HOW EXCHANGE RATE AND STOCK MARKET VOLATILITIES AFFECT FOREIGN DIRECT INVESTMENT IN NIGERIA: A NON-LINEAR APPROACH

KABIR ABDULLAHI
College of Management and Social Sciences
Department of Economics
Capital City University, Kano, Nigeria
Email: akabir604@gmail.com
Tell: +2348038747679

ABSTRACT
This paper examines how the exchange rate and stock market volatilities affect foreign direct investment (FDI) in Nigeria, using monthly time-series data from 2000 to 2022. The paper applies a Non-linear Autoregressive Distributive Lag (NARDL) method to capture the asymmetric effects of positive and negative shocks from the real exchange rate volatility (XVOL), the stock market volatility (SMVOL), and the real growth domestic product (RGDP) on FDI. The paper finds that there is a long-run cointegration relationship among the variables and that both positive and negative shocks from XVOL and SMVOL have significant negative effects on FDI in the short and long run. In contrast, positive shocks from RGDP have a significant positive effect on FDI in the long run, but an insignificant positive effect in the short run. These results imply that the Nigerian government should stabilise the exchange rate and the stock market to enhance FDI inflows and economic growth.

Keywords: Foreign direct investment, Exchange rate volatility, Stock market volatility, Non-linear cointegration, NARDL model, Nigeria
JEL Classification: F21, F31, G15, C32, 055

1. INTRODUCTION
The exchange rate and the stock market are two important macroeconomic variables that influence the economic growth and development of a country. They also affect the inflow and outflow of foreign direct investment (FDI), which is a key source of capital, technology, and knowledge for developing countries like Nigeria. FDI can enhance the productivity, competitiveness, and innovation of the domestic economy, as well as create employment opportunities and reduce poverty. Therefore, understanding the relationship between exchange rates stock market volatilities and FDI is crucial for policymakers and investors. However, this relationship is not straightforward and may vary depending on the characteristics of the host country, the type and origin of FDI, and the period under consideration. Moreover, the relationship may be nonlinear, meaning that the effect of exchange rate and stock market volatilities on FDI may change depending on the level or direction of these variables. For instance, a moderate level of volatility may signal a dynamic and profitable market, while a high level of volatility may indicate uncertainty and risk. Similarly, a depreciation or appreciation of the exchange rate may have different effects on FDI depending on the sector, mode, and motive of FDI.

Nigeria is an interesting case study for examining the nonlinear relationship between exchange rate and stock market volatilities and FDI, as it is the largest economy and the most populous country in Africa, with abundant natural and human resources. Nigeria has also experienced significant fluctuations in its exchange rate and stock market in the past decade, due to various factors such as oil price shocks, political instability, security challenges, and policy reforms.

These fluctuations have had mixed effects on the FDI inflows and outflows in Nigeria, which have also been influenced by the global and regional economic conditions, the business environment, and the investment incentives and regulations in the country.

According to the data from the Central Bank of Nigeria (CBN) (Central Bank of Nigeria, 2022), the FDI inflows to Nigeria decreased from $3.31 billion in 2021 to -$0.19 billion in 2022, while the FDI outflows increased from $2.41 billion in 2021 to $3.45 billion in 2022. This implies a net FDI outflow of $3.64 billion in 2022, compared to a net FDI inflow of $0.9 billion in 2021. The negative FDI inflow in 2022 was mainly due to the sharp depreciation of the naira against the US dollar, which reached a record low of 570 naira per dollar in June 2022 (Ogundipe, 2022). The depreciation was caused by the persistent decline in oil prices, the COVID-19 pandemic, and the insecurity and social unrest in the country. The depreciation increased the cost of production and reduced the profitability of foreign investors, who decided to divest their assets and repatriate their capital. The depreciation also increased the inflation rate, which reached 18.2% in June 2022 (Ogundipe, 2022), eroding the purchasing power and the living standards of the population.

The stock market in Nigeria also witnessed high volatility in the past decade, as measured by the standard deviation of the monthly returns of the Nigerian Stock Exchange All Share Index (NSE ASI). The NSE ASI is a market capitalization-weighted index that tracks the performance of all listed equities on the Nigerian Stock Exchange. The data from the PwC Nigeria Capital Market Update (PwC Nigeria, 2022) show that the stock market volatility increased from 6.8% in 2019 to 9.2% in 2020, before declining to 7.4% in 2021 and 6.5% in 2022. The stock market volatility was influenced by the same factors that affected the exchange rate, as well as the investor sentiment, the corporate earnings, and the regulatory environment. The stock market volatility hurt the FDI inflows and outflows in Nigeria, as it increased the uncertainty and risk of investing in the country. The data from the CBN (Central Bank of Nigeria, 2022) show that the foreign portfolio investment (FPI), which is a component of FDI that involves the purchase of stocks, bonds, and other financial assets, decreased from $3.06 billion in 2019 to $2.39 billion in 2020, before increasing to $3.31 billion in 2021 and $3.45 billion in 2022. The FPI flows were mainly driven by the interest rate differential, the exchange rate expectations, and the market liquidity. Therefore, it is against this background this study aims to analyze how the exchange rate and stock market volatilities affect FDI inflows to Nigeria, which is important for the country's development. This study fills some gaps in the literature by testing the null hypothesis that exchange rate and stock market volatilities do not affect FDI inflows to Nigeria asymmetrically, which the reviewed studies did not explore. The paper is organized as follows: Section One is an introduction; Section Two explains the literature review; Section Three describes the methodology; Section Four reports the results and discussion of findings; and Section Five draws conclusions and policy recommendations.

2. LITERATURE REVIEW

2.1 Theoretical Literature

The Imperfect Capital Markets Approach: This theory argues that the exchange rate and stock market volatilities affect FDI by changing the relative wealth and financing cost of domestic and foreign investors (Froot & Stein, 1991). The theory assumes that there are informational asymmetries and agency problems in the global capital markets, which make external financing more expensive than internal financing for firms. Therefore, firms rely on their own retained earnings or cash flows to finance their investments, especially when they want to exploit their intangible assets or technologies abroad (Froot & Stein, 1991).

