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Oil Price Volatility, Exchange Rate Depreciation and Inflation Persistence in Nigeria: A Quantile ARDL Approach

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Abstract

This study examined the relationship among oil price volatility, exchange rate depreciation and inflation persistence in Nigeria using monthly data from January 2015 to February 2026. The study was motivated by the persistent nature of inflation in Nigeria and the country's exposure to crude oil price fluctuations, exchange rate instability and imported inflation. Inflation rate, exchange rate and crude oil price data were sourced from the Central Bank of Nigeria, while exchange rate depreciation was computed as the percentage change in the naira–US dollar exchange rate and oil price volatility was generated using absolute crude oil price returns. The study employed the Quantile Autoregressive Distributed Lag (QARDL) approach to determine whether the effects of oil price volatility and exchange rate depreciation differ across low, moderate, high and extreme inflation regimes. Preliminary results from the Augmented Dickey-Fuller test showed that inflation was integrated of order one, I(1), while exchange rate depreciation and oil price volatility were stationary at level, I(0), justifying the use of the QARDL framework. Based on the Akaike Information Criterion, the final model was specified as QARDL(4,0,0). The empirical results revealed that inflation persistence is the most dominant feature of Nigeria's inflation dynamics, as lagged inflation was positive and statistically significant across all selected quantiles. The long-run persistence estimates increased from 0.9735 at the 0.25 quantile to 1.0358 at the 0.90 quantile, indicating that inflation becomes more entrenched under high-inflation regimes. However, exchange rate depreciation and oil price volatility showed weak and statistically insignificant direct contemporaneous effects, suggesting that their influence may operate indirectly through import prices, fuel costs, production costs, fiscal pressure and inflation expectations. The study concludes that Nigeria's inflation is both inertia-driven and regime-dependent, requiring early, coordinated and sustained policy intervention. It recommends credible monetary policy, exchange rate stability, fiscal discipline, oil-sector reform and expansion of domestic productive capacity to reduce inflation persistence and limit the transmission of external shocks into domestic prices.

Keywords: Oil price volatility; exchange rate depreciation; inflation persistence; Quantile ARDL; Nigeria

1. Introduction

Inflation remains one of the most difficult macroeconomic problems in Nigeria because it weakens purchasing power, increases business uncertainty, reduces real income, discourages investment and complicates monetary policy, while Nigeria's inflationary process is strongly linked to structural and external-sector pressures such as crude oil price instability, exchange rate depreciation, imported inflation, energy cost adjustments and weak domestic productive capacity (AESS Publications, 2026; IMF, 2025; World Bank, 2025; World Journal of Advanced Research and Reviews, 2025). This makes the study of oil price volatility, exchange rate depreciation and inflation persistence highly relevant, particularly in an oil-dependent and import-dependent

economy such as Nigeria. Nigeria's dependence on crude oil exposes the economy to global oil market shocks. Crude oil remains a major source of foreign exchange earnings and public revenue; therefore, fluctuations in oil prices influence external reserves, fiscal operations, exchange rate stability and the capacity to finance imports. In theory, rising oil prices should benefit oil-exporting economies through increased revenue and foreign exchange inflows. However, Nigeria's case is more complex because the country also depends heavily on imported refined petroleum products, raw materials, machinery and consumer goods. As a result, oil price increases may raise domestic fuel, transportation and production costs, while oil price declines may weaken foreign exchange inflows and worsen exchange rate depreciation. Recent evidence confirms that oil price shocks affect inflation in Nigeria both directly and indirectly through exchange rate volatility, fiscal balance and monetary policy channels (AESS Publications, 2026). This suggests that oil price volatility is not merely an external commodity-market issue but a central factor in Nigeria's domestic price instability.

Exchange rate depreciation is another major driver of inflation in Nigeria. Because many Nigerian firms rely on imported inputs, depreciation of the naira increases the domestic currency cost of raw materials, machinery, fuel, spare parts and finished goods. These higher costs are often transferred to consumers through price increases, thereby creating exchange rate pass-through to inflation. Recent studies have continued to confirm the importance of this channel. Oyadeyi, Oyadeyi, and Iyoha (2024), using threshold-based methods, found evidence of nonlinear exchange rate pass-through to producer prices, consumer prices, export prices and import prices in Nigeria. Similarly, Ikue et al. (2024) examined asymmetric exchange rate pass-through from 2010Q1 to 2024Q2 using Autoregressive Distributed Lag (ARDL) and Nonlinear Autoregressive Distributed Lag (NARDL) models and showed that exchange rate movements have important short-run and long-run implications for headline and food inflation. Yunusa (2025) also found a significant short-run relationship between official exchange rate movements and inflation in Nigeria using an ARDL framework. These recent studies show that exchange rate depreciation remains a major inflationary channel in Nigeria, especially because of the country's high import dependence and persistent currency instability. The persistence of inflation makes the problem more serious. Inflation persistence refers to the tendency of current inflation to remain influenced by past inflation, even after the original shock has occurred. In Nigeria, this persistence may arise from repeated exchange rate depreciation, fuel price adjustments, high transport costs, insecurity in food-producing areas, fiscal pressures, weak infrastructure and inflation expectations. When firms and households expect prices to continue rising, producers adjust prices in advance, workers demand higher wages, importers build exchange rate risk into pricing decisions and consumers accelerate purchases to avoid future price increases. These behaviour can make temporary shocks become prolonged inflationary episodes. Recent Nigerian inflation developments reinforce this concern. The National Bureau of Statistics rebased the Consumer Price Index to better reflect current consumption patterns, while the Central Bank of Nigeria has continued to pursue reforms toward inflation targeting, indicating that inflation control remains a major policy priority (Central Bank of Nigeria [CBN], 2024; National Bureau of Statistics [NBS], 2024).

The recent policy environment further strengthens the need for this study. Nigeria has experienced major reforms, including fuel subsidy removal, exchange rate adjustments and foreign exchange market reforms. These reforms were designed to improve fiscal sustainability and external-sector efficiency, but they also increased short-run inflationary pressures through higher fuel costs, transport costs and import prices. The World Bank observed that Nigeria's recent reforms improved fiscal and external-sector conditions, but inflation remained a key challenge requiring

tight monetary and disciplined fiscal policies (World Bank, 2025). Reuters also reported that subsidy removal and naira devaluation contributed to inflationary pressures, even as the reforms supported macroeconomic adjustment (Reuters, 2025). These developments suggest that Nigeria's inflation problem cannot be fully understood by examining oil price or exchange rate effects in isolation. Rather, it requires a joint analysis of how oil price volatility and exchange rate depreciation interact with inflation persistence. Although the existing literature provides useful evidence, important gaps remain. Many studies on Nigeria have examined oil price shocks and inflation, or exchange rate depreciation and inflation, using conventional methods such as OLS, VAR, VECM, ARDL, NARDL and threshold regression. While these methods are useful, most of them focus on average effects or broad nonlinearities. They may not adequately show whether oil price volatility and exchange rate depreciation affect inflation differently during low, moderate and high inflation regimes. This is a major limitation because the inflationary effect of exchange rate depreciation may be weak when inflation is low but stronger when inflation is already high. Similarly, oil price volatility may have different effects during stable price periods than during periods of severe inflationary pressure. Therefore, average-based models may conceal important distributional differences in Nigeria's inflation dynamics.

