EFFECTS OF EXCHANGE RATE VOLATILITY ON ECONOMIC GROWTH IN NIGERIA: A NONLINEAR ARDL APPROACH (1984–2024)

Nasiru Ibrahim
Tazaar Management Consultants Ltd., Nigeria.
nasiruibrahim0400@gmail.com

Samaila Yahaya
Universitas Islam International, Indonesia

Faisal Suleiman Ahmad
Federal University of Kashere, Gombe, Nigeria

Safiyanu Adamu Damanda
Gombe State University, Gombe, Nigeria.

Corresponding Author:
Nasiru Ibrahim
Tazaar Management Consultants Ltd., Nigeria.
nasiruibrahim0400@gmail.com

ABSTRACT

Exchange rate volatility remains a central concern for macroeconomic management in Nigeria, particularly following the June 2023 foreign exchange window unification and subsequent naira depreciation. This study examines whether exchange rate volatility affects economic growth symmetrically or asymmetrically over 1984–2024. This study used a Nonlinear Autoregressive Distributed Lag (NARDL) framework based on a REER-derived rolling-window volatility measure. Similarly, the GARCH/EGARCH models are used only as sensitivity checks because of weak identification at annual frequency. The ARDL result revealed that the bounds test confirms a long-run cointegrating relationship among real GDP, exchange rate volatility, inflation, terms of trade, and trade openness. The negative and significant error correction term (−0.13) implies a five-year half-life of adjustment towards equilibrium. Although long-run volatility effects are statistically insignificant, reductions in exchange rate volatility have a significant positive short-run effect on growth, whereas increases show no significant effect. Wald tests confirm asymmetry in both the long run F-Statistic 0.0495. The findings suggest that reducing exchange rate volatility may support short-run economic growth, rather than treating increases and decreases in volatility as equivalent. The study recommends that the Central Bank of Nigeria prioritize foreign exchange market design, liquidity provision, and orderly price discovery to reduce short-run volatility, while avoiding the interpretation of volatility alone as a reason to alter the long-run exchange rate regime.

Keywords: *Exchange Rate Volatility, Economic Growth, Nonlinear ARDL, and Nigeria.*

JEL Classification: F31, F43, C22, O47

1. Introduction

Exchange rate volatility has remained a central concern for macroeconomic management in developing economies, particularly those that are heavily import-dependent and export-concentrated, such as Nigeria. Since the adoption of the Structural Adjustment Programme in 1986, Nigeria has experienced persistent fluctuations in the value of the naira, moving through several distinct regimes a fixed/overvalued rate prior to 1986, managed floats, and the unification/float of June 2023 each accompanied by bursts of volatility whose effects on real activity are a longstanding policy concern.

Theoretical perspectives on this relationship are genuinely divided. Friedman (1953) argued flexible exchange rates act as an automatic stabilizer; Mundell (1961, 1963) and Fleming (1962) showed the appropriate regime depends on whether real or monetary shocks dominate; Poole (1970) and Mussa (1982, 1986) extended this into a shock-variance framework; while Obstfeld and Rogoff (1995, 2000) and Calvo and Reinhart (2002) argue effectiveness depends on institutional strength, with many developing economies exhibiting "fear of floating" regardless of their formal regime. Since volatility as distinct from the exchange rate level captures the uncertainty dimension common to both real and monetary shock channels, this study focuses on exchange rate volatility rather than the exchange rate level. Nigeria provides a directly relevant setting: repeated real-sector shocks (the 1986 and 2014-2016 oil price collapses, the 2020 COVID-19 oil shock, persistent production shortfalls) alongside chronic monetary disturbances (inflation, fiscal deficits financed through monetary expansion, parallel-market pressures). On 14 June 2023, the Central Bank of Nigeria unified all FX windows into a single, market-driven structure; the naira depreciated sharply thereafter, from about N449/US$ at end-2022 to roughly N1, 544/US$ by February 2024 (IMF, 2024), with inflation reaching 32% in the same month. According to World Bank (2025) subsequently linked a decline in inflation from 33.2% (2024) to 23.0% (2025) to reduced exchange-rate volatility suggesting volatility itself, not merely the level of the naira, plays an important independent role in macroeconomic performance. The central research problem is therefore: does exchange rate volatility have symmetric or asymmetric effects on economic growth in Nigeria, and to what extent do positive and negative volatility shocks differ in their short-run and long-run impacts?