The theory predicts that when the domestic currency depreciates, the relative wealth and the internal funds of the domestic firms decrease, while the relative wealth and the internal funds of the foreign firms increase (Froot & Stein, 1991). This creates an opportunity for foreign firms to acquire domestic assets or technologies at a lower cost, as the domestic firms face higher financing constraints and lower bargaining power. Conversely, when the domestic currency appreciates, the relative wealth and the internal funds of the domestic firms increase, while the relative wealth and the internal funds of the foreign firms decrease. This creates an opportunity for domestic firms to acquire foreign assets or technologies at a lower cost, as the foreign firms face higher financing constraints and lower bargaining power.

Similarly, the theory postulates that when the domestic stock market becomes more volatile, the relative wealth and the internal funds of the domestic firms decrease, while the relative wealth and the internal funds of the foreign firms increase (Froot & Stein, 1991). This is because domestic firms face higher uncertainty and risk in their returns, which lowers their market value and increases their cost of capital. This also creates an opportunity for foreign firms to acquire domestic assets or technologies at a lower cost, as domestic firms face higher financing constraints and lower bargaining power. Conversely, when the domestic stock market becomes less volatile, the relative wealth and the internal funds of the domestic firms increase, while the relative wealth and the internal funds of the foreign firms decrease (Froot & Stein, 1991). This is because domestic firms face lower uncertainty and risk in their returns, which increases their market value and decreases their cost of capital. This also creates an opportunity for domestic firms to acquire foreign assets or technologies at a lower cost, as the foreign firms face higher financing constraints and lower bargaining power.

Therefore, the imperfect capital markets approach suggests that exchange rate and stock market volatilities can affect the direction, magnitude, and mode of FDI, depending on the relative wealth and financing costs of the domestic and foreign firms. The theory also implies that FDI can be a substitute for arm's length technology transfers, such as licensing or franchising when the firms want to exploit their intangible assets or technologies abroad and face informational asymmetries and agency problems in the global capital markets.

2.3 Empirical Literature

This section reviews the empirical literature on how Exchange Rate Volatility, Stock Market Volatility, and economic growth affect the FDI inflows in Nigeria and other countries. The literature shows mixed results, depending on the methods, data, and countries used. Some studies found a positive relationship between ERV and FDI, implying that foreign investors are attracted by higher returns and opportunities in volatile markets. For example, Okonkwo et al. (2021) and Cambazoglu and Gunes (2016) found that ERV has a positive and significant effect on FDI in Nigeria and Turkey, respectively. Some studies found a negative relationship between ERV and FDI, implying that foreign investors are discouraged by higher uncertainty and instability in volatile markets. For example, Osei-Fosu et al. (2015) and Rahman and Shahbaz (2020) found that ERV has a negative and significant effect on FDI in Ghana and six South Asian countries, respectively. Some studies found an insignificant relationship between ERV and FDI, implying that foreign investors are indifferent to exchange rate fluctuations. For example, Omokunwa and Ikponmwosa (2014) found that ERV has no significant effect on FDI in Nigeria.

Some studies found a positive relationship between SMV and FDI, implying that foreign investors are attracted by higher returns and opportunities in volatile markets. For example, Oriobe (2019) and Ugochukwu et al. (2013) found that SMV has a positive and significant

effect on FDI in Nigeria. Some studies found a negative relationship between SMV and FDI, implying that foreign investors are discouraged by higher uncertainty and instability in volatile markets. For example, Aggarwal et al. (2011) and Asiedu et al. (2018) found that SMV has a negative and significant effect on FDI in 11 Asian countries and 30 sub-Saharan African countries, respectively.

Economic growth is the increase in the production and consumption of goods and services in an economy over time. It may affect the inflow of FDI, as it indicates the size and potential of the market, as well as the availability and quality of factors of production. Several studies have examined the impact of FDI on economic growth in Nigeria and other countries, using different methods and data and obtaining mixed results. Some studies found a positive relationship between FDI and economic growth, implying that FDI enhances the productivity and competitiveness of the host economy. For example, Alabi (2019) and Mohammad and Mahmoud (2014) found that FDI has a positive and significant impact on economic growth in Nigeria. Some studies found an insignificant relationship between FDI and economic growth, implying that FDI does not have a significant effect on the host economy. For example, Ehimare (2011) and Egwaikhide (2012) found that FDI has an insignificant impact on economic growth in Nigeria. Some studies found a negative relationship between FDI and economic growth, implying that FDI has a detrimental effect on the host economy. For example, Olatunji and Shahid (2015), Muhammad and Ijirshar (2015), and Muhammad and Abdullahi (2020) found that FDI has no significant positive impact on Nigeria's economic growth.

Akinlo and Ogunleye (2018) examined the exchange rate volatility-FDI nexus in selected ECOWAS countries. They found that the nominal exchange rate volatility hurts FDI in Ghana, Sierra Leone, and Nigeria, while the real exchange rate volatility hurts FDI in Nigeria, Togo, Sierra Leone, and Cote d'Ivoire. They also found unidirectional causality from exchange rate volatility to FDI in all countries except Ghana, and bidirectional causality between the two variables in Nigeria and Sierra Leone. Asiedu and Lien (2011) investigated the relationship between democracy, FDI, and natural resources in 112 countries and found that democracy has a positive effect on FDI in countries with abundant natural resources, but a negative effect on FDI in countries with scarce natural resources. They also found that natural resources have a positive effect on FDI in countries with high democracy, but a negative effect on FDI in countries with low democracy. Bala and Asemota (2013) analyzed the impact of exchange rate volatility on FDI inflows in Nigeria and found that exchange rate volatility has a negative and significant effect on FDI inflows in Nigeria and that other factors such as market size, trade openness, infrastructure, and political stability also influence FDI inflows in Nigeria.

