
Exchange Rate Volatility and Economics Growth Nexus in Nigeria

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ABSTRACT: One of the problems experienced by developing countries is exchange rate instability. This study analysed exchange rate volatility and economic growth (GDP) in Nigeria between 1989 and 2019. The objective of the study is to examine the impact of exchange rate volatility on economic growth in Nigeria. Secondary data sourced from World Development Indicators (2020) were used. Autoregressive Distributed Lag Model Approach (ARDL) and Pairwise Granger Causality test were applied to analyse the data. The ARDL result revealed a long run relationship between Exchange Rate Volatility (EVOL) and economic growth. The Exchange rate volatility (EVOL) is negatively (-3.5682) related to economic growth and statistically significant. Thus, a 1% increase in EVOL would decrease economic growth by 3.5682%. Pairwise Granger Causality Tests result shows that EVOL has no causal relationship with economic growth. Based on the findings, there is need to diversify the economy from oil export to non-oil export. Since Nigeria does not have control over crude oil prices and also to make effort of increasing her foreign reserves, in order to serve as a shock absorber against Exchange Rate volatility. Government should encourage export promotion strategies in order to maintain a surplus balance of trade, which will strengthen the domestic currency and prevent it from further depreciation. Since exchange rate granger causes inflation, a sustained favourable exchange rate policy will reduce inflationary pressure, which will in turn stabilized the economy.
Keywords: Exchange rate, Volatility, Autoregressive Distributed Lag Model Approach.

INTRODUCTION

Nigeria in recent times has witnessed the greatest depreciation of its currency since its existence as a nation (\$1 = 379.5 as of 22/2/2021); the fall in her exchange rate has been adduced to erosion of her reserves, triggered by the global decline in oil prices. Nigeria being a mono- product export nation highly dependents on the proceeds of crude oil sales has experienced a decline in its foreign exchange receipts and is presently struggling to meet the demand of its teeming import reliant populace (CBN, 2021). Nigerian Government over the years has different exchange rate management policies with a view to achieve realistic and stable exchange rate. Thus, after all these policies the economy still experienced high exchange rate fluctuation which translates into high degree of uncertainty or volatility. Exchange rate volatility is associated with unpredictable movements in the relative price in the economy. It also refers to the swings or fluctuations in the exchange rate over a period of time or deviations from a benchmark or equilibrium

exchange rate, Exchange rate volatility is an important contributor to risk in the financial world. During the period of excessive movements in exchange rates, foreign trade and investments could be affected negatively (Mordi, 2006).

The avoidance of prolonged real exchange rate misalignment requires that the policy makers have proper understanding of real exchange rate dynamics and concept of plausible predictions for the equilibrium real exchange rate (i.e. a rate that guarantees internal and external balance in an economy). As a guide, the International Monetary Fund's Consultative Group on Exchange Rate (CGER) developed three methodologies for evaluating the value of its member countries' domestic currencies. These are the macroeconomic balance, external sustainability and equilibrium real exchange rate approaches. The third methodology, which is often referred to as the Behavioural Equilibrium Exchange Rate Model (BEER) approach, estimates the 'ideal' exchange rate based on a set of macroeconomic fundamentals believed to be driving the economy (Sunday, Essie, Stephen, Uyaabo, & Babatunde, 2017).

Given the structure of Nigerian economy, maintaining a realistic exchange rate for the naira in Nigeria is very crucial. Sanusi (2004) opined the importance of maintaining a realistic exchange rate for naira, and also the need to minimize distortions in production and consumption, increase the inflow of non-oil export receipts and attract foreign direct investment. This is expected to ensure that the naira is not overvalued in real terms, and that the external sector remains competitive. Nigeria in 1960 and in the early 1970s, maintained fixed exchange rates. Between 1970 and mid 1980 Nigeria exchange rate shifted from fixed exchange rate to a pegged arrangement and since the introduction of Structural Adjustment Programme in 1986 till date Nigeria has adopted various types of floating exchange regime (Sanusi, 2004). Nigeria, having adopted various types of exchange rate mechanism over the years with Dutch Auction System (DAS) being the latest and still the exchange rate did not maintain both internal and external balance, continued depreciation of the naira, surrounded by negative or sluggish growth indices. Nigeria has passed through different exchange rate regimes in order to find a realistic exchange rate for macroeconomic stability, but without remarkable success. Exchange rate steady fluctuations seem to have far reaching implications for inflation, price incentives, fiscal viability and competitiveness of exports in Nigeria. Thus, the ultimate objectives of this research is to analyze the macroeconomic variables that determine exchange rate volatility in Nigeria and to investigate the effect of exchange rate volatility on economic growth in Nigeria. Autoregressive distributed lag (ARDL) bound testing approach which will be use to explore this relationship.

This study is imperative given the recent efforts by monetary authorities in Nigeria to revive the economy through the financial sector reform which among other things sought to maintain stability in exchange rate. Exchange rate and economic growth in Nigeria have been volatile and fluctuating over time. The volatility requires investigation given the time lag between the current study and other similar researches in the same area. Due to the wide spread effect of exchange rate volatility, its policy and development are a great concern to the government, the business sector, researchers, the household and the general public. More so, the task of managing the exchange rate is herculean for an economy struggling out of recession. The stability or appreciation of the naira is very important for many reasons; it provides the barometer for measuring the resilience of the Nigerian economy; boosts the confidence of investors, competitiveness of exports, positively impact on balance of payment; increases employment, productivity and directly reduces inflation. Consequently, this study will assist the nation's policy makers in their economic development planning. Specifically, the outcome of this study would provide a basic understanding of the dynamics of exchange rate and the key macroeconomic variables in Nigeria. The study is also important as it will serve as a good and reliable empirical framework for future researchers who may likely embark on similar or same topic in their urge to solve future problem in the economy and also contribute to knowledge.

