Journal of Information Systems Engineering and Management
2025, 10(58s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

Research Article

Asymmetric Effects of Currency Valuation and Oil Price Movements on Inflation in Nigeria

Philip Azubuike Nwauko*[1], Olajide Oladipo[2], Emomotimi Agama[3] and Anthony Adejo Okpanachi[4]
[1]*Department of Economics, Nile University of Nigeria, Abuja, Nigeria.*
** Corresponding Author's Email: nwaukophilip@gmail.com*
[2]*Department of Economics, Nile University of Nigeria, Abuja, Nigeria. Email: osoladipo@gmail.com*
[3]*Securities and Exchange Commission, Central Business District, Abuja, Nigeria: Email: eagama@sec.gov.ng*
[4] *Development Bank of Nigeria, Abuja, Nigeria. Email: tokpanachi@hotmail.com*

ARTICLE INFO

Received: 31 Dec 2024
Revised: 20 Feb 2025
Accepted: 28 Feb 2025

ABSTRACT

This study examines how currency valuations (exchange rates) and oil prices affect inflation in Nigeria from 1986 to 2024. The research uses time series data to understand the relationships between these important economic factors. The main goal is to find out if changes in currency value and oil prices cause inflation to go up or down in Nigeria. The study uses several testing methods to analyze the data. The BDS nonlinearity test finds strong evidence of non-linear patterns in both inflation and exchange rate data, with z-statistics of 18.39 and 17.36 respectively, both significant at the 1% level while the Kapetanios, Shin and Snell test confirms that both inflation and exchange rates have unit roots even when allowing for nonlinear behavior. This means inflation, exchange rates, oil prices, money supply, and interest rates move together over long periods. The main findings come from the Nonlinear Autoregressive Distributed Lag (NARDL) model, which shows important differences between how exchange rate increases and decreases affect inflation. In the symmetric model, a 1% increase in exchange rate (currency getting weaker) leads to a 0.55% increase in inflation in the long run. However, the asymmetric model reveals stronger effects. When the currency gets weaker by 1%, inflation increases by 1.17% in the long run, which is more than double the symmetric effect. Interestingly, when the currency gets stronger, it does not significantly reduce inflation, showing an unbalanced relationship. Money supply also affects inflation positively in the symmetric model, where a 1% increase in broad money (M2) causes a 0.36% rise in inflation in the long run. Real interest rates have a negative effect on inflation, with a coefficient of -0.041 in the symmetric model, meaning higher interest rates help control inflation. Surprisingly, oil prices do not significantly affect inflation in the long run, despite Nigeria being an oil-producing country. In the short run, exchange rate changes immediately affect inflation. A 1% currency depreciation increases inflation by 0.17% right away in the symmetric model and 0.12% in the asymmetric model. Past exchange rate changes also matter, with a lagged effect coefficient of 2.29. The error correction terms are -0.46 and -0.35 for the symmetric and asymmetric models respectively, showing that about 46% and 35% of any imbalance gets corrected each year. The study concludes that exchange rate changes, especially when the currency gets weaker, are the main drivers of inflation in Nigeria. The effects are not balanced - currency weakness causes much more inflation than currency strength reduces it. This happens because Nigeria depends heavily on imported goods, and when the currency loses value, these imports become more expensive, pushing up local prices. Oil prices do not directly affect inflation, possibly because of government fuel subsidies that protect consumers from global oil price changes. These findings have important policy implications for Nigeria. The Central Bank should focus on keeping the exchange rate stable to control inflation.

Keywords: Exchange rate, oil prices, inflation, Nigeria, NARDL, asymmetric effects, monetary policy

I INTRODUCTION

In any economy, decisions about using limited resources to produce goods and services are made by economic agents to achieve the main goals of production growth, stable prices and better living standards. How these goals are reached

Journal of Information Systems Engineering and Management
2025, 10(58s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/

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varies across countries because economic conditions differ worldwide. These variables serve as channels through which the economic health and growth of a nation is determined. They include exchange rate, oil prices, inflation, government spending, interest rate, gross domestic product, foreign direct investment, taxation and money supply. When these variables are managed well, they work together to achieve the main objectives of stable prices and improved welfare for a country. David Romer (2018) observed that living standards in developed nations have increased over the last few centuries to levels that were almost unimaginable because these factors were controlled favorably to achieve stability. He noted that available data shows that average real wages in the Western world are now between five and twenty times higher than they were a century ago, and between fifteen and one hundred times higher than they were two centuries ago.

Nigeria's economic performance from the 1970s to recent periods shows a consistently high inflation environment following a shift in monetary policy to direct monetary targeting due to post-civil war reconstruction spending and oil money inflow (Asogu, 1991; Rapu et al., 2016; CBN, 2024). Over these decades, the average annual headline inflation rate was in double digits, reaching almost 80% in 1994. Similarly, core inflation, which excludes volatile food and energy prices, also frequently reached double digits in many of the observed years, with a high of roughly 35% in 2003 and 34.8% in November 2024 (National Bureau of Statistics, NBS, 2024; Oyadeyi et al., 2025). This historical analysis shows that Nigeria has struggled to maintain low and stable inflation despite changes in its monetary policy framework (CBN, 2024).

Literature is filled with studies on how oil prices affect inflation and the subsequent effects on the economy. According to Musa and Maijama'a (2021), changes in global crude oil prices are a worldwide event with significant results for all countries. Developing nations are particularly vulnerable to these price changes due to their financial weakness and exposure to external economic shocks. A key impact of oil price variations is on the rate of inflation or general price levels. Kathuria and Sabat (2020) identified that oil is an essential component of any economy's production process and the economy is most severely affected by changing oil prices. According to economic theory, there are several ways that oil prices and economic activity could be negatively related.

On the other hand, the exchange rate, which represents the value of one country's currency in relation to another, is important for helping international trade by enabling the exchange of goods and services between nations (Ugomma & Chijioke, 2024). The weak performance of exchange rates in many developing nations, including Nigeria, against major global currencies like the US Dollar, Euro, and British Pound has been a significant and ongoing concern (Timothy et al., 2016). Nigeria's foreign exchange markets have shown significant and persistent volatility over the years. In the official market, the Naira experienced substantial depreciation against the US dollar, moving from N11.08 in 1987 to N22.00 by 1994. Overall, between 1971 and 2024, the Naira depreciated from N0.7 to almost N1700 per US dollar (CBN, 2024), representing a significant increase in average depreciation rate.

Despite extensive literature on inflation and its causes, a clear agreement on how exchange rate, and oil prices affect inflation in the specific case of Nigeria remains missing. Existing studies often examine these relationships separately or with limited scope. The discussions in the literature have not reached agreement on the causes of inflation pressures, in terms of variables as well as the direction of causation. More importantly, there have not been complete studies in the literature on this subject matter. Therefore, there is a knowledge gap in understanding how these variables work together asymmetrically to influence inflation in Nigeria. There is also an evidence gap as few studies have explored the asymmetric effects using advanced econometric methods like NARDL (Nonlinear Autoregressive Distributed Lag) which can capture both positive and negative shocks separately. This methodology gap is important because traditional linear models may not capture the true relationship between these variables and inflation. Additionally, there is a variable gap in how currency valuation is measured and decomposed in Nigerian studies. This study will contribute to research by providing new evidence on asymmetric effects and offering valuable insights for policymakers in managing inflation in Nigeria.

