

Dynamic Relationships Between Exchange Rate Volatility, Inflation, and Foreign Direct Investment in Nigeria.

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Abstract

This study examines the dynamic relationship between exchange rate volatility, inflation rate, and foreign direct investment (FDI) in Nigeria from 1986 to 2023. The period captures the post-Structural Adjustment Programme era and subsequent macroeconomic reforms. Annual time series data were obtained from the Central Bank of Nigeria and World Bank. Exchange rate volatility was measured using a five-year rolling standard deviation of the naira-dollar exchange rate. The Vector Error Correction Model (VECM) was employed after establishing cointegration among the variables using the Johansen procedure. To allow for residual diagnostics, the short-run equations of the VECM were re-estimated using Ordinary Least Squares (OLS). The results reveal the existence of a significant long-run relationship among exchange rate volatility, inflation, and FDI in Nigeria. Exchange rate volatility was found to exert a positive impact on FDI inflows in the long run, while inflation exerted a positive and significant effect in both the short and long run. Although short-run responses to volatility were weak, the persistent positive association suggests that investor decisions in Nigeria are shaped more by sector-specific profit opportunities than by conventional macroeconomic risk. The study underscores the need for credible macroeconomic management, particularly transparent exchange rate policies and predictable inflation control, to sustain investor confidence and enhance Nigeria's investment climate.

1. Introduction

Foreign Direct Investment (FDI) is an essential factor in the economic development of countries, especially in emerging economies, where resources, technology, or management capacity may be limited (Nguyen, 2022). FDI involves investing in business in other countries, usually through buying substantial equity or setting up operational entities like subsidiaries or branches.

Economic policies such as those aimed at stabilizing Nigeria's macroeconomic environment, including interest rates, fiscal policy, and exchange rate policy, have not had an ideal impact. Some economic policies have proved to be successful in encouraging foreign investments in some areas, though largely affected by macroeconomic instability in Nigeria (Nikolenko et al., 2022). For example, there have been instances whereby inflation rates in Nigeria have far exceeded 10% in a given year, increasing business costs, especially for foreign investors with interests in Nigeria, regarding risks posed by Nigeria's business environment (Okeke & Nwafor, 2022).

Nigeria, one among the largest economies on the continent, offers an appropriate context in which to analyse relationships between exchange rate volatility, inflation, and FDI. Economic history in Nigeria has observed several instances of instability, especially after its adoption of the Structural Adjustment Programme (SAP) in 1986, aiming to move towards market-based economic reform. Though SAP pushed for economic liberalization with private sector engagement, there have been instances of substantial levels of inflation as well as exchange rate volatility (Kombo & Isah, 2024). Various instances of Naira devaluations, coupled with alternate exchange rate policies, have generated hurdles in consistently encouraging investments into Nigeria's economy, thereby becoming areas for debate on their impact on FDI inflows.

Still, Nigeria remains an attractive destination for FDI, especially in its oil and gas, telecom, and agriculture industries. Various incentives, tax holidays, and other foreign investment welcoming initiatives have been rolled out by the Nigerian Government for creating an attractive environment for foreign investors. Still, the volatile nature of its economy remains an underlying factor hindering the success of these measures in attracting stable and long-term foreign investment.

Rather than testing for simple effects, this research explores the causal relationships between exchange rate volatility, inflation, and FDI in Nigeria. Understanding how these factors interact and influence one another can provide valuable insights for policymakers and help promote more stable and sustained foreign investment.

From this perspective, the study addresses the following research questions:

- What is the effect of exchange rate volatility and inflation rate on foreign direct investment in Nigeria?
- Is there a causal relationship among exchange rate volatility, inflation rate, and foreign direct investment in Nigeria?

To answer these questions, the study pursues the following objectives:

- Examine the effect of exchange rate volatility and inflation rate on foreign direct investment in Nigeria.
- Investigate the causal interactions among exchange rate volatility, inflation rate, and foreign direct investment in Nigeria.

The remainder of the paper is structured as follows: Section 2 presents the literature review and theoretical framework. Section 3 details the methodology. Section 4 discusses the results and their implications. Section 5 concludes with a summary of findings, policy recommendations, and suggestions for future research.

2. Literature Review

2.1 Theoretical Framework

Exchange rate volatility, inflation, and foreign direct investment (FDI) are crucial determinants in shaping economic stability and dynamics in emerging economies. Exchange rate volatility and inflation affects capital costs, market expectations, and overall risk, which could have a direct influence on foreign investment inflows in an economy. Understanding these elements in their relationship requires a combination of macroeconomic and investment theories.

According to the Purchasing Power Parity (PPP) theory, countries with varying rates of inflation are likely to correct their exchange rates in an effort to maintain their relative value. Within regions with levels of inflation above those of their major partners, such as in Nigeria, their respective currencies are likely to depreciate, resulting in exchange rate volatility. This volatility can create uncertainty for investors, affecting the timing and magnitude of FDI inflows.

The Mundell Fleming model proves to be helpful in understanding the impact of macroeconomic policies on exchange rates and investments. In an open economy, an expansionary policy raises concerns regarding currency depreciation, thereby creating an unstable environment in an economy, which affects investments, especially foreign investments, in a particular region. It is particularly applicable to Nigeria, especially in the post-Structural Adjustment Programme period, in which exchange rate variability due to macroeconomic policies, along with inflation, affected investments.