LITERATURE REVIEW

Owolabi and Adejare (2013) statistical test evaluated on 27 years' time series data proved the significant impact of foreign exchange rate on Nigeria economy. And this exchange rate has continuously fluctuating, immersing, the country's foreign exchange rate volatility that favour Nigeria between 1981 and 1991 rises from NO.64 to N9.75) encouraged the nation's exportation. This continue, in 1992, the exchange rate rose to N17 to a US Dollar and in 1995 it increased to N21.89 but from 2003 to 2008 it reduces from N135.41 to N117.78 while later rises again to N147.20 and N150.3 in 200 and 2010 respectively at US Dollar. At this period exportation was totally discouraged and gradually importation was later encouraged to meet the vast population. To control this fluctuation there is need to implement foreign exchange rate management policies which must be concerned with both the foreign sectors and domestic balance of the economy. This can be achieved if government focuses more attention on policies that will affect the accounts in balance of payment. Outcome of this paper work as proved it with decrease in the GDP by NO.02 as the export rate increases; that is the current exchange rate policy did not really affect the development of oil and non-oil export. Thus there is the need for proper management of the Nigeria foreign policy so as to achieve good level of exportation.

Attah-Obeng, Enu, Osei-Gyimah and Opoku (2013) examined the relationship between GDP growth rate and exchange rate in Ghana from the period 1980 to 2012. The study employed the graphing of the scatter diagram for the two variables which are GDP growth rate and exchange rate, establishes the correlation between GDP growth rate and exchange rate using the Pearson's Product Moment Correlation Coefficient (PPMC) and finally estimates the simple linear regression using OLS. Which confirms to the theory that undervaluation (high exchange rate) stimulates economic growth in the short run. Therefore, policy makers should stabilize monetary and fiscal policies in the long run.

Mohammed (2013) examined the exchange rate depreciation and Nigeria economic growth during the SAP and post SAP period. The study covers the period of 1986–2012, using the Johansen co-integration test and error correction model analyses after conducting the stationary test, the results show that broad money supply, net export and total government expenditure have significant impact on real output performance in the long run while exchange rate has direct and insignificant effect on Nigeria economic growth in both short and long run this implies that exchange rate depreciation during the SAP period has no robust effect on Nigeria economic performance. Therefore, the study suggested that policy makers should not totally rely on exchange rate depreciation policy instrument to induce economic growth, but should use it to complement other macro-economic policies such as monetary and fiscal policies.

Adeniran, Yusuf and Adeyemi (2014) examined the impact of exchange rate on Nigeria economic growth from 1986 to 2013. Employing the correlation and regression analysis, the ordinary least square (OLS) analyze the data. The result revealed that exchange rate has positive and insignificant impact on Nigeria economic growth and recommended that government should encourage the export promotion strategies in order to maintain a surplus balance of trade and also conducive environment, adequate security, effective fiscal and monetary, as well as infrastructural facilities should be provided so that foreign investors will be attracted to invest in Nigeria. Using the Vector Error Correction Model (VECM). Babatolu, (2015) employed the ARCH and GARCH methodology to measure the volatility of exchange rate and its effect on the GDP of Nigeria, using the Seemingly Unrelated Regression method (SUR) in estimating the coefficient of the two system equation. The ARCH and GARCH results indicated that the exchange rate is volatile, while SUR results shows that exchange rate has negative but statistically not significant effect on the GDP.

Ugochukwu (2015) evaluated the effect of exchange rate volatility on economic growth in Nigeria on the basis of annual data from 1980 to 2012. A review of the literature reveals that exchange rate volatility can have either positive or negative effect on economic growth. The empirical analysis began with testing for stationarity of the variables by applying the Augmented Dickey-Fuller (ADF). This was followed by co-integration test of the model. The unit root test results show that all variables were integrated at order one that is $I(1)$. Also, co-integration analysis indicated that variables are co-integrated. Employing the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) technique to generate exchange rate volatility, the relationship between exchange rate volatility and economic growth was estimated. Findings further show that in the short run, economic growth is negatively responsive to exchange rate volatility in Nigeria case while in the long run; a negative relationship exists between the two variables in the Nigerian economy. The result also indicates that foreign direct investment depresses economic growth in Nigeria. Thus, the huge inflow and stock effect of rising foreign direct investment is not felt while the output effect is evidenced in factory closure and re-location to neighboring countries. The study recommends control of import content of both public and private expenditure, greater diversification of the economy through investment in key productive sectors of the economy to guard against the vicissitude exchange rate volatility.

Kalu and Ogunjo (2015) examined the causal relationship between exchange rate and Gross Domestic Product using the pairwise Granger causality and also estimate the Error Correction Term (ECT) in a Vector Auto-Regression (VAR) model environment. The result shows that there exists a unidirectional causality running from exchange rate GDP and that the exchange rate deregulation has negatively influenced the GDP in Nigeria.

Alagidede and Muazu, (2016) adopted the vector auto-regression method in their study the results demonstrated that real exchange rate and real income were significantly co-integrated. The real exchange rate negatively and significantly impacted on economic growth, as a 1% increase in exchange rate volatility led to -0.8% (decrease) in economic growth, using GDP as a proxy for the latter. Thus, excessive exchange rate volatility is detrimental to economic growth. They recommend, amongst other things, significant improvement in exchange rate modeling and forecasting by the Central Bank. Incorporating the impact of asset prices in domestic monetary policy could improve both the transparency and functioning of foreign exchange market.

Okorontah and Odoemena, (2016) investigated the effects of exchange rate fluctuation on economic growth of Nigeria. Using annual data for the period 1986–2012, the study employed the Ordinary Least Square (OLS) technique, the Johansson co-integration test and the Error Correction Mechanism (ECM) to examine the relationship between exchange rate and economic growth. The result suggests that there is no strong relationship between exchange rate and economic growth in Nigeria. It was therefore suggested that Nigeria improve its competitive capacity in the international market through export diversification.

Ebele, Takon and Samuel (2017) investigated exchange rate volatility in Nigeria and its effect on economic growth. The data used comprised of Exchange Rate, Gross Domestic Product, Government Expenditure, External Reserve, and Foreign Direct Investment, these data was generated from the Central Bank of Nigeria Statistical Bulletin for the years 1981 to 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.