2. Literature Review

This section provides conclusive empirical evidence on exchange-rate volatility on economic growth in Nigeria. Hence we reviewed the following studies and ascertain the empirical exchange rate volatility on growth in Nigeria Rasaki and Oyedepo (2023) examine Nigerian trade flows using quarterly data from 1995Q1 to 2020Q4 and apply both linear ARDL and nonlinear ARDL models. Their results show that exchange-rate volatility has short-run effects on exports and both short- and long-run effects on imports. Their nonlinear estimates indicate asymmetric effects for imports but not for exports: increases in volatility reduce imports, while decreases in volatility increase imports. The study uses a GARCH-based measure of exchange-rate volatility. Oyadeyi (2024) examines the determinants of exchange rate volatility and its impact on the Nigerian macro economy using quarterly data from 1986 to 2023. Auto regressive conditional Heteroscedasticity (ARCH), non-linear Generalized Autoregressive conditional heteroscedasticity (GARCH) and dynamic autoregressive distributed lag (ARDL) were applied for the data. Findings of the studies revealed that monetary policy rate, lending rate, oil prices, government expenditure and financial development significant drive volatility. In addition, the study found that the volatility itself exerts significant effects on Nigeria's macroeconomic performance. Elian, et al. (2024) investigate the impact of economic growth and exchange rate volatility on foreign direct investment inflows in BRICS countries. Panel data for the spanned period of 1981 to 2019. Autoregressive distributed lag model (ARDL) was applied for the data analysis. Finding of the study shows that exchange rate volatility has a negative effect on foreign direct investment inflows. Ebeh and Halilu (2026) conducted empirical study on sectoral analysis of the impact of exchange rate volatility on trade performance in Nigeria use a Johansen Vector Error Correction Model for 1970–2011 and report a positive relationship between the exchange rate and economic growth, alongside a positive effect of oil revenue. Such evidence contributes to understanding the broader exchange-rate growth relationship, but it does not directly identify the effect of exchange-rate volatility. In addition, Faisal, et al. (2026) conducted empirical study on macroeconomic determinants of food inflation in Nigeria using time series for the spanned period of

2005-2023. Auto regressive distributed lag (ARDL) was applied for the data analysis. This study found that trade openness and fuel subsidy has negative and statistically significant effect on food inflation in Nigeria in the long run. Similarly, exchange rate has negative and statistically significant in the short run on food inflation.

3. Methodology

3.1 Methodological Framework

In view of the main objective of this research work which aim at assessing the exchange rate volatility on economic growth in Nigeria. The study employed time series data from 1984 to 2024. Data on Gross domestic product, trade openness, and inflation were collected from World Bank indicator (WDI) and real effective exchange rate and trade were collected from International monetary fund (IMF). While data on rolling window realized volatility was derived from REER. The study examined the stationarity of the variables using the Augmented Dickey Fuller (ADF) and Phillip perron (PP) unit root tests to test the null hypothesis that assume the presence of a unit root for the variables at level by including the constant and the time trend and the same at the first difference. The relationship among the variables are examined using autoregressive distributed lag (ARDL).similarly, volatility will be examined using nonlinear autoregressive distributed lag.

3.1 Theoretical Framework

The study draws on four complementary theoretical perspectives. Uncertainty (Risk-Aversion) Theory provides the principal explanation for the potential negative effect of exchange-rate volatility on trade, investment and economic activity. Endogenous Growth Theory provides a longer-run mechanism through which exchange-rate uncertainty can influence investment, productivity and output. The asymmetric-effects perspective provides the basis for distinguishing between increases and decreases in volatility rather than imposing a symmetric response. Absorption Theory provides an additional trade and expenditure channel through which exchange-rate conditions can influence domestic output. This study adopted the Mundell-Fleming as a theoretical framework because it provides the broader open-economy context in which exchange-rate movements interact with monetary conditions, external shocks and output. Taken together, these perspectives provide a theoretical basis for examining the direction, persistence and asymmetry of the relationship between exchange-rate volatility and economic growth.