The Eclectic Paradigm, or OLI Framework, offers investment theory that emphasizes the value of location-based factors such as economic stability. If there is stability in inflation rates coupled with stable exchange rates, there is less investment risk, and such countries become more attractive to investments. Investors balance any gains with perceived risks, and a stable macroeconomic environment lowers the risk premium required to invest.

Additionally, the International Capital Asset Pricing Model (ICAPM) and Portfolio Balance Theory emphasize the importance of risk in capital investments. Exchange rate volatility leads to uncertainty, thereby lowering capital inflows, including FDI, in the long run. But these frameworks also assume variations in investment behaviour. In emerging economies, there could be opportunities in particular industries like oil, gas, telecommunications, or agriculture, which could generate enough returns to compensate for macroeconomic risks, thereby rendering the relationship between volatility, inflation, and FDI complex.

Taken together, these theories provide a holistic model for discussing the interaction between macroeconomic variables and foreign investments. PPP captures the relationship between inflation and currency changes, while Mundell-Fleming explains these concepts in the context of overall policy frameworks. The OLI, ICAPM, and Portfolio Balance models distinguish macroeconomic environments and their interaction with FDI in decision-making. These concepts, together, enable researchers to explore their relationship with exchange rate volatility, inflation, and FDI in Nigeria.

2.2 Empirical Literature.

Existing empirical studies on the impact of exchange rate volatility and inflation on foreign direct investment (FDI) have generated a complex result with some inconsistencies, due to variations in countries, periods, and models employed in those studies.

A substantial body of research have confirmed the conventional view that macroeconomic instability is a deterrent to FDI. Exchange rate volatility leads to uncertainties, making it difficult for investors to forecast return on investments, thereby discouraging investments. For instance, Udoh & Egwaikhede (2008) using GARCH models on Nigeria, found negative effects on FDI caused by exchange rate volatilities and inflation uncertainties. Akinlo & Onatunji (2021) also found FDI in some West African countries to be negatively influenced in the long run by exchange rate volatilities, thereby emphasizing stability in policy in attracting investments.

Inflation is also extensively observed to constitute a discouraging factor. High and uncertain inflation levels erode purchasing powers, thereby increasing costs for business entities. Asmae and Ahmed (2019), in their research on Morocco and Turkey, identified the negative influence on FDI from exchange rate volatility, yet there was some positivity with prices, indicating that to some extent, inflation improves marginal profitability. It was identified in other research by Dal Bianco and Loan (2017) on Latin America that exchange rate volatility caused negativity in FDI, while prices were negligible with some positivity. Vasileva (2018) also noted that inflation-targeting policies in countries could attract FDI with weakening market volatility, improving policy credibility. Valli and Masih (2014), examining South Africa, observed a negative long-term relationship between inflation and FDI, reinforcing the importance of price stability.

Nevertheless, some studies suggests that these effects could be context-dependent. For example, Osinubi & Amaghionyeodiwe (2009) found a positive relationship between exchange rate depreciation and FDI inflows to Nigeria, postulating that exchange rate depreciation could make investments in Nigerian assets more attractive to foreigners due to their lower value. On their part, Warren, Seetanah, & Sookia (2023) observed that excessive exchange rate volatility could be perceived to represent market activity, resulting in some positive inflows of FDI.

The relationship between inflation and FDI is similarly nuanced. Agudze and Ibhagui (2021) established that, while inflation dampens FDI in industrialised and developing, countries, its critical value affects each adversely in varying capacities. Tsaurai (2018) examined Southern Africa, yielding inconclusive findings for inflation to have influenced

FDI in ways indicated: having insignificant positive, negative, or significant negative coefficients in respective model estimations, with financial sector development being critical in interpreting such interactions.

Despite these insights, there have not been many studies investigating the dynamics among exchange rate volatility, inflation, and FDI. Most studies have considered correlations in pairs or studied each variable individually. It is particularly significant, given that exchange rates and inflation are interrelated, while their interaction affects macroeconomic conditions in which investments take place.

This study intends to bridge this gap in literature by examining dynamic and causal links between exchange rate volatility, inflation, and FDI in Nigeria from 1986 to 2023. By taking such an extensive methodological route, it is hoped that a broader perspective on these core macroeconomic indicators can be comprehended to understand their joint impacts on overall foreign investments in such a major developing country.

3. Methodology

The study adopts a Vector Error Correction Model (VECM) to analyse relationships between exchange rate volatility, inflation, and foreign direct investments in Nigeria. It is appropriate for these variables because they are not stationary in nature, having an equilibrium relationship in the long run. The approach allows the study to capture both short-run adjustments and long-run behaviour.

The empirical model gets its support from three different economic concepts. The Purchasing Power Parity theory discusses how prices affect exchange rate movement. The Mundell Fleming model discusses macroeconomic instability in relation to capital flow changes. Finally, the Eclectic Paradigm views a stable policy and pricing environment as increasing the chances of attracting foreign capital inflows into countries. These concepts inform the empirical model's structure.