The Quantile Autoregressive Distributed Lag approach provides a suitable framework for addressing this limitation. Unlike the conventional ARDL model, which estimates average short-run and long-run relationships, Quantile ARDL allows the researcher to examine whether the effects of explanatory variables differ across various points of the inflation distribution. This means that the lower quantiles may represent low inflation regimes, the middle quantiles may represent moderate inflation regimes, while the upper quantiles may capture high inflation regimes. Recent applications of quantile and nonlinear models have shown that macroeconomic relationships often vary across regimes rather than remaining constant over time (Hashmi et al., 2022; Ikue et al., 2024; Oyadeyi et al., 2024). Therefore, applying Quantile ARDL to Nigerian inflation will provide deeper evidence on whether oil price volatility and exchange rate depreciation have stronger effects when inflation is already high.

This study is therefore necessary because it addresses a clear empirical, methodological and policy gap. Empirically, it jointly examines oil price volatility, exchange rate depreciation and inflation persistence in Nigeria. Methodologically, it moves beyond average-effect estimation by applying a Quantile ARDL framework that captures regime-specific inflation responses. In terms of policy, the study provides evidence that can guide inflation-control strategies under different inflation conditions. If exchange rate depreciation has a stronger effect at upper inflation quantiles, then exchange rate stabilization and foreign exchange liquidity management become more urgent during inflationary crises. If oil price volatility intensifies inflation persistence at higher quantiles, then oil revenue stabilization, domestic refining capacity, fiscal buffers and energy-market reforms become critical. Thus, the study contributes to the literature by offering a clearer understanding of how oil price and exchange rate shocks shape inflation persistence in Nigeria across low, moderate and high inflation regimes.

2. Data and Methodology

2.1 Data Source and Description

The data used for this study consist of monthly time series observations on inflation rate, exchange rate and crude oil prices in Nigeria, covering the period January 2015 to February 2026. The data were sourced from the Central Bank of Nigeria (CBN) statistical database, which provides official

macroeconomic and financial sector data suitable for empirical research and policy analysis. Inflation rate represents the monthly movement in the general price level and serves as the dependent variable for examining inflation persistence, while exchange rate, measured as the naira value per United States dollar, captures the extent of naira depreciation or appreciation over the study period. Crude oil price, measured in US dollars per barrel, reflects global oil market conditions and is relevant because Nigeria depends heavily on crude oil export earnings while also being exposed to imported inflation through exchange rate movements. The period covered is appropriate because it captures major macroeconomic episodes, including oil price fluctuations, exchange rate reforms, recessionary pressures, COVID-19-related disruptions, fuel subsidy adjustments, naira depreciation and recent inflationary pressures. The monthly frequency provides sufficient observations for analyzing short-run fluctuations, volatility patterns and dynamic relationships among the variables. The raw data were organized and cleaned using Microsoft Excel, which was also used for graphical presentation and preliminary trend analysis, while R statistical software was employed for advanced econometric procedures such as stationarity testing, volatility estimation, model specification, Quantile ARDL estimation and diagnostic checking.

2.2 Methodology: Quantile ARDL Framework

This study employs the Quantile Autoregressive Distributed Lag (QARDL) approach to examine the effect of oil price volatility and exchange rate depreciation on inflation persistence in Nigeria. The QARDL method is appropriate because it allows the study to determine whether the effects of exchange rate depreciation and oil price volatility on inflation differ across various inflation regimes, rather than estimating only an average relationship. In this study, lower quantiles represent periods of relatively low inflation, middle quantiles represent moderate inflation, while upper quantiles capture high inflation regimes. This is important because the inflationary effects of exchange rate depreciation and oil price volatility may be stronger when inflation is already high than when inflation is low or moderate.

2.2.1 Model Specification

The empirical model is specified with inflation rate as the dependent variable, while exchange rate depreciation and oil price volatility serve as the main explanatory variables. Inflation persistence is captured by including lagged inflation in the model. The general functional relationship is expressed as:

$$INF_t = f(INF_{t-1}, EXD_t, OPV_t) \quad (1)$$

where INF_t represents inflation rate, INF_{t-1} captures inflation persistence, EXD_t denotes exchange rate depreciation, and OPV_t represents oil price volatility. Exchange rate depreciation is computed as the percentage change in the naira–US dollar exchange rate:

$$EXD_t = \frac{EXR_t - EXR_{t-1}}{EXR_{t-1}} \times 100 \quad (2)$$

where EXR_t is the current exchange rate and EXR_{t-1} is the previous month's exchange rate. Since the exchange rate is measured as naira per US dollar, a positive value of EXD_t indicates naira depreciation, while a negative value indicates naira appreciation.

Oil price volatility is computed using the absolute return of crude oil prices. First, the logarithmic return of crude oil price is calculated as:

$$ROP_t = [\ln(OP_t) - ln(OP_{t-1})] \times 100 \quad (3)$$

where OP_t is the crude oil price at time t, and $OP_{t-1}$is the crude oil price in the previous month. Oil price volatility (OPV_t) is then obtained as the absolute value of oil price return (ROP_t):

$$OPV_t = |ROP_t| \quad (4)$$

The use of absolute oil price return is justified because it captures the magnitude of oil price fluctuations regardless of direction. This means that both positive and negative oil price shocks are treated as volatility-generating movements. Since the focus of the study is on the instability of oil prices rather than whether oil prices rise or fall, the absolute return provides a simple and interpretable measure of oil price volatility.

2.2.2 Pre-Estimation Procedures

Before estimating the QARDL model, several pre-estimation procedures are conducted. First, descriptive statistics are used to examine the mean, minimum, maximum, standard deviation, skewness and kurtosis of the variables. This provides initial information on the distributional behaviour of inflation, exchange rate depreciation and oil price volatility. Graphical analysis is also carried out to observe the movement, trends, volatility patterns and possible structural shifts in the variables over the study period. Microsoft Excel is used for preliminary data organization and graphical presentation.

Second, stationarity tests are conducted to determine the order of integration of the variables. The Augmented Dickey-Fuller unit root test is applied to examine whether the variables are stationary at level, $I(0)$, or become stationary after first differencing, $I(1)$. This step is necessary because ARDL-based models are valid when variables are $I(0)$, $I(1)$, or a mixture of both, but they are not appropriate when any variable is integrated of order two, $I(2)$. Therefore, any variable found to be $I(2)$ would invalidate the use of the ARDL/QARDL framework.

Third, the appropriate lag length is selected using information criteria such as the Akaike Information Criterion, Schwarz Bayesian Criterion and Hannan-Quinn Criterion. Proper lag selection is important because insufficient lags may lead to omitted dynamic effects, while excessive lags may reduce degrees of freedom and weaken model efficiency. Given the monthly nature of the data, the lag structure is selected carefully to capture short-run adjustment patterns without over-parameterizing the model.