3.2 Model Specification

The objective of the paper is: examined the effect of exchange rate volatility on economic growth in Nigeria. The model of estimation is specified to achieve the objective of this study. The model is: nonlinear autoregressive distributed lag (NARDL). The general functional and econometric relationship is expressed in hybrid form as:

$$InGDP_t = f\left(EXV_{t,}Inflation_{t,}InTOT_{t,}TradeOpen_t\right) \quad 3.1$$

Where: $InGDP_t$= natural logarithm of real Gross Domestic Product, used as the measure of economic growth, $EXV_{t,}$= exchange rate volatility derived from the REER, $Inflation_{t,}$= annual inflation rate, $InTOT_{t,}$= natural logarithm of the terms of trade, $TradeOpen_t$= trade openness.

The econometric form of the model is specified as:

$$InGDP_t = \alpha_0 + \beta_1 EXV_t + \beta_2 Inflatio_t + \beta_3 InTOT_t + \beta_4 TradeOpen_t + \varepsilon_t \quad 3.2$$

Taking the natural log of the equation

$$InGDP_t = f\left(EXV_{t,}Inflation_{t,}InTOT_{t,}TradeOpen_t\right) = \alpha_0 + \beta_1 EXV_t + \beta_2 Inflatio_t + \beta_3 InTOT_t + \beta_4 TradeOpen_t + \varepsilon_t \quad 3.3$$

3.2.1 Nonlinear autoregressive distributed lag

A nonlinear autoregressive distributed lag (ARDL) model was used to examine exchange rate volatility in Nigeria. Shin, Yu and Greenwood-Nimmo (2014), exchange rate volatility is decomposed into positive and negative partial sums to allow the effects of increases and decreases in volatility to be estimated separately:

$EXV_t^+ = \sum_i = {}_1^t \max\ (\Delta EXV_{i,}\ 0)$ 3.4

Where:

EXV_t^+ represents cumulative positive changes in exchange rate volatility and EXV_t^- represents cumulative negative changes. Since EXV_t^- is constructed using the minimum of the changes in volatility, it is non-positive and its coefficient is interpreted according to this sign convention.

The positive and negative partial sums are incorporated into the ARDL framework to obtain the nonlinear ARDL (NARDL) specification

The model is specified as follows:

$InGDP_t$ = f($EXVt^+\ EXVt^- Inflation_t\ InTOT_t\ TradeOpen_t$) = α∘ + $\beta_1 EXV_t^+ + \beta_1 - EXV_t^-$ +

$\beta_2 Inflation_t + \beta_3 InTOT_t + \beta_4 TradeOpen_t + \varepsilon_t$ 3.5

3.3 Stationarity Analysis

Stationarity of the series is a basic condition that must be satisfied in order to avoid the problem of sperious regression result, and also as means of selecting an estimation technique. Hence, the study tested for unit root with without consideration of structural breaks. The study considered Augmented Dickey Fuller (ADF) test and Phillips-Perron (PP) test assess unit root properties and integration order of the series without considering structural break. The ADF and PP tests are method of testing the size of the co-efficient in the equation.

$\Delta_\varkappa = \alpha^0 + \alpha\varkappa_{t-i} + \alpha b \sum \Delta_{\varkappa t-i} + \mu_t$ 3.6

Where:

μ_t is white noise error term and $\boldsymbol{\Delta}$ is the first difference operator. The test hypotheses that there is unit root or the variable is not stationarity. The augmented Dickey Fuller (ADF) test and Phillips-Perron tests are employed to analyse unit roots.

3.3.1 Augmented Dickey- Fuller (ADF) Test

The Augmented Dickey Fuller (ADF) test is necessary in order to determine whether ARDL approach is suitable or not (Pesaran, *et al.*, 2001). The ADF test is performed on three equations as presented bellow;

$\Delta Y_t = \emptyset + \gamma y_{t-1} + \sum \beta_i \Delta y_{t-1} + \varepsilon_t$ 3.7

$\Delta y_t = \emptyset_0 + \emptyset_2 t + \gamma\ y_{t-1} + \sum \beta_i \Delta y_{t-1} + \varepsilon_t$ 3.8

$\Delta y_t = \gamma y_{t-1} + \sum \beta_i \Delta y_{t-1} + \varepsilon_t$ 3.9

Where Δ represents the first difference operator, y_t is the series under consideration, $\emptyset$ is the intercept term, t is the linear time trend y_{t-1} is the lag variable being tested, Δy_{t-1} means first difference lagged series usually taken to eliminate the problem of series correlation (Dickey & Fuller, 1979) and ε is the white noise process.

