



## NEXUS OF EXCHANGE RATE VOLATILITY AND FOREIGN DIRECT INVESTMENT IN NIGERIA

By

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### Abstract

*The paper examined nature of relationship existing between exchange rate volatility and foreign direct investment (FDI) in Nigeria. It equally sheds light on direction of causal relationship between the two variables during the period 1970 -2018. The study employed annual time-series data on foreign direct investment; GDP growth rate; exchange rate; export and import for the analysis. The data were sourced from statistical bulletins published by Central bank of Nigeria and the World Development Indicators (WDI) published by the World Bank. Auto-regressive Distributed Lag (ARDL) method was employed for the estimation. The results from the estimation revealed an existence of negative relationship between exchange rate volatility and FDI in Nigeria. The results also showed that high degree of trade openness negatively influence level of foreign direct investment in Nigeria. Unidirectional causality was also found to exist between exchange rate volatility and foreign direct investment in the country as causality runs from volatility to FDI. The study recommended that stable exchange rate should be vigorously pursued through sound exchange rate management system in order to increase investors' confidence encouraging foreign direct inflows in Nigeria.*

**Keywords:** Foreign Direct Investment (FDI); exchange rate volatility; economic growth; and Auto-regressive Distributed Lag (ARDL)

**JEL Classifications:** C22, F21, F23, F31, F43.

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### 1.0 Introduction

The need for foreign capital in developing countries has remained an issue of concern in the economics literature. The inflows of capital and services tagged as foreign direct investment (FDI) and portfolio investment are considered to

influence economic growth of the recipient countries. It does this through transfer of technologies and technical know-how, formation of human resources, global markets integration and increase competition. This is

evidence in the neoclassical theory of growth that reveals the effectiveness and efficiency of capital when move from developed economy to the less developed ones (Alfaro and Jasmina, 2017). That is, the capital-deficient economies most times turn to foreign capital inflow in the form of FDI as a means of solving unemployment problem, price instability and stunt economic growth.

Apart from these, FDI has also assumed major role in the world economy's expansion. It provides the channel for resource movement between industrialised and less industrialised economies of the world (Gupta Akshay and Monica Singhanian, 2011). This explains reason for the increased in inflow and outflow of capital amongst nations resulting into economic integration, markets liberalization and technological advancement of the world. Base on all these, it can be hypothesized that an emerging economy like Nigeria may make progress into steady state of economic growth by relying on inflow of foreign capital in form of FDI in her economy.

However, the inflows and outflows of FDI comes with large exchange of various currencies among the participating nations. The increasing protectionist policy of most countries involved in these transaction, have created room for almost complete shift from fixed to floating exchange rate of their countries' currencies. This has expanded the magnitude of movements in exchange rates fluctuations within most these countries (Peter, Natalia, Shang-Jin, Azim and Li, 2004). The nature of exchange rate policies and reform of some of them have remained an influencing factor that determines the general inflow of FDI into their countries. This volatility in exchange rate has made international trade and investment decisions more dicing as it increases the potential of losing or gaining money due to uncertainty that often clouds the fluctuation in exchange rate. This sometimes attracts or reduces foreign investment incentive, fluctuating FDI movement to most developing countries.

Theoretically, exchange rate volatility is said to increase risk and uncertainty of return from investment. This sometimes, reduces

foreign investors' incentives declining inward FDI. That is, exchange rate volatility increase cost for risk-averse investors and reduces new foreign investment movement to countries desiring their presence. Most exchange rate is agreed on at a time contract where payment is made on future delivery or execution of the contract. When changes in exchange rates become unpredictable, it creates uncertainty about the profits to be made which might reduce the benefits on investment especially by the foreign investors.

Carrera and Vuletin (2003) gave credence to this argument with their explanation on how exchange rates volatility produces offsetting effects on potential profit of multinational firms in foreign land. Adeoye and Atanda (2010) equally aligned themselves with this position base on results from their research work, where they showed how exchange rate volatility led to reduction in FDI impaction the world trade expansion. This declining impact and imbalances often trigger economic distortions, trade pressures, and sharp currency reversals (Philippe, Philippe, Romania and Kenneth, 2009).