2.2.3 QARDL Representation

The QARDL model is estimated across selected quantiles, commonly $\tau = 0.25,0.50,0.75$ and 0.90. These quantiles allow the study to compare the behaviour of inflation under low, moderate, high and extreme inflation conditions. The general QARDL specification may be written as:

$$QINF_t(\tau|X_t) = \alpha(\tau) + \sum_{i=1}^{p} \phi_i(\tau) INF_{t-i} + \sum_{j=0}^{q} \beta_j(\tau) EXD_{t-j} + \sum_{k=0}^{r} \gamma_k(\tau) OPV_{t-k} + \varepsilon_t(\tau) \quad (5)$$

where $QINF_t(\tau|X_t)$ represents the conditional quantile of inflation, τ denotes the selected quantile, $\phi_i(\tau)$ captures inflation persistence, $\beta_j(\tau)$ measures the effect of exchange rate depreciation, and $\gamma_k(\tau)$ captures the effect of oil price volatility. The coefficients are allowed to vary across quantiles, making it possible to determine whether the impact of exchange rate depreciation and oil price volatility is stronger or weaker under different inflation regimes.

After estimation, the study examines both short-run and long-run coefficients across the selected quantiles. The coefficient of lagged inflation is interpreted as evidence of inflation persistence. A

positive and significant coefficient implies that past inflation contributes to current inflation, while stronger coefficients at higher quantiles indicate that inflation persistence is more severe during high inflation regimes. Similarly, a positive and significant coefficient of exchange rate depreciation implies that naira depreciation increases inflation, while a positive coefficient of oil price volatility indicates that oil price instability contributes to inflationary pressure.

Finally, post-estimation diagnostic tests are conducted to evaluate the reliability of the model. These include tests for serial correlation, heteroskedasticity, normality of residuals and parameter stability. The overall methodological approach therefore provides a robust framework for examining whether oil price volatility and exchange rate depreciation influence inflation persistence differently across low, moderate and high inflation regimes in Nigeria.

3. Results and Discussion

3.1 Data Presentation

The descriptive statistics in Table 1 provide useful preliminary evidence on the behaviour of the variables. According to the table, the inflation rate recorded a mean value of 17.738, a median of 16.050, a minimum of 8.400, and a maximum of 34.800. This indicates that Nigeria experienced both relatively moderate and very high inflation episodes over the study period. The standard deviation of 6.937 shows that inflation varied considerably around its average value, suggesting that the inflation process was not stable throughout the period. The positive skewness value of 0.9250 indicates that inflation was moderately right-skewed, meaning that higher inflation episodes were more pronounced than those of very low inflation. The kurtosis value of 3.0219 is close to the normal benchmark of 3, suggesting that inflation is moderately peaked but not extremely abnormal in distribution. This supports the relevance of examining inflation across different quantiles, since the distribution contains both lower and upper inflation regimes.

Table 1:
Summary Statistics of the Variables

	INF	EX	EXD	COP	OPV
Mean	17.738	696.068	1.928	67.725	8.945
Median	16.050	411.280	0.070	66.740	6.784
Maximum	34.800	1674.640	54.929	130.100	81.590
Minimum	8.400	181.780	-35.456	14.280	0.078
Std. Dev.	6.937	544.756	8.568	19.766	11.125
Skewness	0.9250	0.7792	2.8721	0.3404	4.0771
Kurtosis	3.0219	1.7820	20.1953	3.5729	23.3053
Observations	133	133	133	133	133

Note: INF=Inflation Rate, EX=Exchange Rate ₦/USD, EXD=Exchange Rate Depreciation, COP=Crude Oil Prices, OPV=Oil Prices Volatility

Also, according to Table 1 the exchange rate statistics show substantial depreciation of the naira over the period. The mean exchange rate was ₦696.068 per US dollar, while the median was ₦411.280 per US dollar. The large difference between the mean and median indicates that the exchange rate increased sharply in the later part of the sample, pulling the average upward. The minimum exchange rate was ₦181.780 per US dollar, while the maximum was ₦1,674.640 per US dollar, revealing a major depreciation of the naira over time. The standard deviation of 544.756 confirms strong exchange rate instability. The skewness value of 0.7792 shows that the exchange

rate distribution is positively skewed, while the kurtosis value of 1.7820 suggests a flatter distribution relative to the normal distribution. These results indicate that the naira experienced large upward shifts, especially during periods of foreign exchange market pressure and exchange rate reforms. Similarly, the exchange rate depreciation, measured as EXD, also shows evidence of instability (see Table 1). The mean depreciation rate was 1.928%, while the median was only 0.070%, suggesting that most monthly exchange rate changes were relatively small, but a few extreme depreciation episodes raised the average. The maximum depreciation rate was 54.929%, while the minimum was -35.456%, indicating that the exchange rate experienced both sharp depreciation and appreciation episodes. The standard deviation of 8.568 confirms considerable volatility in monthly exchange rate changes. More importantly, EXD recorded a skewness value of 2.8721 and kurtosis of 20.1953, indicating that exchange rate depreciation is highly right-skewed and leptokurtic. This means that exchange rate changes were marked by occasional extreme movements rather than smooth adjustments. For Nigeria, this reflects the effects of foreign exchange market reforms, oil revenue shocks, reserve pressures and policy-induced exchange rate adjustments.