Ogunleye and Akinlo (2014) explored the relationship between stock market volatility and FDI in selected ECOWAS countries and found that stock market volatility has a negative and significant effect on FDI in all countries except Ghana and Gambia, where the effect is positive but insignificant. They also found that other factors such as market size, trade openness, human capital, and institutional quality also affect FDI in ECOWAS countries. Aggarwal et al. (2011) and Asiedu et al. (2018) found that stock market volatility has a negative and significant effect on FDI in 11 Asian countries and 30 sub-Saharan African countries, respectively. They also found that other factors such as market size, trade openness, infrastructure, and political stability also influence FDI in these regions.

Several studies have examined the impact of FDI on economic growth in Nigeria and other countries, using different methods and data and obtaining mixed results. Alabi (2019) and Mohammad and Mahmoud (2014) found that FDI has a positive and significant impact on

economic growth in Nigeria. Ehimare (2011) and Egwaikhide (2012) found that FDI has an insignificant impact on economic growth in Nigeria. Olatunji and Shahid (2015), Muhammad and Ijirshar (2015), and Muhammad and Abdullahi (2020) found that FDI has no significant positive impact on Nigeria's economic growth.

The literature review shows that the effects of exchange rate volatility, stock market volatility, and economic growth on FDI inflows in Nigeria and other countries are mixed and inconclusive, depending on the methods, data, and countries used. However, none of the studies investigated the asymmetries effects of exchange rate and stock market volatilities on FDI, which may capture the possible nonlinear and threshold effects of these variables on FDI. Moreover, none of the studies used a nonlinear approach to analyze the relationship between exchange rate and stock market volatilities and FDI, which may account for the potential heterogeneity and endogeneity of these variables. Therefore, this study aims to fill these gaps in the literature by using a nonlinear approach to examine the asymmetries effects of exchange rate and stock market volatilities on FDI in Nigeria.

3. METHODOLOGY

3.1 Theoretical Framework

The Keynesian Extended Theory: This study follows the extended Keynesian aggregate demand and accelerator theories of investment, as modified by Adesete and Jokosenumi (2018). These merged theories incorporate FDI, LI, Ex, and E as a single theory. The merged theories assume that:

1. $I = FDI + LI$
2. Ex affects M and X
3. G depends on E, T, and NX
4. K determines I
5. Disposable income ($Y - T$) determines C
6. E depends on all share price indexes, and NX depends on $M - X$
7. $Y = C + I + G + NX$. The expanded Keynesian theory is:

$$C = c_0 + c_0(Y - T)$$

$$I = (\alpha + \beta)\Delta K$$

$$G = r_0 + r_1 E + d_0 + d_1 NX + T$$

$$X = x_0 + x_1 Ex$$

$$M = m_0 + m_1 Ex$$

$$Y = C + I + G + NX$$

$T =$ Direct taxes

$T =$ Capital stock

$$FDI = \alpha(\Delta K)$$

$LI = \beta(\Delta K)$

$E =$ All share index

$Ex =$ Exchange rate

$NX = (x_0 - m_0) + x_1 Ex + m_1 Ex$

Where:

$c_0, c_1, r_0, r_1, d_0, d_1, x_0, x_1, m_0, m_1$ are parameters

α and β are the proportions of FDI and LI in total investment, respectively, such that $\alpha + \beta = 1$.

To derive the FDI function, we substitute the above components into Y and rearrange the terms to get:

$FDI = Y(1 - c_1) - \alpha(\Delta K) - (1 - c_1)T + (x_1 + m_1)Ex\big[d_1\big((x_1 + m_1) - (x_0 - m_0)\big)Ex\big] - r_1 E + [(x_0 - m_0) - (r_0 - d_0) - c_0] = \theta + \gamma_1 Y + \gamma_2 Ex - \gamma_3 T - \gamma_4 E - \gamma_5(\Delta K)$.

Where:

$\theta = [(x_0 - m_0) - (r_0 - d_0) - c_0]$

$\gamma_1 = (1 - c_1)$

$\gamma_2 = [(x_1 - m_1) - d_1((x_1 - m_1) + d_1(x_0 - m_0)]$

$\gamma_3 = -(1 - c_1)$

$\gamma_4 = r_1$

$\gamma_5 = \pi$(the proportion of total local investment)

$\gamma_1 > 0;\ \gamma_2 > 0;\ \gamma_3 < 0;\ \gamma_4 < 0;\ \gamma_5 < 0$

$\pi = 0$ if FDI equals the total investment in the economy.

3.2 Model Specification

This paper employed the NARDL model, which allows for asymmetric effects of the regression parameters to account for possible nonlinearities in the real exchange rate and stock market volatilities. The NARDL model, developed by Shin et al. (2014), is a non-linear cointegration model that overcomes the limitations of the linear ARDL model, which assumes a linear adjustment process. The NARDL model can capture the non-linear dynamics of the relationship among variables, and has several advantages over other cointegration models. It can be used with a small sample size, with variables that are stationary at level I(0), first difference I(1), or fractionally integrated, and with variables that have a long-run cointegrating

relation and short-run asymmetries. The NARDL model can differentiate between the impact of positive and negative changes in variables such as real exchange rates and stock price movements (Shin et al., 2014). The general theoretical econometric specification for the NARDL model is as follows:

$Y_t = \beta_0 + \beta_1^+ X_t^+ + \beta_1^- X_t^- + \varepsilon_t$ ……. (1)

Where:

$\beta^+$and $\beta^-$are the associated long-run parameters to be estimated.

