Exchange Rate Volatility: Effect on Foreign Direct Investment Inflows in Nigeria

Charles Odinakachi Njoku [1] *, Kelechi Enyinna Ugwu [1], Chilaka Emmanuel Nwaimo [1],
Emmanuel Chijioke Nwadike [1], Chinonso Karen Eke [1],
Christopher Chiedozie Ikeogu [1], Edward Uche Omeire [1],
Anthony Ifeanyi Otuonye [1], Ibeawuchi Ifeanyi Echeme [1],
Babatunde Oyelade Eriwa [2]

[1] Federal University of Technology, Owerri
[2] Bowling Green State University, Bowling Green, Ohio, USA
*Corresponding author E-mail: nj4charlie@gmail.com

Abstract

A nation's high GDP, high exports, and influx of foreign direct investment all indicate its economic growth and stability; yet, exchange rate risk—that is, the possibility of a country's currency depreciating or appreciating—can also cause concern for international investors and the nation of origin. The uncertainty surrounding their currency exchange rate presents a formidable challenge: is it better for their economy to have low or high volatility, and does it have the potential to draw in or hinder FDI? The research used the Autoregressive Distributed Lag (ARDL) model to investigate the effect of exchange rate volatility on foreign direct investment inflows into Nigeria from 1986 to 2023. The study aims to determine whether the Nigerian government should impose more stringent measures on foreign direct investment flows while formulating strategies to ensure stable exchange rates. The ARDL bounds testing approach was utilized in the cointegration analysis to investigate the relationship between the variables in the model. The result of the analysis revealed that inflation and interest rates have a long-term negative effect on foreign direct investment inflows to Nigeria as a result of high currency volatility. Also, exchange rate fluctuations have a long-term, significant negative effect on foreign direct investment inflows into Nigeria, highlighting the concerns of international investors regarding currency instability in the country. The research recommends that Nigeria diversifies its economy in order to attract more Foreign Direct Investment.

Keywords: *Foreign Direct Investment; Exchange Rate; Interest rates; Volatility.*

1. Introduction

Foreign Direct Investment (FDI) is basically undertaken to generate economic and strategic benefits for the host economy as well as the investing firm in the long term. Unlike portfolio investments, which involve passive holdings of financial assets without managerial influence, FDI is characterized by control and a significant ownership stake as its two defining features. These two features distinguish FDI as a form of investment that grants the foreign investors the lasting authority over business decisions and their operations in the host country.

In developing economies like Nigeria, Foreign Direct Investment (FDI) Inflows are seen as a critical catalyst for economic growth. It stimulates the transfer of technology and managerial skills while serving as a source of non-debt financing, creating employment, and enhancing integration into the global economy (World Bank, 2023). Successive Nigerian governments have implemented various policies and reforms, recognizing the importance of FDI, aimed at attracting FDI into key sectors such as extractive industries, telecommunications, manufacturing, and financial services.

The stability of the host country's macroeconomic environment is a pivotal factor influencing FDI decisions. This stability centers on the exchange rate regime being operational in the host country. The Nigerian landscape has been characterized by significant volatility and multiple exchange rate windows as the country operates a managed float exchange rate system. This exchange rate volatility stems from a combination of factors such as domestic fiscal and monetary policies, persistent political and security uncertainties, and fluctuations in global crude oil prices, as crude oil accounts for over 80% of foreign exchange earnings (CBN 2024).

Some elements of uncertainty for multinational corporations (MNCs) are introduced by Exchange rate volatility. These uncertainties complicate financial planning, make cross-border operations riskier and costlier, as they affect the valuation of future investment cash, and increase the risk associated with repatriating profits from investment. High volatility can deter investment according to international finance theory, as it acts as a tax on international trade and investment (Adegboye, Aluko, & Onabote, 2023). Foreign Investors generally prefer a predictable domestic economic environment to accurately forecast returns on their investments in the long term.

Despite Nigeria's abundant resources and large viable market size, which are traditional pull factors for FDI, the persistent foreign exchange volatility in the market presents a formidable challenge to investors. The Central Bank of Nigeria's (CBN) efforts to unify the exchange rate windows in 2023, in recent developments, are yet to yield the desired lasting stability, with Nigeria's currency experiencing significant depreciation pressures into 2024 (IMF 2024). This continuous exchange rate instability necessitates a renewed investigation into its precise effect on FDI inflows in the country.

A link between macroeconomic instability and FDI has been established in Previous studies, but Nigeria's economic dynamic nature and the evolving foreign exchange market require contemporary analysis. Therefore, this study is aimed at providing an up-to-date empirical analysis of the effect of exchange rate volatility on FDI inflows in Nigeria, covering a period that captures the recent shifts in economic policy and economic realities.

Despite its immense economic potential and efforts to position itself as an investment hub in Sub-Saharan Africa, Nigeria has consistently underperformed in attracting stable and significant Foreign Direct Investment inflows when compared with other developing countries in the region. Though Nigeria has remained a top recipient in West Africa, its Foreign Direct Investment (FDI) inflows have been so erratic and often overshadowed by countries with more stable macroeconomic policies (UNCTAD 2023).

The Naira has experienced severe fluctuations, and the subsequent continued instability throughout 2024, which has continued in 2025, has been a predominant feature of the Naira in recent decades. This volatility creates uncertainty in the business environment for foreign investors. This feature erodes confidence and discourages capital commitments in the long term (Okafor & Eze, 2024). The problem is that while the government actively seeks Foreign Direct Investment (FDI) inflows to drive economic diversification and growth, the very volatility of the exchange rate as a key macroeconomic indicator may be acting as a significant deterrent.