Figure 1:
Trend of Crude Oil Prices (COP) and Oil Price Volatility

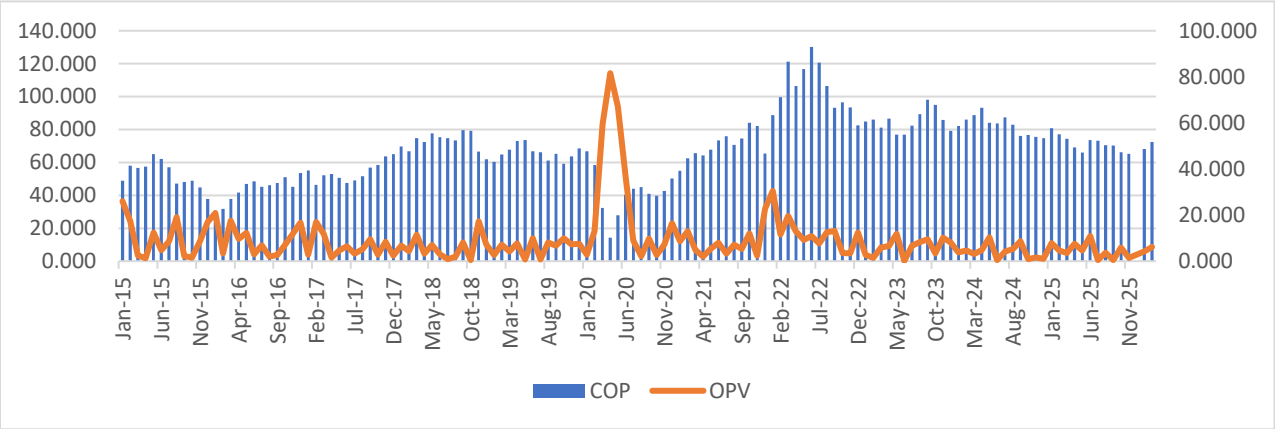


Figure 2:
Trend of Nigeria Inflation Rate

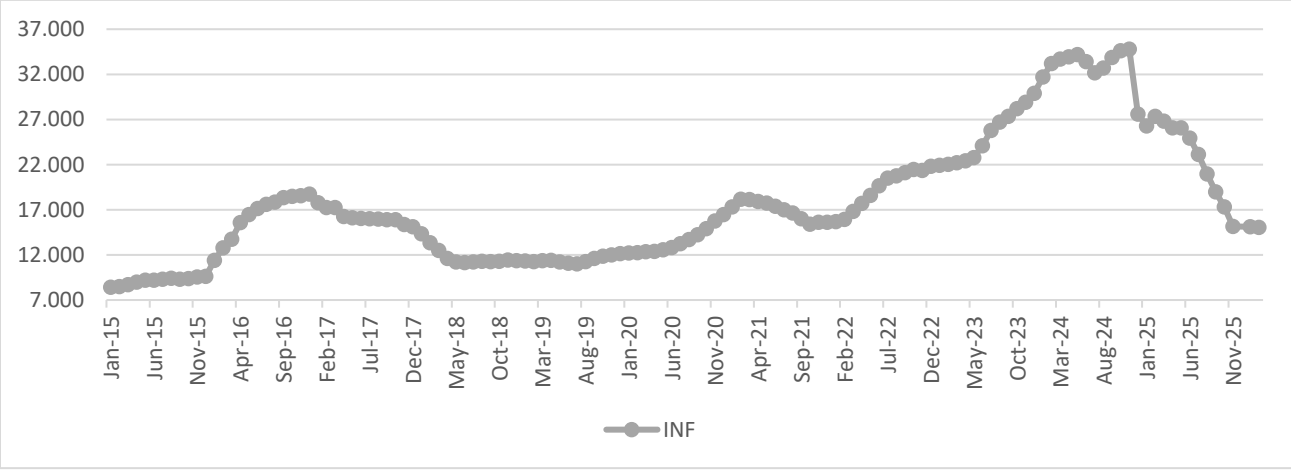
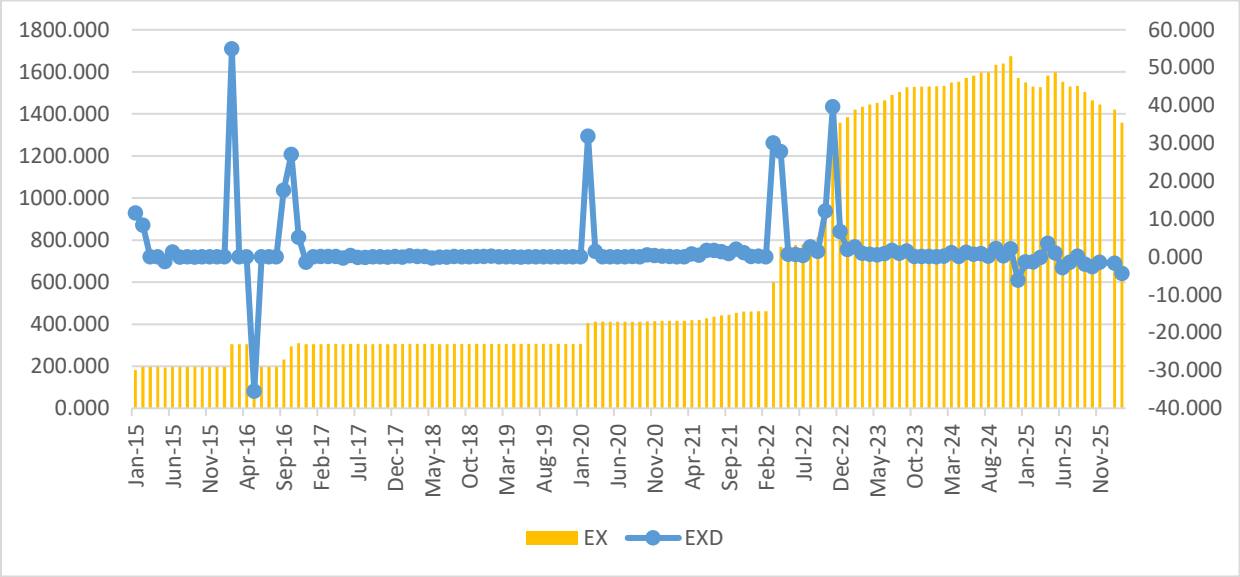


Figure 3:
Trend of Nigeria Exchange Rate (EX) and Its Depreciation (EXD)



In addition, the descriptive statistics for crude oil prices in Table 1 show that crude oil prices averaged US$67.725 per barrel, with a median of US$66.740 per barrel. The closeness of the mean and median indicates that crude oil prices were relatively centered around the average. However, the minimum crude oil price of US$14.280 and maximum of US$130.100 show that the period covered major global oil price shocks, including sharp collapses and strong recoveries. The standard deviation of 19.766 further confirms substantial variation in oil prices. The skewness value of 0.3404 indicates mild positive skewness, while the kurtosis value of 3.5729 suggests that crude oil prices were slightly more peaked than the normal distribution. This confirms that oil price movements were important during the study period and could transmit into Nigeria's economy through revenue, exchange rate and energy cost channels. In the same vein, Table 1 presents the Oil price volatility, represented by OPV. The mean value of OPV was 8.945, while the median was 6.784, indicating that crude oil prices experienced noticeable monthly fluctuations. The minimum OPV value was 0.078, while the maximum was 81.590, showing that there were extreme oil price volatility episodes during the period. The standard deviation of 11.125 confirms strong dispersion in oil price volatility. The skewness value of 4.0771 and kurtosis value of 23.3053 show that oil price volatility is highly right-skewed and strongly leptokurtic. This means that oil price volatility was dominated by occasional sharp spikes. Since Nigeria is highly dependent on crude oil export earnings, such volatility is important because it can influence foreign exchange inflows, government revenue, external reserves and ultimately inflationary pressures.

The graphical trends reported in Figures 1 to 3 reinforce the descriptive statistics. Figure 1, which presents crude oil prices and oil price volatility, suggests that oil price movements were not stable over the study period, with volatility spikes corresponding to periods of major price swings. Figure 2 shows that inflation followed a rising and persistent pattern, especially in the later part of the sample, confirming that inflation became more severe over time. Figure 3 shows that the exchange rate increased sharply, especially after major foreign exchange adjustments, while exchange rate depreciation displayed irregular spikes. Thus, the graphical evidence suggests that Nigeria's inflation experience occurred alongside oil price instability and substantial naira depreciation.

3.2 Preliminary Assessment

The ADF unit root test results in Table 2 show that the variables have mixed orders of integration. Inflation rate is integrated of order one, I(1), with a p-value of 0.0041, while exchange rate depreciation and oil price volatility are stationary at level, I(0), with p-values of 0.0100 and 0.0220, respectively. This result is important because ARDL and QARDL models are appropriate when variables are I(0), I(1), or a mixture of both, provided none of the variables is integrated of order two, I(2). Therefore, the unit root results validate the use of the QARDL framework for this study. The fact that inflation is I(1) implies that inflation is persistent and requires differencing to become stationary. This is consistent with the nature of inflation in Nigeria, where current inflation often depends on previous inflationary pressures, expectations, exchange rate movements, energy prices and structural bottlenecks. On the other hand, the stationarity of EXD and OPV at level implies that monthly exchange rate depreciation and oil price volatility fluctuate around a stable mean, even though they may display occasional extreme spikes. This supports the idea that inflation is the more persistent series, while exchange rate depreciation and oil price volatility behave more like shock variables.