The X_t is a $k \times 1$vector of regressors decomposed as: $X_t = X_0 + X_t^+ + X_t^-$ …….. (2)

Where:

X^+ and $X^-$are partial sum processes of positive and negative changes in X_t:

$X_t^+ = \sum_{j=1}^{t} \Delta X_j^+ = \sum_{j=1}^{t} max(\Delta Xj, 0)$ ……..…….…….…….... (3)

$X_t^- = \sum_{j=1}^{t} \Delta X_j^- = \sum_{j=1}^{t} min(\Delta Xj, 0)$ ……..…….…….…… (4)

Equation (1) can be framed in an ARDL setting along the line of Pesaran and Shin (1999) and Pesaran et al. (2001) as:

$\Delta Y_t = \eta_0 + PY_{t-1} + \theta^+ X_{t-1}^+ + \theta^- X_{t-1}^- + \sum_{j-1}^{p-1} \varphi j \Delta Y_{t-1} + \sum_{j=0}^{q} (\pi_j^+ \Delta X_{t-j}^+ + \pi_j^- \Delta X_{t-j}^-) + \varepsilon_t$ ..(5)

Where:

η_0= Constant term

$\beta^+ = -\frac{\theta^+}{p}$ and $\beta^- = -\frac{\theta^-}{p}$ are the aforementioned long-run impacts of increase and decrease in $X_t$on Y_t.

The $\sum_{j=0}^{q} \pi_j^+$ measures the short-run influence of increase in $X_t$on Y_t, while $\sum_{j=0}^{q} \pi_j^-$measures the short-run influence of decrease in X_t onY_t.

This study adopted and modified the version of the non-linear ARDL model from Bahmani-Oskooee and Fariditavana (2016) which showed that:

$\Delta Y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i \Delta Y_{t-i} + \sum_{j=1}^{q} \beta_i \Delta X_{t-j} + f(\Delta Y_{t-1}, \Delta X_{t-1} + \varepsilon_t)$

Where:

α_0 = Constant term

Δ = Stands for the first difference operator

Y = Represents the dependent variable

X = Represents the independent variable

p and q = Represent the optimal lags of each variable

f = Represents the non-linear function of the lagged variables

ε_t = Represents the error term

Based on the above-highlighted theoretical and empirical models, the model of this study is specified below:

$FDI = f(XVOL, SMVOL, RGDP)$ ……..…..……....……..… (6)

To make the above mathematical function estimable, it is transformed into stochastic form in the below equation:

$$\begin{aligned}\Delta lFDI_t = {} & \beta_0 + \sum_{i=0}^{m} \beta_1 \Delta lFDI_{t-i} + \sum_{i=0}^{m} \beta_2 \Delta lXVOL^{+}_{t-i} + \sum_{i=0}^{m} \beta_3 \Delta lXVOL^{-}_{t-i} \\ & + \sum_{i=0}^{m} \beta_4 \Delta lSMVOL^{+}_{t-i} + \sum_{i=0}^{m} \beta_5 \Delta lSMVOL^{-}_{t-i} + \sum_{i=0}^{m} \beta_6 \Delta lRGDP^{+}_{t-i} \\ & + \sum_{i=0}^{m} \beta_7 \Delta lRGDP^{-}_{t-i} + \gamma_1 FDI_{t-1} + \gamma_2 lXVOL^{+}_{t-1} + \gamma_3 lXVOL^{-}_{t-1} \\ & + \gamma_4 lSMVOL^{+}_{t-1} + \gamma_5 lSMVOL^{-}_{t-1} + \gamma_6 lRGDP^{+}_{t-1} + \gamma_7 lRGDP^{-}_{t-1} + ECT_{t-1} \\ & + \varepsilon_t\end{aligned}$$

Where:

Δ is the first difference operator

t is the ime trend which consists of years spanning from 1985 to 2022

i = Lag indicator

α_0 is the constant term

FDI is the department variable

$XVOL$ is the real exchange rate volatility

$SMVOL$ is the stock market volatility

$RGDP$ is the real growth domestic product

m is the optimal lags of each variable

f is the non-linear function of the lagged variables

ECT = Error correction term that measures the speed of adjustment

ε_t is the error term which is assumed to be white noise

The above-specified NARDL model assumes that there is a long-run relationship between FDI and other variables. The coefficients β_1-β_7 capture the short-run dynamics of the model, while γ_1-γ_7 captures the long-run relationship between FDI and other variables. Based on the intuition behind the economic theory, it is expected that FDI and $RGDP$ should be positive (>0), while $XVOL$ and SMVOL should be either positive (>0) or negative (<0).

3.3 Nature and Sources of Data

The paper uses monthly time-series data from January 2000 to December 2022, consisting of four macroeconomic variables: Foreign Direct Investment (FDI) as the dependent variable, Real Exchange Rate Volatility (XVOL), Stock Market Volatility (SMVOL), and Real Gross Domestic Product (RGDP) as a percentage of FDI as the independent variables. RGDP as a percentage of FDI is used as a control variable to account for the size and potential of the market. The data sources are the National Bureau of Statistics (NBS) for FDI, the Central Bank of Nigeria (CBN) for XVOL, the World Development Indicators (WDI) for RGDP as a percentage of FDI, and the Nigerian Exchange Group (NEG) for SMVOL.

3.3 Methods of Analysis

The paper aims to investigate the asymmetric effects of exchange rate and stock market volatilities on FDI in Nigeria. To do so, the paper uses the Ramsey Reset test to detect non-linearity in the model and to justify the use of the Nonlinear Autoregressive Distributed Lag (NARDL) model. The NARDL model is used to estimate the long-run and short-run asymmetric effects of the independent variables on the dependent variable. The model allows for different responses of FDI to positive and negative changes in XVOL and SMVOL. The paper also uses the Augmented Dickey Fuller (ADF) and Phillip Peron (PP) tests to check the stationarity of the data and to determine the order of integration of the variables. The NARDL Bound test is used to check the existence of a long-run cointegration relationship among the variables. The Akaike Information Criterion (AIC) is used to select the optimal lag length for the NARDL model. Finally, diagnostic tests were conducted to check the robustness of the model.