Similarly, Nsofo, Takson and Ugwuegbe (2017) examined the extent of exchange rate volatility and its impact on economic growth in Nigeria covered the period of 1981 to 2015. Generalized Autoregressive Conditional Heteroscedasticity (GARCH) and Generalized Method of Moment (GMM) technique was employed. Findings from their study showed that there is persistent in exchange rate volatility in Nigeria. Furthermore, the found that exchange rate volatility and foreign direct investment have negative impact on output in Nigeria. Similar result was obtained by Nwosu (2016). The study is however in conflict with the findings of Iyeli and Utting (2017), who employed the Error Correction Model in discovering a positive long run relationship between exchange rate and gross domestic product in Nigeria.

Michael (2018) explored the effect of Nigeria's currency rate on the economic growth of Nigeria. It is focused on establishing the extent to which Naira rate have influenced economic growth from using data spanning between 2006 and 2016; and the extent to which the Naira rate has influenced inflation in Nigeria within the same time frame. This study however employed Ordinary Least Squares technique of analysis to construct a regression model to test stated hypotheses. Findings revealed that the Naira rate has no significant impact on economic growth in Nigeria and that the Naira rate has a significant influence on inflation rate in Naira. The study, therefore, recommends that the export base of Nigeria should be strengthened to ensure a sustainable impact and that local manufacturing should be fully encouraged.

John and Oladapo (2018) evaluated the effect of exchange rate volatility on economic growth in Nigeria from 1986 to 2014. It determines the extent and manner to which economic growth responds to exchange rate volatility in Nigeria. The empirical analysis of this study is to determine the degree of volatility of real effective exchange rate using the Generalized Autoregressive Heteroskedasticity (GARCH) model and the Generalized Method of Moments is used to determine the effect of real exchange rate volatility on economic growth. The study finds that there is high volatility of real effective exchange rate. It also reveals that real effective exchange rate is negatively and significantly related to economic growth. This finding suggests that exchange rate volatility is harmful to the growth of the Nigerian economy. This study recommends that government should constantly seek to maintain a stable exchange rate, increase its expenditure, particularly capital expenditure and implement sustainable reforms to increase the depth of the financial sector.

Idris, Ashemi and Mohammed (2019) investigated the relationship between exchange rate and the Gross Domestic Product (GDP) in Nigeria from 1981 to 2017. The annual data was obtained from CBN statistical bulletin. ARDL co-integration procedure was deployed. The result indicates that GDP in Nigeria is not responsive to official exchange rate movement. A long run relationship was found to exist between GDP and official exchange rate, but not statistically significant. The Error Correction Mechanism (ECM) estimate was rightly signed but was found to have a short-run disequilibrium adjustment of less than 2% for correcting any deviation from long-run equilibrium. The models are found not to have serial correlation and also found to be stable meaning that the result is appropriate for policy consideration. It is therefore suggested that policy makers should not totally rely on exchange rate manipulation as an instrument to boost the economy, but should consider other economic variables to strengthen the GDP.

In all literatures reviewed none of them considered the existence of structural break in the time series, Structural break tests, helps to determine when and whether there is a significant change in our data. It could also be an unexpected change over time in the parameters of regression models, which can lead to huge forecasting errors and unreliability of the model in general. But in this research the Chaw test was applied to examine if structural break exists in the data so as to have a model reliability and good forecasting.

METHODOLOGY

The study covers the period of 1990 to 2019; a sample size of 30 years, which is long enough for time series analysis was used. The choice of this period is largely informed by data availability, and also due to the circumstance that Nigerian economy has practiced different types of exchange rate regimes within the given period. Secondary data obtained from World development indicators World Bank online databank, Central Bank of Nigeria statistical bulletin, the annual report of accounts and other CBN publications as well as resource materials sourced from internet were used. ARDL model was used prior to which, the study tested the stationarity of the data obtained for each variable to ascertain whether or not a unit root existed using Augmented Dickey-Fuller (ADF) test as suggested by Dickey and Fuller in 1979. The co-integration was examined using the bounds testing approach. The stability of ARDL long run model parameters were examined using the cumulative sum of the recursive residuals (CUSUM) and the cumulative sum of the squares of recursive residuals (CUSUMSQ) tests proposed by Brown et al. (1975). The researcher also used Chaw test proposed by Gregory Chaw in 1960, to test the presence of structural break in the series.

Model Specification

Econometricians establish the model on which the economic phenomenon will be investigated and empirically evaluated in order to investigate the relationship between variables and express this relationship in mathematical form (Gujarati, 2009). To achieve the study objective of determining the impact of exchange rate volatility on economic growth of Nigeria, the theoretical underpinning this work is based on the general approach to endogenous growth models that rely on firm production function of the form;

$$Y_t = A_t F(K_t, L_t, H_t) \dots \dots \dots (1)$$

Where 'H' represents the aggregate stock of knowledge; 'K' stands for capital; and 'L' for Labour, A represents the level of technology and the subscripts *t* represent time period. Following Romer (1986), equation (1) suggests that investment in knowledge leads to a natural externality, thus the production of knowledge by one

firm is assumed to have positive external effects on other firms. Now relating the production function in equation (1) to aggregate production function that relates Gross Domestic Product (GDP) at time t to factors of production leads to equation (2).

$$Y_t = A_t K_{t\alpha} L_{t\beta} H_{t\gamma} \quad \dots \dots \dots (2)$$

As Adopted from Eunice (2019), where exchange rate volatility and economic growth of Ghana was investigated, this study was carried out in Nigeria analyzing the exchange rate volatility and economic growth from 1989 to 2019.