3.1 Model Specification

This study investigates the interrelationship among foreign direct investment (FDI), exchange rate volatility, and inflation in Nigeria using a Vector Error Correction Model (VECM)

The linear form of the relationship among the variables could be presented as thus;

$$LFDI_t = f(EXR_t, INFR_t)$$

1

Putting the above equation in its intensive form, the log-linear version of the level model is specified as:

$$LFDI_t = \beta_0 + \beta_1 EXR_t + \beta_2 INFR_t + \epsilon_t$$

2

Where:

$LFDI_t$ = log of foreign direct investment at time t

EXR_t = exchange rate volatility at time t

$INFR_t$ = inflation rate at time t

ϵ_t = stochastic error term

Since the study is interested in the interactions among the variables, a vector model is specified as thus:

$$\Delta LFDI_t = \alpha + \sum \beta \Delta LFDI_{t-p} + \sum \beta \Delta EXR_{t-p} + \sum \beta \Delta INFR_{t-p} + \lambda ECM_{t-p} + \epsilon_t$$

3

$$\Delta EXR_t = \alpha + \sum \gamma \Delta LFDI_{t-p} + \sum \gamma \Delta EXR_{t-p} + \sum \gamma \Delta INFR_{t-p} + \lambda ECM_{t-p} + \epsilon_t$$

4

$$\Delta INFR_t = \alpha + \sum \delta \Delta LFDI_{t-p} + \sum \delta \Delta EXR_{t-p} + \sum \delta \Delta INFR_{t-p} + \lambda ECM_{t-p} + \epsilon_t$$

5

Δ indicates first differences. p is the chosen lag length. α is the constant term. γ , δ , and θ capture short-run adjustments. λ measures how fast each variable returns to long-run equilibrium. A negative and significant λ confirms the presence of stable long-run correction.

3.2 Data Source and Measurement

The study uses annual data from 1986 to 2023. This period covers the post Structural Adjustment Programme era and later reforms in Nigeria. Data come from the World Bank World Development Indicators and the Central Bank of Nigeria Statistical Bulletin.

Variables are measured as shown in Table 1:

Table 1 Variables and Measuremnt			
Variable	Definition	Measurement	Source
Foreign Direct Investment (LFDI)	Net inflows of investment from foreign entities into Nigeria, including equity capital, reinvested earnings, and other long-term capital	Measured in US dollars (USD) and transformed using the natural logarithm to stabilize variance	World Bank (World Development Indicators)
Exchange Rate Volatility (EXR)	Degree of fluctuation in the naira-dollar nominal exchange rate over time	Calculated as the five-year rolling standard deviation of the percentage changes in the nominal exchange rate	Central Bank of Nigeria (CBN) and World Bank (WDI)
Inflation Rate (INF)	General increase in the overall price level of goods and services in the economy	Measured as the annual percentage change in the Consumer Price Index (CPI)	World Bank (World Development Indicators)
Source: Author's Computation			

3.3 Estimation Procedure

The estimation process follows a sequence of steps that strengthens the validity of the model. The first step involves unit root testing with the Augmented Dickey Fuller and Phillips Perron tests. This confirms that each

variable is integrated of order one, which is required before the Johansen approach is applied. The second step involves selecting the optimal lag length for the underlying VAR structure. The Akaike and Hannan Quinn criteria guide this choice. Once the lag structure is set, the Johansen cointegration test is conducted to determine whether the variables share a long-run equilibrium path. The null hypothesis of no cointegration is rejected when the trace statistic exceeds the critical values, which confirms the presence of at least one cointegrating vector. With cointegration established, the system is then estimated in its Vector Error Correction form. The VECM produces both long-run coefficients and short-run adjustments. The error correction term measures how fast the system returns to equilibrium after a shock. To strengthen the reliability of the results, the short-run equations are re-estimated with Ordinary Least Squares for diagnostic checks. The Lagrange Multiplier test checks serial correlation, the Breusch Pagan Godfrey test checks heteroskedasticity, and the Jarque Bera test assesses normality. Stability is verified by inspecting the inverse roots of the characteristic polynomial. This process ensures that the estimates are robust, consistent, and ready for interpretation.

4. Result Presentation and Discussion

Table 2 presents the summary statistics for the study variables, indicating that foreign direct investment (LFDI) in Nigeria has an average index of 21.29 over the sample period from 1986 to 2023, ranging between 19.08 and 22.90 with a standard deviation of 1.05, suggesting relatively stable but moderate variation in FDI inflows over the years. Exchange rate volatility (EXR) averaged 36.93, ranging from 0.21 to 144.02, with a high standard deviation of 45.05, reflecting significant fluctuations and persistent currency instability across the period. Inflation (INFR) averaged 19.58% per annum, ranging from 5.39% to 72.84%, with a standard deviation of 17.35, confirming the presence of substantial and often high inflationary pressures in the Nigerian economy.