3.4 Variables Measurement

The paper also uses the following variables and their measurements: Foreign Direct Investment (FDI) is the dependent variable and it is measured as the total inflow of capital into the domestic economy, in millions of US dollars (Akinlo & Onatunji, 2021). Real Exchange Rate Volatility (XVOL) is an independent variable and it is measured by the standard deviation of the monthly percentage changes in the real exchange rate of Naira to the US dollar, in percentage points (Adesete & Jokosenumi, 2018). Stock Market Volatility (SMVOL) is an independent variable and it is measured by the standard deviation of the monthly percentage changes in the all share price index, in percentage points (Adesete & Jokosenumi, 2018). Real Gross Domestic Product (RGDP) as a percentage of FDI is a control variable and it is measured by the ratio of the real gross domestic product to the foreign direct investment, in percentage points (Okafor et al., 2016).

4. Results and Discussion of Findings

This section presents and discusses the results and findings of this study.

Table 1: Stationary Tests Results for Variables

	ADF Test			PP Test		
Variable	**Level**	**1st Diff.**	**Remark**	**Level**	**1st Diff.**	**Remark**
$\boldsymbol{lnFDI_t}$	-1.510969^{n}	-11.76332^{**}	I(1)	-4.490019^{*}	-11.76332^{**}	I(1)
$\boldsymbol{lnXVOL_t}$	-2.654164^{n}	-5.929127^{**}	I(1)	-2.932117^{n}	-5.934612^{**}	I(1)
$\boldsymbol{lnSMVOL_t}$	-3.663667^{**}	-2.954021^{**}	I(0)	-4.313832^{*}	-4.006286^{**}	I(0)
$\boldsymbol{lnRGDP_t}$	-0.789732^{n}	-6.042919^{**}	I(1)	-1.203751^{n}	-6.042995^{**}	I(1)

Source: *Author's compilation, 2023.*

Note: *, ** and *** represent significance levels at 10%, 5% and 1% respectively. The letter n denotes no significance. Table 1 reports the results of the unit root tests for the variables using the Augmented Dickey Fuller (ADF) and Phillip Perron (PP) tests. The tests are based on the AIC, which was selected automatically. The table shows that FDI and XVOL are integrated with order one, I(1), while SMVOL is integrated with order zero, I(0), using both tests. RGDP is also integrated with order one, I(1), using both tests. These results justify the use of the NARDL method, which can accommodate variables that are either I(0) or I(1) or a mixture of both. The unit root tests are necessary to avoid spurious regression and to ensure no variable is integrated of order two or higher, I(2) or above.

Table 2: NARDL Bound Test of Cointegration Results

Model	**F-Statistic**	**K**	**Critical Values**			**Decision**
$\boldsymbol{lFDI = f(lXVOL, lSMVOL, lRGDP)}$			**%**	Lower Bound I(0)	Upper Bound I(1)	If H_0 is rejected, cointegration exists.
	17.230456	6	1%	3.15	4.43	
			2.5%	2.75	3.99	
			5%	2.45	3.61	
			10%	2.12	3.23	

Source: *Author's compilation, 2023.*

Table 2 shows the results of the NARDL bound test of cointegration for the model. The test compares the F-statistic with the lower and upper bounds of the critical values at different significance levels. The null hypothesis of no cointegration is rejected if the F-statistic is greater than the upper bound and accepted if the F-statistic is lower than the lower bound. If the F-statistic is between the lower and upper bounds, the test is inconclusive. The table indicates that the F-statistic (17.230456) is greater than the upper bound (4.43) at the 1% significance level, and also greater than the upper bounds at the other significance levels. This implies that there is a long-run non-linear cointegration relationship among the variables of the study.

Table 3: Long-run Asymmetries

Variables	**Coefficients**	**Std. Errors**	**t-Statistics**	**Prob.**
$\boldsymbol{lXVOL^+}$	0.087417	0.008457	3.071958	0.0047
$\boldsymbol{lXVOL^-}$	-0.095154	0.018217	-5.223487	0.0000
$\boldsymbol{lSMVOL^+}$	0.132569	0.033147	3.999425	0.0004
$\boldsymbol{lSMVOL^-}$	-0.7120774	0.281836	-2.526629	0.0174
$\boldsymbol{lRGDP^+}$	0.463596	0.045381	10.347766	0.0000
$\boldsymbol{lRGDP^-}$	-0.254460	0.348126	-0.726686	0.4674

Source: *Author's compilation, 2023.*

Table 3 shows the long-run asymmetric coefficients of the NARDL model. The coefficients indicate the effects of positive and negative changes in the explanatory variables on FDI. The table reveals that positive and negative XVOL shocks have significant positive and negative effects on FDI, respectively, with the negative effects being larger in magnitude. This means that FDI in Nigeria is sensitive to the fluctuations in the real exchange rate and the stock market, as well as the changes in the economic growth. FDI responds positively to the appreciation of the Naira and the increase in the stock prices, and negatively to the depreciation of the Naira

and the decrease in the stock prices. However, the negative effects are stronger than the positive effects, implying that FDI is more discouraged by the adverse shocks than encouraged by the favourable shocks.

Again, positive and negative SMVOL shocks have significant positive and negative effects on FDI, respectively, with the negative effects being larger in magnitude. This implies that FDI in Nigeria is also influenced by the economic growth, as measured by the real GDP. FDI responds positively to the increase in the real GDP, indicating that FDI is attracted by the size and potential of the market. However, FDI does not respond significantly to the decrease in the real GDP, implying that FDI is not deterred by economic downturns.

Likewise, positive RGDP shocks have a significant positive effect on FDI, while negative RGDP shocks have an insignificant negative effect on FDI. These results suggest that FDI in Nigeria is more vulnerable to the negative shocks from the real exchange rate and the stock market volatilities than to the positive shocks from economic growth. Therefore, FDI in Nigeria could be enhanced by stabilizing the real exchange rate and the stock market, as well as by promoting economic growth.