3.3.2 Phillips-Perron (PP) Test

Phillips and Perron (1988) developed the PP test to be employed in this study that is similar to ADF tests. However, the PP test is more comprehensive because the test incorporates an automatic correction to the Dickey-Fuller procedure to allow for auto correlated residuals and heteroscedasticity. Also, unlike the ADF test, the PP test does not require the specification of the lag length (P). The PP test is based on the t – statistic calculation specified:

$$t_{\alpha}^{pp} = t_{\alpha}\left(\frac{\gamma_0}{f_0}\right)^{1/2} \frac{T(f_0-\gamma_0)(s_{\eth})}{2f_0^{1/2}s} \qquad 3.10$$

Where: f_0 = Residual estimator; Y_0 = Error variance estimator with; Frequency = 0; $s_{\eth}$ = standard error coefficient; s=standard Error. Similar to the ADF tests, the conclusions and hypothesis for the PP tests is the same. The null hypothesis of non-stationary series is rejected in favor of the stationary alternative for each test when the PP test statistic is more than the critical values, and the corresponding probability value less than 5%.

3.5 sources of Data

The study employed secondary data and annual time series in nature.

Table 3.1: Data sources

Variables	Sources
GDP	World Bank
Exchange rate	World Bank
Inflation	Central Bank of Nigeria (CBN)
Trade	International Monetary fund (IMF)
Trade Openness	World Bank

Source: *Researcher's computation 2026.*

4. Results and Discussion

This section deals with the analysis of the data and interpretation which will help in drawing conclusion and recommendation of the study.

4.1 Descriptive Statistics

Descriptive statistics has been used in this study to provide summary in the form of mean, standard deviation, minimum and maximum of the variables.

Table1: Result of Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
lnTOT	4.4144	0.4671	3.4619	5.0428	-0.2901	-1.2313
lnGDP	32.2665	0.5502	31.4048	33.0145	-0.0126	-1.6236
lnREER	4.7521	0.5661	3.9075	6.2858	1.4375	1.7937
TradeOpen	2.6938	0.1945	2.336	3.1226	0.4841	-0.39
Inflation	18.5998	15.5932	5.388	72.8355	2.0625	3.7642

Source: *Researcher's computation 2026.*

The result revealed that variables exhibit considerable variation over the study period. Inflation recorded the highest level of dispersion, with a standard deviation of 15.5932 and values ranging from 5.3880 to 72.8355, reflecting the persistent macroeconomic instability and inflationary episodes experienced in Nigeria. In contrast, Trade Open displayed the lowest variability, suggesting relatively stable movements in trade openness over the sample period. The remaining variables exhibit moderate dispersion, indicating sufficient variability for meaningful econometric analysis. The skewness coefficients show that (lnTOT and lnGDP) are approximately symmetric, while (lnREER, Trade Open and Inflation) are positively skewed, indicating that higher-than-average observations occurred more frequently than lower-than-average observations. The kurtosis statistics reveal that Inflation is leptokurtic, suggesting the presence of extreme observations, whereas the other variables are generally platykurtic, indicating relatively flatter distributions. Overall, the statistical properties of the variables suggest the absence of serious distributional concerns and provide support for subsequent econometric estimation.

4.2 Unit Root Test

The unit root has been conducted to determine the stationary condition of the time series, and also to know their order of integration. Augmented Dickey-Fuller (ADF) and Phillips-Perron test were employed. The result test is presented in Table 4.2 below:

Table 2: Results of Unit Root Test (ADF& P-P At level and At First Differenced)

Variable	Series	ADF Statistic	p-value	Lags	Decision
lnTOT	Level	-1.0564	0.7322	2	Non-stationary
lnTOT	1st Difference	-6.5621	0.0	1	Stationary
lnGDP	Level	-0.7064	0.8451	1	Non-stationary
lnGDP	1st Difference	-4.3455	0.0004	0	Stationary
lnREER	Level	-4.0055	0.0014	1	Stationary
TradeOpen	Level	-3.1562	0.0227	0	Stationary
Inflation	Level	-1.4552	0.5556	7	Non-stationary
Inflation	1st Difference	-2.6261	0.0877	6	Non-stationary