To achieve the study objective, equation (3) is formulated as;

$$RGDPR = f(EVOL, OP, GCF, SCER) \quad \dots \dots \dots (3)$$

Where:

RGDPR = Real GDP Growth Rate

EVOL = Exchange Rate Volatility

OP = Trade Openness

GCF = Gross Capital formation

SCER = Average years of schooling (Secondary) rates

Equation (3) can be presented in an econometric form as:

$$RGDPR_t = \beta_0 + \beta_1 EVOL + \beta_2 OP + \beta_3 GCF + \beta_4 SCER + \mu_1 \quad \dots \dots \dots (4)$$

Converting equation (4) to log form:

$$\text{Log}RGDPR_t = \beta_0 + \beta_1 \text{Log}EVOL + \beta_2 \text{Log}OP + \beta_3 \text{Log}GCF + \beta_4 \text{Log}SCER + \mu_1 \quad \dots \dots \dots (5)$$

Where:

β_0 to β_4 = parameters to be estimated

$\beta_1 < 0$; $\beta_2 > 0$; $\beta_3 > 0$; $\beta_4 > 0$;

Table 1: Variables Description and a priori expectation of the Model

Variable	Definition/Measurement	A priori Expectation
Real Gross Domestic Product Growth Rate (RGDPR)	Annual percentage growth rate of GDP at market prices based on constant local currency.	Dependent variable
Volatility of exchange rate (EVOL)	a statistical measurement of how much the exchange rate fluctuates over time. Calculated using a GARCH (1,1) model.	EVOL < 0
Trade openness (OP)	Trade openness (OP) is a policy variable that measures the level of international transactions undertaken by a nation.	OP > 0

Gross Capital formation (GCF)	Consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements,	GCF > 0
The Level of Human Capital (SCER)	Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education.	SCER > 0

RESULTS

Table 2 Descriptive Statistics of the variables considered in the study.

STATISTICS	RGDPR	EVOL	GCF	SCER	OP
Mean	5.058613	0.015836	29.48519	33.14644	52.78748
Median	4.279277	0.005735	27.58251	31.86770	57.69099
Maximum	33.73578	0.210852	53.18669	56.20540	81.81285
Minimum	-1.541057	0.000926	14.90391	23.55180	21.12435
Std. Dev.	6.167558	0.029034	11.84411	9.584649	16.42863
Skewness	3.224773	4.246499	0.401885	0.635125	-0.400606
Kurtosis	15.55292	24.21003	1.986669	2.188031	2.186543
Jarque-Bera	1029.058	2675.232	8.643239	10.98534	6.735533
Probability	0.000000	0.000000	0.013278	0.004117	0.034467
Observations	124	124	124	124	124

Source: E-views Results and Author's Computation 2021

The descriptive statistics reported in Table 2 indicates that Real Gross Domestic Product Rate (RGDPR) and exchange rate Volatility (EVOL) has mean values of 5.06% and 0.016 and respectively. Also, the mean values for Gross Capital Formation (GCF), School Enrolment Rate (SCER), and Trade Openness (OP) are 29.49%, 33.15% and 52.79% respectively during the period under investigation. Exchange rate Volatility (EVOL) and Real Gross Domestic Product Rate (RGDPR) has maximum rates of 0.21 and 33.74.2% respectively. Likewise, the maximum values Gross Capital Formation (GCF), School Enrolment rate (SCER), and Trade Openness (OP) are 53.19%, 56.21% and 81.81% respectively.

Correlation Analysis

This section presents the results of correlation analyses among variables. This is to determine and ascertain if there are bivariate relationships between each pair of

variables considered in this study. The result of the correlation analysis of variables under consideration is presented in Table 3. The skewness values Real Gross Domestic Product Rate (RGDPR) and Exchange Rate Volatility (EVOL) indicate they are positively skewed, having values that are higher than their sample means. It also means that they have long right tails since their values are positive and greater than one. However, the skewness values of Gross Capital Formation (GCF), School Enrolment Rate (SCER) indicate that each of them mirrors a normal distribution, given that their skewness values lies between zero and one. The kurtosis values of Real Gross Domestic Product Rate (RGDPR) and Exchange Rate Volatility (EVOL) are all greater than three, indicating that they are all leptokurtic, meaning that they have higher values than their samples mean. However, Gross Capital Formation (GCF), School Enrolment rate (SCER) and Trade Openness (OP) have kurtosis values that are less than three. This implies platykurtic. It suggests that they have lower values than their sample mean. The Jarque-Berra statistics shows that all variables have probability values which are statistically significant at both 5% and 1% level. This implies that they are not normally distributed.

Table 3: Correlation Analysis of the Variables

	RGDPR	EVOL	GCF	SCER	LOP
RGDPR	1				
EVOL	-0.25468	1			
GCF	-0.07178	0.20763	1		
SCER	0.10959	-0.26267	-0.88612	1	
OP	0.05889	0.05412	0.519625	-0.69059	1

Source: E-views Results and Author's Computation 2021

Result in table 3 shows that there is a Negative relationship between Real Gross Domestic Product Rate (RGDPR) and Exchange rate Volatility in Nigeria ($r = -0.255$) This is expected as increase in Exchange rate Volatility, it will lead to decrease in growth of economy and vice versa. On the other hand, the relationship between School Enrolment rates (SCER), Trade Openness (OP) was found to be positive. With Real Gross Domestic Product Rate (RGDPR)

Table 4: Unit Root Test (Augmented Dickey Fuller (ADF) Test and PhilipPerron (PP) Test

Variable	Test	CONSTANT AND TREND		Order of Integration
		@Level	@ First Diff.	
RGDPR	ADF	-2.8535** (0.0540)	-8.6544*** (0.0000)	I(0)
	PP	-3.210830** (0.0217)	-14.04329*** (0.0000)	
EVOL	ADF	-3.2795** (0.0181)	-1.0112*** (0.0000)	I(0)
	PP	-3.438354** (0.0115)	-7.709135*** (0.0000)	
GCF	ADF	-2.057623 (0.2623)	-11.18825*** (0.0000)	I(1)
	PP	-2.056500 (0.2627)	-11.19961*** (0.0000)	
SCER	ADF	-0.741327 (0.8311)	-10.6995*** (0.0000)	I(1)
	PP	-0.667849** (0.8496)	-10.73794*** (0.0000)	
OP	ADF	-1.7981 (0.3800)	-10.9701*** (0.0000)	I(1)
	PP	-1.632662 (0.4629)	-12.27897*** (0.0000)	

Source: Author's Computation 2019, Note: EVOL =Exchange rate Volatility; RGDPR = Real Gross Domestic Product Growth Rate; OP = Trade Openness; GCF = Gross Capital Formation; SCER= School Enrolment Rate; *, ** and *** imply statistical significance at 10%, 5% and 1% levels respectively

Table 4 depicts the ADF and PP Test results. It evidently shows that Real Gross Domestic Product Rate (RGDPR) and Exchange rate Volatility (EVOL) were stationary at level. On the other hand, School Enrolment rate (SCER), Trade Openness (OP) and Gross Capital Formation (GCF) wasn't stationary at level, although it did so at the First of deference. This is because their ADF and PP Test values are less than the critical value at 5% the series reveals the presence of different order of integration (I(0) and I(1)), we proceed to bound test.