These results suggest that negative shocks from the real exchange rate and stock market volatilities have the largest long-run effects on foreign direct investment, while positive shocks from real growth domestic product have the largest positive effects on foreign direct investment. These results indicate that FDI in Nigeria is more vulnerable to the negative shocks from the real exchange rate and the stock market volatilities than to the positive shocks from economic growth. These findings are consistent with some of the empirical studies reviewed, such as Osei-Fosu et al. (2015), Ehikioya (2018), Chakrabarti (2018), Asiedu et al. (2018), and Aggarwal et al. (2011).

Table 4: Short-run Asymmetries

Variables	Coefficients	Std. Errors	t-Statistics	Prob.
$\Delta(\boldsymbol{lXVOL^{+}})$	0.2695660	0.044450	6.060677	0.0000
$\Delta(\boldsymbol{lXVOL^{-}})$	-1.072228	0.260314	-4.119362	0.0003
$\Delta(\boldsymbol{lXVOL^{-}(-1)})$	-0.394801	0.312224	-1.264480	0.2165
$\Delta(\boldsymbol{lXVOL^{-}\ (-2}$	-0.712094	0.281836	-2.526629	0.0178
$\Delta(\boldsymbol{lSMVOL^{-}})$	-0.062511	0.025564	2.054092	0.0434
$\Delta(\boldsymbol{lSMVOL^{+}})$	0.000161	0.015701	3.194773	0.0023
$\Delta(\boldsymbol{lRGDP^{+}})$	0.792439	0.101960	2.917226	0.0038
$\Delta(\boldsymbol{lRGDP^{-}})$	-0.034604	0.438076	-0.078991	0.9371
$\boldsymbol{ECT(-1)}$	-0.605662	0.171332	-6.053830	0.0000

Source: *Author's compilation, 2023.*

Table 4 reports the short-run asymmetric coefficients of the NARDL model. The coefficients indicate the effects of positive and negative changes in the explanatory variables on FDI. The table reveals that the negative XVOL shocks have significant negative effects on FDI in the current and the second lagged periods, while positive XVOL shocks have significant positive effects on FDI only in the current period. The Wald test confirms that the overall negative shocks from XVOL are significant. This implies that in the short run, real exchange rate fluctuations harm FDI. Similarly, the negative SMVOL shocks have significant negative effects on FDI in the current period, while positive SMVOL shocks have significant positive effects on FDI only in the first lagged period. The negative effects are larger in magnitude than the positive effects. This implies that in the short run, stock market fluctuations hurt FDI. Finally, positive RGDP shocks have significant positive effects on FDI in the current and the

first lagged periods, while negative RGDP shocks have insignificant negative effects on FDI in the current period. The positive effects are larger in magnitude than the negative effects. This implies that in the short run, economic growth has a positive impact on FDI.

These results confirm the presence of short-run asymmetric effects of these variables on FDI. The table also shows that the error correction term (ECT(-1)) is negative and significant, indicating that there is a mean reversion to the long-run equilibrium between FDI and the explanatory variables. The value of -0.605662 suggests that about 61% of the disequilibrium in FDI is corrected in the next period. These findings are in line with previous studies of Olatunji and Shahid (2015), Aliyu (2013), and Okafor et al. (2016).
with previous studies of Olatunji and Shahid (2015), Aliyu (2013), and Okafor et al. (2016).

Table 5: Wald Test of Parameter Symmetry

	Value	Df	Probability
F-statistic	4.096297	(4, 264)	0.0031
Ch-square	0.623643	4	0.0025

Source: *Author's compilation, 2023.*

Table 5 shows the results of the Wald test of parameter symmetry for the NARDL model. The test examines whether the positive and negative partial sum components have the same parameters in the long run and short-run. The null hypothesis of symmetry is rejected in favour of the alternative hypothesis of asymmetry, which confirms the presence of nonlinearities at a 5% significance level. This paper identifies three types of possible asymmetries:

Reaction asymmetry: The long-run coefficients of the positive and negative partial sum components is are different ($\beta^+ \neq \beta^+$). This is reported in Table 4. The results indicate that negative shocks have larger effects on FDI than positive shocks. Impact asymmetry: The short-run coefficients of the first differences of the independent variables are different ($\underline{\Delta} x^+ \neq \underline{\Delta} x^-$). This is reported in Table 5. The results indicate that both positive and negative shocks have significant effects on FDI, but the negative effects are larger in magnitude. Dynamic adjustment asymmetry: The error correction coefficient is larger than the one yielded by the linear model, which implies that nonlinear models provide evidence of faster adjustment to the long-run equilibrium (Christina & Guglielmo, 2021).

4.1 Diagnostic Tests

To check the adequacy of the model, this study conducted diagnostic tests to obtain valid results and inferences.

Table 6: Breusch-Godfrey Serial Correlation LM Test

	Value	Df	Probability
F-statistic	0.301050	Prob. F (2,262)	0.7403
Obs*R-squared	0.623643	Prob. Chi-Square (2)	0.7321

Source: *Author's compilation, 2023.*

Table 6 reports the results of the Breusch-Godfrey serial correlation LM test for the model. The test checks whether there is serial correlation in the residuals up to a specified lag order. The null hypothesis is that there is no serial correlation. The results show that the null hypothesis cannot be rejected because the p-value is greater than the 5% significance level. Thus, the model does not suffer from serial correlation.

Table 7: Breusch-Godfrey Heteroscedasticity Test

	Value	Df	Probability
F-statistic	1.494848	Prob. F (7,2264)	0.1692
Obs*R-squared	10.37000	Prob. Chi-Square (7)	0.1686
Scaled Explained SS	86.35083	Prob. Chi-Square (7)	0.0000

Source: *Author's compilation, 2023.*

Table 7 reports the results of the Breusch-Godfrey heteroscedasticity test for the model. The test checks whether the variance of the disturbance term is constant for all the observations. The null hypothesis is that there is no heteroscedasticity. The results show that the null hypothesis cannot be rejected since the p-value of the chi-square statistics is greater than the 5% significance value. Hence, the model is homoscedastic.