Table 2:
Unit Root Test (ADF)

Variables	$\hat{k}$	Integration Order (*I*)	P-Value
INF	2	1	0.0041
EXD	5	0	0.0100
OPV	5	0	0.0220

Note: *$\hat{k}$ is the AIC lag term is used to select the optimal lag, to make the residuals white noise*

Table 3:
Lag Order Selection Criteria

INF	EXD	OPV	Criteria
4	0	0	AIC
2	0	0	BIC
4	0	0	HQC

Note: AIC: Akaike information criterion, BIC: Schwarz information criterion, HQC: Hannan-Quinn information criterion

The lag selection results in Table 3 show that the Akaike Information Criterion (AIC) and Hannan-Quinn Criterion (HQC) selected four lags of inflation, while the Schwarz Bayesian Criterion (BIC) selected two lags of inflation. For exchange rate depreciation and oil price volatility, the selected lag length was zero across the criteria. In this study, the AIC lag selection was adopted because it provides a more flexible lag structure and is often preferred in dynamic time series modelling where the objective is to adequately capture short-run adjustments and avoid omitting relevant lagged effects. Therefore, the final QARDL specification was based on four lags of inflation and zero lags for exchange rate depreciation and oil price volatility, that is, QARDL (4,0,0). This specification indicates that inflation in Nigeria has a strong autoregressive structure, meaning that current inflation is strongly influenced by its previous values. This is directly related to inflation persistence because it shows that inflationary pressure does not disappear immediately but is transmitted from one month to another.

The adoption of the AIC-selected lag structure further implies that the model gives priority to capturing the dynamic behaviour of inflation over time. Since inflation was assigned four lags, the result suggests that inflation persistence in Nigeria operates beyond the immediate past month and may extend over several months. This is consistent with the nature of inflation in Nigeria, where price increases are often reinforced by expectations, exchange rate pressures, fuel price adjustments, transport costs and repeated cost pass-through. The zero lag selection for exchange rate depreciation and oil price volatility means that their effects are captured contemporaneously in the model rather than through delayed lagged terms. However, this should not be interpreted to mean that exchange rate depreciation and oil price volatility are unimportant. Rather, within the adopted AIC-based QARDL (4,0,0) specification, their strongest statistical representation is their immediate effect, while any delayed effect may be indirectly absorbed through past inflation. Therefore, the AIC-based lag structure supports the central focus of the study by emphasizing the role of inflation persistence while still allowing exchange rate depreciation and oil price volatility to enter the model as contemporaneous external-sector shock variables.

3.3 Assessment of Oil Price Volatility, Exchange Rate Depreciation and Inflation Persistence

The QARDL results in Table 4 provide evidence on how inflation persistence, exchange rate depreciation and oil price volatility behave across inflation quantiles. The selected quantiles are 0.25, 0.50, 0.75 and 0.90, representing low, moderate, high and extreme inflation regimes respectively. The key advantage of this approach is that it allows the effect of each variable to vary across inflation regimes instead of assuming a single average effect. The first major finding is that inflation persistence is strong across all quantiles. The coefficient of the first lag of inflation, INF_L1, is positive and statistically significant at the 5% level in all inflation regimes. At the 0.25 quantile, the coefficient is 1.7277 with a p-value of 3.55E-15. At the 0.50 quantile, the coefficient increases to 1.7841 with a p-value of 1.48E-13. At the 0.75 quantile, the coefficient remains positive and significant at 1.4250, with a p-value of 2.85E-08. At the 0.90 quantile, the coefficient is 1.3716, with a p-value of 1.26E-10. This clearly indicates that past inflation strongly influences current inflation across low, moderate, high and extreme inflation conditions. This finding means that inflation in Nigeria is highly inertial. In other words, once inflation rises, it tends to continue into subsequent months rather than quickly returning to its previous level. This may be explained by inflation expectations, price mark-ups, wage adjustments, import-cost pass-through, transport cost increases and structural rigidities in the economy. The strong positive coefficient of INF_L1 across all quantiles suggests that inflation control in Nigeria requires more than temporary policy responses. Once inflationary pressure becomes established, it tends to reproduce itself through market expectations and repeated price adjustments.

According to Table 4, the second lag of inflation, INF_L2, is negative and statistically significant at the 0.25 and 0.50 quantiles. At the 0.25 quantile, INF_L2 has a coefficient of -0.7739 and p-value of 0.036, while at the 0.50 quantile, the coefficient is -0.940520 with a p-value of 0.010. This suggests that after the strong positive influence of the immediate previous month's inflation, there is some corrective adjustment from the second lag during low and moderate inflation regimes. In practical terms, inflation may initially carry forward strongly, but some short-run correction occurs after two months when inflation is not yet extremely high. However, at the 0.75 and 0.90 quantiles, INF_L2 becomes statistically insignificant. This suggests that the corrective adjustment observed in low and moderate inflation regimes weakens under high and extreme inflation conditions. This is an important result because it implies that inflation becomes less self-

correcting when it is already high. Therefore, high inflation regimes in Nigeria may be more difficult to reverse because the natural adjustment mechanism becomes weaker.

Table 4:
QARDL Model Estimation

Quantile	Variable	Value	Std. Error	t value	Pr(>|t|)
0.25	(Intercept)	0.232797	0.146714	1.586738	0.115182
0.25	INF_L1	1.727696	0.191804	9.007606	3.55E-15*
0.25	INF_L2	-0.77395	0.365671	-2.11653	0.036348*
0.25	INF_L3	0.143023	0.297431	0.480863	0.631482
0.25	INF_L4	-0.12323	0.135318	-0.91066	0.364283
0.25	EXD_L0	0.001898	0.007009	0.270802	0.787005
0.25	OPV_L0	0.001794	0.003097	0.579314	0.563454
0.5	(Intercept)	0.069203	0.123377	0.560909	0.575897
0.5	INF_L1	1.784057	0.214261	8.326565	1.48E-13*
0.5	INF_L2	-0.94052	0.360219	-2.61096	0.010171*
0.5	INF_L3	0.367678	0.228555	1.608704	0.110287
0.5	INF_L4	-0.2153	0.089001	-2.41907	0.017049*
0.5	EXD_L0	-0.00096	0.008396	-0.11413	0.909323
0.5	OPV_L0	0.001394	0.002805	0.497123	0.620004
0.75	(Intercept)	-0.14684	0.17875	-0.8215	0.412975
0.75	INF_L1	1.424981	0.240034	5.936581	2.85E-08*
0.75	INF_L2	-0.53388	0.386551	-1.38115	0.169779
0.75	INF_L3	0.382017	0.229966	1.661191	0.099264
0.75	INF_L4	-0.24498	0.102774	-2.38372	0.018694*
0.75	EXD_L0	0.008842	0.008011	1.103815	0.271864
0.75	OPV_L0	-0.00058	0.005753	-0.10135	0.91944
0.9	(Intercept)	-0.0811	0.262679	-0.30873	0.758055
0.9	INF_L1	1.371554	0.194824	7.039952	1.26E-10*
0.9	INF_L2	-0.42306	0.305455	-1.38503	0.168593
0.9	INF_L3	0.352877	0.281037	1.255623	0.211672
0.9	INF_L4	-0.26557	0.190853	-1.3915	0.166626
0.9	EXD_L0	0.011084	0.009097	1.218371	0.225453
0.9	OPV_L0	0.001022	0.01779	0.057454	0.954278

Note: * denotes significant at 5% (i.e. t-stat>1.95)