Existing literature may have explored the relationship between exchange rates and FDI, but many studies predate the profound economic shocks in recent times. Some of these shocks include: the post-pandemic global supply chain disruptions, the conflict between Russia and Ukraine, and 2023 2024 Nigeria's specific forex policy reforms. There is a scarcity of recent empirical research that measures how this renewed and intense period of exchange rate volatility has influenced FDI inflows specifically. Consequently, there is a lack of contemporary evidence for policymakers and economic planners to guide them in effective stabilization and investment-attraction strategies.

The Human Capital Flight as a result of the "Japa" Syndrome poses a great challenge to Nigeria. There has been a recent review linking macroeconomic volatility to human capital in an emerging interdisciplinary review. In their study, Eze & Chukwuma (2024) explored how persistent Exchange rate fluctuations fuel economic instability, specifically the emigration of Nigerian Indigenous skilled professionals known as "Japa" syndrome, which in turn erodes the key attraction for efficiency-seeking FDI, which is the human capital base, thereby creating a vicious cycle.

2. Empirical Review

For emerging economies like Nigeria, the relationship between exchange rate fluctuations and Foreign Direct Investment (FDI) is a critical area of inquiry, which relies heavily on foreign capital flows and foreign direct investment for technological transfer, economic growth, and infrastructure development. Conventional economic theory posits that high ERV increases risk and uncertainty for multinational corporations (MNCs) in the theory of investment under uncertainty (Dixit & Pindyck, 1994), regarding their future profits and the value of repatriated earnings, thereby acting as a deterrent to foreign Direct Investment. However, the empirical landscape in the Nigerian context is still far from conclusive and has continued to be a puzzle for policymakers. This empirical review synthesizes the empirical evidence on this relationship, critically examining the reasons for contradictory findings and highlighting gaps in methodology, and incorporates recent interdisciplinary insights to provide a broader, more nuanced understanding.

Nigeria's exchange rate fluctuations are interwoven deeply with the changes in political cycles, rent-seeking behavior, and governance structures (Nwankwo 2024). FDI decisions are based on a holistic assessment of this political risk, not just econometric measures of volatility.

By assuming perfect rationality, Adegbite & Ayadi (2023) suggest that the perception of risk, by introducing insights from behavioral finance, is often amplified by negative media coverage of the local currency performance. This can have a more significant effect on investor sentiment than the statistical measure of volatility itself.

In their study titled: 'How Does the Exchange Rate and Its Volatility Influence FDI to Canada? A Disaggregated Analysis, Lajevardi & Chowdhury (2023), investigated how the real effective exchange rate (REER) and the influence of its volatility affect the net inflow of foreign direct investment (FDI) into the economy of Canada. They used time series data from 2007 to 2022. Using the Autoregressive Distributed Lag (ARDL) method to evaluate both short-run and long-run relationships among these variables, the result of their analysis revealed that the real exchange rate volatility had a significant effect on net FDI in the short term. Meanwhile, Gross Domestic Product, exchange rate volatility, and trade openness, when lagged by one year, had long-term effects on Foreign Direct Investment (FDI) in Canada. FDI inflows to the energy and mining, manufacturing, finance, and insurance sectors of the economy were significantly influenced by changes in the real exchange rate at the sectoral level.

From real options theory, a few studies present a more complex picture. Adegbite & Ayadi (2023) argue that valuable growth options can be created by volatility. A "wait-and-see" approach may be adopted by a firm during high volatility periods, but it is strategic. This market-seeking FDI might also be incentivized to establish a large market foothold, for future economic stability, treating the initial investment as a call option. In certain contexts, this could result in a non-linear or even positive relationship.

In their research, Ozigbo & Anuya (2023) investigated the volatility effect of the real exchange rate on the Inflows of Foreign Direct Investment (FDI) into Nigeria from 1983 to 2022. They used the Ordinary Least Squares (OLS) method, the Error Correction Model (ECM) approach, and cointegration analysis in their research. The cointegration test confirmed a long-term equilibrium relationship among the variables. The findings indicated that significant volatility in the real exchange rate adversely affected FDI inflows into Nigeria. Similarly, Odionye, Ojiaku, & Uba (2023) explored the impact of political stability, interest rate variations, and currency rate changes on foreign capital inflows into Nigeria from 1981 to 2021. They utilized a Discrete Threshold Regression Model (DTRM) for their analysis. The study revealed that when the interest rate differential exceeds the differential threshold of 3.68 percent, it encourages a substantial and positive influx of foreign capital into the country. On the other hand, political stability and exchange rate fluctuations significantly affect the capital inflow to Nigeria negatively.

Similarly, Oladeji & Musa (2022) investigated how foreign direct investment (FDI) influences the foreign exchange rate in Nigeria from 1986 to 2018. The research used conducted regression analysis, Granger causality tests, correlation matrices, and descriptive statistics, all within an Error Correction Model (ECM) framework. The Granger causality test result of the analysis indicated an absence of a causal relationship between FDI and the exchange rate for the period under review. A significant and strong correlation existed between FDI

and the currency rate, suggesting a connection in both the short and long term between the two. Furthermore, it was indicated that significant capital inflows led to a notable depreciation of FDI , particularly in relation to the currency rate. In a related research, Tan, Xu, & Gashaw (2021) studied how the exchange rate affects FDI inflows in Zhejiang province, China. Using co-integration tests, vector error correction models, Granger causality tests, and impulse response tests for their analysis, the results revealed a unidirectional causal, long-term, and stable relationship between the exchange rate and FDI inflows. The underlying mechanism of this long-term relationship was attributed to the wealth effect rather than cost or demand effects. Nevertheless, neither the exchange rate nor the three influencing factors exerted a significant effect on FDI inflows in the short run.