II LITERATURE REVIEW

Exchange Rate and Inflation Relationship

Several studies show that when a country's currency loses value, inflation goes up. Adedokun, Ogbaekirigwe and Tiamiyu (2022) studied Nigeria from 2000 to 2021 and found that exchange rate changes strongly affect inflation.

Journal of Information Systems Engineering and Management
2025, 10(58s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/ **Research Article**

They used special tests and found that the impact was getting smaller over time, but it was still important. Similarly, Akpan and Udo (2023) looked at Nigeria from 1981 to 2021 and discovered that exchange rate changes make inflation worse. Their study showed that when the exchange rate goes up, inflation follows.

Musa and Maijama'a (2021) found that exchange rates cause both inflation and oil prices to change in Nigeria. They studied the period from 1985 to 2019 and saw clear patterns where exchange rate movements led to higher inflation. Henry and Sabo (2020) also supported this view, showing that exchange rates had a negative relationship with inflation in Nigeria from 1985 to 2019, meaning that when the exchange rate became more stable, inflation went down.

Some researchers found that exchange rates affect inflation differently when the currency gets stronger versus when it gets weaker. Ikue, Ofuru, Onodjaefe, Onuosa, Ajaba and Emeke (2024) studied Nigeria from 2010 to 2024 and found that currency weakening had a much bigger effect on inflation than currency strengthening. This was especially true for food prices. They found that it takes about three to four months for exchange rate changes to fully affect inflation.

Musti and Siddiki (2018) agreed with these findings. They looked at Nigeria from 1986 to 2013 and found that the relationship between exchange rates and inflation was not the same in both directions. When the Nigerian currency got weaker, inflation went up more than it went down when the currency got stronger. Adedokun et al. (2022) also found similar patterns in Nigeria, showing that the effects were getting smaller over time but were still uneven.

Not all studies found strong relationships. Idoro and Ehiedu (2024) studied Nigeria from 1986 to 2022 and surprisingly found that exchange rate changes did not significantly affect economic growth, even though they looked at different ways to measure both exchange rates and growth. This was different from what most other studies found.

Studies from other countries show similar patterns. Asafo and Matuka (2020) studied Ghana and found that exchange rate shocks had small but real effects on consumer prices. Ha, Stocker and Yilmazkuday (2023) looked at 55 countries and found that exchange rate pass-through to prices depended on what caused the currency to move in the first place. Countries with flexible exchange rates and good inflation targeting had smaller effects.

Oil Prices and Inflation

Many studies found that higher oil prices lead to higher inflation. Musa et al. (2021) studied Nigeria from 1985 to 2019 and found that oil prices, exchange rates, and inflation all affect each other, with exchange rates playing the biggest role. Jacob and Umoh (2023) looked at Nigeria from 2006 to 2022 and found positive but weak relationships between oil prices and other economic measures.

Leblanc and Chinn (2004) studied developed countries and found that oil price increases do cause inflation, but the effects are not very large. They found that a 10% increase in oil prices only raises inflation by 0.1 to 0.8 percentage points. Choi et al. (2018) studied 72 countries from 1970 to 2015 and found that a 10% rise in oil prices increases domestic inflation by 0.4 percentage points on average.

Several studies found that oil price increases and decreases have different effects on inflation. Zakaria et al. (2021) studied South Asian countries and found that oil price increases cause inflation, but oil price decreases do not reduce inflation by the same amount. This means that the relationship is not balanced.

Ha et al. (2023) used data from 55 countries and found that oil price shocks account for about 4% of inflation changes overall, but the effects were statistically significant in most countries, especially those that import energy and have more trade connections.

Different countries show different responses to oil price changes. Kose et al. (2021) studied Turkey and found that while oil prices had limited effects on inflation early in their study period, these effects grew much stronger over time. However, exchange rates were still the most important factor affecting inflation throughout the whole period.

Ahmed et al. (2023) studied the UK from 2010 to 2022 and found that inflation shocks initially hurt other economic indicators, but oil prices recovered quickly, usually within one month. The effects were strongest in the short term and became weaker over time.

Journal of Information Systems Engineering and Management
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e-ISSN: 2468-4376
https://www.jisem-journal.com/
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III METHODOLOGY

The study used annual data series from the World Bank Development Indicators (WDI) and the Central Bank of Nigeria (CBN) Statistical Bulletin. A total of nine variables were examined, with the consumer price index (CPI) serving as the dependent variable. The independent variables included the official exchange rate (OEX) as a measure for currency valuation, oil prices (OP), broad money supply (M2), real interest rate (RIR). These variables covered the period from 1986 to 2024.

Model Specification

The general model was developed within the theoretical framework linking currency valuation, government spending, and oil price movements to inflation. The study looked at the dynamic relationships among these economic variables, as mentioned in the literature. Three Ordinary Least Squares (OLS) regression models were created to assess how currency valuation, different types of government spending, and oil price movements affect the inflation rate in Nigeria.

The functional form of the model is written as:

Consumer Price Index (Inflation) = *f* (official Exchange Rate, Broad Money Supply, Oil Prices, and Real Interest Rate)

The mathematical form for the first model was expressed as:

$CPI_t = \beta_o + \beta_1 OEX_t + \beta_2 M2_t + \beta_3 OP_t + \beta_4 RIR_t$ ....(1)

Since the equations above are exact in nature, the study added a stochastic error term "µt" and used logarithm of some variables to allow for the inexact relationship among the variables. The econometric form of the model is expressed as:

$LOGCPI_t = \beta_o + \beta_1 LOGOEX_t + \beta_2 LOGM2_t + \beta_3 LOGOP_t + \beta_4 RIR_t$ ....(2)

For the model, the study looked at the effect of currency valuation on inflation in Nigeria by breaking down the exchange rate into positive and negative changes. This was done to understand how different types of exchange rate movements affect inflation differently.

$CPI_t = f(OEX_t^+, OEX_t^-, OP_t + M2_t + RIR_t)$..(3)

$LOGCPI_t = \beta_o + \beta_1 LOGOEX_t^+ + \beta_2 LOG\ OEX_t^- + \beta_3 LOGM2_t + \beta_4 LOGOP_t + \beta_5 RIR_t$ ......(4)

Recall: OEX = official exchange rate

OEX_t^+ = partial sum of positive change in official exchange rate

OEX_t^- = partial sum of negative change in official exchange rate

OP_t = Europe Brent Spot Price FOB (Dollars per Barrel), representing oil prices

$M2_t$ = Broad money supply (in billions of naira)

RIR_t = Real interest rate (%)

β_i = coefficients of the variables

Log = logarithm of the variables

μ_t= stochastic error term.

This section includes the pre-estimation tests such as summary statistics and unit root tests.

A brief descriptive summary was presented. The measures of central tendencies (mean, median, and mode) were computed. The skewness and kurtosis were also computed along with probability plots.