Modelling Exchange Rate Volatility

Real effective exchange rate volatility was modelled using GARCH model. Due to the non-normal distribution of real effective exchange rate, Gaussian error distribution cannot be assumed. Therefore, a non-normal error distribution method (Generalized Error Distribution method) was used. The predicted (fitted) values are obtained for the estimated GARCH model as the volatility series. Table 5 presents the results of the GARCH model.

Table 5: GARCH Model Result

Variable	Coefficient	p-value
Mean Equation		
C	4.941561	0.0000*
EXT(-1)	0.00321	0.0011*
Variance Equation		
C (ω)	0.090456	0.4867
RESID(-1) (α)	-0.154662	0.0093**
GARCH (β)	0.407570	0.6401
$\alpha + \beta$	0.252908	-----
Model Diagnostics		
ARCH LM(1)	0.041661	0.8386
ARCH LM(2)	0.040064	0.9607

Note: * and ** denote statistical significance at 1% and 5% significance level respectively.

Source: Authors' computation

From Table 5, the result of the mean equation shows that the immediate past value of exchange rate positively and significantly affects present value of exchange rate. The result of the variance equation indicates that the ARCH term is statistically significant, thus implying the presence of volatility clustering. It also shows that the GARCH term is not statistically significant and this indicates that there is no long term persistence in real effective exchange rate volatility? The sum of the ARCH and GARCH term tends to unity and this confirms that real effective exchange rate volatility is high. The ARCH LM test shows that ARCH effects remaining in the model.

From the results the mean and variance equations are specified in equations (6) and (7), respectively:

$$EXT = 0.00321 + 4.941561 EXT(-2) \quad (6)$$

$$Q^2_t = 0.090456 - 0.154662\hat{\epsilon}^2_{t-1} + 0.407570 Q^2_{t-1} \quad (7)$$

The result obtained from the conditional variance equation indicates that mean Ω from equation (7) is positive, hence indicating a proper specification of the conditional variance, which is statistically significant at the 1 per cent level. Also, the result shows that previous information about volatility, measured as the lag of the squared residual from the mean equation (ARCH term) is negative and the previous forecast error variance (the GARCH term) is positive. The sum of the coefficients of these two variables (ARCH and GARCH term) is positive close to unity meaning that the volatility shocks are persistent. Figure 1 below shows the trend in the volatility of the exchange rate from 1992 to 2022.

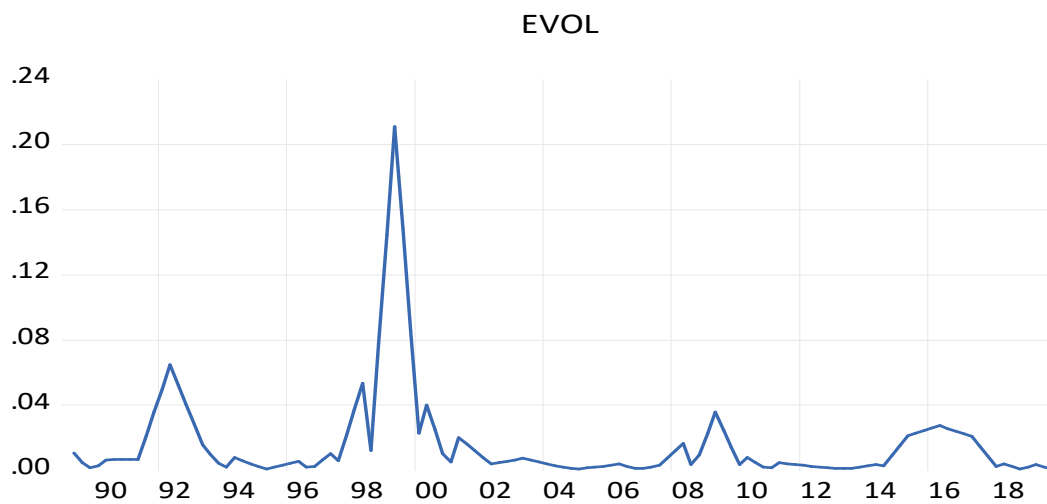


Figure 1: shows the trend in the volatility of the exchange rate from 1989 to 2019.

Optimal Lag Length Criteria.

Table 6 Optimal Lag Length Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-60.94976	NA	2.05e-06	1.090079	1.205607	1.136999
1	562.0832	1184.278*	1.04e-10*	-8.794764*	-8.101593*	-8.513241*
2	581.3062	34.95080	1.15e-10	-8.699275	-7.428461	-8.183149

Authors Computation using E-views10

The optimal lag length of this model has to be determined before proceeding to the bound test. Table 6 report the optimal lag length of 1 out of maximum lag lengths of 3 lag as selected by the 2 different criteria because 2 lags has the lowest

values. After conforming the number of lags used in the models. Hence, the study continues to estimate the ARDL bounds test for co-integration.

ARDL Bound Cointegration Test Results

Table 7 ARDL Bound Test for Economic Growth Model

Test Statistic	Value	K
F-statistic	4.872027	4
Critical Value Bounds		
Significance	10 Bound	11 Bound
10%	2.68	3.53
5%	3.05	3.97
2.5%	3.4	4.36
1%	3.81	4.78

Source: Authors computation using E-views 10

The result from Table 7 indicates that the value of F-statistics (30.83) is higher than the I(1) critical bounds at 10%, 5%, 2.5% and 1%. This suggests the rejection of the null hypothesis of no co-integration. This led to the conclusion that there is a long run relationship between GDP rate, Exchange rate Volatility (EVOL), School Enrolment rate (SCER), Trade Openness (OP) and Gross Capital Formation (GCF) in Nigeria.

