EXCHANGE RATE DYNAMICS AND ECONOMIC GROWTH IN NIGERIA: NONLINEAR TIME SERIES MODEL

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Abstract
Sustained and stable economic growth is one of the fundamental macroeconomic objectives pursued by countries across the world because it promotes improvements in living standards, creates employment opportunities, reduces poverty, and stimulates overall economic development through its multiplier effects on various sectors of the economy. The study investigates the effect of exchange rate dynamics on economic growth in Nigeria using quartly data from 1981q1 to 2024q4. The Zivot-Andrew unit root test indicates that real gross domestic product and exchange rate are integrated of order one while inflation rate and oil price are integrated of order zero. The nonlinear ARDL model shows that the positive and negative coefficient of exchange rate have negative effect on economic growth in Nigeria for the period under study. The positive and negative coefficient of inflation rate have positive effect on economic growth in Nigeria. The positive coefficient of oil price has a negative effect on economic growth while the negative coefficient oil price has a positive effect on economic growth in Nigeria. The asymmetric result shows that the positive and negative exchange rate changes effect on economic growth in Nigeria is statistically symmetric. Therefore, the current study concludes that the exchange rate dynamic on economic growth in Nigeria symmetric. The study recommends that the Central Bank of Nigeria should prioritize reducing excessive exchange rate volatility through credible monetary and exchange rate policies instead of responding differently to appreciation and depreciation episodes.

Keywords: Exchange rate dynamics, inflation, Economic growth, Nonlinear ARDL
JEL Classification: F31, E31, O40, C22

1.0 Introduction

Sustained and stable economic growth is one of the fundamental macroeconomic objectives pursued by countries across the world because it promotes improvements in living standards, creates employment opportunities, reduces poverty, and stimulates overall economic development through its multiplier effects on various sectors of the economy. As a developing economy, Nigeria is equally committed to achieving sustained economic growth as a means of fostering inclusive development and enhancing the welfare of its citizens. No economy exists in isolation, as countries depend on one another for goods and services in areas where they lack a comparative advantage. This interdependence necessitates international trade and underscores the importance of exchange rates in facilitating cross-border transactions (Olawale, 2024).Achieving sustainable economic growth is critical. Gross Domestic Product (GDP) growth, a key indicator of economic progress, is influenced by various macroeconomic factors,

including the exchange rate. As such, strategic international trade and exchange rate policies are essential for Nigeria's economic development (Olawale, 2024).

The nonlinear nature of exchange rate dynamics is particularly evident in developing economies, where exchange rate movements are frequently characterized by structural changes, commodity price dependence, exchange market imperfections, policy interventions, and recurrent macroeconomic shocks (Kilian & Vigfusson, 2011). Nigeria represents one of the most appropriate cases for investigating nonlinear exchange rate behaviour because its economy has experienced persistent exchange rate instability since the introduction of the Structural Adjustment Programme (SAP) in 1986. Over the past four decades, the country has witnessed repeated episodes of currency depreciation, multiple exchange rate windows, foreign exchange shortages, oil price collapses, speculative attacks, and monetary policy adjustments. These developments have created significant uncertainty regarding the response of economic growth to exchange rate movements (Central Bank of Nigeria, 2024; International Monetary Fund, 2024).

Exchange rate dynamics have become a major concern among policymakers and researchers because of their significant implications for economic growth, trade performance, price stability, and investment decisions. The exchange rate serves as an important macroeconomic variable that influences the competitiveness of exports and imports, the allocation of resources, and the attractiveness of a country to foreign investors. In an increasingly globalized world, fluctuations in exchange rates affect both domestic and international economic activities, making exchange rate management a critical component of macroeconomic policy (IMF, 2024; World Bank, 2025). Theoretically, exchange rate movements can influence economic growth through several channels. A depreciation of the domestic currency may stimulate exports by making locally produced goods cheaper in international markets, thereby increasing production and employment. Conversely, excessive depreciation can increase the cost of imported inputs, worsen inflationary pressures, and discourage investment. Similarly, exchange rate appreciation may lower import costs and inflation but reduce export competitiveness. These contrasting effects suggest that exchange rate changes may not affect economic growth symmetrically, as positive and negative exchange rate shocks may produce different economic outcomes (IMF, 2024; UNCTAD, 2024).

In developing economies, exchange rate volatility constitutes a major source of macroeconomic instability due to heavy dependence on primary commodity exports and vulnerability to external shocks. According to the World Bank (2025), many developing countries continue to experience exchange rate pressures arising from fluctuations in global commodity prices, capital flow reversals, and geopolitical uncertainties. Similarly, the African Development Bank (AFDB, 2025) notes that exchange rate instability can reduce investment, distort trade activities, and undermine sustainable economic growth by creating uncertainty in economic decision-making. As a result, exchange rate management has become an essential policy instrument for promoting economic resilience and long-term development across Africa.

Nigeria presents a unique case in the study of exchange rate dynamics and economic growth due to its heavy dependence on crude oil exports as the primary source of foreign exchange earnings. Since the adoption of the Structural Adjustment Programme (SAP) in 1986, Nigeria has experienced several exchange rate regimes, ranging from fixed and managed exchange rates to

more market-determined arrangements. These policy changes were intended to improve external competitiveness, correct balance of payment disequilibria, and stimulate economic growth. However, exchange rate instability has persisted, largely due to fluctuations in international oil prices, declining foreign exchange earnings, speculative activities, and structural weaknesses within the economy (CBN, 2024; IMF, 2024). Over the past decade, the Nigerian economy has witnessed significant depreciation of the naira, accompanied by rising inflation and foreign exchange market distortions. The existence of multiple exchange rate windows prior to 2023 created inefficiencies and encouraged arbitrage activities, thereby undermining investor confidence and macroeconomic stability. To address these challenges, the Nigerian government introduced exchange rate reforms in 2023 aimed at unifying the foreign exchange market and enhancing exchange rate flexibility. The IMF (2024) and the World Bank (2025) argue that these reforms have improved transparency in the foreign exchange market and strengthened external balances, although inflationary pressures and exchange rate volatility remain major concerns.