The argument is not different from that of Anthony and Kwame (2008). It emphasized the influence of exchange rate volatility as determinant of foreign direct investment (FDI) in Ghana. The paper revealed negative effect of real exchange rate volatility on FDI inflow and how liberalization process of exchange rate failed to increase inflow of FDI in Ghana. This means that inefficient management of exchange rate fluctuation can cause distortions in both patterns of production and consumption in the economies of the participating countries. Therefore, right exchange rate remains an essential component of international transaction and FDI destinations among nations.

On the contrary, some studies have presented exchange rate volatility as appropriate and good for the growth of FDI and portfolio investment inflow, especially in developing countries (see Achouak and Ousama, 2018; and Murtala, 2017). Some investors are said to seek out higher volatility in exchange rate with the hopes of making higher profits. Some foreign

portfolio investors feel that if exchange rate or stocks are characterised with low volatility, it may result into low gain from investment in that economy. Cuslunan (1988), put this position better base on what he called market-orientation perspective. If a firm is involved in exporting goods or services to a particular country, an increase in exchange rate volatility in that country may stimulate the use of direct investment as a partial substitute for trade to secure their revenue streams from that economy. Sharifi-Renani and Mirfatah (2012) agreed with this position in their employment of Johansen cointegration method which investigated the determinants of FDI in Iran between 1980 and 2006 periods. Their results confirmed an existence of positive relationship between exchange rate volatility and FDI in Iran. A study by Osinubi and Amaghionyeodiwe (2009) got a similar result for Nigeria where their study revealed positive relationship between FDI inflow and nominal exchange rate in Nigeria.

Froot and Stein (1991) analysed the reasons for this kind of relationship as they showed how depreciation and uncertainty in the currency of an FDI host's country can increase the inflow of FDI into that economy. Their explanation showed that depreciation in currency of an FDI host country may results in decrease cost of acquiring assets and other factors of production which may serve as incentive and attraction to would be foreign investors into that economy.

These back and front argument have generated growing debate in the economic literature with many studies establishing the danger of prolonged exchange rate fluctuations and how it can creates macroeconomic imbalances that may affect the performance of FDI in developing economies. They found negative relationship between exchange rate volatility and FDI, while others found positive relationship between these two variables. It becomes important to know if volatility in exchange rate can serve as determinant of inward FDI in Nigeria. That is, if the FDI performance in the last three decades can be attributed to exchange rate volatility in Nigeria. It becomes imperative to re-examine the nature

of relationship between these variables as the situation in Nigeria economy in the recent time has shown that domestic savings and internal sources of capital are no longer sufficient for uplifting the country into the desire state of economic growth. There is a need for foreign capital inflow in the economy considering the current high rate of unemployment in the country.

Therefore, this research work was set out to provide empirical evidence on the beneficial and detrimental role of exchange rate volatility on FDI inflow in Nigeria. Although, a number of studies have uncovered some ranges of determinants of FDI and their relationship in developing countries, but relatively less is known on the specific nature of relationship between these determinants especially, exchange rate volatility and FDI in Nigeria as a result of existing ambiguity in the literatures. The goal of this research work was to find how exchange rate volatility relates to FDI in Nigeria, especially when absolute percentage change of exchange rate is used as a measure of exchange rate volatility. The paper also examined empirical causal directional relationship between the two variables. It is important to know this as designing effective policies and strategies that put the country on a more competitive position for FDI destination, requires an empirical understanding of this relationship.

The rest of the paper is structured as follows: Section two focuses on literature review which includes: theoretical framework and empirical literature. Section three covers methodology while section 4 deals with analysis and results. Section five concludes the paper.