Unit root tests play an important role in time series analysis, as they are mainly used to determine whether a time series is stationary or has a unit root, showing non-stationarity. In econometrics, failing to address non-stationary

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e-ISSN: 2468-4376
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time series will likely result in false regressions, highlighting the importance of unit root testing for ensuring model validity (Gujarati & Porter, 2009). The Augmented Dickey-Fuller (ADF) test was employed for this purpose.

The Augmented Dickey-Fuller (ADF) test, developed by Dickey and Fuller (1979), is an extension of the Dickey-Fuller test that addresses autocorrelation in the residuals by including lagged difference terms of the dependent variable. The ADF test evaluates the null hypothesis H0: ρ = 1 (non-stationarity) against the alternative hypothesis H1:ρ < 1 (stationarity) (Dickey & Fuller, 1981). The test equation takes three primary forms with intercept only.

The BDS Test for Nonlinearity

Brock, Dechert, Scheikman and Lebaron (1996) have developed a test for testing linear independence in time series. The test is a general test for time-based dependence in a series. It can be used for testing against various possible deviations from independence, including linear dependence, nonlinear dependence or chaos. The hypothesis is that H0: the series follows linear dependence and H1: the series follows nonlinear dependence.

Kapetanios, Shin, and Snell (2002) Nonlinear Unit Root Test

Traditional unit root tests such as the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are widely used to determine whether a time series is stationary or contains a unit root. However, these tests assume a linear adjustment process and may lack power when the true process is nonlinear. Recognizing this limitation, Kapetanios, Shin, and Snell (2002) developed a nonlinear unit root test, often called the KSS test, to detect unit roots in the presence of nonlinear mean-reverting behavior.

The KSS test is based on the idea that economic time series may show nonlinear adjustments towards balance, especially in economic variables such as exchange rates and inflation, where adjustment may not be symmetric or linear due to transaction costs, policy interventions, or market frictions. The test specifically focuses on detecting a unit root against the alternative of a Smooth Transition Autoregressive (STAR) stationary process.

The starting point of the KSS test is a first-order nonlinear STAR process. The key feature of the model is the term that allows for nonlinear adjustment around the equilibrium. The null hypothesis (H0) of the test is that the time series has a unit root, while the alternative hypothesis (H1) is that the series is stationary but nonlinearly mean-reverting.

Kapetanios et al. (2002) created non-standard critical values for the test using simulation methods. Therefore, the t-statistic from the estimated equation must be compared with their tabulated critical values rather than standard t-distribution tables. The test does not require the specification of the transition function as in traditional STAR models. Instead, it approximates the STAR process by a Taylor expansion, making the estimation simpler and allowing for a straightforward application of nonlinear unit root testing.

The main advantages of the KSS test include greater power in detecting mean-reverting processes when the true data-generating process is nonlinear, applicability in many economic situations where policy interventions or threshold effects create nonlinearities, and no need to pre-specify the transition function, as in standard STAR models. The KSS test represents an important methodological advancement in time series econometrics, especially when dealing with nonlinear economic dynamics.

ARDL Bound Cointegration Test

Following the unit root tests, the Autoregressive Distributed Lag (ARDL) bound cointegration test will be employed to examine the long-run relationship between government revenue and the independent variables. The ARDL model will be specified as:

$$\Delta \mathrm{LOGCPI}_t = \beta_0 + \sum_{i=1}^{P} \beta_1 \Delta \mathrm{LOGCPI}_{t-i} + \sum_{i=0}^{q} \beta_2 \Delta \mathrm{LOGOEX}_{t-j} + \sum_{k=0}^{r} \beta_3 \Delta \mathrm{LOGOP}_{t-k} + \sum_{n=0}^{u} \beta_5 \Delta LOGM2_{t-n} + \sum_{n=0}^{x} \beta_5 \Delta RIR_{t-n} + \mu_t \quad (5)$$

This framework enables the examination of both short-run dynamics and long-run relationships among the variables.

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2025, 10(58s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/ **Research Article**

The null hypothesis must be tested to see if there is a long-term link between the variables by cointegration. For the combined significance of the lagged levels of the variables in the hypothesis, the Wald test (F-statistics) is used:

H_0: $\vartheta_1 = \vartheta_2 = \vartheta_3 = \vartheta_4 = \vartheta_5 = 0$ Absence of co-integration

H_1: $\vartheta_1 \neq \vartheta_2 \neq \vartheta_3 \neq \vartheta_4 \neq \vartheta_5 \neq 0$. Presence of co-integration

If the F statistic is greater than the upper bound critical value at the standard significance level, the null hypothesis is rejected. H0 cannot be rejected if the F statistic is less than the lower bound critical value. If the F statistic falls between the two critical values, no conclusion can be drawn about H0

Non-linear Autoregressive Distributed Lag (NARDL)

The NARDL model, developed by Shin et al. (2014), is particularly suitable for analyzing both linear and nonlinear relationships, allowing for asymmetric effects of currency valuation on inflation. Given Nigeria's exposure to exchange rate fluctuations, particularly in response to oil price volatility and fiscal policies, this model helps capture how positive and negative exchange rate shocks influence inflation differently. The decomposition of the exchange rate ($LOGOEX_t$) into positive ($LOGOEX_t^+$) and negative ($LOGOEX_t^-$) components provides understanding of whether currency appreciation and depreciation exert asymmetric pressure on inflation.

The NARDL error correction mechanism (ECM), similar to the standard ARDL model proposed by Pesaran et al. (2001), is specified as follows::

$$\Delta LOGCPI_t = v + p_1 LOGCPI_{t-1} + p_2^+ LOGOEX_{t-1}^+ + p_3^- LOGOEX_{t-1}^- + \gamma_1 LOGOP_{t-1} + \gamma_4 LOGM2_{t-1} + \gamma_5 RIR_{t-1} + \sum_{i=0}^{p} \delta_i \Delta LOGCPI_{t-i} + \sum_{i=0}^{q_1^+} \emptyset_{1i}^+ \Delta LOGOEX_{t-1}^+ + \sum_{i=0}^{q_1^-} \emptyset_{1i}^- \Delta LOGOEX_{t-1}^- + \sum_{i=0}^{q_2} \vartheta_2 \, LOGOP_{t-1} + \sum_{i=0}^{q_2} \vartheta_5 \, LOGM2_{t-1} + \sum_{i=0}^{q_2} \vartheta_6 \, RIR_{t-1} + \infty ECM_{t-1} + \xi_{t-1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

where:

- v is the drift term,
- $p_1, p_2, p_3, \gamma_1\ \gamma_2\ \gamma_3\ \gamma_4 \gamma_5$ represent the long-run multipliers,
- δ_i $\emptyset$ and ϑ are the short-run dynamic coefficients,
- ∞ is the speed of adjustment
- ξ_t is the error term.

The NARDL model allows for the decomposition of the exchange rate (RER_t) into its positive and negative components. This approach accounts for the possibility that currency appreciation (positive shocks) and currency depreciation (negative shocks) may have different effects on inflation in Nigeria.

$$LOGOEX_t^+ = \sum_{j=1}^{t} \max(\Delta LOGOEX_j, 0)\,,\ RER_t^- = \sum_{j=1}^{t} \mathrm{mix}(\Delta LOGOEX_j, 0)\,,$$

The positive and negative decompositions of exchange rate movements are represented as:.