Recent economic indicators reveal the importance of exchange rate developments for Nigeria's growth performance. According to the World Bank (2025), Nigeria's economy grew by approximately 3.4 percent in 2024, supported by reforms in the foreign exchange market, fiscal consolidation measures, and improved investor confidence. Similarly, the IMF (2024) reports that exchange rate reforms contributed to improved foreign reserve accumulation and increased foreign capital inflows. Nevertheless, the depreciation of the naira has also contributed to higher production costs, rising inflation, and reduced purchasing power, thereby raising concerns regarding the long-term growth implications of exchange rate fluctuations. The emergence of nonlinear econometric techniques has provided researchers with opportunities to examine asymmetric relationships among macroeconomic variables. Nonlinear models such as the Nonlinear Autoregressive Distributed Lag (NARDL) model allow positive and negative changes in exchange rates to exert different effects on economic growth in both the short run and the long run. Threshold regression (TAR), and Regime-switching dynamics etc. Given the recent exchange rate reforms, persistent depreciation of the naira, and growing volatility in Nigeria's foreign exchange market, there is a need for a comprehensive investigation of exchange rate dynamics and economic growth using a nonlinear time-series framework. Such an approach is expected to provide deeper insights into the asymmetric effects of exchange rate movements and generate evidence-based policy recommendations for sustainable economic growth in Nigeria. The rest of the paper is organised as follows literature review which is the second part of the paper, methodology which exhibits methodology of the study and how to achieved the objective of the study and is the third part of the paper, part four of the paper is presentation and analysis of the empirical findings and the final section concludes the paper.

2.0 Literature review

The exchange rate, defined as the price at which one currency is exchanged for another, is a pivotal macroeconomic variable that shapes a country’s trade competitiveness, investment climate, and economic stability. In Nigeria, an oil-dependent economy, the exchange rate significantly influences economic outcomes due to the country’s reliance on foreign exchange earnings from oil exports. Volatility in the naira’s value often stems from fluctuations in global oil prices, which account for over 80% of Nigeria’s export revenue, leading to frequent and severe depreciations (Omojolaibi & Egwaikhide, 2023). This volatility results in currency misalignment, where the naira’s value deviates from its equilibrium, distorting resource

allocation and eroding investor confidence. For instance, the naira's depreciation from ₦0.61 per US dollar in 1980 to over ₦1,600 by 2023 has heightened economic uncertainty, deterring long-term investments (CBN, 2023). The concept of exchange rate fluctuation implies persistent change in the value of the domestic currency relative to another currency. This is common with exchange rates since currencies are being traded like other commodities. A currency fluctuates based on prevailing economic conditions. A country's currency can be traded against another currency at a given period (OECD, 2024). There are five exchange rates the average exchange rate, nominal effective exchange rate, real exchange rate, real effective exchange rate and bilateral effective exchange rate. Exchange rate fluctuations essentially affect the prices of imported products, services, and exports. According to Fofanah (2021), exchange rate volatility or shock or instability describes the rapid movement of the value of one currency relative to another. This study aligns with this view. In a similar vein, Musa (2021) defined exchange rate shocks as the phenomenon in which the value of one currency sharply increases in relation to another over a very short period.

Economic Growth

Economic growth, defined as the sustained increase in real gross domestic product (GDP), reflects improvements in a country's production capacity, employment, and living standards. In Nigeria, economic growth is driven by the components of aggregate demand: consumption, investment, government expenditure, and net exports (Faroug, musa & Muhammad, 2025). According to Olamide, Ogujiuba and Maredza (2022), economic growth is the term used to describe the expansion in the value of goods and services produced by an economy over a period of time. Put differently, economic growth could be viewed as the enhancement in the commodities an economy produces over some time. Conversely, Iqbal, Mahmood, Nosheen and Wohar (2022) consider economic growth as a continued increase in an economy's actual national income over time.

Theoretical framework

The Exchange Rate Overshooting Theory was developed by Rudiger Dornbusch (1976) to explain why exchange rates often fluctuate more than their long-run equilibrium values following monetary shocks. The theory assumes that financial markets adjust much faster than goods markets due to price stickiness. Consequently, exchange rates initially overshoot their long-run equilibrium before gradually converging as prices adjust over time. According to Dornbusch (1976), when an expansionary monetary policy reduces domestic interest rates, investors shift their portfolios toward foreign assets, causing an immediate depreciation of the domestic currency. Because prices are sticky in the short run, the exchange rate depreciates by more than is necessary in the long run. As domestic prices gradually adjust, the exchange rate appreciates toward its equilibrium level. This adjustment process creates nonlinear exchange rate dynamics, where exchange rate movements are characterized by volatility, overshooting, and gradual correction.

Empirical literature

Oshaota and Olanrele, (2026) investigated the impact of Nigeria's multiple exchange rate volatilities on macroeconomic stability, focusing on implications for exchange rate unification. The study employed the followings variables in the model such as Real GDP, exchange rate, inflation rate, money supply, foreign external reserve and interest rate. The study used GJR-

GARCH (1,1) models and a structural VAR (SVAR) in the analysis and found significant volatility clustering, particularly in the BDC market, where past volatility strongly influences current rates. Depreciation of the Naira leads to short-term volatility increases, which neutralize over time. The Structural VAR analysis reveals that exchange rate volatility in the BDC market has the most significant impact on inflation and lending rates, while shocks in the official and interbank rates are more predictable with milder long-term effects. The major flaws of the study are presenting a very long Abstract. Conventionally, Abstract should be short and precise the contained motivation, objective, methodology, finding and recommendations.