On the other hand, Nadine, Ashraf & Nagia (2021) in their research they used enhanced and fundamental FDI gravity models in Egypt, analyzing data from 42 different countries for the period 2005 to 2019. They applied a Generalised Method of Moments (GMM) estimation technique to investigate the effect of various relative factors on foreign direct investment (FDI) inflows in Egypt, as well as the effect of the effective exchange rate on these investments in the countries. The findings revealed that FDI in Egypt is significantly influenced by the relative volatility of currency rates negatively. The study also highlighted that inward FDI to the country was significantly influenced by the market sizes of both the home and host countries, positively. In their study, Akinlo & Onatunji (2021) examined the relationship between exchange rate volatility and FDI across selected ECOWAS nations, using time series data from 1986 to 2017. Their research made use of the Toda-Yamamoto causality approach and the ARDL model to assess how exchange rate fluctuations affect FDI and determine the direction of their causal relationships. The research revealed that the coefficient of nominal exchange rate volatility had a significant effect only in Ghana, Sierra Leone, and Nigeria. The real exchange rate volatility significantly affected Nigeria, Togo, Sierra Leone, and Côte d'Ivoire negatively in line with the a priori expectation. For Ghana and The Gambia, the effect was positive but statistically insignificant. Furthermore, apart from Ghana, the causality test results indicated a unidirectional causal relationship between FDI and exchange rate volatility in the other countries.

A substantial body of research aligns with traditional theory, like Adeoye & Atanda (2020), who employed the ARDL approach and GARCH model to measure exchange rate volatility in their analysis. Their findings revealed a significant negative long-run relationship between the exchange rate and FDI inflows. They concluded that long-term, commitment-intensive investments were discouraged by uncertainties. Uwubanmwen & Eghosa (2022) again concluded that for non-oil sector FDI, macroeconomic instability, proxied by exchange rate fluctuations, was a key challenge, particularly for non-oil sector FDI.

Finding no robust statistical relationship, another strand of research, Osinubi & Amaghionyeodiwe (2021), argued that the primary driver of FDI for Nigeria is the availability of natural resources (oil). Exchange rate volatility was found to be statistically insignificant after controlling for the market size and oil prices. This suggests that FDI that is "resource-seeking" is relatively inelastic to short-term fluctuations of currency, as financial uncertainties are outweighed by the long-term value of resource extraction.

In a comparative analysis by Jannat (2020) he examined the effects of exchange rate volatility on foreign direct investment (FDI) inflows in Nepal, Bangladesh, Sri Lanka, India, and Pakistan. Using panel data from these developing South Asian nations, for the period 1980 to 2017, given that exchange rate volatility was not directly observable. The research used a GARCH (1,1) model to derive the volatility data needed for the research. The study then incorporated the volatility derived from the GARCH (1,1) model along with other control variables in exploring the influence of this volatility on FDI. Within the panel, fixed-effect models were estimated for each country. The findings indicated that fluctuations in exchange rates significantly affected FDI inflows into these South Asian economies negatively, which are in dire need of increased foreign investment. Utilizing monthly time series data from 1986 to 2016, Adokwe, Agu, & Maduka (2019), in a similar research, analyzed the effect of exchange rate volatility on FDI in Nigeria. The variables they employed included FDI, external reserves, trade openness, domestic interest rates, and RGDP growth rates. Using the GARCH approach, the exchange rate volatility was estimated. The 2-stage least Squares method was applied to estimate the model following a unit root test. The results revealed that exchange rate fluctuations had a statistically significant negative effect on Nigeria's foreign direct investment.

Similarly, Uzoma-Nwosu & Orekoya (2019) examined the correlation between exchange rate fluctuations and foreign direct investment in Nigeria, using secondary data for the period 1999 to 2016. The GARCH (1,1) model was employed to generate volatility series, with estimates derived through the Vector Error Correction Mechanism. The results revealed that over time, the responses of FDI to exchange rate variations changed significantly. In the short run, FDI exhibited a significant negative reaction. But, in the long term, it had a positive response to exchange rate fluctuation. Again, applying the EC, GARCH, and ARCH models to time series data from 1970 to 2016, Ehikioya (2019) analyzed the influence of currency rate volatility on foreign direct investment in Nigeria. Through cointegration tests, the stationarity of the data series was confirmed, revealing that during the study period, exchange rate volatility tended to persist throughout the. Furthermore, using data from April 1995 to March 2018 in India, Jacob & Kattookaran (2019) explored the effects of currency rate changes on FDI inflows. To assess the impact of exchange rate volatility on FDI flows, they employ the Autoregressive Distributed Lag (ARDL) model. In both the short- and long-term, their findings revealed that exchange rate volatility had a significant negative effect on FDI inflows into India, resulting in a temporary increase in foreign direct investment because of currency devaluation in the country.

In a similar vein, investigated the effect of interest and currency rates on foreign direct investment (FDI) in Nigeria, Emmanuel, Ike & Alhassan (2019) during the period from 2000 to 2018. They used secondary data derived from the financial statements of the Central Bank of Nigeria (CBN). Through the Augmented Dickey Fuller Test, the data's unit root test was analyzed, and characteristics revealed that all variables were stationary at their first difference. To further evaluate the cointegrating relationships within the data, the Johansen co-integration test results were employed, while to explore both short- and long-term associations among the variables under study, the error correction model was utilized. The findings indicated a statistically significant positive correlation between FDI and exchange rates.

Again, Latief and Lefen (2018), along with the 'One Belt and One Road' initiative, examined the effect of exchange rate fluctuations on foreign direct investment (FDI) and trade with developing nations. The study focused on Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka as seven developing countries using data from 1995 to 2016. The research employed the Generalised Autoregressive Conditional Heteroscedasticity (GARCH) (1,1) and threshold-Generalised Autoregressive Conditional Heteroscedasticity (TGARCH) (1,1) models to assess exchange rate volatility in those countries. Additionally, using a fixed effect model, they investigated the effects of exchange rate volatility on trade and FDI. Their findings were in line with the economic theory that posits FDI and trade can be adversely affected by exchange rate volatility.