The coefficients p_2^+ and p_3^- capture the long-run effects of positive and negative changes in the exchange rate on inflation, respectively. This allows for testing whether currency valuation affects inflation asymmetrically, providing deeper insights into how exchange rate fluctuations influence Nigeria's macroeconomic stability.

Asymmetry and Cointegration Testing:-The long-run symmetry between positive and negative shocks is tested using the Wald test, with the null hypothesis being $p_2^+ = p_3^-$. If this hypothesis is rejected, it suggests that exchange rate

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2025, 10(58s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/ **Research Article**

movements have asymmetric long-run effects on inflation in Nigeria. Similarly, short-run asymmetries are tested using the hypothesis δ_i^+ and δ_i^- , where *i* represents the lag order.

To test for cointegration between exchange rate movements and inflation, the bounds test (Pesaran et al., 2001) is applied. The null hypothesis of no cointegration H_0: $\rho_1 = p_2^+ = p_3^- = 0$ is tested against the alternative hypothesis H_1: $\rho_1 \neq p_2^+ \neq p_3^- \neq 0$. The F-statistic is compared to the critical bounds values from Pesaran et al. (2001) to determine if the variables are cointegrated.

Asymmetric Dynamic Multiplier Effects**:-**Following the analysis of long-term asymmetry, the Asymmetric Dynamic Multipliers (ADM) are computed to track how economic growth respond to positive and negative shocks in oil revenue over time. These dynamic multipliers show how $LOIR_t$ adjusts to its new long-run equilibrium in response to positive or negative shocks to oil revenue.

The cumulative dynamic multiplier effects of positive and negative oil revenue are calculated as:

$$m_h^+ = \sum_{j=0}^{h} \frac{\Gamma LOGOEX_{t+j}}{\Gamma LOGOEX_t^+},\ m_h^+ = \sum_{j=0}^{h} \frac{\Gamma LOGOEX_{t+j}}{\Gamma LOGOEX_t^-},\ for\ any\ h = 0,1,2$$

As $h \to \infty, m_h^+ \to -\frac{p_2^+}{p_t}$ $and\ m_h^- \to -\frac{p_2^-}{p_t}$, indicating the long-run adjustment paths for positive and negative shocks, respectively.

Residual diagnostics

Residual diagnostics are used to check if a regression model meets key assumptions for reliable results. This study applies several tests, starting with the Breusch-Godfrey LM and Durbin-Watson tests to detect serial correlation, where residuals are related across time, which can make estimates inefficient (Breusch & Godfrey, 1986). The Jarque-Bera test checks if residuals follow a normal distribution, as required by the classical linear regression model (Jarque & Bera, 1981). The Breusch-Pagan test identifies heteroscedasticity, a condition where residual variance changes across observations, which can lead to biased standard errors (Breusch & Pagan, 1979). The Ramsey RESET test is used to verify if the model's functional form is correct and to detect omitted variables (Ramsey, 1969). Stability is examined using the CUSUM and CUSUMSQ tests, which assess if model coefficients remain stable over time (Brown et al., 1975). Together, these diagnostics ensure the model is free from specification errors, maintains constant variance, has uncorrelated residuals, and remains stable throughout the sample period, thereby improving the validity and credibility of its findings.

Description and Measurement of Variables

This aspect gives a proper measurement of the variables used in this study. This is necessary because of proper understanding of interpretation of results from the estimations as concern to the variables used in the study. The measurements of the variables used in this study are presented in table 1 below;

Table 1 Variables' Definition, Measurement and Sources

Variables	Definition/Measurement	Sources of Data
CPI	Consumer Price Index (2010 = 100), serving as a proxy for inflation (dependent variable)	World Bank (WDI)
OEX	Official Exchange Rate (LCU per US$, period average), representing currency valuation	World Bank (WDI), CBN Statistical Bulletin
OP	Europe Brent Spot Price FOB (US$ per barrel), representing global oil prices	U.S. Energy Information Administration (EIA), World Bank (WDI)

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e-ISSN: 2468-4376
https://www.jisem-journal.com/ **Research Article**

M2	Broad Money Supply (in billions of naira)	World Bank (WDI), CBN Statistical Bulletin
RIR	Real Interest Rate (annual %, adjusted for inflation)	World Bank (WDI)

Source: Authors Compilation 2025

IV RESULTS AND DISCUSSIONS

Descriptive Statistics

The descriptive statistics presented in Table 2 provide an overview of the central tendencies, dispersion, and distributional characteristics of the variables used to assess the impact of currency valuation, , and oil price movement on inflation (proxied by the Consumer Price Index, CPI) in Nigeria over the period 1986-2024. With 39 observations, the data reflect long-run macroeconomic trends and offer a basis for understanding how each variable has behaved in relation to inflation.

Table 2 Descriptive Statistics

	CPI	OEX	OP	M2	RIR
Mean	120.3952	178.9236	47.68641	1.29E+13	2.401427
Maximum	699.3949	1478.965	99.67	5.22E+13	18.18
Minimum	0.868947	1.754523	14.42	2.36E+10	-31.4526
Std. Dev.	157.5871	256.4569	28.97428	1.63E+13	9.560361
Skewness	1.976378	3.597396	0.467976	1.060443	-1.20857
Kurtosis	6.770492	18.24176	1.776294	2.765839	5.553152
Sum	4695.413	6978.02	1859.77	5.03E+14	93.65564
Observations	39	39	39	39	39

Source computed by the researcher using E-views version 12 (2025)

The Consumer Price Index (CPI), which is the dependent variable, shows a mean value of 120.40, meaning that on average, consumer prices rose significantly compared to the 2010 base year (CPI = 100). The standard deviation of 157.59 shows high variability in inflation over the years, which is consistent with Nigeria's history of economic instability, multiple currency crises, and unstable fiscal and monetary environments. The maximum CPI of 699.39 and minimum of 0.87 show the exponential rise in prices over time. The CPI's positive skewness (1.98) and leptokurtic distribution (kurtosis = 6.77) indicate a long right tail and extreme inflationary outliers that are consistent with periods of hyperinflation and sharp price surges during currency devaluations and economic crises. The Official Exchange Rate (OEX) shows a mean of ₦178.92/$ with a wide dispersion (standard deviation = ₦256.46) and a high maximum of ₦1,479/$, highlighting Nigeria's repeated currency devaluations. The extremely high positive skewness (3.60) and kurtosis (18.24) confirm that the distribution is heavily skewed to the right, driven by large jumps in exchange rate especially after 2016 due to oil shocks, external reserve depletion, and Central Bank's policy adjustments. This volatility supports the idea that currency depreciation has a significant pass-through effect on inflation through import prices and cost-push mechanisms.