Oyadeyi (2026) explored the determinants of exchange rate volatility in Nigeria and the effects of exchange rate volatility in influencing macroeconomic performance in Nigeria using real gross domestic product, current account, inflation rate, monetary policy rate, oil price, exchange rate volatility, government expenditure and financial development as variables in the analysis. Autoregressive conditional heteroscedasticity (ARCH), non-linear generalised ARCH and the novel dynamic autoregressive distributed lag (ARDL) techniques were used in the study. The findings revealed that ARCH and nonlinear generalised autoregressive conditional heteroscedasticity effects influenced exchange rate volatility. Furthermore, the findings showed that the monetary policy rate, average lending rate, oil prices, government expenditure and financial development are all significant determinants of exchange rate volatility in Nigeria. In addition, the findings revealed that exchange rate volatility had significant effects on Nigeria's macroeconomics.

Farouq, Musa and Muhammad (2025) examines the impact of exchange rate fluctuations on economic growth in Nigeria using real gross domestic product, exchange rate, inflation rate, trade openness, foreign direct investment, oil prices and dummy variables as variables in the model. The study employed Autoregressive Distributed Lag (ARDL) model. The study reveal that exchange rate depreciation has a significant negative effect on economic growth in the long run, while showing mixed effects in the short run. The study further shows that inflation, trade openness, foreign direct investment, and oil prices positively influence growth, whereas interest rates exert a negative impact.

Abdulhamid, Aliyu, Rabiu, Ibrahim and Cavusoglu (2024) investigates the effect of exchange rate shocks on the growth of the Nigerian economy using real GDP, exchange rate, inflation rate, import, export and natural resources as variables in the study. The study employed Bootstrap Autoregressive Distributed Lag (BARDL) model. The study established a cointegration relation between exchange rate and economic growth, indicating that exchange rate is a key indicator of inducing growth performance in Nigeria in the long-run horizon. The nonlinear model reveals the existence of strong asymmetries in exchange rate and economic growth nexus which validate the J-curve effect in Nigeria. The major weakness of the study is failure to review the J curve theory as the study linked its finding with the theory.

Eze, Nnenna, and Ifeanyi, (2024) investigate the effect of exchange rate on economic growth in Nigeria employing the following variables in the analysis such as gross domestic product, exchange rate, total government expenditure, foreign reserve, foreign direct investment, and money supply. The study used Vector error correction model (VECM). The findings indicated that exchange rate appreciation contracts output in Nigeria. The granger causality tests revealed that exchange rate and economic growth reinforce one another.

Kene and Anthony (2024) ascertained the impact of exchange rate volatility on economic growth of Nigeria, examine the effect of exchange rate volatility on inflation in Nigeria and to assess the influence of exchange rate volatility on Nigeria's unemployment rate. The study employed the following variables in the analysis such as GDP, exchange rate volatility measured as nominal exchange rates mean and variance equation using the GARCH (1,1), money supply, monetary policy rate and unemployment. The study used GARCH model and found that exchange rate volatility has a negative impact on economic growth, exchange rate volatility leads to higher levels of inflation and further reveals a positive correlation between exchange rate volatility and unemployment.

Effiong and Omaliye, (2024) examined the implications of exchange rate gaps on key macroeconomic indicators in Nigeria. The study employed foreign reserves balance, exchange rate gap (between official and parallel market rates), Oil revenue, parallel exchange rate, official exchange rate, and Current Account Balance as variables in the analysis. Non-linear ARDL methodology was use in the study. The finding indicates that exchange rate gaps significantly negatively impact Nigeria's foreign exchange reserves, GDP growth, and current account balance. Policy recommendations include infrastructure investment, sectoral diversification, and sound monetary policies to mitigate inflationary pressures exacerbated by exchange rate volatility.

Olawale (2024) investigates the impact of exchange rate volatility on Nigeria's economic growth using Multivariate Adaptive Regression Spline (MARS) method and include the following variables in the model GDP, Exchange rate, interest rate, inflation rate, export and import. The study found nonlinear relationships between GDP and key variables, including exchange rates, interest rates, inflation, imports, and exports. The major flaws of the study are presenting a very long Abstract that contains sources of data etc. Conventionally, Abstract should be short and precise that contains motivation, objective, methodology, finding and recommendations.

Ogwuche, Tule, Dandaura, Akogwu and Nkpubre (2024) examines the effect of exchange rate fluctuations on economic growth in Nigeria, using quarterly data from 2010 to 2023 using real GDP, exchange rate, crude oil price, Macroeconomic index measured asNegative values of the index imply instability while the positive values indicate relative stability of an economy as variables in the model. The study employed Nonlinear ARDL model. The results reveal that positive oil price has stimulated economic growth while structural break has negative and strong effect on economic growth. The major weakness of the study is heavily concentrated on oil price discussion ignoring the main objective of the study which is the exchange rate. Furthermore, the study fails to test for asymmetric which is termed as Wald test that shows whether the coefficients are equal or not. If they are not identical, there is evidence of asymmetry; otherwise, it would not be.

Dada (2022) investigated the asymmetric effect of real exchange rates on the economic growth of twenty African countries using GDP, real exchange rate appreciation, real exchange rate depreciation as variables in the analysis. The study employed Two-steps System Generalized Method of Moments, Driscoll-Kraay and Augmented Mean group. The study established the presence of asymmetries in the real exchange rate in the region. Further, the study found that real exchange rate appreciation influence economic growth while real exchange rate depreciation is

beneficial to growth in the region. The major weakness of the study is the techniques of data analysis employed, the best model for the study is nonlinear panel model such as nonlinear panel ARDL (PMG and MG) or nonlinear panel VAR etc. Nkemdilim and Elvis (2021) examined the effects of persistent exchange rate fluctuations on Nigeria's economic performance using growth rate GDP, exchange rate, net foreign direct investment, inflation rate and interest rate as variables. The technique of analysis that the study used is Autoregressive distribution lag (ARDL) technique. The result revealed that the exchange rate, net foreign direct investments, and inflation rate had a significant adverse impact on Nigeria's economic growth in the long run.