## **2.0 Review of Related Literature**

Review of some theoretical and empirical studies have reinforced the ambiguous nature of relationship between exchange rate volatility and FDI destination amongst nations, as there is no clear consensus yet in the existing literature. A survey of theoretical literatures on this topic shows negative, positive and indeterminate relationship between the variables. For instance, the monetarists argued that exchange rate

fluctuations do not have any influence on real variables in the long run. They are of the opinion that exchange rate devaluation affect real magnitudes mainly through real balance effect in the short run but leaves all real variables unchanged in the long run (Domac, 1999). The classical economists, on the other hand, opined that exchange rate depreciation would promote trade balance, alleviate balance of payments difficulties, expansion of output and employment (Kenneth, Jonathan and Kenneth, 2016).

Another argument states that depreciation would lead to expansion in output if the sum of price elasticity of demand for export and the price elasticity of demand for imports are greater than unity (Taye, 1999). The reason for is that devaluation in form of volatility switches demand from imports to domestically produced goods by increasing the relative prices of imports and making export to be more competitive in international markets thus stimulating domestic production of tradable goods and inducing domestic industries to use more domestic inputs. This is in line with export substituting argument where firms engage in FDI to avoid the costs of international trade and currency risk.

A numbers of empirical studies have been conducted in finding the nature of relationship between these two variables. Amongst them is that of Osinubi & Amaghionyeodiwe (2009), who found a significant positive relationship between inward FDI and exchange rate in Nigeria. The study examined the effect of exchange rate volatility on foreign direct investment (FDI) in Nigeria, using secondary time series data from 1970 to 2004. The paper employed error correction model (ECM) and OLS method of estimation for the study. The results revealed that exchange rate volatility which comes with some degree of Naira depreciation, leads to increases in real inward FDI Nigeria. The paper suggests that exchange rate volatility might not be a source of worry for foreign investors in Nigeria.

A similar study by Murtala (2017), examined the nature of relationship between foreign exchange rate fluctuation on FDI and

their effect on GDP in Nigeria. The study employed time series data from 1990 to 2015 using ordinary least square regression and correlation methods for the analysis. The results revealed a strong positive relationship between FDI and exchange rate in Nigeria. The study recommended a full liberalization of exchange rate that will be devoid of fixed multiple exchange rates in order to attract more FDI into the country.

Also, Fapetu, and Oloyede (2014), revealed a significant positive relationship between exchange rate volatility and economic growth. They examined the effects of exchange rate volatility on FDI in Nigeria between 1970 and 2012 using the ordinary least square estimation techniques within the error correction model (ECM) model. Their result showed that foreign investors need not to worry about exchange rate volatility as it presents insignificance effect on FDI in Nigeria. The situation is not different from that of Sharifi-Renani and Mirfatah (2012) who aligned with the results from Osinubi & Amaghionyeodiwe (2009) and Murtala (2017). They employed Johansen cointegration method to investigate the determinants of FDI in Iran between 1980 and 2006 periods. Their results revealed an existence of positive relationship between exchange rate volatility and FDI in Iran.

However, a study by Yakub, Sani, Obiezue, and Aliyu (2019) slightly disagreed with the findings by Osinubi & Amaghionyeodiwe (2009); Murtala (2017); and Sharifi-Renani and Mirfatah (2012) on the issue of their relationship. Yakub, Sani, Obiezue, and Aliyu (2019) examined the effect of exchange rate volatility on trade flows in Nigeria using monthly data from the period of 1997 - 2016. The paper employed GARCH model to generate nominal exchange rate volatility series. ARDL bounds testing approach was used to determine the nature of relationship among the variables of interest. Granger causality test was also employed to determine the direction of causality among the variables. The study revealed that in the short run, negative relationship between exchange rate volatility and Nigeria's trade

flows while the relationship becomes positive in the long run.