Numerous scholars have long sought to predict the influence of exchange rate volatility on FDI as revealed by existing empirical literature. Based on the methodologies employed, their findings have varied, which highlights the need for further research into the implications of currency rate volatility on foreign direct investment in Nigeria. The empirical evidence on the Exchange rate fluctuations and Foreign Direct Investment nexus in Nigeria is characterized by contradictions, arising from methodological limitations and a failure to account for the complex nature of foreign direct investment decisions. The majority of evidence suggests that while exchange rate fluctu-

ations are a concern, their effect is often secondary to more fundamental drivers like institutional quality, the type of FDI, and the broader investment climate in the country.

The divergence in empirical results stems from several critical methodological and contextual factors, so it is not arbitrary: There is no standard method for measuring exchange rate volatility and its effect on macroeconomic factors, so different studies use different proxies:

Another reason for the different results could be attributed to the standard deviation of growth rates. This was adopted by most reviewed research works as it is a simple but flawed measure that may not capture volatility clustering. This is addressed in this research work, as it adopted the ARDL model in determining the effect of exchange rate fluctuations on Foreign Direct Investment Inflows in Nigeria.

Again, Findings in this area are highly sensitive to the period of study. Different dynamics will be captured if analyses cover different policy regimes (e.g., pre- and post-2008 financial crisis, the 2016 and 2023 forex crises). Many studies fail to account for structural breaks like the COVID-19 pandemic period and the shift to a unified exchange rate in 2023, resulting in spurious and unreliable results.

Notably, the studies reviewed did not utilize the most current datasets, prompting this research to analyze annual time series data from 1986 to 2023 to accurately reflect the contemporary effect of exchange rate volatility on Foreign Direct Investment in Nigeria.

3. Methodology

The study analyzes inflation (INF), interest rate (INT), exchange rate volatility (EXR), and their effect on Foreign Direct Investment Inflows (FDI) using annual data for Nigeria (37 observations) from 1986 to 2023. Foreign Direct Investment Inflows (FDI) and exchange rate volatility (EXR) Data were collected from the World Development Indicators (WDI) database 2024, while inflation (INF) and interest rate (INT) datasets were collected from the 2024 Statistical Bulletin of the Central Bank of Nigeria. To ensure unbiased and meaningful results, the variables of the model were used in their raw form. Annual nominal exchange rate fluctuations were used as a parameter for Exchange rate volatility. First, a Unit Root Test was conducted using the Augmented Dickey-Fuller (ADF) because the ADF unit root result revealed that the variables had mixed orders of integration. Exchange Rate, Foreign Direct Investment were stationary at a level, while Interest rate and Inflation rate were stationary at First Difference, then the Autoregressive Distributed Lag (ARDL) model was appropriate for the research. The Autoregressive Distributed Lag (ARDL) model was used to assess the impact of exchange rate volatility on FDI inflows.

Leveraging on the work of Ehikioya (2019), this study's model was developed. The functional form of the model of (15) was specified as detailed in equation (1):

$$Y_t = f(\llbracket EXRV \rrbracket_t^*) \tag{1}$$

Where 'Y' represents FDI expressed as a ratio of GDP, and 'EXRV' denotes exchange rate volatility. The model of Ehikioya (2019) was modified by incorporating the macroeconomic theory of the Mundell-Fleming framework, which implied that FDI in an economy, exchange rate, interest rate, and price (measured by inflation), and similar variables can be implicitly related, leading to equation (2).

$$Y_t = f(\llbracket EXRV \rrbracket_t^*, Z_t) \tag{2}$$

Where Y_t is FDI expressed as a ratio of GDP, $\llbracket EXRV \rrbracket_t^*$ is exchange rate volatility; Z_t denotes macroeconomic variables. Hence, the explicit equation of equation (3.2) is represented econometrically by equation (3):

$$\llbracket FDI \rrbracket_t = f(EXRV, INT, INF) \tag{3}$$

Where INT is the interest rate and INF is the inflation rate.

Therefore, taking a leaf from the Mundell–Fleming assumption of equation (3), the functional form of the models is specified thus:

$$RGDP = f(EXRV, INT, INF) \tag{4}$$

The econometric model formation of this study is illustrated in equation (5):

$$\llbracket FDI \rrbracket_t = \beta_0 + \beta_1 EXRV + \beta_2 TOT + \beta_{(3)} INT + \mu \tag{5}$$

In accordance with Pesaran et al. (2001), the cointegration ARDL limits test is stated as follows:

$$\llbracket \Delta FDI \rrbracket_t = \delta o + \sum_{(i=1)}^p \llbracket \delta_1 \llbracket \Delta FDI \rrbracket_{(t-i)} \rrbracket + \sum_{(i=1)}^p \llbracket \delta_2 \llbracket \Delta EXRV \rrbracket_{(t-i)} \rrbracket + \sum_{(i=0)}^p \llbracket \delta_3 \llbracket \Delta INT \rrbracket_{(t-i)} \rrbracket + \sum_{(i=0)}^p \llbracket \delta_4 \llbracket \Delta INF \rrbracket_{(t-i)} \rrbracket + \beta_1 \llbracket FDI \rrbracket_{(t-1)} + \beta_2 \llbracket EXRV \rrbracket_{(t-1)} + \beta_3 \llbracket INT \rrbracket_{(t-1)} + \beta_4 \llbracket INF \rrbracket_{(t-1)} + \mu_t \tag{6}$$

The long-run estimation of the model's relationship was estimated using the conditional ARDL model as follows: Once cointegration was completed:

$$\llbracket \Delta FDI \rrbracket_t = \delta_0 + \beta_1 \llbracket FDI \rrbracket_{(t-1)} + \beta_2 \llbracket EXRV \rrbracket_{(t-1)} + \beta_3 \llbracket INT \rrbracket_{(t-1)} + \beta_4 \llbracket INF \rrbracket_{(t-1)} + \mu_t \tag{7}$$