Broad Money Supply (M2) averaged ₦12.9 trillion, with the maximum at ₦52.2 trillion and a standard deviation of ₦16.3 trillion. The positive skewness (1.06) implies a steady monetary expansion with a few years of rapid growth, particularly after 2010, as the Central Bank adopted accommodative monetary policies. The monetary expansion corresponds with inflationary pressures, especially when not matched with output growth—validating the monetarist view that inflation in Nigeria is partly a result of excess liquidity. Real Interest Rate (RIR) shows a mean of 2.4%, but with extreme variation—ranging from -31.45% to 18.18%, and a standard deviation of 9.56%. The negative skewness (-1.21) reflects that in many years, real interest rates were negative, reducing the incentive to save and increasing the consumption and speculation that fuel inflation. Additionally, the leptokurtic distribution (kurtosis = 5.55) reflects the clustering of extreme values, often linked to poor monetary policy transmission and inflation-targeting challenges. Oil Price (OP), measured by Brent crude in dollars, averaged $47.69, with a maximum of $99.67 and a relatively moderate standard deviation of $28.97. The distribution is mildly skewed (0.47) and platykurtic (1.78),

Journal of Information Systems Engineering and Management
2025, 10(58s)
e-ISSN: 2468-4376
https://www.jisem-journal.com/ **Research Article**

indicating a fairly symmetric and normal trend with occasional surges, such as the 2008 boom. Given Nigeria's oil dependence, this variable plays a central role in fiscal capacity, exchange rate stability, and ultimately, inflation through the supply and demand channels.

Unit Root Test

Table 3 presents the results of the Augmented Dickey-Fuller (ADF) unit root tests conducted to assess the stationarity of the time series variables relevant to the study Stationarity is a critical prerequisite for time series modeling because non-stationary variables can produce spurious regression results, leading to invalid inferences. A variable is considered stationary if its statistical properties such as mean and variance are constant over time. The test was applied at both level and first difference using a 5% level of significance.

Table 3 Unit Root Tests

Variables	ADF	5% level Test critical values	P-Values	Remakes	Order of Integration
			@LEVELS		
LOGCPI	-2.099305	-2.943427	0.2461	Not Stationary	Unknown
LOGOEX	-1.658434	-2.941145	0.4437	`Not Stationary	Unknown
LOGOP	-1.449745	-2.941145	0.5478	`Not Stationary	Unknown
LOGM2	-2.448320	-2.943427	0.1361	`Not Stationary	Unknown
RIR	-2.388205	-2.948404	0.1522	Not Stationary	Unknown
			@FIRST DIFFERENCE		
Δ(LOGCPI)	-3.649171	-2.945842	0.0094	Stationary	I(1)
Δ(LOGOEX)	-5.556200	-2.943427	0.0000	Stationary	I(1)
Δ(LOGOP)	-6.047153	-2.945842	0.0000	Stationary	I(1)
Δ(LOGM2)	-3.287995	-2.943427	0.0227	Stationary	I(1)
Δ(RIR)	-5.131107	-2.948404	0.0002	Stationary	I(1)

Source: computed by the author using E-views. Version 12 (2025)

At level form, all the key variables including the log-transformed CPI (LOGCPI), official exchange rate (LOGOEX), oil price (LOGOP), money supply (LOGM2), and real interest rate (RIR) were found to be non-stationary. Their ADF test statistics were all greater (in absolute value) than the 5% critical values. This is evident in their p-values, all of which exceed the 0.05 significance level (for example, LOGCPI has a p-value of 0.2461, LOGOP has 0.5478), indicating a failure to reject the null hypothesis of unit root.

The finding means that each series contains a unit root and thus shows time-dependent behavior, meaning their current values depend significantly on past values. This suggests that inflation and its potential causes like exchange rates, oil prices, and monetary variables have persistent trends over time in the Nigerian economy, often influenced by shocks from both domestic and global sources.

The non-stationarity of these variables at levels also reflects Nigeria's historical economic instability. For instance, the official exchange rate (LOGOEX) has undergone several structural shifts due to currency devaluations, while CPI

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reflects prolonged inflationary pressures. Oil prices (LOGOP), as externally driven variables, are naturally volatile and thus non-stationary due to global market dynamics such as the 2008 financial crisis, the 2014 oil price crash, and the COVID-19 pandemic in 2020.

Upon differencing the data once, all the variables become stationary, as shown by their ADF test statistics now exceeding the 5% critical values in absolute terms, and p-values dropping well below 0.05.

These results confirm that all variables are integrated of order one, I(1). This is a common outcome in economic data, where series like CPI, exchange rates, oil prices, and money supply follow long-run trends and only become stationary after differencing. The stationarity at first difference means that while each series has a persistent trend, their short-run changes (i.e., first differences) are mean-reverting, making them suitable for further time series analysis such as cointegration and Autoregressive Distributed Lagged Models (ARDL).

Non-linearity Test

The BDS (Brock–Dechert–Scheinkman) nonlinearity test results presented in Table 4 provide critical insights into the presence of non-linear structures in the time series data of inflation (proxied by LOGCPI) and exchange rate (LOGOEX).

Table 4 BDS Nonlinearity Test

Variables	**LOGCPI**	**LOGOEX**
Dimension	2	2
BDS Statistic	0.199460	0.189128
Std. Error	0.010847	0.010895
z-Statistic	18.38817	17.35984
Prob.	0.0000	0.0000

Source: Researchers' computation (2025)

The test was conducted at dimension 2, which examines whether the time series behaves in a purely random (linear) or non-linear fashion. For both LOGCPI and LOGOEX, the BDS statistic values are 0.199460 and 0.189128 respectively, with standard errors of 0.010847 and 0.010895. The z-statistics for both variables are considerably high (18.38817 for LOGCPI and 17.35984 for LOGOEX), and the associated p-values are 0.0000 in both cases. These highly significant p-values indicate strong rejection of the null hypothesis of identically and independently distributed (i.i.d.) residuals, implying the presence of non-linear dependencies in the inflation and exchange rate series.

Kapetanios, Shin & Snell (2003) test results Nonliner Unit Root Test

The results presented in Table 5 report the outcomes of the Kapetanios, Shin and Snell (KSS, 2003) non-linear unit root test for the variables LOGCPI (log of Consumer Price Index) and LOGOEX (log of exchange rate).

Table 5 Kapetanios, Shin & Snell (2003) test results non-linear unit root test

Variables	Criteria	Lags	KSS stat.	p-value	1% cv	5% cv	10% cv
LOGCPI	FIXED	3	0.067	0.067	-3.503	-2.859	-2.557
LOGOEX	FIXED	3	0.487	0.978	-3.503	-2.859	-2.563

Source: Researchers' computation (2025)

The Kapetanios, Shin, and Snell (KSS) test detects unit roots while allowing for nonlinear mean reversion. For both LOGCPI and LOGOEX, the KSS test statistics (0.067 and 0.487) with p-values (0.067 and 0.978) fail to reject the null hypothesis of unit root, as they don't exceed critical values. This confirms both inflation and exchange rate are non-stationary even considering nonlinearity. The findings suggest shocks have persistent effects, indicating

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Nigeria's inflation and exchange rate systems face structural rigidities and policy inconsistencies. This requires econometric models like NARDL that handle non-stationary data for valid analysis.

Summary of Lag Selection Criteria and BOUNDS TEST to Cointegration

The ARDL Bounds Test results presented in Table 6 provide critical insight into the long-run relationships between inflation and its proposed determinants under three distinct research objectives. This table evaluates the existence of a long-term equilibrium among the variables by comparing calculated F-statistics (FPSS) with critical values from Pesaran et al. (2001) and Narayan (2005). The null hypothesis tested is that no long-run relationship exists.