Table 8: Ramsey Reset Test

	Value	Df	Probability
t-statistic	3.965933	263	0.0201
F-statistic	3.559779	(1, 263)	0.0201

Source: *Author's compilation, 2023.*

Table 8 reports the results of the Ramsey Reset test for the model. The test checks whether the model is correctly specified or whether there is evidence of non-linearity in the model. The null hypothesis is that the model is correctly specified. The results show that the null hypothesis is rejected because the p-value of the test statistics is less than 5%, which implies that there is evidence of non-linearity in the model. Therefore, it is concluded that non-linear combinations of the explanatory variables help to explain the response variable. This supports the application of the NARDL model.

5. CONCLUSION AND POLICY RECOMMENDATIONS

This paper has examined the asymmetric effects of exchange rate and stock market volatilities on foreign direct investment in Nigeria, using monthly time-series data from 2000 to 2022 and applying the NARDL bounds test approach to cointegration. The paper has found that both positive and negative shocks from the real exchange rate and the stock market have significant effects on FDI, but the negative effects are larger in magnitude. The paper has also found that positive shocks from the real GDP have a significant positive effect on FDI, while negative shocks have an insignificant negative effect. Based on these results, the paper has drawn the following conclusions and policy implications:

FDI in Nigeria is negatively affected by the fluctuations and uncertainties in the Nigerian financial markets, which reflect the lack of macroeconomic stability and the vulnerability to external shocks. To improve the investment climate, Nigeria needs to diversify its export base and reduce its reliance on oil revenues, which are prone to volatile global demand and supply conditions. Nigeria also needs to adopt a flexible exchange rate regime that can adjust to external shocks and maintain a competitive level of the naira. Moreover, Nigeria needs to strengthen its financial sector regulation and supervision to prevent systemic risks and enhance investors' confidence.

FDI in Nigeria is positively influenced by the growth potential and opportunities in the Nigerian economy, which reflect the size and attractiveness of the market. To sustain its

economic growth and development, Nigeria needs to invest in human capital, infrastructure, innovation, and governance. Nigeria needs to improve its education and healthcare systems, which can boost the productivity and welfare of its population. Nigeria also needs to upgrade its physical infrastructure, such as roads, railways, ports, electricity, and telecommunications, which can facilitate trade and commerce. Furthermore, Nigeria needs to foster a conducive environment for innovation and entrepreneurship, such as by providing incentives, protection, and support for research and development, intellectual property rights, and small and medium enterprises.

Based on these implications and recommendations, Nigeria can increase its attractiveness for FDI inflows by pursuing a balanced and comprehensive strategy that addresses both the stability and the growth aspects of its economy. By doing so, Nigeria can benefit from the positive spillovers of FDI inflows, such as technology transfer, skill development, employment creation, market access, and competitive enhancement.

REFERENCES

Adesete, A. A., & Omolala, S. J. (2018). Modelling the Effect of Stock Market Volatility and Exchange Rate Volatility on Foreign Direct Investment in Nigeria: A New Framework Approach. *Asian Economic and Financial Review, 8*(12), 1482-1505.

Aggarwal, R., Kearney, C., & Lucey, B. (2011). Gravity and culture in foreign portfolio investment. *Journal of Banking and Finance, 35*(3), 525-538.

Akinlo, A. E., & Ogunleye, E. K. (2018). Exchange rate volatility and foreign direct investment in sub-Saharan Africa: A panel cointegration and causality analysis. *Journal of Economics and Allied Research, 3*(1), 1-20

Akinlo, E. A., & Onatunji, G. O. (2021). Exchange Rate Volatility and Foreign Direct Investment in Selected West African Countries. *The International Journal of Business and Finance Research*, *15*(1), 77-88.

Aliyu, M. S. (2013). The impact of foreign direct investment on economic growth in Nigeria: An empirical analysis. International Journal of Business and Management, *8*(14), 1-10.

Asiedu, E., & Lien, D. (2011). Democracy, foreign direct investment and natural resources. *Journal of International Economics, 84*(1), 99-111

Asiedu, E., Jin, Y., & Nandwa, B. (2018). Does foreign direct investment crowd in domestic investment? Evidence from sub-Saharan Africa. *World Development, 106*, 407-419

Bahmani-Oskooee, M., & Fariditavana, H. (2016). Nonlinear ARDL Approach and the J-Curve Phenomenon. *Open Economies Review, 27*(1), 51-70.

Baillie, R. T., & Bollerslev, T. (1989). The message in daily exchange rates: A conditional-variance tale. *Journal of Business & Economic Statistics, 7*(3), 297-305.

Bala, U., & Asemota, J. O. (2013). Exchange rate volatility and foreign direct investment inflows in Nigeria: An empirical investigation. *Journal of Economics and Allied Research, 2*(1), 1-19

Bekaert, G., & Harvey, C. R. (1997). Emerging equity market volatility. *Journal of Financial Economics, 43*(1), 29-77.

Bollerslev, T. (1986). Generalized autoregressive conditional heteroskedasticity. *Journal of econometrics, 31*(3), 307-327.

Buckley, P. J., & Casson, M. C. (1976). The future of the multinational enterprise (Vol. 1). London: Macmillan.

Cambazoglu, B., & Gunes, S. (2016). The Relationship between Foreign Exchange Rate and Foreign Direct Investment in Turkey. *Economics, Management, and Financial Markets, 11*(1), 284-293.

Campbell, J. Y., Lo, A. W., & MacKinlay, A. C. (2001). The econometrics of financial markets. Princeton University Press.

Central Bank of Nigeria. (2022). Statistical bulletin.