Also, Table 4 reveals that the fourth lag of inflation, INF_L4, is negative and statistically significant at the 0.50 and 0.75 quantiles. At the 0.50 quantile, the coefficient is -0.2153 with a p-value of 0.0170, while at the 0.75 quantile, the coefficient is -0.2449 with a p-value of 0.0187. This indicates that some delayed correction exists in the inflation process, particularly under moderate and high inflation regimes. However, because the first lag of inflation remains strongly positive and significant across all quantiles, the dominant feature of inflation in Nigeria remains persistence. According to Table 4, exchange rate depreciation has a weak and statistically insignificant effect across all quantiles. At the 0.25 quantile, EXD_L0 has a coefficient of 0.0019 with a p-value of 0.7870. At the 0.50 quantile, the coefficient is -0.0009 with a p-value of 0.9093. At the 0.75 quantile, the coefficient becomes positive at 0.0089, with a p-value of 0.27196, while at the 0.90 quantile, the coefficient increases to 0.0111, with a p-value of 0.2255. Although these coefficients are not statistically significant, the positive increase at the upper quantiles suggests that exchange rate depreciation may become more inflationary when inflation is already high. The insignificance of exchange rate depreciation should be interpreted carefully. It does not necessarily imply that exchange rate depreciation has no relevance for inflation in Nigeria. Rather, it may

indicate that in the current model, the immediate effect of depreciation is not statistically strong after accounting for lagged inflation. This may be because the effect of exchange rate depreciation is transmitted indirectly through imported goods, fuel prices, transport costs, food prices and inflation expectations. Since the model is parsimonious and includes only inflation, exchange rate depreciation and oil price volatility, some transmission channels may not be explicitly captured. It is also possible that past inflation already embodies earlier exchange rate effects, thereby reducing the direct statistical significance of EXD in the QARDL model.

Similarly, oil price volatility has no statistically significant direct effect across the quantiles (see Table 4). At the 0.25 quantile, OPV_L0 has a coefficient of 0.0018 with a p-value of 0.5635. At the 0.50 quantile, the coefficient is 0.0014 with a p-value of 0.6200. At the 0.75 quantile, the coefficient becomes slightly negative at -0.0006, with a p-value of 0.9194, while at the 0.90 quantile, the coefficient is 0.0010, with a p-value of 0.9543. These results suggest that oil price volatility does not exert a direct contemporaneous effect on inflation in the estimated QARDL model. This finding may be explained by the indirect nature of oil price transmission in Nigeria. Oil price volatility may affect inflation through foreign exchange earnings, government revenue, exchange rate stability, fuel prices, fiscal policy and import capacity. Therefore, the relationship between oil price volatility and inflation may not be immediate or direct. In addition, the use of absolute oil returns captures the magnitude of oil price movements but not the direction of oil price shocks. Since oil price increases and decreases may affect Nigeria differently, the insignificant OPV coefficient may also reflect the fact that positive and negative oil price movements have different macroeconomic effects that are combined in the absolute volatility measure.

Table 5:
QARDL Long Run Results

Quantile	Long_Run_EXD	Long_Run_OPV	Inflation_Persistence
0.25	0.071722245	0.067800517	0.973536514
0.5	-0.234877346	0.341750549	0.995920287
0.75	-0.314329515	0.02072689	1.028130724
0.9	-0.309651656	-0.028554345	1.035795489

Table 5 presents the long-run QARDL results. The most important finding is that inflation persistence increases across quantiles. Inflation persistence is 0.9735 at the 0.25 quantile, 0.9959 at the 0.50 quantile, 1.02813 at the 0.75 quantile and 1.0358 at the 0.90 quantile. This shows that inflation persistence becomes stronger as inflation moves from low to high regimes. At the lower quantile, persistence is below unity, suggesting that inflation is persistent but still mean-reverting. At the upper quantiles, persistence exceeds unity, suggesting that high inflation may become self-reinforcing and more difficult to reverse. This result is central to the study. It confirms that inflation persistence in Nigeria is regime-dependent. When inflation is low or moderate, it still carries forward, but the process is less explosive. However, when inflation enters high or extreme regimes, persistence becomes stronger than unity, indicating that inflation shocks may become entrenched. This means that high inflation in Nigeria is not merely a temporary price movement but a condition that can sustain itself through expectations, cost adjustments and repeated market responses.

The long-run coefficient of exchange rate depreciation is 0.0717 at the 0.25 quantile, -0.2349 at the 0.50 quantile, -0.3143 at the 0.75 quantile and -0.3097 at the 0.90 quantile. The positive

coefficient at the lower quantile suggests that exchange rate depreciation may contribute to inflation under low inflation conditions. However, the negative coefficients at the median and upper quantiles require caution. Since the short-run EXD coefficients are statistically insignificant across all quantiles, the long-run exchange rate results should not be interpreted as strong evidence that depreciation reduces inflation. Rather, they may reflect model dynamics, dominance of inflation persistence, omitted transmission channels or policy reactions that occur during high inflation periods. In addition, the long-run oil price volatility coefficient is 0.0678 at the 0.25 quantile, 0.3418 at the 0.50 quantile, 0.0207 at the 0.75 quantile and -0.0286 at the 0.90 quantile. This suggests that oil price volatility has a positive long-run association with inflation at the lower, median and high quantiles, but a negative association at the extreme quantile. The strongest positive long-run OPV effect occurs at the 0.50 quantile, suggesting that oil price volatility may matter more under moderate inflation conditions. However, since the contemporaneous OPV coefficients are statistically insignificant, this result should be treated as indicative rather than conclusive.

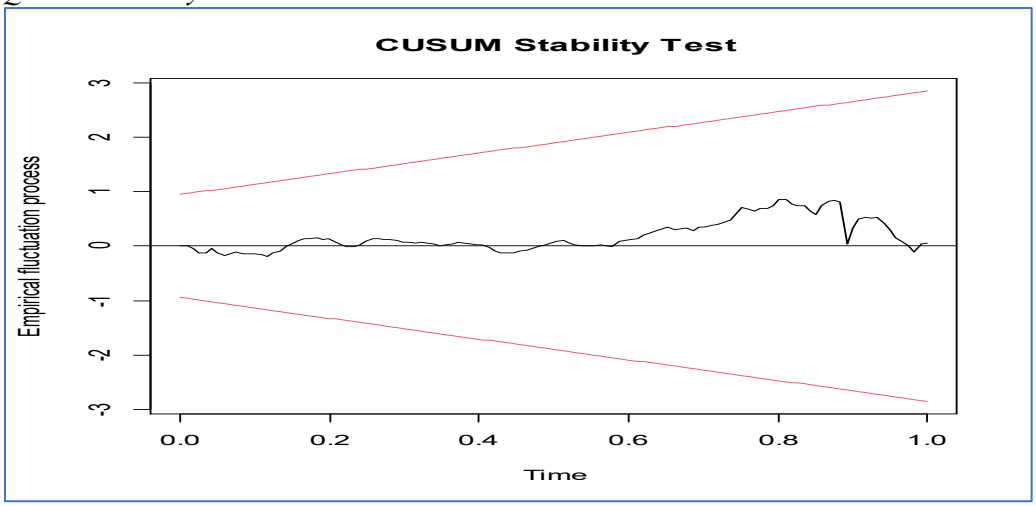
The overall implication of the QARDL estimates is that inflation persistence is the most dominant and statistically robust feature of inflation dynamics in Nigeria. Exchange rate depreciation and oil price volatility are economically relevant, but their direct effects are not statistically significant in the estimated model. This suggests that the inflation process is largely driven by its own past values, while oil price and exchange rate shocks may influence inflation through indirect channels. Therefore, the study provides evidence that inflation in Nigeria is not only shock-driven but also inertia-driven