Table 6 ARDL BOUNDS TEST Results, Null Hypothesis: No Long-run Relationship

Panels	Lag Length	K/n	F-Statistic (FPSS)	Pesaran et al. (2001) Critical Values (5%)	Narayan (2005) Critical Values (5%)
Panel A (linear)	ARDL(4,3,4,4,4)	4/35	6.861990	I(0) 2.56	I(0) 3.058
				I(1) 3.49	I(1) 4.223
Panel B (non-linear)	ARDL(4,4,3,3,4,4)	5/34	7.368983	I(0) 2.39	I(0) 2.804
				I(1) 3.38	I(1) 4.013

Source: computed by the author using E-views. Version 12 (2025)

The above is divided into linear and non-linear models and pertains to the third objective: examining the influence of exchange rate (currency valuation) and oil price movements on inflation. For the linear model, the F-statistic is 6.861990, which surpasses both the Pesaran I(1) critical value (3.49) and Narayan's (4.223), indicating a significant long-run relationship. Similarly, the non-linear model yields an F-statistic of 7.368983, again exceeding all critical bounds. This implies that the relationship between exchange rate, oil prices, and inflation persists in the long run even under nonlinear specifications, potentially capturing asymmetries or threshold effects.

NARDL Regression Analysis

The Nonlinear Autoregressive Distributed Lag (NARDL) regression results presented in Table 7 offer valuable insights into the asymmetric effects of currency valuation (exchange rate), broad money supply (M2), and oil price movements on inflation (proxied by the log of Consumer Price Index, LOGCPI) in Nigeria from 1986 to 2024.

The analysis is framed within the broader research, specifically addressing the third objective: to examine the impact of currency valuation and oil price movements on inflation in Nigeria.

Table 7 NARDL Regression Estimates

Dependent Variable: LOGGCPI				
	Symmetric Model Results		***Asymmetric Model Results***	
Variables	**Coefficients [S.E]**	**T-Values (P-Values)**	**Coefficients [S.E]**	**T-Values (P-Values)**
Long-Run Values				
Constants	-3.336309 [0.536388]	-6.219959 (0.0001)	2.597092 [4.848953]	0.535598 (0.6115)
LOGOEX	0.552774 [0.091426]	6.046128 (0.0001)		
LOGOEX+			1.165035 [0.482526]	2.414449 (0.0523)
LOGOEX-			-7.941265 [6.927252]	-1.146380 (0.2953)

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LOGM2	0.357177 [0.063153]	5.655747 (0.0001)	-0.205790 [0.455285]	-0.452002 (0.6671)
LOGOP	0.060985 [0.102641]	0.594161 (0.5644)	0.150414 [0.157393]	0.955656 (0.3761)
RIR	-0.041101 [0.005278]	-7.787213 (0.0000)	-0.055009 [0.016222]	-3.391027 (0.0147)
Short-Run Values				
ΔLOGOEX	0.169879 [0.029355]	5.787150 (0.0001)		
$\Delta LOGOEX^{+}$			0.124550 [0.021886]	5.690927 (0.0013)
$\Delta LOGOEX^{-}$			-0.154025 [0.536509]	-0.287088 (0.7837)
$\Delta LOGOEX(-1)^{-}$			2.288882 [0.645923]	3.543585 (0.0122)
ΔLOGM2	-0.201041 [0.047488]	-4.233515 (0.0014)	-0.165287 [0.038965]	-4.241934 (0.0054)
ΔLOGOP	-0.068158 [0.022031]	-3.093776 (0.0102)	-0.074843 [0.019016]	-3.935748 (0.0077)
ΔRIR	-0.003358 [0.000286]	-11.75805 (0.0000)	-0.003183 [0.000230]	-13.85021 (0.0000)
ECT_{t-1}	-0.461326 [0.059613]	-7.738634 (0.0000)	-0.347562 [0.034219]	-10.15705 (0.0001)
Residual Diagnostic Test	**Test-Statistic**	**P-Value**	**Test-Statistic**	**P-Value**
R-squared	0.976116		0.999922	
Adjusted R-squared	0.949246		0.999570	
Durbin-Watson stat	2.085207		2.685763	
F-statistic	2996.044	0.000000	2839.497	0.000000
Jarque-Bera test on normality (X^2)	0.079497	0.961031	1.288897	0.524952
Breusch-Godfrey Serial Correlation LM Test (F)	0.268459	0.7705	2.208930	0.2258
Heteroskedasticity Test: Breusch-Pagan-Godfrey (F)	0.849983	0.6454	1.645058	0.2091
Ramsey RESET test (F)	3.277884	0.1003	3.510196	0.1199

Source: computed by the author using E-views. Version 12 (2025)

*Note: *** Statistical significance at the 1 per cent levels,**Statistical significance at the 5 per cent levels.*

**Statistical significance at the 10 per cent levels,*

Long-Run Dynamics (Elasticities and Economic Interpretations):-In the symmetric model, the exchange rate (LOGOEX) shows a statistically significant positive coefficient of 0.5528 ($p < 0.01$). This implies that a 1% depreciation of the Naira (increase in the exchange rate) leads to a 0.55% increase in the general price level in the long run. This result aligns with theoretical expectations that currency depreciation increases the domestic cost of imported goods and services, thereby pushing up inflation. It reflects Nigeria's high import dependency, especially for essential consumer goods and intermediate inputs used in domestic production.

The broad money supply (LOGM2) is also significant, with a coefficient of 0.3572 ($p < 0.01$), suggesting that a 1% increase in money supply raises inflation by approximately 0.36% in the long run. This supports classical monetarist views that excessive liquidity in the economy without a corresponding increase in output will exert upward pressure on prices.

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Interestingly, oil price (LOGOP) is not statistically significant in the long run, with a coefficient of 0.0609 ($p = 0.5644$). This indicates that oil price fluctuations, despite Nigeria being an oil-dependent economy, may not have a direct or sustained influence on inflation. This could be due to the government's fuel subsidy mechanisms, exchange rate pass-through effects being delayed, or a lack of full transmission of global oil price shocks into domestic prices due to policy interventions.

The real interest rate (RIR) is negatively and significantly associated with inflation, having a coefficient of -0.0411 ($p < 0.01$). A 1% rise in the real interest rate is associated with a 0.041% decrease in inflation, consistent with monetary policy expectations: higher interest rates can dampen consumer and investment demand, thereby reducing inflationary pressures.

In the asymmetric model, exchange rate is decomposed into its positive (LOGOEX+) and negative (LOGOEX-) changes. The positive changes (depreciation) in exchange rate are statistically significant with a long-run coefficient of 1.1650 ($p = 0.0523$), indicating that a 1% depreciation in the exchange rate causes a 1.17% increase in inflation — more than double the effect in the symmetric model. This suggests strong inflationary pressure from currency depreciation in Nigeria. On the contrary, the coefficient for negative exchange rate changes (appreciation) is -7.9413, but not statistically significant ($p = 0.2953$), implying that currency appreciation does not significantly reduce inflation. This asymmetry reveals a critical insight: inflation responds more aggressively to depreciation than it does to appreciation a typical scenario in developing economies with weak monetary transmission mechanisms, import dependency, and speculative expectations about exchange rate movement.