Source: *Researcher's computation 2026.*

Table2: Result of Unit Root Test (ADF &P-P At level and At First Differenced

Variable	Series	PP Statistic	p-value	Lags	Decision
lnTOT	Level	-1.9314	0.3174	10	Non-stationary
lnTOT	1st Difference	-5.8845	0.0	10	Stationary
lnGDP	Level	-0.8054	0.8175	10	Non-stationary
lnGDP	1st Difference	-4.5964	0.0001	10	Stationary
lnREER	Level	-3.3551	0.0126	10	Stationary
TradeOpen	Level	-2.9929	0.0356	10	Stationary
Inflation	Level	-2.9147	0.0437	10	Stationary

Source: Researcher's computation, 2026

Table 2, revealed that ADF and PP unit root test result. lnTOT and lnGDP are non-stationary at level but become stationary after first differencing, implying integration of order one, I(1). In contrast, lnREER and TradeOpen are stationary at level and are therefore I(0). Inflation is non-stationary at level F- Statistics 0.5556) and remains non-stationary after first differencing at the 5% significance level (p = 0.0877). Thus, the ADF results provide clear evidence of I(1) behaviour for lnTOT and lnGDP and I(0) behaviour for ln_REER and TradeOpen, but do not establish an I(0) or I(1) classification for inflation at the 5% level.

The PP results in Table 2 provide broadly consistent evidence for ln_TOT, ln_GDP, ln_REER, and TradeOpen. However, they differ from the ADF result for inflation: the PP test rejects the unit-root null at level (p = 0.0437), classifying inflation as I(0). The difference between the ADF and PP results for inflation should not be treated as an error or resolved simply by selecting the result that produces the preferred model specification. The two tests use different procedures for dealing with serial correlation and the error process. The ADF test controls for serial correlation parametrically through lagged differences, whereas the PP test applies a non-parametric correction based on the long-run variance (Dickey & Fuller, 1979; Phillips & Perron, 1988). Consequently, their finite-sample performance can differ. Schwert (1989), using Monte Carlo experiments, demonstrates that alternative unit-root tests can have different finite-sample properties and that their performance depends on the underlying data-generating process. Ng and Perron (2001) further show that lag-length selection can affect the size and power of unit-root tests, while Leybourne and Newbold (1999) document finite-sample size distortions in unit-root testing under particular data-generating processes. Similarly, the discrepancy for inflation is interpreted as mixed unit-root evidence rather than as evidence that either test is necessarily invalid. For the purpose of the NARDL analysis, the combined results establish that ln_TOT and ln_GDP are I(1), while ln_REER and TradeOpen are I(0). Inflation is classified as I(0) according to the PP test but remains inconclusive under the ADF test at the 5% level. Importantly, neither test provides evidence that any variable is integrated of order two, I(2). Since the ARDL bounds-testing framework of Pesaran, Shin, and Smith (2001) is designed for variables that are I(0) and/or I(1), the unit-root evidence supports proceeding with the NARDL bounds-testing framework, subject to confirming the integration properties through the structural-break analysis and other relevant diagnostics.

4.2 ARDL Long-Run Analysis

Table 3: Nonlinear ARDL Error-Correction Model Results

Variable	Coefficient	Std. Error	t-stat	p-value
Const	3.87514	0.80285	4.827	0.0001
y_L1	-0.13015	0.02511	-5.183	0.0000
ln_TOT_L1	0.09592	0.01747	5.492	0.0000
TradeOpen_L1	-0.03914	0.02748	-1.424	0.1673
Inflation_L1	-0.00037	0.00033	-1.118	0.2748
EXV_POS_L1	0.00001	0.00022	0.037	0.9704
EXV_NEG_L1	-0.00035	0.00024	-1.422	0.1678
D_ln_TOT	0.04748	0.02076	2.287	0.0313
D_TradeOpen	-0.06425	0.02643	-2.431	0.0229
D_Inflation	0.00025	0.00033	0.761	0.4542
D_EXV_POS	0.00007	0.00028	0.246	0.8076
D_EXV_NEG	-0.00140	0.00032	-4.366	0.0002

Source: *Researcher's computation 2026.*

Table 3 revealed that the nonlinear ARDL error-correction model, including the long-run and short-run coefficients. The coefficient of y_L1 is negative and statistically significant at the 1% level (−0.13015, p = 0.0000), indicating a statistically significant error-correction mechanism through which deviations from the long-run equilibrium are gradually corrected. The magnitude of the coefficient implies an adjustment speed of approximately 13.0% per period. In the long run, ln_TOT_L1 has a positive and statistically significant effect on economic growth (0.09592, p = 0.0000). However, the coefficients of TradeOpen_L1, Inflation_L1, EXV_POS_L1 and EXV_NEG_L1 are statistically insignificant, indicating that their individual long-run effects on economic growth are not statistically significant over the study period. The short-run coefficients show that ln_TOT has a positive and statistically significant effect on economic growth (0.04748, p = 0.0313), while _TradeOpen has a negative and statistically significant effect (−0.06425, p = 0.0229). D_EXV_NEG has a negative and statistically significant effect on economic growth (−0.00140, p = 0.0002), whereas D_Inflation and D_EXV_POS are statistically insignificant.