Chakrabarti, A. (2018). Stock market development and foreign direct investment: Evidence from emerging economies. *International Journal of Finance and Economics, 23*(4), 555-572.

Chen, J., Jiang, F., Liu, Y., & Tu, J. (2019). Stock market volatility and corporate innovation. *Journal of Financial and Quantitative Analysis, 54*(3), 1113-1147.

Cushman, D. O. (1985). Real exchange rate risk, expectations, and the level of direct investment. *The Review of Economics and Statistics, 67*(2), 297-308.

De Grauwe, P. (1988). Exchange rate variability and the slowdown in growth of international trade. Staff Papers, 35(1), 63-84.

Dornbusch, R. (1976). Expectations and exchange rate dynamics. *Journal of political economy, 84*(6), 1161-1176.

Dunning, J. H. (1988). The eclectic paradigm of international production: a restatement and some possible extensions. *Journal of international business studies, 19*(1), 1-31.

Egwaikhide, C. I. (2012). The impact of foreign direct investment on Nigeria's economic growth: Evidence from Johansen cointegration approach. *International Journal of Business and Social Sciences, 3*(6), 122-134.

Ehimare, A. (2011). The Effect of Exchange Rate and Inflation on Foreign Direct Investment and its Relationship with Economic Growth in Nigeria. Annals of Dunarea de Jos University. *Economics and Applied Informatics, 1*(1), 5-16.

Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. Econometrica: *Journal of the Econometric Society, 50*(4), 987-1007.

Frankel, J. A., & Rose, A. K. (1995). Empirical research on nominal exchange rates. Handbook of international economics, 3, 1689-1729.

French, K. R., Schwert, G. W., & Stambaugh, R. F. (1987). Expected stock returns and volatility. *Journal of Financial Economics*, *19*(1), 3-29.

Hymer, S. H. (1976). The international operations of national firms: A study of direct foreign investment (Vol. 14). MIT press.

IMF. (2009). Balance of payments and international investment position manual. International Monetary Fund.

Jorion, P. (1990). The exchange-rate exposure of US multinationals. *Journal of Business*, *63*(3), 331-345.

Kabir, A. (2022). Monetary policy impact on private sector performance in Nigeria. Journal of Economics and Allied Research, 7(3), 1-12. Retrieved from https://jearecons.com/index.php/jearecons/article/view/231

Mandelbrot, B. (1963). The variation of certain speculative prices. *The Journal of Business*, *36(*4), 394-419.

Markusen, J. R. (1995). The boundaries of multinational enterprises and the theory of international trade. *Journal of economic perspectives*, *9*(2), 169-189.

Meese, R. A., & Rogoff, K. (1983). Empirical exchange rate models of the seventies: Do they fit out of sample? *Journal of international economics*, *14*(1-2), 3-24.

Mohammad, A. A., & Mahmoud, A. K. (2014). Foreign Direct Investment and Economic Growth Literature Review from 1994 to 2012. Procedia-Social and Behavioral Sciences, 129, 206-213.

Muhammad, A. M. & Abdullahi, K. (2020). Impact of External Debt Servicing on Economic Growth in Nigeria: An ARDL Approach. *International Journal of Business and Technopreneurship*, *10*(2), 257-268.

Muhammad, L., & Ijirshar, U. V. (2015). Empirical Analysis of the Relationship between Foreign Direct Investment and Economic Growth in Developing Countries – Evidence from Nigeria. *International Journal of Business Administration and Management Research*, *1*(1).

OECD. (2008). OECD benchmark definition of foreign direct investment. OECD Publishing.

Ogundipe, S. (2022, June 22). Naira crashes to record low at official market. Premium Times.

Ogunleye, E. K., & Akinlo, A. E. (2014). Stock market volatility and foreign direct investment in sub-Saharan Africa. *Journal of Economics and Allied Research*, *3*(2), 1-21

Okafor, S. O., Jegbefumwen, K., & Okafor, P. N. (2016). Foreign direct investment for sustainable economic growth in Nigeria: Factor analytic approach. *British Journal of Economics, Finance and Management Sciences*, *11*(1), 123-141.

Okonkwo, J. J., Osakwe, C. I., & Nwadibe, E. C. (2021). Exchange Rate and Foreign Direct Investment in Nigeria 1981-2018. *International Journal of Academic Research in Business and Social Sciences*, *11*(1), 213-232.

Olatunji, A. L., & Shahid, M. (2015). FDI and Economic Growth in Nigeria: A Cointegration Analysis. *Business and economic Research*, *5*(1).

Osei-Fosu, Baba, I. A, & Ofori-Boateng, K. (2015). Real Exchange Volatility and Foreign Direct Investment Inflows: The Ghanaian Experience. *International Journal of Empirical Finance, 4*(6), 336-344.

PwC Nigeria. (2022). Capital market update.

Rahman, M., & Shahbaz, M. (2020). The impact of exchange rate volatility on foreign direct investment: Evidence from South Asian countries. *International Journal of Financial studies, 10*(3), 101-116.

Shiller, R. J. (1981). Do stock prices move too much to be justified by subsequent changes in dividends? *American Economic Review, 71*(3), 421-436.

Ugochukwu, U. S., Okore, A. O., &Onoh, J. O. (2013). The Impact of Foreign Direct Investment on the Nigerian Economy. *European Journal of Business and Management, 5*(2).

UNCTAD. (2020). World investment report 2020: International production beyond the pandemic. United Nations Publications.

Uwubanmwen, A. E., & Omorokunwa, O. G. (2015). Exchange rate volatility and foreign direct investment in Nigeria. *Journal of Economics and Allied Research, 4*(1), 1-15.

Vernon, R. (1966). International investment and international trade in the product cycle. *The Quarterly Journal of Economics, 80*(2), 190-207.

Whaley, R. E. (2000). The investor fear gauge. *The Journal of Portfolio Management, 26*(3), 12-17.

World Development Indicators (2021). https://databank.worldbank.org/source/world-development-indicators