Ehikioya (2019) examined the impact of exchange rate volatility on economic growth in Nigeria using Real GDP, Exchange rate volatility measured using the GARCH (1, 1) model, inflation rate, credit to private sector, crude oil prices, money supply, trade openness, government expenditure and dummy variable for fixed and flexible exchange rate regimes taking the value of the period is fixed, 0 otherwise as variables in the model. The study employed the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model and the system Generalized Method of Moments (GMM) technique. The study found that exchange rate volatility persists throughout the period under study, and has a negative effect on the economic growth of Nigeria. The study also indicates negative relationship between inflation and economic growth in Nigeria. credit to the private sector, crude oil prices, money supply, trade openness and government expenditure exerts positive relationship with economic growth in Nigeria. The major weakness of the study is using time series data to estimate system GMM. System GMM was specifically designed for dynamic panel data, where: there are many cross-sectional units (N is large), such as countries, firms, states, or households. The time dimension is relatively short (T is small).

Adeniyi and Olasunkanmi (2019) examine the impact of exchange rate volatility on economic growth in Nigeria employing the following variables in the analysis such as real gross domestic product, exchange rate, inflation, export and import. The study used Autoregressive Distribution lag (ARDL) technique and found thatpositive relationship exists between exchange rate volatility and economic growth in Nigeria.

Adegboyo (2019) examined the nexus between exchange rate fluctuations and macroeconomic variables in Nigeria employing the following variables in the analysis such as real gross domestic product, exchange rate fluctuations, consumer price index, terms of trade, foreign direct investment, the ratio of government spending, world crude oil price, and total foreign reserve. The study used Autoregressive Distribution lag (ARDL) technique and found that foreign direct investment and real gross domestic product had positive significant effect on exchange rate fluctuations, while terms of trade have a positive insignificant impact on exchange rate fluctuations. Furthermore, consumer price index, total foreign reserve and world crude oil price had negative significant impact on exchange rate fluctuations. The error correction model coefficient which is -0.704469 means that nearly 70.45 percent of any disequilibrium in exchange rate fluctuation is corrected by the selected variable within one period (one year). The findings further revealed that there is causal relationship between exchange rate and the terms of trade, foreign direct investment, consumer price index, and world crude oil price. The implication of this is that there are directional and equilibrium relationship between exchange rate fluctuations and macroeconomic variables in Nigeria.

Ibrahim (2016) investigated the determinants of real effective exchange rate in Nigeria using nominal exchange rate, real exchange rate, money supply, trade openness, consumer price index, import and export as variables in the analysis. Vector Error Correction Mechanism was used in the study. The findings from the results revealed that; terms of trade, openness of the economy, net capital inflow and total government expenditure were the major long run determinants of real effective exchange rate in the country while variables such as; broad money supply (M2), nominal effective exchange rate, structural adjustment program dummy, June 12 crisis and change to civil rule dummies were revealed as the major short run determinants of exchange rate in Nigeria for the period under study.

Adeniran, Yusuf and Adeyemi (2014) investigated the determinants of real effective exchange rate in Nigeria using GDP, exchange rate, interest rate, and inflation rate as variables in the model. ordinary least square (OLS) was used in the study. The result revealed that exchange rate has positive impact on economic growth, interest rate and inflation rate have negative impact on growth in Nigeria. The study is faulty for not conducting pre-estimation teste so that to know the appropriate technique of data analysis that best fit the study.

Akpan and Atan (2011) investigated the effect of exchange rate movements on real output growth in Nigeria using Real GDP, exchange rate, money supply and inflation rate as variables in the model and employed a Generalised Method of Moments (GMM) technique. The results suggest that there is no evidence of a strong direct relationship between changes in exchange rate and output growth. Rather, Nigeria's economic growth has been directly affected by monetary variables. The major weakness of the study is the techniques of data analysis employed, that is using time series data to estimate the panel model.

Gap identified

Three recurring weaknesses emerge from the reviewed literature. First, the majority of studies (the ARDL/VECM/OLS group, including Farouq, Musa and Muhammad (2025), Nkemdilim and Elvis (2021), Adeniyi and Olasunkanmi (2019), Adegboyo (2019), Eze, Nnenna and Ifeanyi (2024), Ibrahim (2016), and Adeniran, Yusuf and Adeyemi (2014)) are purely linear and therefore structurally unable to distinguish the effects of exchange rate depreciation from appreciation, or positive trade shocks from negative ones.Second, even among studies that attempt nonlinear analysis, execution is often inconsistent. Ogwuche, Tule, Dandaura, Akogwu and Nkpubre (2024) label their model 'nonlinear' (NARDL) but never conduct the Wald test for asymmetry, leaving the asymmetric claim unverified; Abdulhamid, Aliyu, Rabiu, Ibrahim and Cavusoglu (2024) find evidence consistent with the J-curve but fail to review the underlying J-curve theory; Dada (2022) investigates an inherently nonlinear asymmetry question (appreciation vs depreciation) but applies standard linear panel estimators (System GMM, Driscoll-Kraay, Augmented Mean Group) rather than nonlinear panel techniques such as PMG/MG-ARDL or nonlinear panel VAR. In addition, Ehikioya (2019) and Akpan and Atan (2011) apply System GMM, a technique designed for panel data with large cross-sectional and small time dimensions, to single-country time series data, a clear technique-data mismatch.Third, no reviewed study on Threshold/Regime Autoregressive (TAR), and Regime-Switching dynamics. Therefore, the current study employed Non-linear Autoregressive Distributive lag (NARDL) model to measure the positive and negative effect of exchange rate dynamics on economics growth in Nigeria.