Table 2 presents the summary statistics for each variable in the analysis. Foreign direct investments in Nigeria had an average index of 21.29 for the period from 1986 to 2023, ranging from 19.08 to 22.90, and with a standard deviation of 1.05, indicating some stability in their levels over the years. On the other hand, exchange rate volatility has an average value of 36.93, varying from 0.21 to 144.02, with a significantly high average standard deviation of 45.05, indicating extreme variability in values due to currency fluctuations in the Nigerian market. Inflation averaged at 19.58 percent for each year, ranging from 5.39 percent to 72.84 percent, with an average standard deviation of 17.35, indicating extreme inflationary levels in Nigeria.

Table 2
Descriptive Statistics

	LFDI	EXR	INFR
Mean	21.290096	36.927564	19.583561
Median	21.3568	14.06135	12.876579
Maximum	22.90267	144.0163	72.835502
Minimum	19.07931	0.211193	5.388007
Std. Dev.	1.05091	45.04892	17.350169
Observations	37	37	37
	LFDI	EXR	INFR
Correlation	Matrix		
LFDI	1.00000		
EXR	-0.299669	1.00000	
INFR	-0.291989	-0.012391	1.00000
<i>Source: Author's computation</i>			

The lower part of Table 2 presents the correlation matrix, which indicates that a weak negative correlation exists between foreign direct investment (LFDI) and both exchange rate volatility (EXR) (-0.30) and inflation (INFR) (-0.29). This suggests that higher macroeconomic instability is generally associated with lower FDI inflows, although the relationships are not strong at the bivariate level. The correlation between exchange rate volatility (EXR) and inflation (INFR) is very weak and negative (0.01), implying that these two variables vary largely independently in the short term, possibly due to policy lags or differing transmission mechanisms.

This initial analysis provides a foundational understanding of the distributional characteristics and pairwise relationships among the key variables under investigation.

Table 3
Unit root result- Trend and Intercept

Variables	Standard unit root tests						Results
	ADF			Philips Peron			
	Level	1st Diff.	Critical values (5%)	Level	1st Diff.	Critical values (5%)	
EXR	-2.617217	-6.015777***	-3.540328	-2.706347	-6.015862***	-3.540328	I(1)
INFR	-4.409069	-4.140919**	-3.557759	-3.371581	-6.472591***	-3.540328	I(1)
LFDI	-1.889753	-8.843145***	-3.548490	-2.919040	-8.849625***	-3.548490	I(1)
Source: Author's Computation							

Table 3 presents the results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, conducted with an intercept and trend. These tests are essential to determine the order of integration of each variable, a prerequisite for cointegration analysis.

The results indicate that all three variables, foreign direct investment (LFDI), exchange rate volatility (EXR), and inflation rate (INFR), are non-stationary at their levels, as the null hypothesis of a unit root cannot be rejected. However, after first differencing, the test statistics for all variables become statistically significant at the 1% level under both the ADF and PP tests. This confirms that LFDI, EXR, and INFR are each integrated of order one, $I(1)$.

Before conducting cointegration analysis, it is essential to determine the optimal number of lags for the underlying Vector Autoregressive (VAR) model. The choice of lag length is critical as it ensures that the error terms are adequately behaved, thereby eliminating residual autocorrelation and providing reliable inference. It therefore important to determine the lag length as given below in Table 4.

Table 4
Lag length selection

	LogL	LR	AIC	SC	HQ
0	-355.430144	NA	21.72304	21.85909	21.76881
1	-316.589180	68.26594	19.91450	20.45868*	20.09760
2	-304.411109	19.18969*	19.72189*	20.67421	20.04231*
3	-296.822315	10.57832	19.80741	21.16787	20.26517
<i>Source: Author's Computation</i>					

The lags' structure is central to the identification of the dynamics of the underlying system and the assurance that the error terms of the model are adequately behaved (Udo, & Idochi, 2024). The results of the lag length selection including the Akaike Information Criterion (AIC) and the Hannan-Quinn Criterion (HQ), both of which selected the optimal lag length at lag 2 of the VAR system.

Having confirmed that all variables are integrated of order one, $I(1)$, the next step is to test for the existence of a long-run equilibrium relationship among them. The Johansen cointegration test was applied using a lag length of two, as determined by the Akaike Information Criterion (AIC) and Hannan-Quinn Criterion (HQ).

Table 5
Johansen Cointegration Test Result

Hypothesized No. of CE(s)	Trace Statistic	5% Critical Value	Prob.
None *	40.34000	29.797073	0.002145
At most 1	11.02259	15.494712	0.210115
At most 2	1.842277	3.8414654	0.174683
Note: Trace test indicates 1 cointegrating equation(s) at the 0.05 level			
* denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) p-values			
Source: Author's Computation			

The results, reported in Table 5, indicate the presence of one cointegrating relationship at the 5% significance level. The trace statistic for the null hypothesis of no cointegration is 40.340, which exceeds the critical value of 29.797 and yields a p-value of 0.002. In contrast, the null hypotheses of "at most one" and "at most two" cointegrating vectors cannot be rejected.

This confirms a unique long-run equilibrium relationship among foreign direct investment (LFDI), exchange rate volatility (EXR), and inflation (INFR). The presence of cointegration justifies the use of the Vector Error Correction Model (VECM) to simultaneously capture long-run equilibrium dynamics and short-run adjustments.