Table 6:
QARDL Residuals Diagnostic Tests

Test	Stat (df)	P=value
Breusch-Godfrey	0.038 (1)	0.8464
Breusch-Pagan	10.741 (6)	0.097

Note: * denotes significant at 5%

Figure 4:
QARDL Stability Test: CUSUM



Note: CUSUM Test: S = 0.32804, p-value = 0.944 with **RESET Test:** 6.8011 p-value = 0.002

The post-estimation diagnostic results provide evidence on the adequacy and stability of the estimated QARDL model. The Breusch-Godfrey serial correlation test yielded a statistic of 0.038 with a p-value of 0.8464, indicating that the null hypothesis of no serial correlation cannot be rejected at the 5% level (see Table 6). This suggests that the model residuals are free from serial dependence and that the adopted lag structure sufficiently captures the dynamic interactions among inflation, exchange rate depreciation and oil price volatility. Similarly, the Breusch-Pagan heteroskedasticity test produced a statistic of 10.741 with a p-value of 0.097, implying that there is no evidence of heteroskedasticity at the conventional 5% significance level and that the residual variance is relatively stable (see Table 6). Furthermore, the CUSUM stability test reported a statistic of S = 0.32804 with a p-value of 0.944, confirming that the null hypothesis of parameter stability cannot be rejected (see Figure 4). This indicates that the estimated QARDL parameters remained stable over the sample period, despite major macroeconomic episodes such as oil price shocks, exchange rate reforms, naira depreciation and persistent inflationary pressures. Overall, the diagnostic and stability outcomes support the reliability of the estimated model and strengthen the validity of the finding that inflation persistence is a dominant feature of Nigeria's inflation dynamics. Nevertheless, the significant RESET statistic suggests possible functional-form limitations, implying that future model extensions may incorporate additional control variables or nonlinear specifications to capture broader transmission channels in Nigeria's inflation process.

Figure 5:
QARDL Coefficients Across Quantiles

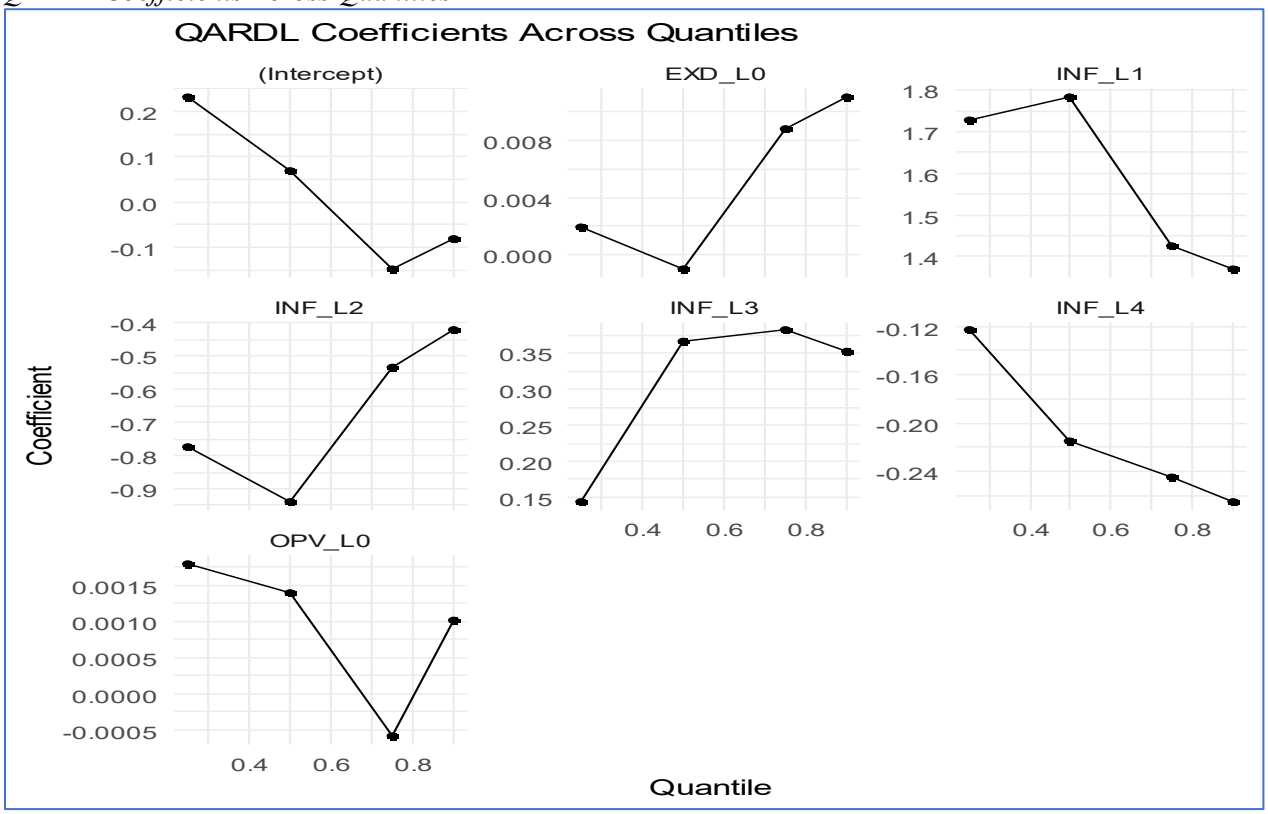


Figure 5 presents the variation in QARDL coefficients across the selected quantiles, thereby illustrating whether the effects of inflation persistence, exchange rate depreciation and oil price

volatility differ across low, moderate, high and extreme inflation regimes. The coefficient profile indicates that inflation persistence remains the most dominant feature of Nigeria's inflation dynamics across the distribution. Although the coefficient of the first lag of inflation declines from the median to the upper quantiles, it remains positive and statistically significant across all regimes. This suggests that inflation persistence is not confined to a specific inflation condition but represents a structural characteristic of the Nigerian inflation process. In other words, past inflation continues to exert a strong influence on current inflation irrespective of whether the economy is experiencing low, moderate or high inflation. The coefficient trajectory for exchange rate depreciation shows a gradual increase at the upper quantiles, although the estimates are not statistically significant. This pattern provides suggestive evidence that exchange rate depreciation may exert stronger inflationary pressure during high-inflation episodes. Economically, this implies that when inflation is already elevated, depreciation of the naira may reinforce inflation expectations, increase import and replacement costs, and accelerate price adjustments by firms.

In contrast, the coefficient pattern for oil price volatility is weak and inconsistent across quantiles. The estimates are positive at the lower and median quantiles, negative at the 0.75 quantile, and positive again at the 0.90 quantile. This unstable pattern suggests that the direct contemporaneous effect of oil price volatility on inflation is not uniform across regimes. The result may reflect the indirect and complex nature of oil price transmission in Nigeria, where oil price movements influence inflation through exchange rate pressure, fiscal revenue, foreign reserves, fuel prices and production costs rather than through a simple direct channel. It may also reflect Nigeria's dual position as a crude oil-exporting economy and an importer of refined petroleum products, which makes the inflationary consequences of oil price movements less straightforward.