3.0 Methodology

Model Specification

The model of study adapted from the work of Ogwuche et al (2024) is shown as

$GDP = F(EXRATE, OIL)$ ……...(3.1)

The model is modified by incorporating inflation rate and trade openness in the model.

$RGDP = F(EXRATE, OILP,\ INFL)$ ……..……(3.2)

$$RGDP = Real\ growth\ domestic\ product$$
$$EXRATE = Exchange\ rate$$
$$OILP = Oil\ price$$
$$INFL = Inflation\ rate$$

Non-linear Auto regressive model

The non-linear Auto regressive model (NARDL) model was developed by Shin et al. (2014) as an offshoot of the error correction model specification of the ARDL model, which captures the asymmetric/differential effect of an increase and decrease in one of the explanatory variables on the regressand. In this study, where we are interested in examining the impact of exchange rate devaluation/depreciation and exchange rate appreciation/revaluation, the non-linear (NARDL) model best estimates this relationship. Following the works of Schorderet (2003) and Shin et al. (2014) as modelled in Ogwuche et al (2024), our asymmetric long-run model of economic growth given exchange rate dynamics becomes:

$y_t = \sum_{j=1}^{p} \theta_j y_{t-j} = \sum_{j=0}^{p} (\sigma_t^+ x_{t-j}^+ + \sigma_t^- x_{t-j}^- + \varepsilon_t)$ ……..…(3.3)

Where x_t represent a vector $k \times 1$as vector of multiple regressors such that $x_t = x_0 x_{t-j}^+ x_{t-j}^-$, θ_j is the autogressive parameter. $\sigma_t^+ \ and\ \sigma_t^-$ represent asymmetric parameters, $\varepsilon_t$is an iid process with zero mean and constant variance. Therefore, the model of the study is expressed as:

$\Delta RGDP_t = \alpha_0 + \alpha_1 RGDP_{t-1} + \alpha_2^+ EXRATE_{t-1}^+ + \alpha_3^- EXRATE_{t-1}^- + \alpha_4 INFL_{t-1} + \alpha_5 OILP_{t-1} + \sum_{t-1}^{p} \beta_1 \Delta RGDP_{t-1} + \sum_j^p \beta_{2i}^+ \Delta EXRATE_{t-i}^+ + \sum_j^p \beta_{3i}^- \Delta EXRATE_{t-1}^- + t-1p\beta 4\Delta INFLt-1 + t-1p\beta 5\Delta OILPt-1 + \varepsilon t$……..……(3.4)

4.0 Results and discussion

Descriptive statistics

Table 1.

Descriptive statistics

Statistics	RGDP	EXRATE	INFL	OILP
Mean	11.51272	253.0970	162.6212	0.637438
Median	11.60889	153.8625	120.5782	0.251476
Maximum	11.73312	1478.965	1478.965	1.999218
Minimum	11.18520	8.038285	8.038285	0.037107
Std. Dev.	0.207626	296.2882	244.1856	0.742419
Skewness	-0.516081	0.851828	0.780332	0.037018
Kurtosis	1.565237	12.10138	19.99989	2.150914

Jarque-Bera	22.77847	841.2168	2524.082	36.62291
Probability	0.000011	0.000000	0.000000	0.000000
Sum	2014.726	44291.98	28458.70	111.5517
Sum Sq. Dev.	7.500862	15274883	10375027	95.90632
Observations	175	175	175	175

Source: Researcher computation using E-views 12, 2026.

The table 1 presents descriptive statistics of the variables employed in the study. The means value of the variables employed are not far away from their standard deviations, indicating a low variability among gross domestic product, exchange rate, inflation rate and oil price during the study period. The Skewness of the distribution in the table shows that gross domestic product is negatively skewed implying that lower values occur more frequently than higher values while exchange rate, inflation rate and oil price are positively skewed, implying more occurrences of high values these variables. The Kurtosis in the table shows that gross domestic product and oil price are less than 3, indicates a platykurtic distribution, meaning the series has flatter tails than a normal distribution while for variables like exchange rate and inflation rate are greater than 3, indicating a leptokurtic distribution characterized by extreme observations and fat tails. The Jarque-Bera test for normality is also conducted. It shows that all the variables employed are normally distributed as their p-values are greater than 5%.

Unit root test

Zivot and Andrew Unit Root Test

The study used Zivot and Andrew unit root test in order to confirm the order of integration among the variables employed, because ignoring unit root test with break may lead the acceptance of null hypothesis where is supposed to be rejected.

Table 2
Zivot-Andrew Unit Root Test

	Test at Level		First difference	
Variables	**Statistics**	**Break point**	**Statistics**	**Break point**
LGDP	-3.359464	1993q1	-5.093742	1991q1
EXRATE	-3.100397	2014q1	-8.792685	2016q1
INFL	-6.186633	2016q1	-	-
LOILP	-4.315479	2010q1	-	-

Source: Researcher computation using E-views 12, 2026.