Table 4: Wald Test for Long-Run Asymmetry (EXV+ vs. EXV−)

Null Hypothesis	F-statistic	p-value	Decision
Long-Run(EXV+) = Long-Run(EXV−)	4.2796	0.0495	Reject H_0; long-run asymmetry confirmed

Source: *Researcher's computation 2026.*

Table 4 show that the Wald test examine whether the long-run effects of positive and negative exchange rate volatility shocks are statistically equal. The test produces an F-statistic of 4.2796 with a p-value of 0.0495. Since the p-value is slightly below the 5% significance level, the null hypothesis of long-run symmetry is rejected. This provides evidence that the long-run effects of positive and negative changes in exchange rate volatility are asymmetric, even though the individual long-run coefficients.

4.3 Short-Run Analysis

Table 4.3 revealed that the short-run result indicate that changes in the explanatory variables have different effects on economic growth. The first difference of ln_TOT has a positive and statistically significant effect on economic growth, while D_TradeOpen has a negative and statistically significant effect. Similarly, D_EXV_NEG has a negative and statistically significant effect on economic growth. However, D_Inflation and D_EXV_POS are statistically insignificant, indicating that they do not have a statistically significant short-run effect on economic growth within the estimated model.

Table5: Wald Test for Short-Run Asymmetry

Null Hypothesis	F-statistic	p-value	Decision
Short-Run(EXV+) = Short-Run(EXV−)	11.8954	0.0021	Reject H_0; short-run asymmetry confirmed

Source: *Researcher's computation, 2026*

The table 5 revealed that the Wald test results examine whether the short-run effects of positive and negative exchange rate volatility shocks are equal. The test produces an F-statistic of 11.8954 with a p-value of 0.0021. Since the p-value is below the 5% significance level, the null hypothesis of short-run symmetry is rejected. This confirms the presence of asymmetry in the short-run effects of exchange rate volatility on economic growth.

4.4 Diagnostic Tests

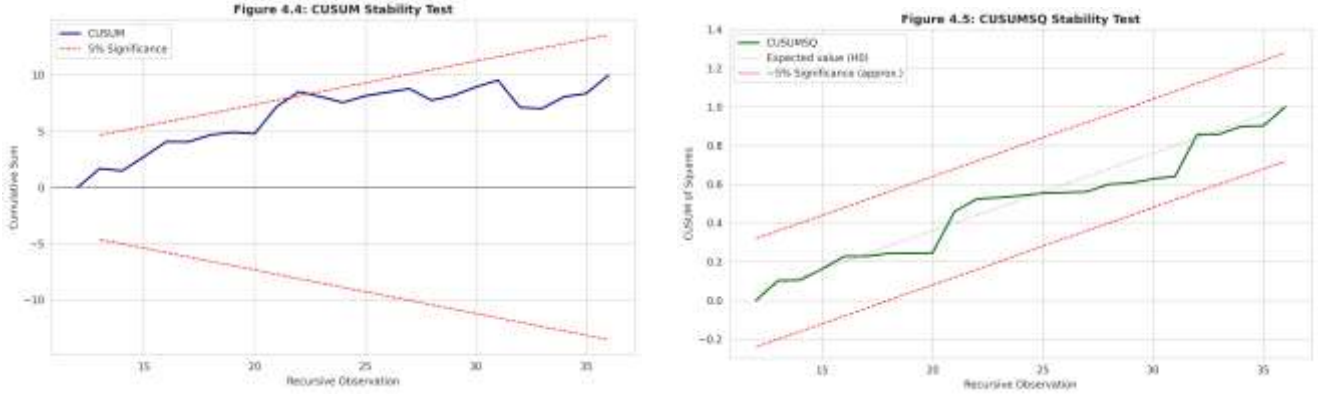
Table 6: Diagnostic Test Results

Test	Purpose	p-value
Breusch-Godfrey LM	Serial correlation	0.3000
Breusch-Pagan-Godfrey	Heteroskedasticity	0.4322
Jarque-Bera	Normality of residuals	0.8360
Ramsey RESET	Functional-form misspecification	0.0000