The Vector Error Correction Model (VECM) was estimated to analyse the long-run equilibrium and short-run dynamics among foreign direct investment (LFDI), exchange rate volatility (EXR), and inflation (INFR). Given the confirmed cointegration and I(1) nature of the series, a VECM with two lags was specified.

Table 6
Normalized Long-Run Cointegrating Relationship for LFDI

Variables	Coefficient	Std. Error	t-Statistic
LFDI(-1)	1.000000	Nil	Nil
EXR(-1)	0.010092	0.003338	3.02289
INFR(-1)	0.061279	0.009564	6.40711
C	-22.984526	Nil	Nil
Source: Author's Computation			

Table 6 presents the normalized long-run cointegrating relationship. Both EXR and INFR exhibit a positive and statistically significant effect on LFDI. The coefficient for EXR is 0.0101 ($t = 3.023$), implying that a 1% increase in exchange rate volatility raises FDI by 0.0101%. While counterintuitive, this finding may reflect Nigeria's unique investment landscape, where high-return, resource-seeking FDI (e.g., in oil, telecoms, infrastructure) is attracted to volatile markets, perceiving volatility as a sign of market activity or speculative opportunity (Akinlo, 2004; Warren et al., 2023).

Similarly, the coefficient for INFR is 0.0613 ($t = 6.407$), indicating that a 1% increase in inflation raises FDI by 0.0613%. This unexpected positive result suggests that moderate inflation may signal robust domestic demand and

profitability, attracting capital flows despite theoretical expectations of risk aversion (Agudze & Ibhagui, 2021; Tsaui, 2018). It may also indicate investors' ability to hedge against inflationary risks through contractual mechanisms or dollar-denominated investments.

Table 7
Error correction model Result Model
Summary Statistics

Statistic	Value
R-squared	0.278711
Adjusted R-squared	0.076750
F-statistic	1.380028
S.E. of regression	0.630351
Log likelihood	-27.01527
<i>Source: Author's Computation</i>	

Table 7 shows the result for error correction in the short-run model for LFDI. The error correction term, ECM(-1), is highly significant with coefficient of -0.503 ($p < 0.01$). It establishes stability in the long-term relationship with an adjustment speed for 50% per annum.

For the short-run model, inflation is confirmed to be a major positive factor in FDI, with its first and second lags being positive and significant at 5% and 10% levels, respectively. It suggests that the current inflationary trends have an immediate, although small, positive effect on FDI inflows. This could be due to some adaptive expectations or sector-specific responses in the Nigerian economy.

In contrast, the short-run effects of exchange rate volatility are negative but statistically insignificant. This suggests that investors in Nigeria respond more to long-run exchange rate trends than to short-term fluctuations, reflecting the forward-looking nature of FDI decisions. The autoregressive terms for LFDI are also insignificant, suggesting FDI inflows lack strong momentum and are likely driven by exogenous structural factors rather than past investment behaviour.

On the other hand, for Nigeria, the short-term effects of exchange rate volatility are negative, yet not statistically significant. It is thereby indicated that Nigeria's investment climate is more influenced by long-term patterns in exchange rate volatility rather than short-term patterns. Also, for Nigeria, autoregression in LFDI is not statistically significant, indicating that there isn't any momentum in Nigeria's FDI inflows, which could be driven by exogenous structural elements.

To establish the direction of causation for each set of variables, VEC Granger Causality/Block Exogeneity Wald test analysis was conducted. This test helps determine whether the lagged variables in each series have forecast value for other series with regard to their relationships in Vector Error Correction Model analysis.

Table 8
Granger Causality Test

Dependent Variable	Excluded Variable	Chi-square	df	Prob.	Conclusion
D(LFDI)	D(EXR)	0.3954	2	0.8206	No causality
	D(INFR)	16.5659	2	0.0003	INFR → LFDI (Significant)
D(EXR)	D(LFDI)	0.0112	2	0.9944	No causality
	D(INFR)	5.2207	2	0.0735	INFR → EXR (Weak significance)
D(INFR)	D(LFDI)	3.1050	2	0.2117	No causality
	D(EXR)	0.9649	2	0.6172	No causality

Source: Author's Computation

From the result in the Table 8, Inflation Granger-causes FDI at 1% significance value. It signifies there is presence of relevance of past values of inflation in FDI inflows in Nigeria. It confirms earlier discovery in VECM estimation of inflation as significantly determining FDI in long-run as well as in short-run. There is weak evidence (10% test) that inflation Granger-causes exchange rate volatility, thus some impact of change in domestic price on change in exchange rate but not particularly large. The result did not reveal any causal influence between exchange rate volatility FDI, nor FDI Granger-causing exchange rate volatility or inflation.

Table 9
Diagnostic Tests

Specifications	Statistic	Prob.
Serial Correlation LM Lag 1	9.79294	0.3675
Serial Correlation LM Lag 2	7.88981	0.5453
Breusch Pagan Godfrey	0.3617	0.9158
Normality Test Joint JB	68.4764	0
Stability Max Root Modulus	1	—

Source: Author's Computation

The diagnostic checks from Table 9 show that the model is statistically sound. The LM statistics at both lags produce p values above the five percent level, so the residuals show no serial correlation. This confirms that the chosen lag structure is appropriate. The Breusch Pagan Godfrey statistic also produces a p value above the five percent level, which supports homoskedasticity and indicates stable residual variance in the OLS re estimation used for the short run diagnostics.