On the contrary, Ogunleye (2009) investigated the nature of relationship between exchange rate volatility and foreign direct investment in sub Saharan Africa region taking Nigeria and South Africa as case study. The study employed Generalized Auto Regressive Conditional Heteroscedasticity (GARCH) model to generate exchange rate volatility data. Two stage least square (2SLS) techniques of estimation were applied for the analysis. The results revealed that exchange rate volatility has harmful effects on inflow of FDI in sub-Sahara region. The study recommended the need for exchange rate policy coordination in order to reduce its harmful effects on FDI in the sub-Sahara region.

In another similar study, Rashid and Lin (2018) examined the effect of exchange rate volatility on international trade and foreign direct investment (FDI) in developing countries. Seven countries selected include: Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Panel data for the period 1995 to 2016 sourced from the World Development Indicators (WDI) were used for the study. Generalized Autoregressive Conditional Heteroscedasticity (GARCH) (1,1) and threshold-Generalized Autoregressive Conditional Heteroscedasticity (TGARCH) (1,1) models were employed to measure the exchange rate volatility. Fixed effect model was used to analyze the relationship between exchange rate volatility and inward FDI in these developing countries. The results revealed a significant negative relationship between exchange rate volatility and inward FDI in these developing countries. It means that exchange rate volatility adversely affect inward FDI in these countries.

In summary, predictions from the body of both theoretical and empirical works on this issue are ambiguous across and within models. The explanations for the mixed findings may lie in the model specification and variable measurement of some of these papers. Therefore, this research work was set to overcome these identified problems using

autoregressive distributed lag (ARDL) procedure as developed by Pesaran et.al (2001) and Absolute Percentage Change of Exchange Rate as developed by Bailey, Tavlas and Ulan (1986) to generate nominal exchange rate volatility in analysing the nature of relationships between these two variables. Most similar studies like: Saidu (2018); Rashid and Lin (2018) and some others, made use of ARCH and GARCH as a measure of nominal exchange rate volatilities in their analysis.

### 3.0 *Methods and Procedure*

ARDL is used to analyse the nature of relationship between exchange rate volatility and foreign direct investment in Nigeria. The choice of other control variables was influenced by some earlier empirical studies on the subject. These variables are: GDP growth rate; Degree of Openness and Nominal exchange rate. Following a model as given by Joseph and Eric (2006), the model estimated is specified as:

$$FDI = f(Y, OP, EXCR, EXCRV) + \epsilon \dots\dots\dots (i)$$

Where FDI is foreign direct investment as percentage of gross domestic product; Y represent GDP growth rate; OP which is the degree of openness is calculated in the form of export as percentage of GDP plus import as a percentage of GDP, divided by the GDP growth rate; EXCR is nominal exchange rate; and EXCRV represent exchange rate volatility as extracted through the uses of Absolute Percentage Change of the exchange rate developed by Bailey, Tavlas and Ulan (1986); and  $\epsilon$  is error term.

The expression in equation (i) above is rewritten in explicit form as:

$$FDI = \beta_0 + \beta_1 Y + \beta_2 OP + \beta_3 EXCR + \beta_4 EXCRV + \epsilon \dots\dots\dots (ii)$$

The reduce form of the model is stated follow:  
 $f = \beta_0 + \beta_1 y + \beta_2 op + \beta_3 xr + \beta_4 xrv + \epsilon \dots\dots\dots (iii)$

where  
 $f = FDI; y = Y; p = OP; xr = EXCR; xrv = EXCRV$

In analysing the nature of relationships among these variables, an Autoregressive Distributed

Lag (ARDL) procedure as developed by Pesaran, Shin, and Smith (2001) was used. The method does not require pre-testing of variables included in the model for unit roots unlike other techniques. Though, the method will breakdown if the unit roots of any variable included in the model is of I(2) series. It means that ARDL is

applicable irrespective of whether the regressors in the model are purely I(0), or purely I(1). Also, the test is relatively more efficient in small sample data sizes. Therefore, the Autoregressive Distributed Lag (ARDL) model as used in the study is expressed as:

$$\Delta f_t = \beta_0 + \sum_{i=1}^n \beta_{1i} \Delta f_{t-i} + \sum_{i=1}^n \beta_{2i} \Delta y_{t-i} + \sum_{i=1}^n \beta_{3i} \Delta op_{t-i} + \sum_{i=1}^n \beta_{4i} \Delta(xr)_{t-i} + \sum_{i=1}^n \beta_{5i} \Delta(xrv)_{t-i} + \beta_1 f_{t-1} + \beta_2 y_{t-1} + \beta_3 op_{t-1} + \beta_4 xr_{t-1} + \beta_5 xrv_{t-1} + \mu_t \dots \dots \dots (11)$$