Table 2 presents the Zivot-Andrew unit root test indicates, the test indicate that that gross domestic product, exchange rate, and trade openness are integrated of order one in other words are stationary at first difference i.e. they are I(1) process, the break dates are 1991q1, 2016q1 and 2011q3 respectively. The variables inflation and oil price are integrated of order zero in other word it is stationary at level i.e. it is I(0) process, the break date are 2016q1 and 2010q1. The

structural break in 1991Q1 may be linked to the effects of the Structural Adjustment Programme (SAP)introduced in 1986. By the early 1990s, the reforms had substantially altered Nigeria's economic structure through trade liberalization, exchange rate deregulation, and reduced government intervention. These reforms affected production, investment, and overall economic growth, leading to a significant shift in GDP dynamics. The break in 2016Q1 can be associated with the severe oil price collapse of 2014-2016 and the resulting foreign exchange crisis in Nigeria. During this period, export earnings declined sharply, foreign reserves fell, and pressure on the naira intensified. The break in inflation during 2016Q1 is also attributable to the economic recession and exchange rate crisis. The depreciation of the naira increased import costs, while fuel shortages and supply constraints raised domestic prices. Consequently, inflation accelerated significantly, creating a structural shift in the inflation series. The break in oil prices around 2010Q1 may reflect the recovery of global crude oil markets following the global financial crisis. Oil prices had fallen sharply in 2008-2009 but began recovering in 2010 as global economic activity improved. Since Nigeria is heavily dependent on crude oil exports, this recovery represented a significant structural change in the oil price series.

Test for Breaks

Table 3

Bai-Perron break tests

Break Test	**F-statistic**	**Scaled F-statistic**	**Critical Value**
0 vs. 1 *	1132.142	1132.142	8.58
1 vs. 2 *	141.6949	141.6949	10.13
2 vs. 3 *	227.6286	227.6286	11.14
3 vs. 4	3.986767	3.986767	11.83
Break date		**Sequential**	**Repartition**
1		1998Q1	1991Q3
2		1991Q3	1998Q1
3		2004Q3	2004Q3

Source: Researcher computation using E-views 12, 2026.

Table 3 presents the test for breaks in the series, the test is significant up to 3 breaks and insignificant for a fourth break, because the critical value is less than the F-statistics. Furthermore, both Sequential and Repartition indicated 1998Q1, 1991Q3 and 2004q3 as innovation (break) year. Therefore, the optimal number of structural breaks in the series is 3.

NARDL Bound Test for Long run

The test is conducted in order to ensure the existence of long run association among the variables employed.

Table 4.
Result of Cointegration Bounds test of NARDL

Statistics	Value		Critical bounds			
F-statistics	4.007189		1%	2.5%	5%	10%
		I(0) Bound	2.62	2.33	2.11	1.85
		I (1) Bound	3.77	3.42	3.15	2.85

Source: Researcher computation using E-views 12, 2026.

From table 4, the result of co-integration bound test indicates a higher value of F-statistics than any of the critical values of all bounds 4.007189. Therefore, there is a strong evidence of long run nonlinear equilibrium relationship between dependent and independent variables in the model. Furthermore, it implies that the null hypothesis claiming no asymmetric cointegration is rejected. This indicates strong evidence for asymmetric cointegration among the variables.

Results of Nonlinear Autoregressive Distributed Lag (NARDL) model

As a result of unit root and bound tests conducted in the study which suggests the use of the ARDL model. The appropriate model (number of lags) is selected automatically using Akaike Information Criterion (AIC) which is seen as a more robust model. Below, both short-run and long-run parameters of the model are presented.

Short-run Relationship

Below the result of short-run parameters of the NARDL model is presented. AIC suggests a (1, 0, 0, 0, 0, 0, 1) model after testing for up to 1458different models.

Table 5.
Short run parameters of the NARDL Model

Variables	Coefficient	Std error	t- statistics	Prob.
Δ(LOILP_NEG)	0.059972	0.009722	6.168800	0.0000
ECM	-0.068112	0.017602	-3.869581	0.0002
R-squared	0.997778			
Adjusted R-squared	0.997656			
S.E. of regression	0.009964			
Sum squared resid	0.016181			
Log likelihood	557.0000			
F-statistic	8134.350			
Prob(F-statistic)	0.000000			
Durbin-Watson stat	2.304212			

Source: Researcher computation using E-views 12, 2026.

The result from table 5 presents short run non-linear ARDL model, the negative coefficient of oil price shows positive and statistically significant effect on gross domestic product, this indicates

that a negative change (decline) in oil prices has a positive short-run effect on real GDP. Specifically, a 1% decrease in oil prices is associated with approximately a 0.05% increase in real GDP in the short run, holding other factors constant. The ECM coefficient is negative and highly significant, satisfying the theoretical requirement for convergence.The coefficient of -0.068112 indicates that approximately 6.81. % of short-run disequilibrium is corrected each quarter toward the long-run equilibrium path. In other words, following a shock, the economy adjusts slowly towards its long-run equilibrium, with about 6.8% of the deviation being eliminated each quarter. This relatively low speed of adjustment suggests that it would take several periods for the economy to fully return to its long-run equilibrium after experiencing a disturbance. The R-squared and its adjusted value are very high 0.997778 this implies that 99% change in the gross domestic product is explained by exchange rate, inflation rate, and oil price in Nigeria. The p-value of f-statistics indicates (0.000000), this means that exchange rate, inflation rate, and oil price have 100% significance influence on the gross domestic product.

Long-run and Error Correction Result

As a result of the NARDL bound test which confirms the existence of a long-run relationship among the variables of interest.

Table 6.
NARDL ECM and Long run Form Results

Variables	Coefficient	Std error	t- statistics	Prob.
EXRATE_POS	-0.158071	0.360816	-0.438093	0.0519
EXRATE_NEG	-0.194187	1.171869	-0.165707	0.0097
INFL_POS	0.315972	0.406636	0.777039	0.0383
INFL_NEG	0.096153	0.415887	0.231199	0.0175
LOILP_POS	-0.018614	0.036979	-0.503352	0.6154
LOILP_NEG	0.484857	0.248515	1.951012	0.0528

Source: Researcher computation using E-views 12, 2026.