The short-run dynamic relationship is estimated using the error correction mechanism (ECM) as specified in equation 7:

$$\llbracket \Delta FDI \rrbracket_t = \delta o + \sum_{(i=1)}^p \llbracket \delta_1 \llbracket \Delta FDI \rrbracket_{(t-i)} \rrbracket + \sum_{(i=0)}^p \llbracket \delta_2 \llbracket \Delta EXRV \rrbracket_{(t-i)} \rrbracket + \sum_{(i=0)}^p \llbracket \delta_3 \llbracket \Delta INT \rrbracket_{(t-i)} \rrbracket + \sum_{(i=0)}^p \llbracket \delta_4 \llbracket \Delta INF \rrbracket_{(t-i)} \rrbracket + \llbracket + \theta ecm \rrbracket_{(t-i)} \tag{8}$$

Where,
FDI = Foreign Direct Investment Inflows,

EXRV Exchange rate Volatility,
INT= Interest Rate
INF= Inflation Rate
δ_0 = constant
δ_1 - δ_4 = short-run elasticities (coefficients of the first-differenced explanatory variables)
β_1 - β_4 = long-run elasticity (coefficients of the explanatory variables)
θ = speed of adjustment
$⟦ecm⟧_{(t-i)}$ = error correction term lagged for one period
Δ = first difference operator
p = lag length

3.1. Measurement of Model Variables

Foreign Direct Investment, comprising equity capital, reinvested earnings, and other cross-border short and long-term capital flows, accounts for over 30% of global investment. This justifies its use as a key capital flow indicator. Foreign Direct Investment inflow was measured as a percentage of GDP to allow for meaningful comparison relative to the economic size of Nigeria. An intensity ratio above 5–6% is seen as a strong performance (IMF 2016, OECD 2023) as applied by (Tellez-Leon & Ibarra 2019).
Exchange rate volatility is the fluctuations in currency values over time, which often exhibit volatility clustering (Campa 1993). Following this pattern, the effect of exchange rate volatility on Foreign Direct Investment possibly differs across countries with different levels of volatility. In this research, volatility is measured with the absolute percentage change in the exchange rate, calculated as follows:

$$⟦EXRV⟧_t= [[E_t-E_{(t-1)}]/E_{(t-1)}] \times 100\%$$

Exchange rate volatility (EXRV$_t$) is measured in this research by the absolute percentage change in the spot exchange rate, while E_t is the current rate for the year and $E_{t−1}$ is the rate for the previous year. Interest rate (INT), which represents the cost of capital, influences resource-seeking Foreign Direct Investment, which is expected to have a negative coefficient. The inflation rate (INF) shows the changes in the general price level in the economy, which affects investments, savings, and consumption, which in turn affects Foreign Direct Investment. Inflation (INF) is added to capture the macroeconomic effect of price level fluctuations on Foreign Direct Investment.

4. Results and Discussion

4.1. Trend Analysis

Figures 1 and 2 show the trends in Nigeria's Foreign Direct Investment Inflows (FDI)to Gross Domestic Product (GDP) ratio and exchange rate volatility for the period from 1986 to 2022. As presented in Figure 1, FDI inflows were consistently below the 5–6% benchmark, peaking only in 1994 at 5.79%, before declining to below 3% in subsequent years, showing persistently low Foreign Direct Investment performance.
Figure 2 shows that exchange rate volatility had rising and downward patterns after 1986, but between 1994 and 1998 it stabilized since during that time the fixed exchange rate was anchored at ₦21.89. The year 1999 saw the most volatility, as the democratic government reinstated the floating currency rate system. The global financial crisis of 2008–2010, the economic downturn of 2015–2016, and the 2020 COVID-19 pandemic all contributed to marked spikes in exchange rate volatility in Nigeria in line with the research of Obi (2017).
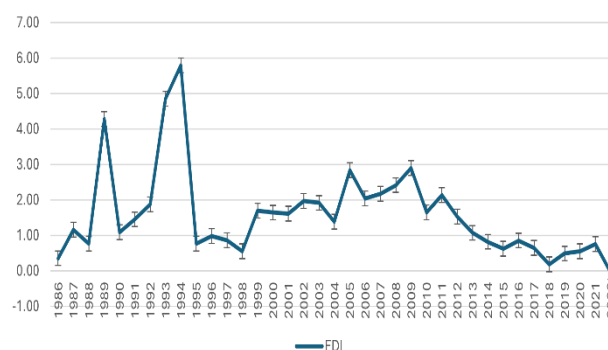

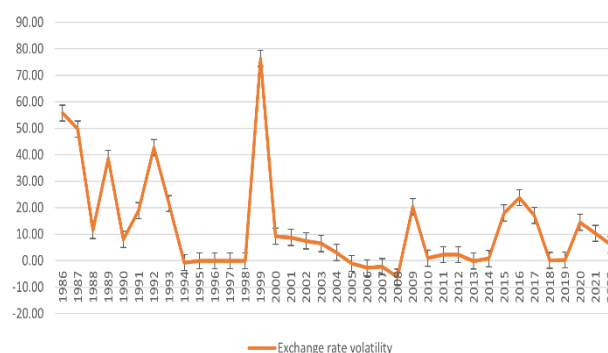**Fig. 1:** Trend of FDI to GDP Ratio.

Source: WDI (2024).

Fig. 2: Trend of EXRV to GDP Ratio.

Source: CBN statistical bulletin (2023).

4.2. Descriptive Statistics

Descriptive statistics were calculated to show a summary of the key characteristics of the dataset used in this study. The results are shown in Table 1.