Where  $y_t$ ,  $op_t$ ,  $xr_t$ ,  $xrv_t$  and  $f_t$  respectively refer to GDP growth rate, trade openness, Exchange rates, Exchange rate volatility and foreign direct investment.  $\Delta$  is the difference

operator,  $n$  indicates the optimum lag and  $\mu_t$  is the error term. The existence of a long - run relationship among the variables is tested.

**3.1 Technique of Data Analysis**

The ARDL bounds testing approach was adopted for testing the existence of long run relationship among our variables of interest using time series data for the period of 1970–2018. The error correction model integrates the short-run dynamics with the long-run equilibrium without losing information about long-run. Wald or F-statistic test was used to ascertain the significance of joint hypothesis coefficients of all (lagged) variables. For the bound test, if the computed F-statistic lies below the 0.05 upper bound, the hypothesis of no level relationship is accepted at 5 percent level. If the F-statistic lies above the 0.05 upper bound, the hypothesis of no level relationship is rejected. Also, the model’s goodness of fit is investigated with the application of LM serial correlation and stability tests. Granger-Causality Test was used to determine the directional causality of the variables. The research work employed annual time-series data for the period 1970 to 2018 for each variable such as: gross domestic product (GDP) growth rate; foreign direct investment as a percentage of GDP; export of goods and

services as a percentage of GDP; import of goods and services as a percentage of GDP and exchange rate. The time series data were derived from various secondary sources such as: the statistical bulletin of the Central bank of Nigeria and World Development Indicators as published by the World Bank.

**4.0 Analysis and Discussion of Results**

In applying ARDL approach to cointegration and Granger-causality test, unit roots test were first conducted to ascertain the stationarity properties of the data. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were applied to all the variables in both levels and their first difference in order to ascertain their order of integration. The results of ADF test and PP test for unit root in the model for all the variables are presented in Table 1 and Table 2 respectively. The null hypothesis is that the series is non-stationary or contains a unit root. The rejection of the null hypothesis for the test is based on the MacKinnon (1991) critical and probability values

**Table 1: Results of Unit Root Test with constant at their Levels**

Variables	ADF		PP	
	t-statistic	p-value	t-statistic	p-value
f	-3.543786	0.0109	-3.543786	0.0109
y	-5.569828	0.0000	-5.581005	0.0000

xr	2.479215	1.0000	2.228211	0.9999
xrv	-7.402622	0.0000	-7.402622	0.0000
op	-6.650470	0.0000	-6.650463	0.0000

Source: Author's Computation (2021)

From the unit root test results in Table 1, it can be seen that all the variables apart from exchange rate are all stationary at levels. This is because the P-values of the ADF and PP statistic are statistically significant. However, when the exchange rate variable was differenced at the

first difference, it became stationary. This is because the null hypothesis of the presence of unit root (non-stationary) is rejected at 1%, 5% and 10% significant levels. Table 2 presents the unit root test results obtained for both ADF and PP test at their first difference.