Source: *Researcher's computation, 2026*

The result of diagnostic tests have been presented in Table6 were conducted to assess the adequacy of the estimated NARDL model. The Breusch-Godfrey LM test has a p-value of 0.3000, indicating no evidence of serial correlation. Similarly, the Breusch-Pagan-Godfrey test has a p-value of 0.4322, indicating no evidence of heteroscedasticity. The Jarque-Bera test has a p-value of 0.8360, so the null hypothesis of normally distributed residuals is not rejected. However, the Ramsey RESET test has a p-value of 0.0000, leading to rejection of the null hypothesis of correct functional form and indicating evidence of functional-form misspecification.

Figure 4.5: CUSUM Stability Test



The CUSUM and CUSUMSQ plots in Figures 4.5 and 4.6 show the recursive residuals remaining within the 5% critical bounds throughout the estimation period, providing evidence that the estimated NARDL parameters are stable over 1984-2024. The bounds shown for CUSUMSQ are approximate 5% critical values following Brown, Durbin and Evans (1975), since exact small-sample critical values for the CUSUMSQ test are not implemented in standard statistical software; the reported bounds should accordingly be read as an approximation rather than exact critical values.

5. Conclusion and Recommendations

5.1 Conclusion

Based on the major findings of the study, it is concluded that there exists a long-run relationship among economic growth, exchange rate volatility, inflation, and terms of trade and trade openness in Nigeria over the period 1984–2024. The negative and statistically significant error-correction coefficient indicates that deviations from the long-run equilibrium are gradually corrected, with an estimated adjustment half-life of approximately five years.

Similarly, the study concludes that exchange rate volatility has an asymmetric relationship with economic growth in Nigeria. The Wald tests reject the null hypothesis of symmetry in both the short run ($p = 0.0021$) and the long run ($p = 0.0495$), indicating that increases and reductions in exchange rate volatility do not have equivalent effects on economic growth. The NARDL model also performs better than the linear ARDL model based on the AIC and BIC criteria.

In the short run, the significant effect of exchange rate volatility is primarily associated with reductions in volatility. The coefficient on D_EXV_NEG is negative and statistically significant (-0.0014, $p = 0.0002$), while D_EXV_POS is statistically insignificant ($p = 0.8076$). Given the construction of the negative partial-sum series, the result indicates that reductions in exchange rate volatility are associated with higher short-run economic growth. However, the individual long-run coefficients of EXV_POS and EXV_NEG are statistically insignificant, indicating limited evidence of a direct long-run effect of exchange rate volatility on economic growth.

Among the control variables, terms of trade has a positive and statistically significant effect on economic growth in both the short run and the long run, while trade openness has a negative and statistically significant short-run effect. Inflation does not have a statistically significant effect on economic growth in either the short run or the long run. The diagnostic results indicate that there is no evidence of serial correlation, heteroscedasticity or non-normality of the residuals, while the CUSUM

and CUSUMSQ tests indicate parameter stability over the estimation period. However, the Ramsey RESET test rejects the null hypothesis of correct functional form (p = 0.0000), indicating evidence of functional-form misspecification in the estimated model.

5.2 Recommendations

Based on the empirical findings of this study, the following recommendations are put forward:

i. Exchange-rate stability: The Central Bank of Nigeria and other relevant monetary authorities should strengthen measures that promote orderly foreign-exchange market conditions, adequate market liquidity and transparent price discovery in order to reduce excessive exchange rate volatility.
ii. Consistency in foreign-exchange policy: Given the gradual adjustment of the economy towards long-run equilibrium and the estimated adjustment half-life of approximately five years, foreign-exchange policies should be implemented consistently over time rather than relying mainly on short-term responses to individual episodes of exchange rate volatility.
iii. Long-run exchange-rate policy: Since the individual long-run coefficients of positive and negative exchange rate volatility are statistically insignificant, exchange rate volatility alone should not be used as the basis for determining the long-run exchange-rate regime. Broader macroeconomic and external-sector conditions should also be considered.

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