ARDL Analysis (Estimation) for Economic Growth

Table 8 Long run (1, 0, 1, 0, 2)

Dependent Variable: Real GDP Growth Rate (RGDPR)

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.279391	2.522020	-1.696811	0.0925
@TREND	0.008349	0.005686	1.468192	0.1449
LRGDPR(-1)*	-0.304410	0.058594	-5.195220	0.0000
EVOL**	-3.568157	1.510253	-2.362622	0.0199
LGCF(-1)	0.473430	0.529406	0.894268	0.3731
LSCER**	0.092546	0.100378	0.921975	0.0385
LOP(-1)	0.614969	0.172495	3.565146	0.0005
D(LGCF)	2.010496	0.866154	2.321177	0.0221
D(LOP)	-0.651692	0.379295	-1.718163	0.0885
D(LOP(-1))	-0.747433	0.393353	-1.900159	0.0600

Source: Authors Computation using E-views 9.0

In this model, the data sample period is 30 years after the adjustment which account for the maximum lag length used. The maximum lag considered is one (1) while the model selection method adopted is the Akaike Information Criterion with a maximum of 1 lags of both the dependent variable and the repressor. The procedure has selected an ARDL (1, 0, 1, 0, 2) model with the lags of 1, 0, 1, 0 and 2 for EVOL, GCF, SCER and OP respectively as the explanatory variables. Generally, it can be observed from the result that Exchange rate volatility (EVOL) is negatively (-2.3626) related to economic growth (RGDPR) and statistically significant at 5% level of significance. Thus a 1 percent increase in exchange rate volatility would significantly decrease GDP growth rate (economic growth) earnings by 2.3626 percent in the long run. This result is consistent with (Musyoki et al, 2012) who found a negative relationship between exchange rate volatility and economic growth in Kenya. Also (Ahmed 2009) investigated on the impact of exchange rate on economic growth using quarterly data from North America, Western and Eastern Europe. Their study points out that volatility of the exchange rate has negative and significant impact in the long run. The coefficient of trade openness was found to be negative and significant in the long run.

The long run coefficient for trade openness is -0.6517 implying that a 1 percent increase in international trade would decrease Nigerian's economic growth rate by 0.6517 percent in the long run. This result coincides with the conclusion of (Geza et al, 2011) who assert that instability of the exchange rate decreases the volume of international trade as it exposes importers and exporters to greater exchange rate risk due to fluctuations and therefore less willing to engage in international trade. Finally, the long run results indicate the growth rate in human capital proxied by secondary school enrollment rate (SCER) is also positively related to economic growth Rate in Nigeria. The coefficient of secondary school enrollment is 0.9219 and is also significant at 5 percent. This indicates that a 1 percent increase in human capital increase Nigerian's GDP growth rate (economic growth) by 1.9219 percent. This result implies that the more educated the people in Nigeria, the more the economy grows.

The R^2 (co-efficient) indicates only 24% of the variations in RGDPR is explained by the independent variables. Also, the adjusted R^2 reveal that even if all the other explanatory variables are within the model, about 22% of the variations in the dependent variable will still be explained by the selected explanatory variables. The F-statistics value of 9.31 revealed the joint significance of the variables used in the model while the Durbin-Watson stat with the value of 1.88 shows that the model indicates the presence of negative serial correlation problem.

Short and Long Run impact of exchange rate volatility on economic growth in Nigeria

Error Correction Model (ECM)

Table 9: ARDL Cointegrating / Short-run Form

Cointegrating Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.271042	0.773684	-5.520395	0.0000
D(LGCF)	2.010496	0.735339	2.734106	0.0073
D(LOP)	-0.651692	0.361980	-1.800352	0.0745
D(LOP(-1))	-0.747433	0.376449	-1.985481	0.0495
CointEq(-1)***	-0.304410	0.055086	-5.526044	0.0000

Source: Author's Computation 2021, Note: EVOL =Exchange rate volatility; RGDPGR = Real Gross Domestic Product Growth Rate; OP = Trade Openness; GCF = Gross Capital Formation; INTR= Interest rate; *, ** and *** imply statistical significance at 10%, 5% and 1% levels respectively.

From the estimated ARDL (1, 0, 1, 0, 2) model, the short-run effect of Exchange rate volatility and the control variables on Economic Growth is presented in Table 9. The short run results associated with the Error Correction term, ECM (-1), in the model explain the speed of adjustment to restore equilibrium in the dynamic model. The ECM (-1) explains how quickly variables converge to equilibrium. According to Bannerjee et al (1998), a highly significant error correction term further confirms the existence of a stable long-run relationship. The coefficient of the lagged error correction term, -0.3044 is negative and significant at 1 percent, confirming the existence of a long run relationship among the variables. It implies that the volatility of the exchange rate is corrected by 0.3044 percent in the model by the coming year. This means that more than 30.4 percent of the disequilibrium in the previous year is corrected in the current year. In other words, if a shock (example is decrease in exchange rate) occurs, the speed of adjustment for correction is 30.4 percent. This speed of adjustment is relatively high in the model. All the short run estimated variables have the signs of their coefficients consistent with the long run estimates. The immediate impact of exchange rate volatility is negative and significant at one percent. This result corroborates that of (Zahoor and Farooq 2009) who found a negative relationship between exchange rate volatility and economic growth in Pakistan.

Long Run Coefficient

Table 10: ARDL Long Run Form

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
EVOL*	-11.72154	4.629723	-2.531801	0.0127
LGCF	1.555238	1.720813	0.903781	0.3681
LSCER	0.304018	0.324802	0.936010	0.3513
LOP**	2.020198	0.523149	3.861608	0.0002
@TREND	0.027426	0.018231	1.504321	0.1353

$$EC = LRGDPR - (-11.7215*EVOL + 1.5552*LGCF + 0.3040*LSCER + 2.0202*LOP + 0.0274*@TREND)$$

Source: Author's Computation 2021, Note: EVOL =Exchange rate volatility; RGDPGR = Real Gross Domestic Product Growth Rate; OP = Trade Openness; GCF = Gross Capital Formation; SCER= School Enrolment rate; *, ** and *** imply statistical significance at 10%, 5% and 1% levels respectively

The result shows that the coefficient of Exchange rate volatility (-11.72) is negative and significant. This suggests that Exchange rate volatility (EVOL) has a negative impact on Economic Growth. Given by the coefficient of Exchange rate volatility, a one percent increase in Exchange rate volatility will reduce Economic Growth by 2.53% percent. Gross Capital Formation (GCF) is positive and insignificant. Also, Trade Openness was found to be positive and significantly related with Economic Growth indicating that a 1% rise in economic growth would result in a 3.8% increase in trade openness. Also, School Enrolment rate (SCER) was found to be positive relationship with Economic Growth in the long run, but is insignificant. Which implies that as 1% increase in economic growth would increase School Enrolment rate (SCER) by 30%.