Broad money supply (LOGM2), oil prices (LOGOP), and real interest rate (RIR) in the asymmetric model lose statistical significance in the long run, except for RIR, which remains significant and negative (-0.0550, $p = 0.0147$). This reinforces the role of interest rate policies in controlling inflation, while also showing that in nonlinear settings, the effects of monetary aggregates and oil prices may become more nuanced, possibly due to interactions with fiscal behavior or market expectations.

Short-Run Dynamics and Error Correction Term (ECT):-In the short run, exchange rate changes (ΔLOGOEX) remain positive and significant in both symmetric and asymmetric models. In the symmetric model, the coefficient is 0.1699 ($p < 0.01$), indicating that a 1% depreciation of the exchange rate immediately increases inflation by 0.17%. Similarly, in the asymmetric model, positive changes (ΔLOGOEX+) are significant at 0.1246 ($p < 0.01$), while negative changes (ΔLOGOEX-) are not statistically significant, again reinforcing the asymmetric inflationary effect of currency depreciation.

The lagged depreciation effect (ΔLOGOEX(-1)-) is also positive and significant (coefficient = 2.2889, $p = 0.0122$), suggesting that past depreciation can have delayed inflationary consequences potentially due to pricing adjustments over time in sectors like food, fuel, and transportation.

Broad money supply and oil price changes are both negative and statistically significant in the short run, contradicting conventional expectations. For example, oil price (ΔLOGOP) changes have coefficients of -0.0682 and -0.0748 in the symmetric and asymmetric models, respectively, both significant at the 1% level. One plausible economic interpretation is the pass-through effect of oil subsidy, where rising global oil prices do not immediately translate into domestic price increases due to subsidies, and instead may be associated with tighter fiscal adjustments or monetary tightening to offset potential inflation. Similarly, the negative short-run effect of money supply may suggest that short-run increases in M2 reflect liquidity injections aimed at stabilizing prices (e.g., through targeted interventions), or that the velocity of money has slowed due to low economic activity.

The error correction term (ECT) is negative and statistically significant in both models: -0.4613 in the symmetric and -0.3476 in the asymmetric model. These indicate moderate speed of adjustment towards long-run equilibrium, where approximately 46% and 35% of disequilibrium is corrected each year, respectively. This affirms the validity of long-run relationships between inflation and the regressors.

Diagnostic Tests and Model Robustness:-Both models pass key diagnostic tests. The Jarque-Bera test confirms residual normality, and no serial correlation is detected by the Breusch-Godfrey test. Heteroskedasticity and functional form misspecification are also not present, as indicated by the Breusch-Pagan-Godfrey and Ramsey

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RESET tests, respectively. The models are robust with high R-squared values (0.976 and 0.9999), indicating excellent goodness-of-fit, though caution is warranted with the near-perfect R^2 in the asymmetric model, which may indicate overfitting.

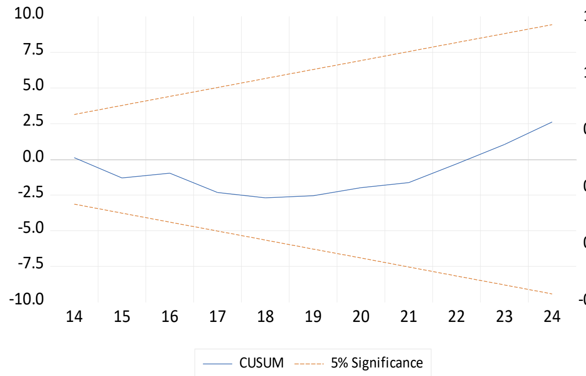
Critical Analysis and Implications for Nigeria:-The findings underscore the dominant role of exchange rate movements in driving inflation in Nigeria. The asymmetric effects where depreciation significantly raises inflation, but appreciation has no deflationary effect reflect Nigeria's structural vulnerabilities: heavy import dependence, limited domestic manufacturing capacity, and persistent foreign exchange shortages. These asymmetries point to policy ineffectiveness in curbing inflation through exchange rate appreciation alone, and they highlight the need for structural reforms to reduce import reliance and enhance domestic production.

Moreover, the weak and inconsistent relationship between oil prices and inflation in both long and short runs challenges assumptions that Nigeria's oil wealth directly influences domestic price levels. Instead, it may signal distortions from subsidy regimes and exchange rate misalignments. Likewise, the unexpected short-run negative impact of money supply suggests monetary policy may sometimes be counter-cyclical or reactive, rather than pro-inflationary, especially when the economy is in a downturn.

In conclusion, the NARDL analysis provides compelling evidence that currency valuation (particularly depreciation) is a key determinant of inflation in Nigeria, and its effects are nonlinear and asymmetric. Oil prices and money supply have more effective and policy-contingent effects, especially in the short run. Policymakers must consider these dynamics when designing inflation-targeting frameworks, particularly in aligning exchange rate policy, external trade strategy, and domestic production incentives. Sustainable inflation control in Nigeria will depend on reducing exchange rate pass-through, improving local production, and reforming fiscal leakages tied to the oil sector.

Stability Test

The stability test is a crucial test to determine whether the predicted ARDL models are stable. The cumulative sum of recursive residuals test and the cumulative sum of squares were used to determine the coefficient's stability.



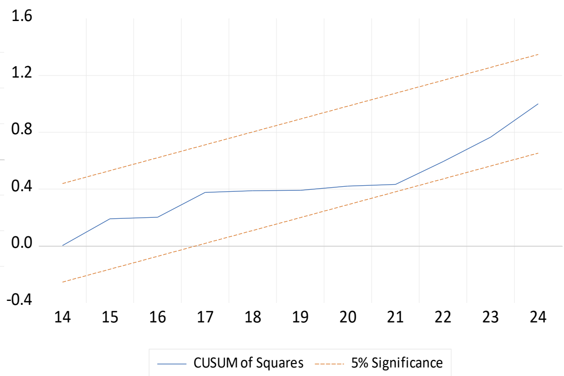


Figure 4.1 CUSUM Squares | Figure 4.2 CUSUM Sum of squares

Source: Generated by the Author using E-views version 12.0 (2025)

The stability of the linear (symmetric) ARDL bounds testing estimates was examined using the CUSUM and CUSUMsq tests, and the outcomes are displayed in Figures 4.1 and 4.2. In the CUSUM statistics plots, the data points remained comfortably within the 5% critical bounds. Similarly, the CUSUM of squares statistics plots indicated that the data points were slightly within the 5% critical bounds. These results confirm the accuracy and consistency of the ARDL estimates. The tests reveal that the coefficients were stable, as evidenced by the fact that the cumulative sum (represented by the blue lines) did not surpass the region between the two critical bounds (represented by the red lines).