The joint normality test shows strong evidence of non normal residuals. This is common in macroeconomic time series with long samples. The VECM and the Johansen cointegration procedure remain valid under moderate deviations from normality, so the long run and short run estimates remain reliable.

The stability test shows that all roots lie inside or on the unit circle as seen in Fig. 1. The system is stable. The dynamic structure of the VECM is consistent and supports valid inference.

Taken together, the results confirm that the model is well specified and suitable for interpretation.

To gain further insight into these interactions, the Generalized Impulse Response Functions (GIRFs) and Forecast Error Variance Decompositions (FEVD) were employed this analysis. These methods reveal the response paths over time to the shocks, as well as decomposing their relative contributions to forecast errors over a period of ten years.

The GIRFs as shown in Fig. 2 reveal that a shock to inflation induces a delayed but persistent negative effect on foreign direct investment (FDI), with the response intensifying after the second period. In contrast, a shock to exchange rate volatility produces a smaller and more gradual negative impact on FDI. This indicates that while both variables deter investment, inflation is the more potent and enduring deterrent.

Conversely, a shock to FDI has a negative impact on exchange rate volatility, indicating that stable capital flows are associated with stable currencies. Additionally, inflation is negatively affected by a shock from exchange rate volatility, indicating that the pass-through process from changes in exchange rates to domestic prices is significant due to currency depreciation.

These findings are confirmed by the FEVD analysis. As shown in Table 10a, in the long run (Period 10), inflation explains 34.2% variance in forecast errors in FDI, while exchange rate volatility explains 18.7%, with the rest (47.1%) being explained by FDI itself. These results again affirm inflation's predominance in explaining FDI's volatilities in Nigeria

For exchange rate volatility (Table 10b), FDI shocks start to account for an increasing proportion of its variation, from 2.9% in the short-term to 27.8% in the long-term. Notably, there appears to be substantial feedback, whereby market sentiment significantly affects exchange rate stability. Lastly, from Table 10c, it is observed that inflation is self-driven, with its own innovations contributing more than 93% to its variability at all forecast horizons. Again, this reiterates that inflation in Nigeria is determined mostly by its own policy variables, and not influenced by other variables such as FDI or exchange rate changes.

Table 10
a: Forecast Error Variance Decomposition of LFDI

Period	S.E.	LFDI (%)	EXR (%)	INFR (%)
1	0.5015	100.00	0.00	0.00
3	0.6800	77.94	17.00	5.06
7	0.9983	49.96	17.74	32.30
10	1.1547	47.06	18.71	34.23

Table 10
b: Forecast Error Variance Decomposition of EXR

Period	S.E.	LFDI (%)	EXR (%)	INFR (%)
1	34.5352	2.85	97.15	0.00
3	57.1595	20.34	73.19	6.47
7	93.2003	26.91	57.38	15.71
10	111.2588	27.85	56.26	15.90

Table 10
c: Forecast Error Variance Decomposition of INFR

Period	S.E.	LFDI (%)	EXR (%)	INFR (%)
1	12.4382	0.36	1.63	98.01
3	19.3302	2.95	2.66	94.40
7	22.2478	2.54	4.51	92.96
10	24.8945	2.03	4.92	93.06
<i>Source: Author's Computation</i>				

Discussion of Findings

These empirical findings demonstrate an interesting, yet counterintuitive dynamic: both exchange rate volatility and inflation have a positive and statistically significant long-run effect on FDI inflows in Nigeria from 1986 to 2023. This finding contrasts with economic principles, which assume that macroeconomic instability discourages FDI by creating risks, uncertainties, and costs (Udoh & Egwaikhide, 2008; Akinlo & Onatunji, 2021). On the other hand, these principles fit into the structural makeup of Nigeria's economy, in which some particular, high-return investments supersede macroeconomic risk considerations.

A positive relationship in the long run between exchange rate volatility and FDI shows that investors in Nigeria are not generally risk-averse in their investments. Rather, they could interpret currency volatility as market activity or speculative opportunity. Warren, Seetanah, and Sookia (2023) explained in their gravity model that foreign investors could interpret currency volatility as market dynamism, especially in resource-abundant economies such as Nigeria's. Again, other studies, such as Akinlo (2004), noted that in Nigeria, there is sectoral specificity in FDI, with primary inflow to oil, gas, telecom, and infrastructure, less exposed to exchange rate changes due to dollar-paying revenues or hedging agreements.

Similarly, the positive long-term relationship between inflation and FDI contradicts conventional principles, which suggests that increasing costs undermine investor sentiment. It could be assumed that moderate inflation rates could emanate from countries with promising growth outlooks, hence attracting more capital, despite theoretical expectations. According to Agudze and Ibhagui (2021), this situation is prevalent in developing countries, whereby increasing inflation rates could emanate from increasing economic activity, not declining performance. Additionally,

foreign investors may be able to hedge against inflationary risks through contractual arrangements, indexation, or pricing power, reducing the real cost of doing business.