Heteroskedasticity

Table 11: Heteroskedasticity Test

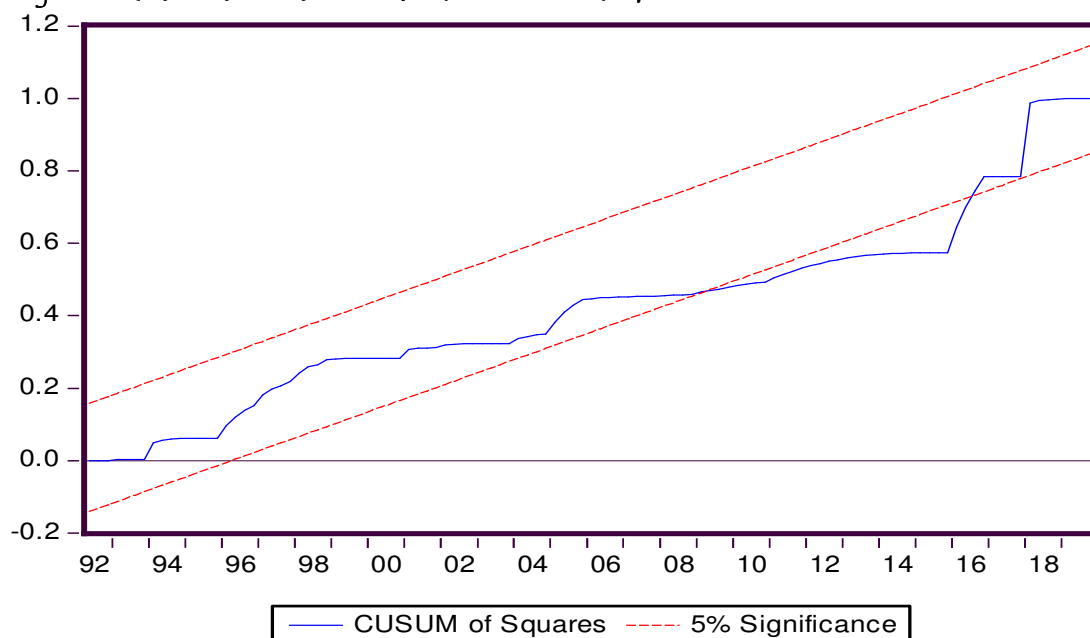
Heteroskedasticity Test: ARCH

F-statistic	0.002375	Prob. F(1,119)	0.9612
Obs*R-squared	0.002415	Prob. Chi-Square(1)	0.9608

Source: Author's Computation 2021, underlying data from World Development Indicator (WDI) Database and CBN Statistical Bulletin

In Table 11, the result shows two test statistics namely; the F -statistic and the Obs*R-squared statistic with their associated p -values in order to examine the Lagrange multiplier test of the null hypothesis of no heteroskedasticity against the alternative that there is heteroskedasticity. Thus, the insignificant values of all tests statistics imply the acceptance of the null hypothesis of homoscedasticity implying that the residual of the model is homoscedastic.

Figure 2 CUSUMSQ TEST: Economic Growth model

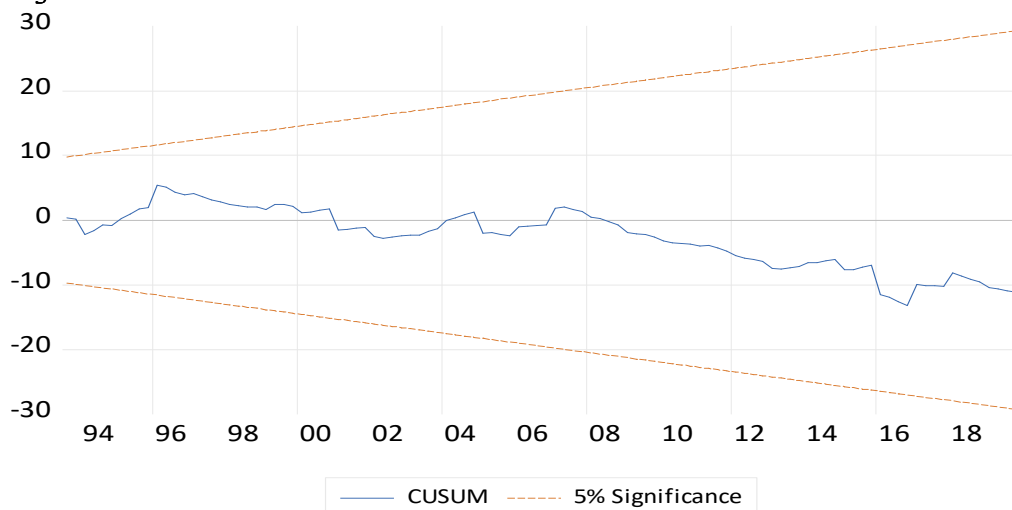


This shows the presence of structural break, the regression coefficients are different from split date, therefore to consider structural break in the analysis.