Table 2: Results of Unit Root Test at their first difference

Variables	ADF		PP	
	t-statistic	p-value	t-statistic	p-value
f	-10.17132	0.0000	-13.10187	0.0000
y	-10.51430	0.0000	-11.60182	0.0000
xr	-4.661466	0.0004	-4.665879	0.0004
xrv	-7.133318	0.0000	-30.70097	0.0001
op	-7.786139	0.0000	-25.57740	0.0001

Source: Author's Computation (2021)

#### 4.1 Bounds Test for Cointegration

Order of lags on the first differenced variables from the model was obtained using Akaike Information Criterion (AIC) and the Schwartz Bayesian Criterion (SBC). The results of the AIC and SBC tests (not reported here) show that

the optimal lag of 4 was appropriate for the model. Bounds test was equally applied to the model in order to ascertain the existence of a long-run relationship amongst the five variables. The results of the bounds test are reported in table 3.

Table 3: The ARDL –Bounds Test for Cointegration Analysis

F-statistic			2.839838		
Critical Value Bounds and interest with no trend					
<b>Significance</b>		<b>I0 Bound</b>		<b>I1Bound</b>	
Critical Value Bounds	5%	2.86		4.01	
Critical Value Bounds	10%	2.45		3.52	
<b>F-statistic</b>		<b>2.839838</b>		<b>K = 4</b>	

Source: Author's Computation (2021)

The results of the Bounds test presented in Table 3 indicate that the computed F-statistic (2.84) is lower than the upper bound critical value (4.01) at the 5% level of significance. This indicated an absence of stable long-run relationship between FDI and its determinants, namely: exchange rate volatility, exchange rate, gross domestic product growth rate and the degree of openness. This none existence of cointegration relationship allowed the

examination of the short run relationship of the variable.

#### 4.2 Short Run Relationship

Table 4 presents the results of the estimation of foreign direct investment and exchange rate volatility in Nigeria using the ARDL technique. The coefficient of the error correction model is not significant and its sign at 0.12998 is not appropriate. This demonstrates that in the long

run, all variables, includes exchange rate volatility are not explaining FDI inflow in Nigeria. It is an indication that no stable relationship exist between FDI inflow and the variables that influence its short term

movements in the model. Thus, foreign direct investment, exchange rate, exchange rate volatility, the degree of openness and gross domestic product are not cointegrated.

**Table 4: Estimated Short-Run with the ARDL**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(f(-1))	-0.464134	0.163706	-2.835174	0.0083
D(f(-2))	-0.312219	0.178178	-1.752288	0.0903
D(f(-3))	-0.404045	0.148465	-2.721477	0.0109
D(xrv)	-0.004493	0.008573	-0.524052	0.6042
D(xrv (-1))	-0.013016	0.007704	-1.689368	0.1019
D(xrv (-2))	-0.033981	0.008072	-4.209838	0.0002
D(xrv (-3))	0.013609	0.009138	1.489153	0.1472
D(xr)	0.000479	0.001452	0.330146	0.7437
D(y)	-0.047190	0.023238	-2.030716	0.0515
D(op)	0.002510	0.001641	1.529715	0.1369
D(op(-1))	-0.002122	0.001533	-1.384365	0.1768
D(op(-2))	-0.006618	0.001513	-4.375477	0.0001
ECM <sub>t-1</sub>	0.129982	0.165508	0.785353	0.4386

R-squared 0.789752 Adjusted R-squared 0.681002  
 F-statistic 7.262136 Durbin-Watson stat 1.833540  
 Prob (F-statistic) 0.000003

**Source: Computed by Author using E-view 9 (2020)**

These results showed that exchange rate volatilities have negative and significant effect on foreign direct investment in Nigeria base on probability value from the wald test. This implies That exchange rate volatility is one of the major determinants of FDI in Nigeria. It suggests that stability in exchange rate will constitute conducive environment for capital inflows and investment in the country as fluctuation in exchange rate can generate risks and uncertainty which may have reduced the inflows of FDI in Nigeria.