Table 1: Descriptive Statistics

	FDI	EXR	INT	INF
Mean	1.582162	12.48459	18.16865	19.77432
Median	1.380000	6.480000	17.59000	12.20000
Maximum	5.790000	76.39000	29.80000	76.80000
Minimum	-0.040000	-6.130000	10.50000	0.200000
Std. Dev.	1.257546	18.45584	3.999617	17.93900
Skewness	1.655129	1.809842	0.737173	1.815129
Kurtosis	5.796969	5.896548	4.173130	5.237413
Jarque-Bera	28.95380	33.13366	5.472808	28.03489
Probability	0.000001	0.000000	0.064803	0.000001
Sum	58.54000	461.9300	672.2400	731.6500
Sum Sq. Dev.	56.93123	12262.24	575.8898	11585.08
Observations	37	37	37	37

Source: Author's results from the EViews 10.0 package (2024).

Note: A p-value that is below 0.05 in the Jarque-Bera test result indicates rejection of the normality null hypothesis (Jarque and Bera, 1987).
Table 1 shows the descriptive statistics for the variables. The mean, minimum, and maximum figures are the summary of central tendency and range, and the standard deviation shows significant variability around the mean. All variables showed positive skewness, which indicates right-tailed distributions. Kurtosis values that exceeded 3 suggest leptokurtic distributions with heavy tails and potential outliers. The Jarque-Bera test ($p < 0.05$) shows that the variables deviate from a normal distribution.

4.3. Test for Stationarity of Data

The stationarity of the data set used for the analysis was subjected to the Augmented Dickey-Fuller (ADF) unit root test. This test was applied to each of the variables to determine whether the time series was stationary. Table 2 reports the results at both levels and first difference stationarity results for the variables used.

Table 2: ADF Unit Root Test

	ADF at Level; I(0)		ADF at first difference; I(1)		Order of integration
Variable	t-Statistic	Prob.	t-Statistic	Prob.	
FDI	-4.447218	0.0059	-	-	I(0)
EXRV	-5.349979	0.0005	-	-	I(0)
INT	-3.491707	0.0574	-5.993907	0.0001	I(1)
INF	-3.357233	0.0734	-5.604932	0.0003	I(1)

Source: Author's results from the EViews 10.0 package (2024).

As shown in Table 2, Interest Rate (INT) and Inflation Rate (INF) were not stationary at the level but became stationary after first differencing. On the other hand, Foreign Direct Investment (FDI) and Exchange Rate Volatility (EXRV) were all stationary at the level. Stationarity of the variables was determined at the 5% significance level based on the t-statistic results and their corresponding p-values; variables with p-values less than 0.05 at either level [I(0)] or first difference [I(1)] were seen as stationary. The application of the Autoregressive Distributed Lag (ARDL) model was justified by these results, as the variables were integrated at different orders and none of the variables were stationary at the second difference.

4.4. Autoregressive Distributed Lag (ARDL) Bounds Testing

This research then applied the bounds testing approach by Pesaran, Shin & Smith (2001). This is based on the Autoregressive Distributed Lag (ARDL) framework, to determine whether a long-run equilibrium relationship (cointegration) exists among the variables. Table 3 presents the results of the bounds test, which evaluates the presence of a long-term relationship within the model.

Table 3: Bound Test Results

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	11.41950	10%	3.47	4.45
K	3	5%	4.01	5.07
		2.5%	4.52	5.62
		1%	5.17	6.36

Source: Author's results from the EViews 10.0 package (2024).

The null hypothesis of the bounds cointegration test assumes tDhat there is no long-run relationship. However, this was rejected for all three models of this research, as the F-statistic value (11.41950) was higher than the upper critical bounds (I(1)) at both the 1% and 5% significance levels. This is a confirmation that a long-run relationship exists between the dependent and independent variables, indicating a long-term link between Foreign Direct Investment (FDI) and exchange rate volatility in Nigeria. Table 4 is the summary of the ARDL model's long-run estimates.

Table 4: Long-Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR	-0.036782	0.016265	-2.261450	0.0363
INT	-0.181432	0.096974	-1.870931	0.0777
INF	-0.029085	0.017417	-1.669888	0.1122
EC = FDI - (-0.0368*EXR -0.1814*INT -0.0291*INF)				

Table 4 indicates that the long-run coefficient of EXRV is negative (-0.036782) and statistically significant, and has a p-value of 0.0363, which is below the 0.05 threshold. The result suggests that a one-unit increase in exchange rate volatility is associated with an approximate 0.04-unit decline in FDI inflows for the period under review on average, ceteris paribus. This negative effect of exchange rate increases hedging costs for multinational firms, making investments less attractive. This depreciation or volatility in the exchange rate makes profit repatriation for foreign investors risky, thereby leading to a decline in Foreign Direct Investment (FDI) inflows. In the process, existing investors may repatriate their funds quickly to avoid further currency losses. Exchange rate Depreciation raises the cost of imported inputs, making importation more expensive, thereby eroding further the profitability of foreign-owned firms.

This finding aligns with previous research by Ozigbo & Anuya (2023), Odionye et al. (2023), Ullah, Haider & Azim (2012), which had reported that persistent exchange rate volatility discourages FDI inflows into Nigeria in their studies.

The negative coefficients for Interest Rate (INT) and Inflation (INF) as shown in the result, suggest that high lending rates and inflationary pressures decrease Foreign Direct Investment (FDI) inflows, which is in line with the Mundell-Fleming framework, which posits that the interplay between Foreign Direct Investment (FDI), exchange rate volatility, interest rates, and inflation. The adverse effect of short-term interest rates further amplifies the negative effect of exchange rate volatility on Foreign Direct Investment (FDI), as investors may likely be reluctant to fund local firms under an unfavorable borrowing condition. Again, local businesses face difficult challenges accessing foreign loans at competitive rates. When the interest rate is higher, it increases the cost of borrowing, while inflation erodes profit margins of investing companies. As a result, Multinational firms delay or cancel planned investments in the short run. A Decline in Foreign Direct Investment Inflows (FDI) weakens foreign reserves, which leads to exchange rate depreciation. And this further Currency volatility discourages investors even more. As this Sustained reduction in FDI continues, there will be less foreign capital for industrialization, technology transfer, and infrastructure development. This limits job creation in manufacturing, services, and infrastructure sectors. This volatility affects Domestic firms, because those local firms with limited access to foreign capital may stagnate, while only speculative investors benefit. These findings are consistent with the works of Oladeji & Musa (2022), Jannat (2020), who observed that interest rate fluctuations increase the negative effect of exchange rate volatility on Foreign Direct Investment (FDI).