In contrast, the short-run effects diverge. While inflation remains a significant positive driver of FDI in the short run, exchange rate volatility shows a negative but statistically insignificant effect. This indicates that investors do not react strongly to transient currency fluctuations, reflecting the forward-looking nature of FDI decisions. Investors appear to base their commitments on long-term expectations of profitability rather than short-term macroeconomic noise.

Additionally, the Granger causality test confirms these relationships, with results indicating unidirectional causality from inflation to FDI on a 1% significance level. This establishes that there is predictive information in inflation regarding FDI inflows, thus affirming it to be an indicator in the decision-making process for investments. There is also weak evidence ($p = 0.0735$) that inflation influences exchange rate volatility, suggesting a mild pass-through effect from domestic price pressures to currency instability.

The dynamic analysis from Impulse Response Functions (IRFs) and Forecast Error Variance Decompositions (FEVD) provide further insights into what drives such behaviour. It is observed from IRFs that while inflation shocks affect FDI negatively with some lag, exchange rate volatility shocks have less pronounced negative effects on FDI. On the other hand, FDI shocks lead to stability in exchange rates, thereby emphasizing the fact that with enough capital inflows, exchange rates become more stable.

The FEVD shows that, in the long run, inflation explains more than 34% of forecast error variance in FDI, followed by exchange rate volatility, which explains about 19%, while FDI explains almost half of its own variability, indicating its self-fulfilling dynamics. Using exchange rate volatility, FDI shock explains up to 28% of its variability, confirming investor sentiment as a key influence on currency stability.

These results consistently point to the fact that, while macroeconomic fundamentals are important, Nigeria's investment environment is driven more by structural profitability than macroeconomic stability. It is, therefore, necessary for policymakers to move beyond their typical macroeconomic stability discourses to strengthen institutional, infrastructure, and administrative predictability to attract sustainable FDI.

5. Conclusion and Policy Recommendations

The study examined the relationship among exchange rate volatility, inflation, and foreign direct investment in Nigeria from 1986 to 2023 using the VECM approach. Unit root tests showed that all variables were integrated of order one i.e. $I(1)$, while the Johansen test indicated the existence of a long-run relationship. The residuals showed no evidence of serial correlations, homoscedasticity, although evidence of non-normal residuals, which did not affect model stability.

The long-run findings indicated that exchange rate volatility and inflation positively and significantly influenced FDI inflows. Conversely, the short-run results indicated that inflation positively and significantly influenced FDI, while exchange rate volatility was not significant. Analysis on Granger causality indicated there was unidirectional causality from inflation to FDI, with extremely weak evidence from inflation to exchange rate volatility. It appears, therefore, that FDI inflows are primarily influenced by sector rather than broad macroeconomic performance.

The following policy recommendations arise from the results.: Improve exchange rate management to reduce uncertainties in investment choices. Continue with good performance in controlling inflation to maintain discipline in

fiscal and monetary policies. Enhance investments by improving infrastructure, cutting costs of doing business, and improving policy consistency. Encourage diversified investment strategies to attract FDI in other sectors, different from oil, to increase productive capacities. Make information disclosure more transparent to attract investments.

Future studies could examine the disaggregation of FDI by sector to incorporate differences in responses. Institutional indicators for quality could be added as moderating variables. Threshold methods in nonlinear models could be used to test for thresholds in volatility or inflation. Firm-level analysis with comparative analysis in ECOWAS countries could also provide new information on how structural conditions influence.

Declarations

Conflict of Interest

The authors declare no conflict of interest.

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Author Contribution

Chijioke Richie Ezekwube conceptualised the topic, obtained the data, wrote the methodology, analysed and interpreted the findings, and produced the first draft. Samuel Omoniyi Oladipo and Timothy Ogbemudiare Ideh contributed to writing the literature review and theoretical framework. All authors read and approved the final manuscript.

Data Availability

The data used in this study are publicly accessible through the World Bank World Development Indicators: [<https://databank.worldbank.org/source/world-development-indicators>] (<https://databank.worldbank.org/source/world-development-indicators>) and the Central Bank of Nigeria Statistical Bulletin <https://statistics.cbn.gov.ng/shop>