The result from table 6 presents long run non-linear ARDL model, the result shows that the positive coefficient of exchange rate shows negative and statistically significant effect on the real gross domestic product in Nigeria, this implies that positive exchange rate shocks reduce real GDP in the long run. Specifically, a 1% positive change in the exchange rate decreases real GDP by approximately 0.15%**,** holding other variables constant. The negative coefficient of exchange rate indicates negative but statistically significant effect on the real gross domestic product in Nigeria, this implies that that negative exchange rate shocks also decrease economic growth in the long run. Quantitatively, a 1% negative change in the exchange rate is associated with a 0.19% decrease in real GDP. The positive coefficient of inflation rate shows positive and statistically significant effect on the real gross domestic product in Nigeria, this simply indicate that that positive inflation shocks increase real GDP in the long run. Specifically, a 1% increase in positive inflation shocks is associated with approximately a 0.32% increase in economic growth. The negative coefficient of inflation rate shows positive and statistically significant effect on the real gross domestic product in Nigeria, this suggest that negative inflation shocks

(declines in inflation) are also associated with improvements in economic growth, although the effect (0.10%) is smaller than that of positive inflation shocks. The positive coefficient of oil price shows negative and statistically insignificant effect on the gross domestic product, this suggest that positive oil price shocks decrease economic growth by about 1% all things being equal. The negative coefficient of oil price shows positive and statistically significant effect on the gross domestic product, this means that negative oil price shocks increase economic growth in the long run. Specifically, a 1% decrease in oil prices is associated with approximately a 0.48% increase in real GDP**.**

Wald Test

An asymmetry test investigates whether the coefficients are equal or not. If they are not identical, there is an evidence of asymmetry; otherwise, it would not be. To test the long run asymmetry in using Wald test.

Table 7

NARDL Wald test

Test Statistic	Value	Df	Probability
F-statistic	-0.459572	155	0.6465
Chi-square	0.211206	(1, 155)	0.6465

Source: Researcher computation using E-views 12, 2026.

Table 7 indicates that the Wald symmetry test was conducted to determine whether positive and negative exchange rate shocks have significantly different effects on economic growth in Nigeria. The result produced an F-statistic of 0.459572 with a corresponding probability value of 0.6465. Since the p-value exceeds the conventional 5 percent significance level, the null hypothesis of symmetry is accepted. This suggests that positive and negative exchange rate changes effect on economic growth in Nigeria is statistically in a similar manner. Hence, there is no evidence of asymmetric exchange rate dynamics in explaining economic growth in Nigeria during the study period. This finding counter with that of Dada (2022).

Post estimation tests

Table 8 Post estimation tests

Tests	P-value
Serial correlation	0.0823
Heteroscedastics	0.8673
Normality	0.0000
Ramsey test	0.3266

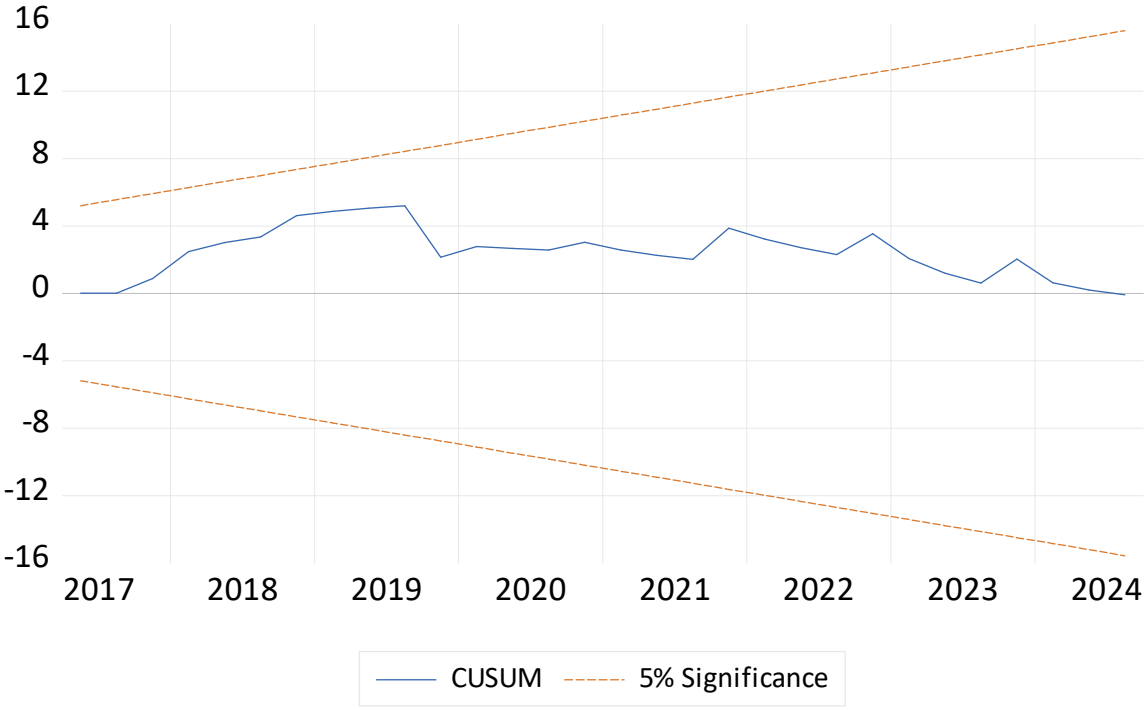
Source: Researcher computation using E-views 12, 2026.

The nonlinear ARDL model estimated passed all post estimation tests such as serial correlation, Heteroscedasticity, and Ramsey except normality test, because their probability values are greater than 5%. Based on this we can conclude that the model is robust.