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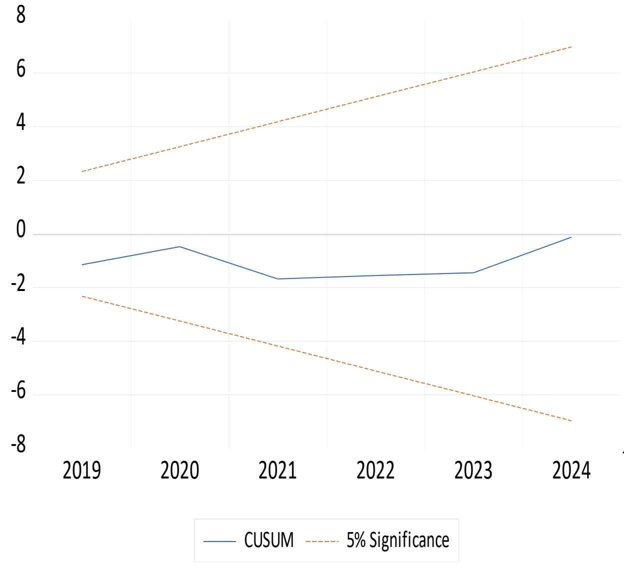

Figure 4.3 CUSUM Squares

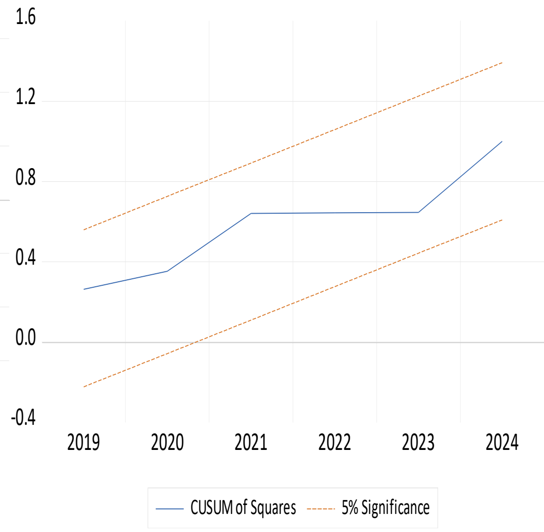

Figure 4.4: CUSUM Sum of squares

Source: Generated by the Author using E-views version 12.0 (2025)

In accordance with the methodology outlined by Pesaran et al. (2001), we conducted a stability test employing the CUSUM and CUSUM of squares of recursive residuals tests. The results of these tests indicate that the estimated parameters are indeed stable, as the values remain within the critical threshold at a 5% significance level. This reaffirms the reliability and consistency of the N-ARDL estimates. The tests confirm the stability of the coefficients, as demonstrated by the fact that the cumulative sum (represented by the blue lines) does not extend beyond the region defined by the two critical bounds (indicated by the red lines).

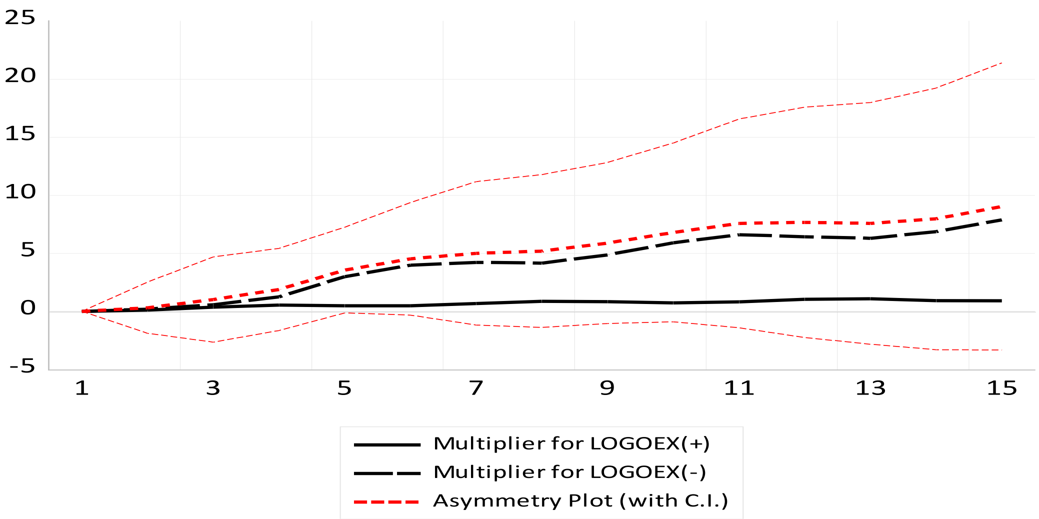

Figure 4.5: CUSUM Sum of squares

Source: Generated by the Author using E-views version 12.0 (2025)

The dynamic multipliers take on different patterns when either short-term asymmetry, long-term asymmetry, or both are incorporated into the model. In the most appropriate model, which combines long-term symmetry with short-term asymmetry, the short-term adjustment process reveals a more pronounced response of inflation (CPI) to a one-unit decrease in exchange rate (CPI). The cumulative responses of $LOGCPI_t$ to $LOGOEX_t$ are both negative and statistically significant.

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V CONCLUSIONS AND RECOMMENDATIONS

The study concludes that the exchange rate is one of the most important factors determining inflation in Nigeria. When the naira loses value against foreign currencies, especially the US dollar, it makes imported goods more expensive, and these higher costs are passed on to consumers in the form of higher prices. The study also found that the effects of exchange rate changes are not the same in both directions. When the naira gets weaker, it has a strong positive effect on inflation, as expected. However, when the naira gets stronger, it can also lead to higher inflation, which is surprising. This happens because a stronger naira usually occurs when oil prices are high, and during these periods, the government tends to spend more money, which drives up prices even though imports become cheaper. Regarding oil prices, the study concludes that their direct effect on inflation is not as straightforward as many people think. While higher oil prices do affect inflation, the effect works mainly through government spending rather than through direct increases in fuel costs. When oil prices go up, the government gets more money and spends more, which is what actually drives inflation. The study concludes that Nigeria's position as an oil exporter means that higher oil prices can actually help the economy overall, but they become inflationary when they lead to excessive government spending.

The Central Bank of Nigeria should implement a managed floating exchange rate system that allows for market-determined rates while providing targeted interventions to prevent excessive volatility. This recommendation should be implemented through the establishment of clear intervention rules that specify the conditions under which the bank will buy or sell foreign currencies in the market. The bank should build up adequate foreign exchange reserves to support these interventions, targeting reserves equivalent to at least six months of imports. The implementation process should involve gradually reducing direct foreign exchange allocations and moving toward a system where the exchange rate reflects market fundamentals while preventing destabilizing speculation. The Central Bank should establish clear communication strategies to help market participants understand the new framework and reduce uncertainty. Regular auctions should be conducted to ensure transparent price discovery while maintaining the bank's ability to intervene during periods of excessive volatility. The bank should also coordinate with the Federal Ministry of Petroleum Resources to develop mechanisms that reduce the economy's vulnerability to oil price shocks. This should include promoting domestic refining capacity to reduce dependence on imported petroleum products and developing alternative export sectors that can provide foreign exchange earnings when oil prices are low. These measures are expected to achieve greater exchange rate stability, which should reduce the pass-through of currency fluctuations to domestic prices. The economy should become more attractive to foreign investors who will have greater confidence in exchange rate predictability. Domestic businesses should be better able to plan long-term investments and pricing strategies without fear of sudden exchange rate shocks. Additionally, the reduced vulnerability to oil price movements should make the economy more resilient and reduce the volatility of government revenues and spending

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