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Figures

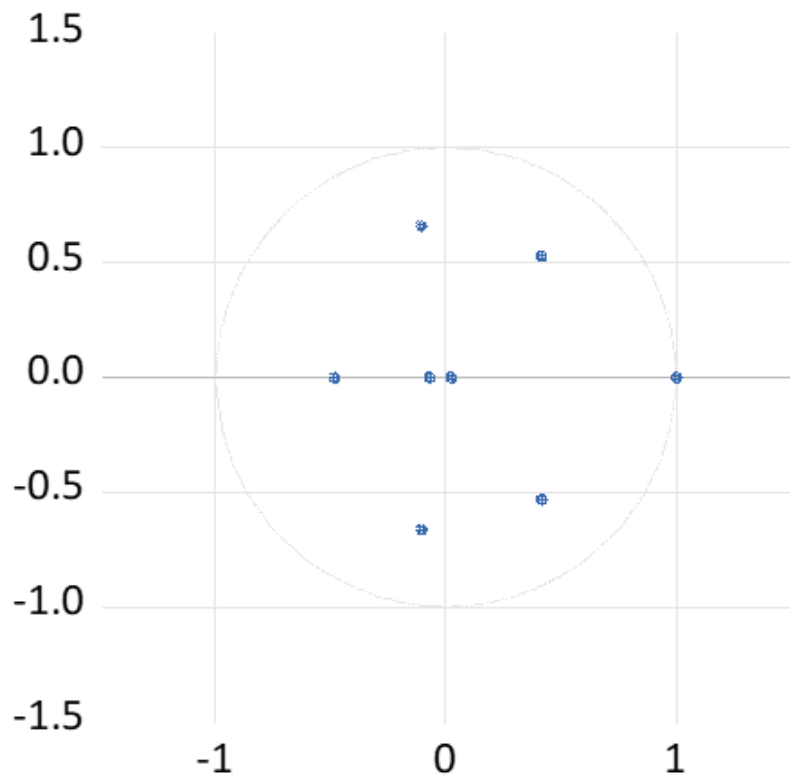


Figure 1

VEC Stability test AR roots

Response to Cholesky One S.D. (d.f. adjusted) Innovations

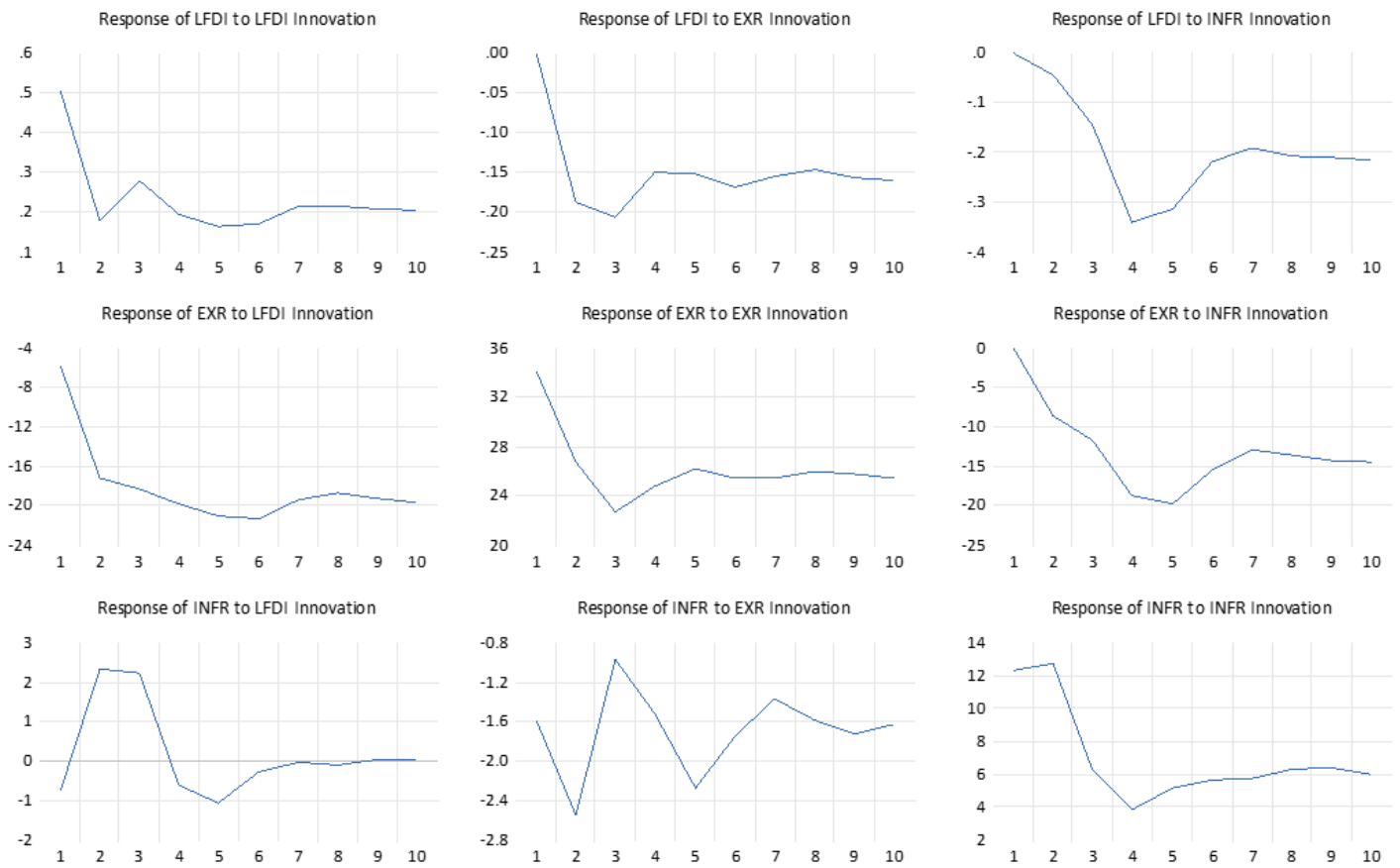


Figure 2

Impulse response function