4. Discussion of Findings

The findings indicate that Nigeria's inflation dynamics are predominantly inertia-driven and regime-dependent. The QARDL estimates show that the first lag of inflation is positive and statistically significant across all selected quantiles, confirming that past inflation strongly influences current inflation in low, moderate, high and extreme inflation regimes. More importantly, the long-run persistence coefficient increases from 0.9735 at the 0.25 quantile to 1.0358 at the 0.90 quantile, implying that inflation becomes more entrenched as the economy moves into higher inflation regimes. This finding is consistent with the view that inflation in Nigeria is sustained by adaptive expectations, repeated cost mark-ups, exchange rate uncertainty, fuel-price adjustments and structural rigidities. It also supports recent studies which argue that inflation in Nigeria is not merely a short-run response to shocks but a persistent macroeconomic process influenced by exchange rate movements, energy prices and policy-related pressures (Ikue et al., 2024; World Bank, 2025). The unique contribution of this study, however, is that it shows that inflation persistence is not constant across the distribution; rather, it strengthens at higher inflation quantiles, suggesting that high inflation regimes are less self-correcting and more difficult to reverse.

The results further show that exchange rate depreciation has no statistically significant direct contemporaneous effect on inflation across the selected quantiles, although its coefficient becomes more positive at the upper quantiles. This suggests that exchange rate depreciation may exert

stronger inflationary tendencies when inflation is already high, but its immediate effect is weakened once inflation persistence is incorporated into the model. This partly differs from studies that find stronger exchange rate pass-through to inflation in Nigeria. For example, Ikue et al. (2024) found evidence of asymmetric exchange rate pass-through to headline and food inflation using ARDL and NARDL models, while recent pass-through evidence also suggests that exchange rate depreciation affects inflation through import prices and persistent currency movements (World Journal of Advanced Research and Reviews, 2024). The present study refines these findings by showing that exchange rate depreciation may not operate mainly as a direct contemporaneous driver in a parsimonious QARDL framework; instead, its influence may be embedded in past inflation or transmitted indirectly through import costs, fuel prices, food prices and inflation expectations.

Oil price volatility also exhibits weak and statistically insignificant direct effects across inflation quantiles. This contrasts with Bawa (2020), who found that positive oil price shocks increase headline, core and food inflation in Nigeria using a NARDL framework, and with recent evidence showing that oil price shocks influence Nigerian inflation through exchange rate volatility, fiscal balance and monetary policy channels (AESS Publications, 2026). The difference may be due to the present study's use of absolute oil price returns as a volatility measure, which captures the size of oil price movements but not whether the shock is positive or negative. Since Nigeria is both a crude oil-exporting economy and an importer of refined petroleum products, positive and negative oil price movements may have different inflationary effects. Thus, the study's unique finding is that oil price volatility, when measured as absolute returns and modelled jointly with inflation persistence, does not exert a stable direct effect; rather, its inflationary relevance is likely indirect and channel-dependent.

Overall, the study establishes that the most robust feature of Nigeria's inflation process is persistence, not the immediate direct effect of exchange rate depreciation or oil price volatility. This advances existing literature by moving beyond average-effect models such as ARDL, NARDL and VAR to show how inflation behaviour differs across quantiles. While previous studies largely emphasize exchange rate pass-through and oil price shock transmission, this study demonstrates that once inflation enters a high regime, its own past values become the dominant mechanism sustaining price increases. The diagnostic results further support the reliability of the findings, as the model shows no evidence of serial correlation, no heteroskedasticity at the 5% level, and stable parameters based on the CUSUM test, although the RESET result suggests that future studies may include additional variables such as fuel prices, money supply, interest rate, food prices and fiscal deficit. Therefore, the study contributes to the inflation literature by establishing that Nigeria's inflation is not only externally vulnerable but also structurally persistent, implying that policy must focus on early intervention, credible inflation-expectation management and coordinated monetary, fiscal and exchange-rate stabilization measures.

5. Conclusion and Recommendations

5.1 Conclusion

The study concludes that inflation in Nigeria is highly persistent and regime-dependent, implying that current inflation is strongly influenced by its past values and that the strength of this persistence differs across inflation regimes. The QARDL results show that lagged inflation

significantly explains current inflation across low, moderate, high and extreme inflation quantiles, while the long-run persistence estimates reveal that inflation becomes stronger and more difficult to reverse at higher quantiles. This suggests that when inflation is relatively low or moderate, it may still respond to corrective policy measures; however, once it moves into a high-inflation regime, it becomes more self-reinforcing through expectations, repeated price adjustments, wage pressures, import-cost pass-through and production-cost increases. Thus, inflation in Nigeria is not merely a temporary response to external shocks but a structural and behavioural process that can sustain itself over time.

Although exchange rate depreciation and oil price volatility are theoretically and economically important to Nigeria's inflation process, their direct contemporaneous effects were statistically weak in the estimated QARDL model. This does not imply that exchange rate depreciation and oil price volatility are irrelevant; rather, it suggests that their inflationary effects may operate indirectly through other channels such as import prices, fuel costs, transport costs, production expenses, fiscal pressures, foreign exchange shortages and inflation expectations. In an import-dependent and oil-revenue-dependent economy such as Nigeria, exchange rate depreciation can raise the domestic cost of imported inputs and consumer goods, while oil price volatility can affect foreign exchange inflows, government revenue, fuel prices and external reserves. However, the findings indicate that once these shocks enter the inflationary process, their effects may become embedded in past inflation, making inflation persistence the dominant channel through which price instability is sustained.

The major policy implication is that inflation control in Nigeria requires early, coordinated and sustained policy intervention. Since inflation persistence becomes stronger under high-inflation regimes, delayed responses may allow temporary shocks from exchange rate depreciation, oil price volatility, fuel price adjustments or food supply disruptions to become entrenched in market expectations and pricing behaviour. Monetary policy tightening alone may therefore be insufficient, especially when inflation is driven by structural and cost-push factors. The Central Bank of Nigeria must strengthen inflation-expectation management through credible policy communication, consistent interest rate policy and improved foreign exchange market stability. At the same time, fiscal authorities must support monetary policy by reducing excessive deficit financing, improving public expenditure efficiency and maintaining fiscal discipline.

5.2 Recommendations

Based on the empirical findings, several important policy recommendations emerge:

First, the Central Bank of Nigeria should strengthen inflation-expectation management through credible, transparent and consistent monetary policy communication, since the results show that inflation is highly persistent once it begins to rise.

Second, exchange rate management should be improved by ensuring adequate foreign exchange liquidity, reducing speculative pressure and promoting non-oil export earnings, because exchange rate instability may indirectly worsen inflation through import and production costs.

Third, government should reduce the inflationary effect of oil price volatility by strengthening oil revenue stabilization mechanisms, improving domestic refining capacity and reducing dependence on imported refined petroleum products.

Fourth, fiscal authorities should maintain discipline in public spending and avoid excessive deficit financing, as fiscal pressure can reinforce inflation persistence.

Finally, structural policies should focus on improving domestic food production, transport infrastructure, energy supply and local manufacturing capacity, since reducing supply-side bottlenecks will weaken the channels through which external shocks translate into persistent inflation.

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