4.5. Error correction Mechanism (ECM)

The Error Correction Mechanism (ECM), which is also called the speed of adjustment test, is a test that measures how quickly short-term deviations adjust toward long-term equilibrium. The error correction term is expected to have a negative coefficient and should lie between 0 and 1, as a positive value would mean an invalid estimation (Fleming 1962). The details of the Error Correction Mechanism (ECM) results are provided in Table 5.

Table 5: Error Correction Mechanism

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.177546	1.073447	7.618025	0.0000
@TREND	-0.148217	0.019646	-7.544470	0.0000
D(FDI(-1))	-0.224401	0.105727	-2.122459	0.0479
D(FDI(-2))	-0.230231	0.088750	-2.594147	0.0183
D(EXR)	0.001908	0.006576	0.290122	0.7750
D(EXR(-1))	0.009396	0.005679	1.654494	0.1154
D(INT)	-0.139272	0.034654	-4.018927	0.0008
D(INT(-1))	-0.032809	0.034852	-0.941374	0.3590
D(INT(-2))	0.061844	0.027411	2.256212	0.0367
D(INF)	0.052190	0.008744	5.968570	0.0000
D(INF(-1))	0.063194	0.007390	8.551655	0.0000
D(INF(-2))	0.074479	0.009862	7.552403	0.0000
ECM(-1)	-0.877755	0.120239	-7.300067	0.0000
R-squared	0.916354			
Adjusted R-squared	0.868556			
F-statistic	19.17148			
Prob(F-statistic)	0.000000			
Durbin-Watson stat	1.783183			

Source: Author's results from the EViews 10.0 package (2024).

The Error Correction Term (ECM(-1)), as shown in Table 5, has the expected negative sign in the adjustment process. The estimated Error Correction Term (ECM) coefficient of -0.877755 indicates a strong statistically significant speed of adjustment toward equilibrium at 87.8% speed, in line with the theoretical expectations. This means that approximately 88% of the deviation of Foreign Direct Investment (FDI) from its long-run equilibrium is corrected within one year. The high significance of the Error Correction Term (ECM(-1)) confirms a stable and long-term relationship existing between FDI and the explanatory variables in the model. The value of the coefficient also indicates that the adjustment process occurs at a moderate rate.

The result has a probability value of 0.0000, the F-statistic value of 19.17148, and it confirmed that the independent variables collectively had a statistically significant effect on Foreign Direct Investment in Nigeria on average, ceteris paribus. This indicates that Foreign Direct Investment (FDI) Inflow in Nigeria is strongly influenced by the combined effect of these variables in the model. The Adjusted R-squared value of 0.868556 in Table 6 shows that about 87% of the variation in Foreign Direct Investment (FDI) Inflow can be explained by the model, indicating the substantial explanatory power of the independent variables. Therefore, the model of this research is considered appropriate, even after the loss of degrees of freedom adjustment. Again, the Durbin-Watson statistic of 1.783183, which is close to 2, indicates that the model is not spurious and does not suffer from serious autocorrelation problems.

The result also shows that the coefficient for the trend variable (@TREND) was negative (-0.148217) and it is statistically significant (p-value = 0.0000, less than 0.05). This indicates that the combined influence of the independent variables: Exchange Rate Volatility (EXRV), Interest Rate (INT), and Inflation Rate (INF) on Foreign Direct Investment (FDI) was both negative and statistically significant at 5% level of significance. This result suggests that a disturbance in one independent variable could lead to an additional disturbance in the others, ultimately leading to in a decline in Foreign Direct Investment (FDI) over time. For instance, an increase in interest rates may increase production costs, thereby causing inflationary pressures. This could weaken the local currency's purchasing power and diminish investor confidence in the domestic economy.

The differenced coefficients for Foreign Direct Investment Inflows (FDI), represented as D(FDI(-1)) and D(FDI(-2)), have statistically significant negative values. This shows that Foreign Direct Investment (FDI) levels in the previous two years had a significant positive effect on the current year's Foreign Direct Investment (FDI). On the other hand, the coefficients for D(EXR) and D(EXR(-1)) had positive values but were not statistically significant at 5% significance level, which suggests that exchange rate fluctuations had a minimal short-term effect on Foreign Direct Investment (FDI) for the period under review. FDI projects are typically planned for years, so short-term volatility is often seen as "noise" that foreign firms can tolerate. This may be connected to the fact that once a multinational firm commits funds, machinery, contracts, etc, to an investment, they usually cannot withdraw immediately. As a result, already-committed FDI projects may not significantly be altered by short-term exchange rate fluctuations. If this volatility persists, in the long run, firms may avoid reinvesting, expanding, or initiating new projects in that country. And as this continues, foreign firms worry about unpredictable conversion rates, which reduce their confidence in recovering their returns on investment. In the short run, the effect of exchange rate volatility on Foreign Direct Investment Inflows (FDI) is minimal, may be because investments are sunk, and firms use hedging strategies, while investors expect volatility to be temporary. Persistent volatility in the long run increases uncertainty and costs, which erodes policy credibility and discourages new inflows and reinvestment, thereby leading to a significant negative effect on Foreign Direct Investment Inflows (FDI).

The coefficients of D(INT) and D(INF) were statistically significant at 5% significance level, showing that interest rates and inflation had a more pronounced short-run effect on Foreign Direct Investment (FDI) on average, ceteris paribus.