This result is in line with some findings in empirical literature. It is in line with the findings of Yakub, Sani, Obiezue, and Aliyu 2019; and Achouak, Ousama and Mourad (2018) who reported significant negative relationship between exchange rate volatility and FDI in Nigeria. Their findings revealed how stability in exchange rate has remained an important determinant of foreign direct investment inflows, growth in income and

economic performance of the country. Similarly, exchange rate volatility and degree of openness have negative relationship in the country, as its F-statistic value is statistically significant at 5% level of significance base on the result from the wald test. It means that, as the degree of openness increased by one unit, it leads to reduction in the value of FDI inflow into the country. The reason for this, is that, the degree of openness might increase importation of goods and services in the country thereby reducing the demand for domestic out of the FDI.

Also, economic growth presented a negative relationship with FDI, though not statistically significant at 5 percent. This result is surprising considering the fact that economic growth is assumed to positively correlate with FDI inflows in an economy. However, FDI decisions depend on various factors that include political structure, investment incentives, and trade policies in the host country. The

implication is that growth of nations might be characterized by political instability and some other unfavorable factors which might not make them a good destination for FDI. Finally, exchange rate has a positive relationship with FDI in the country but not statistically significant.

The  $R^2$  of 0.7897521 indicates that about 78% of total variation in the dependent variable (FDI) is accounted for by the explanatory variables (xrv, xr, y, and op). This result remains robust even after adjusting for the degrees of freedom (d.f.) as indicated by the value of the adjusted  $R^2$ , which is 0.681002 (68.10%). The regression therefore has a good fit. The F-statistic, which is a measure of the overall significance of the model, is 7.262136 with the corresponding probability value of 0.0003, statistically significant at 1%. The implication of this is that the explanatory variables have joint significant effect on the

inflow of foreign direct investment to Nigeria. The Durbin-Watson statistic of 1.8335 indicates no evidence of serial autocorrelation in the residuals of the estimates.

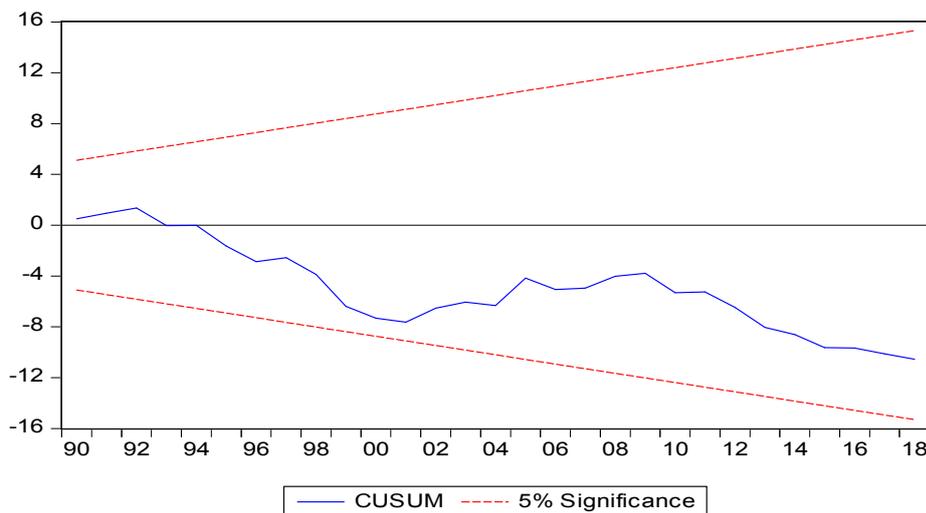
### 4.3 Model Diagnostics and Stability Tests

In order to check for the estimated ARDL model, the significance of the variables and other diagnostic tests such as serial correlation, heteroskedasticity and structural stability of the model are considered. As shown in Table 5 and figure 1 and 2. The model generally passes all diagnostic tests in the first stage. The diagnostic test shows that there is no evidence of autocorrelation and the model passes the normality test indicating that the error is normally distributed. Additionally, the model passes the Arch test for heteroskedasticity for correct specification based on the probability values in parentheses.