Stability of ARDL long run model parameters

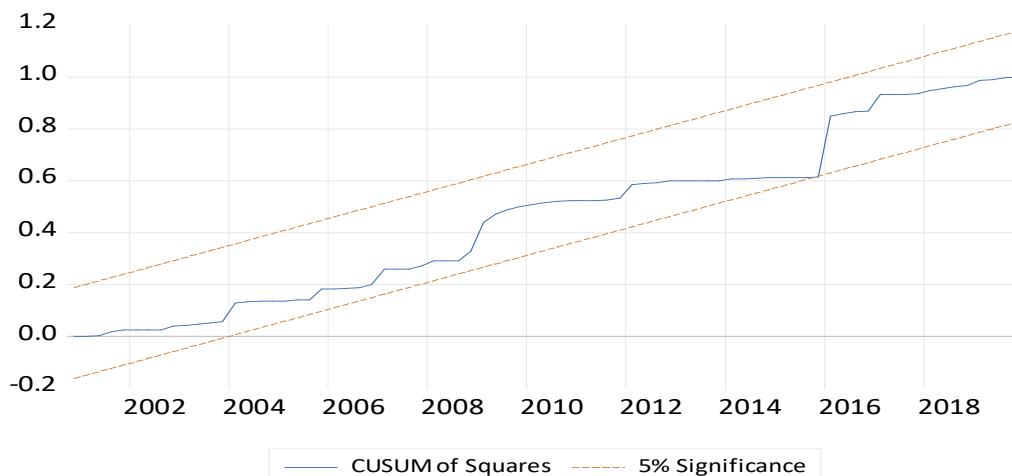
Finally, the stability of ARDL long run model parameters were examined using the cumulative sum of the recursive residuals (CUSUM) and the cumulative sum of the squares of recursive residuals (CUSUMSQ) tests proposed by Brown et al. (1975). The graphical results presented in Figures 3 and 4 respectively illustrate that, residuals were within the critical bounds at 5% level of significance. After test with dummy variable: However, after dummy have being interacted CUSUMSQ plot in figure 12 stay inside 5% critical bounds of parameter. This signifies that the ARDL estimates are dynamically and structurally stable, consistent and reliable.

Figures 3 (CUSUM)



Source: E-views Results and Author's Computation 2021

Figures 4 (CUSUMSQ)



Source: E-views Results and Author's Computation 2021

DISCUSSION

The result of the variance equation indicates that the ARCH term is statistically significant and the sum of the ARCH and GARCH term tends to unity and this confirms that real effective exchange rate volatility is high. The ARCH LM test shows that ARCH effects remaining in the model. it can be observed from the result that Exchange rate volatility (EVOL) is negatively (-2.3626) related to economic growth (RGDPR) and statistically significant at 5% level of significance. Thus a 1 percent increase in exchange rate volatility would significantly decrease

GDP growth rate (economic growth) earnings by 2.3626 percent in the long run. This finding is consistent with (Musyoki et al, 2012) who found a negative relationship between exchange rate volatility and economic growth in Kenya. Growth rate in human capital proxied by secondary school enrollment rate (SCER) is also positively related to economic growth Rate in Nigeria. The coefficient of secondary school enrollment is 0.0926 and is also significant. This indicates that a 1 percent increase in human capital increase Nigerian's GDP growth rate (economic growth) by 9.3% percent. This result implies that the more educated the people in Nigeria, the more the economy grows.

The coefficient of the lagged error correction term, -0.3044 is negative and significant at 1 percent, confirming the existence of a long run relationship among the variables. It implies that the volatility of the exchange rate is corrected by 30.4% in the model by the coming year. This means that more than 30.4 percent of the disequilibrium in the previous year is corrected in the current year. In other words, if a shock (example is decrease in exchange rate) occurs, the speed of adjustment for correction is 30.4 percent. Gross Capital Formation (GCF) is positive and insignificant. Also, Trade Openness was found to be positive and significantly related with Economic Growth, implying that a per cent increase in Economic Growth would increase Trade Openness by 3.8%. Also, School Enrolment rate (SCER) was found to be positive relationship with Economic Growth in the long run, but is insignificant. Which implies that as 1% increase in economic growth would increase School Enrolment rate (SCER) by 30%. The graphs of cumulative sum of the recursive residuals (CUSUM) and the cumulative sum of the squares of recursive residuals (CUSUMSQ) tests proposed by Brown et al. (1975) Shows in Figures 11 and 12 respectively illustrate that, residuals were within the critical bounds at 5% level of significance. This signifies that the ARDL estimates are dynamically and structurally stable, consistent and reliable. Base on Pairwise Granger Causality Tests' Exchange rate Volatility (EVOL) have no causal relationship with real gross domestic product (RGDP)

CONCLUSION

The empirical findings indicated that, both in the long and short terms, Economic Growth has a negative impact on Exchange Rate Volatility, but this impact is only substantial in the long run. This suggests that, in the long run, Economic Growth has a considerable impact on exchange rate volatility, but other factors may be responsible for short-term swings. It also showed that in both the long and short ranges, the exchange rate in Nigeria is significantly influenced by the country's money supply, trade openness, and lending interest rate.

RECOMMENDATIONS

Based on the conclusion above, the following recommendations were put in place made:

- I. I. The negative effects of exchange rate fluctuation on economic growth need a swift shift in Nigeria's export strategy from crude oil to non-oil products, including agricultural products and other solid minerals. This is due to Nigeria's lack of control over the price of crude oil, looking at how crude oil dominated our foreign trade. Jibrilla (2016). The historical volatility of oil prices and that of revenue flows and expenditure in Nigeria may have a far-reaching effect on its budgetary process and the outlook of its fiscal prudence. Government revenues and expenditures can play an important role in managing federal budget deficits. Thus, shifting away from the export of crude oil or other basic goods will significantly decrease the naira's regular fluctuations in value.
- II. Since Exchange Rate fluctuations give a negative impact on Economic Growth more in the long run, it is expected for Nigeria to make prompt effort to increasing her foreign reserves in the short run since it serves as a shock absorber against Exchange Rate volatility. Thus, Nigeria should consciously work to raise her reserve in the short term by carefully managing her foreign exchange policy and encouraging export through incentives.
- III. Government should encourage export promotion strategies in order to maintain a surplus balance of trade, which will help make the domestic currency strong and prevent further depreciation of the Nigeria naira. Since exchange rate granger causes inflation, a sustained favourable exchange rate policy will reduce inflationary pressure, which in turn will stabilized the economy.
- IV. There is need to improve on the existing exchange rate management framework in Nigeria. This can influence the rate of income growth, but only in the context of a broad-based economic reform involving a complementary monetary policy.
- V. Nigeria economy planners and policy makers should therefore design policies that would guarantee stability of exchange rate, Hence, a reduction or stability in the real exchange rate is fundamental for macroeconomic performance to enhance economic growth in Nigeria.

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