Structural Stability test

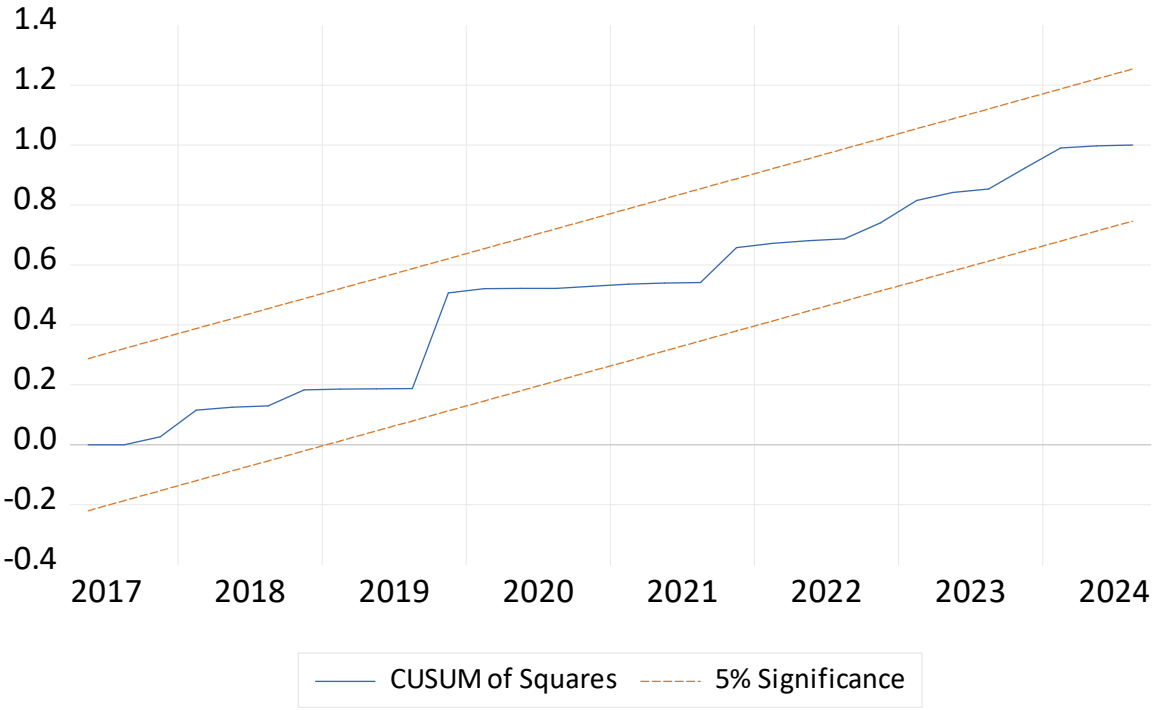
To check the structural stability test, recursive estimation has been applied. There are two types of tests in recursive estimation. The Cumulative Sum and Cumulative Sum of squares test are used to detect the structural stability of the nonlinear ARDL model.

Figure 4.1 Cusum Square Plot Recursive Residual of ARDL Model



Source: Researcher computation using E-views 12.

Figure 4.2 Cusum Square Plot Recursive Residual of ARDL Model



Source: Researcher computation using E-views 12.

The decision rule is that we cannot reject the null hypothesis if the Cumulative Sum (CUSUM) and Cumulative Sum of squares test line lies between two critical lines at a 5% significance level. Otherwise, the null hypothesis would be accepted. In this case the current study cannot reject the null hypothesis, which implies that the NARDL model is structurally stable for the period under study.

Discussion of result

The results indicate that positive exchange rate shocks (EXRATE_POS) have a coefficient of -0.158071**,** implying that exchange rate depreciation exerts a negative influence on real economic growth in the long run. This finding supports the argument that persistent depreciation of the naira increases the cost of imported capital goods and production inputs, raises inflationary pressures, discourages investment, and ultimately constrains long-run economic growth. Similarly, negative exchange rate shocks (EXRATE_NEG)have a coefficient of −0.194187 and a reported probability value of 0.0097**,** indicating a statistically significant negative effect on economic growth. This implies that both appreciation and depreciation of the exchange rate adversely affect Nigeria's economic growth in the long run, although the magnitude of the adverse effect is greater for negative shocks. This outcome reflects the vulnerability of the Nigerian economy to exchange rate fluctuations, largely because of its heavy dependence on oil exports and imported intermediate and capital goods. Consequently, exchange rate instability, regardless of direction, creates uncertainty that undermines production, investment, and sustainable economic growth.

5.0 Conclusions and recommendations

The study investigates the effect of exchange rate dynamics and economic growth using quartly data from 1981q1 to 2024q4. The Zivot-Andrew unit root test indicates that gross domestic

product, and exchange rate are integrated of order one while inflation rate and oil price are integrated of order zero. The nonlinear ARDL model shows that the positive and negative coefficient of exchange rate has a negative effect on economic growth in Nigeria for the period under study. The positive and negative coefficient of inflation rate has a positive effect on economic growth in Nigeria. The positive coefficient of oil price has a negative effect on economic growth while the negative coefficient oil price has a positive effect on economic growth in Nigeria. The asymmetric result shows that the positive and negative exchange rate changes effect on economic growth in Nigeria is statistically symmetric. Hence, there is no evidence of asymmetric exchange rate dynamics in explaining economic growth in Nigeria during the study period. Therefore, the current study concludes that the exchange rate dynamic on economic growth in Nigeria symmetric. The study recommends that the Central Bank of Nigeria should prioritize reducing excessive exchange rate volatility through credible monetary and exchange rate policies instead of responding differently to appreciation and depreciation episodes. Nigerian government efforts should focus on improving foreign exchange market transparency, reducing speculative activities, and ensuring adequate foreign exchange liquidity. Government should diversify exports beyond crude oil through incentives for non-oil sectors such as agriculture, manufacturing, and services, thereby reducing the economy's vulnerability to exchange rate shocks.

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