**Table 5: Model diagnostics**

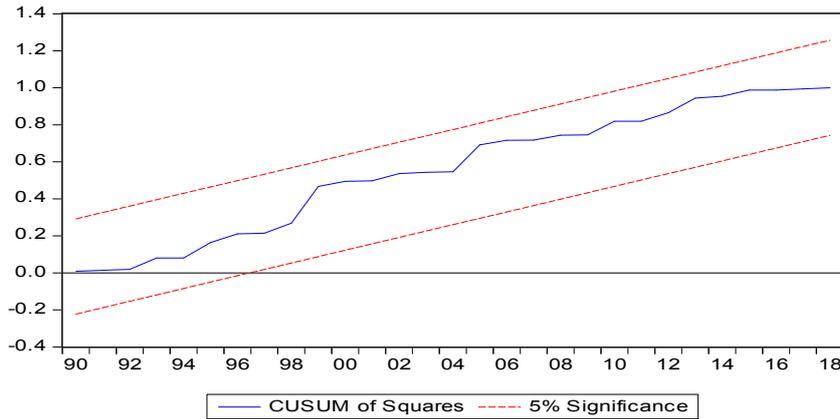
Diagnosics	LM-Version	F-Version
Breusch-Godfrey Serial Correlation LM Test:	Obs*R-squared = 5.027337 [0.2845]	F(4, 25) = 0.786059 [0.5451]
Breusch-Pagan-Godfrey Heteroskedasticity Test:	Obs*R-squared = 6.327007 [0.9737]	F(15,29) = 0.316299 [0.9890]

Source: Computed by Author using E-view 9 (2020)



Figures i: CUSUM plot for the ARDL (1, 2, 3, 4)

Source: Computed by Author using E-view 9 (2020)



Figures ii: CUSUMSQ plot for the ARDL (1, 2, 3, 4)

Source: Computed by Author using E-view 9 (2020)

The result of the Recursive Residual from cumulative sum of residual (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) class of tests showed that the parameter of the estimated model is stable. That is, the model is within the 5% critical line for sample period as shown in Figures 1 and 2.

#### 4.4 Granger Causality Test

Though, there was no evidence of cointegration relationship between FDI and exchange rate volatility, there might still be an existence of causality in at least one direction. Therefore, Granger causality test was applied to measure the linear causation between foreign direct investment inflows and exchange rate volatility in Nigeria. The results of the test are presented in Table 6 below.

Table 6: Results of Bivariate Granger causality test

Null Hypothesis:	Obs	Chi-sq	Probability
xrv does not Granger Cause fdi	45	19.61358**	0.0006
fdi does not Granger Cause xrv		7.165431	0.1274

Source: Computed by Author using E-view 9 (2020)

The bivariate Granger causality test results in Table 6 reject the null hypothesis that the xrv does not Granger cause FDI at 5 per cent level. The rejection of the null hypothesis indicates that exchange rate volatility causes foreign direct investment. However, the null hypothesis that foreign direct investment does not Granger cause the exchange rate volatility cannot be rejected at the conventional level. The results of Granger causality tests confirm causation runs from exchange rate volatility to foreign direct investment. There is evidence of unidirectional causality running from exchange rate volatility to foreign direct investment at 5% significance level in Nigeria.

#### 5.0 Conclusion

The study, in line with the empirical literature, has shown the existence of negative relationship between exchange rate volatility and foreign direct investment where FDI reduces as the volatility increases in the country. This implies that volatility in exchange rates increases the level of uncertainty and risk factors which serve as discouraging elements for foreign investors to be actively involved in economic activities in the country. The results also showed degree of trade openness as a statistical important determinant of foreign direct investment in Nigeria as it negatively affects FDI. In addition, the study found a unidirectional causality between exchange rate volatility and foreign direct investment in Nigeria. This means that exchange rate volatility influence the changing

value of foreign direct investment in Nigeria. The study recommends restoration of investors' confidence and encourages foreign direct investment inflows into the country. Stable exchange rate should be vigorously pursued through sound exchange rate management

system and policies that leads to increase in domestic production of export commodities. This will increase the country's foreign exchange earnings and reduce volatility in exchange rate.

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