4.6. Diagnostic Tests

To ensure the stability and correct functional specification of the models—while also trying to avoid significant serial correlation and heteroscedasticity—it was essential to assess the robustness of the results (Goldberg & Kolstad, 1995; Jarque & Bera, 1987). For the various tests to guarantee that the aforementioned econometric issues are not present, the test statistic needs to be statistically insignificant.

Table 6: Diagnostic Tests

Test	Test statistic	Prob.	Null hypothesis	Remark
Serial correlation test:	0.122535	0.8855	p > 0.05	Residuals are not serially correlated
Heteroskedasticity test:	0.765387	0.6966	p > 0.05	Residuals are homoscedastic
Jarque-Bera test:	1.176106	0.5554	p > 0.05	Residuals are normally distributed

Source: Author's results from the EViews 10.0 package (2024).

Table 6 shows the results of the diagnostic tests. The Breusch-Godfrey Serial Correlation LM test indicates an insignificant F-statistic value. This indicates that there is no evidence of significant serial correlation in the residuals. Similarly, the Breusch-Pagan-Godfrey test for heteroscedasticity shows an insignificant F-statistic at the 5% level of significance, which suggests that the residuals are homoscedastic. Again, the Jarque-Bera test had a p-value greater than 0.05, meaning that the residuals from the ARDL model were normally distributed. These results enhance confidence in the model's reliability, making it good for forecasting, policy formulation, and decision-making.
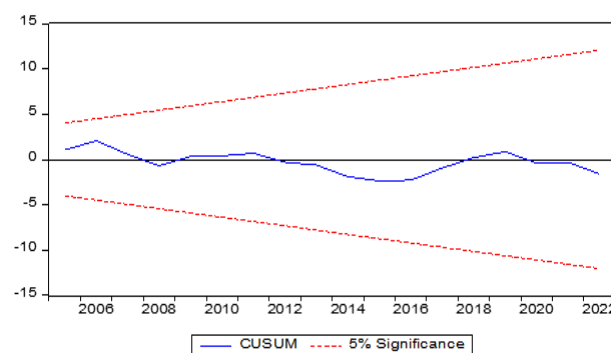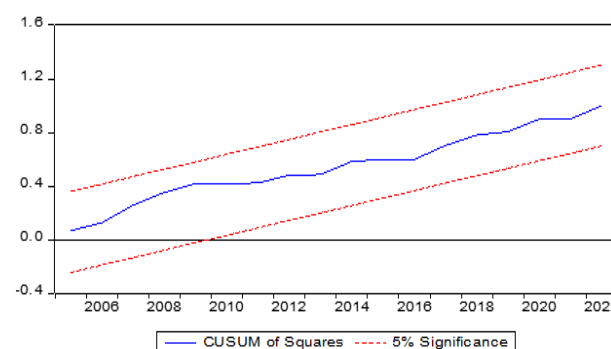

Fig. 3: CUSUM Test.

Fig. 4: CUSUMSQ Test.

Figures 3 and 4 indicate that both the Cumulative Sum (CUSUM) and the Cumulative Sum of Squares (CUSUMSQ) of the recursive residuals for the ARDL models were within the 5% significance level. This indicates that the coefficients of the ARDL model were stable across all specifications in the model.

5. Conclusion and Recommendations

This study examined the effect of Exchange Rate Fluctuations on Foreign Direct Investment (FDI) Inflows in Nigeria. Through a comprehensive literature review of existing studies, major determinants of Foreign Direct Investment (FDI) Inflows were identified and used as control variables in this research. The ARDL model estimation results show that changes in the Real Exchange Rate had a statistically significant negative effect on Foreign Direct Investment (FDI) to Nigeria for the period under review. The results of the analysis showed that real Exchange Rate Volatility carried statistically significant negative coefficients, a finding supported by the long-run estimates. Furthermore, the study revealed that inflation and interest rates negatively and significantly influenced the relationship between Exchange Rate Volatility and Foreign Direct Investment (FDI) Inflows over the long term. Based on these results, the research concludes that exchange rate volatility in Nigeria hinders Foreign Direct Investment (FDI) Inflows into the country. The result of this research underscores the need for policymakers to implement a comprehensive strategy that addresses the various factors affecting Foreign Direct Investment (FDI) Inflows to encourage greater investment inflows into Nigeria.

Based on the results of the data analysis, key recommendations emerged:

To encourage FDI inflows, policies targeted at maintaining a sustained exchange rate stability should be developed in the country. These policies should include both monetary policy and fiscal policy measures in order to reduce inflation, lower interest rates, and stabilize the exchange rate. This is in line with prior research findings. To reduce artificial distortions while avoiding excessive volatility, there is a need to adopt a market-reflective but managed exchange rate regime. The monetary authorities should manage interest rates to ensure that policy rates encourage productive investment rather than speculative inflows, thereby reducing pressure on the exchange rate.

Again, beyond stabilizing the exchange rate, monetary authorities should focus on managing interest rates, as interest rate policies play a crucial role in moderating the impact of exchange rate volatility on Foreign Direct Investment Inflows.

This research also recommends that Nigeria should diversify its economy to attract more Foreign Direct Investment Inflows. As a fiscal policy measure, the government should provide targeted fiscal incentives for export-oriented Foreign Direct Investment (FDI) inflows. Some of these incentives could be tax holidays, duty-free import of machinery to offset potential losses from exchange rate movements.

As the economy is diversified, it would enhance the country's ability to manage exchange rates more effectively and leverage its comparative advantage in primary commodity exports.

Recommendation for future research: This research work therefore recommends further studies on the relationship between exchange rate volatility and foreign direct investment (FDI), which should disaggregate FDI data by type (resource-seeking vs. market-seeking) and include integrated institutional and political economy variables (corruption indices, political stability scores) as control variables.

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