should put in place a deliberate policy that will ensure total ban on importation of some selected goods and an increase local production to serve the demand of the domestic economy.

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