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Research article

Oil price shocks in Nigeria: implications on economic growth

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Abstract
Persistent fluctuations in oil prices remain a major source of macroeconomic instability in Nigeria. Against this backdrop, this study examines the impact of oil price volatility on economic growth in Nigeria using annual data from 1970 to 2022. Specifically, it evaluates how volatility in petrol, diesel, gas, and kerosene pump prices influences the growth rate of real gross domestic product (RGDP). The study relies on secondary data obtained from the World Bank database, the Central Bank of Nigeria (CBN) Statistical Bulletin, and volatility series generated using the GARCH framework. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests confirm a mixture of I(0) and I(1) variables, justifying the use of the Autoregressive Distributed Lag (ARDL) model. The results indicate that, in the long run, petrol and kerosene price volatilities have negative and statistically significant effects on RGDP, suggesting that instability in these key energy prices constrains economic growth. In contrast, diesel and gas price volatilities are not statistically significant, indicating no meaningful long-run impact on aggregate output. Evidence from the EGARCH model further reveals asymmetric volatility in petrol prices, where negative shocks exert stronger disruptive effects than positive shocks. The study concludes that volatility in petrol and kerosene prices poses significant risks to economic stability in Nigeria. It recommends the adoption of effective price stabilization measures, including strategic reserves, hedging mechanisms, and targeted subsidies, alongside broader structural reforms aimed at economic diversification and resilience to external shocks.

Keywords: Oil price volatility, GARCH framework, EGARCH model, Economic growth, ARDL

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INTRODUCTION

Oil price shocks or volatility refer to the degree of fluctuation in oil prices over a specific period. When oil prices undergo substantial changes within a short duration, the market is considered highly volatile, thereby affecting crucial macroeconomic variables such as investment, manufacturing, and overall economic growth (Chen et al., 2024). Since the discovery of oil in Oloibiri, Bayelsa State, in 1956, Nigeria's economy has become heavily reliant on oil, contributing significantly to the nation's GDP. According to figures released by the National Bureau of Statistics (NBS), the oil sector contributed 5.87% to Nigeria's real GDP in Q4 2020 and 7.32% in Q4 2019 (NBS, 2022). Despite its importance, the inherent volatility in oil prices introduces uncertainties that discourage investment and production, ultimately impacting Nigeria's economic stability and growth (CBN, 2022).

However, existing empirical studies have largely focused on crude oil prices rather than their volatility and have paid limited attention to the volatility of refined petroleum products such as petrol, diesel, gas, and kerosene which are directly consumed by end users and have more immediate implications for production costs and economic activities. Furthermore, prior studies have predominantly examined price levels or market values, with little emphasis on the rate of change (volatility) of these subcomponents. In addition, the empirical literature presents mixed and inconclusive findings regarding the relationship between oil price volatility and economic growth in Nigeria, thereby necessitating further investigation. More importantly, many of these studies rely on linear modeling techniques, which may be inadequate in capturing the asymmetric and volatility-clustering behaviour characteristic of oil price movements. Consequently, this study addresses these gaps by examining the impact of oil price volatility particularly across key petroleum subcomponents on economic growth in Nigeria, using advanced econometric techniques that account for both symmetric and asymmetric effects.

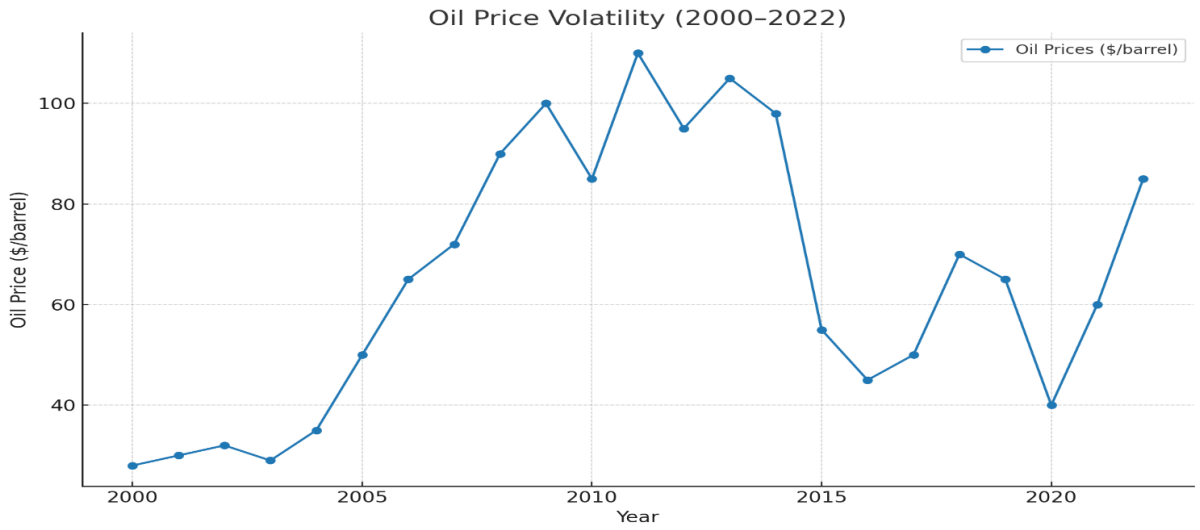


Figure 1. Oil price volatility between 2000 and 2022

Source: Author's computation based on data obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin (various years) and the World Bank World Development Indicators database.

Figure 1 illustrates the trend of oil price volatility between 2000 and 2022, highlighting the sharp fluctuations that have significantly shaped Nigeria's macroeconomic environment and dependence on oil revenues. Measuring oil price volatility involves assessing the deviation of oil prices from their equilibrium state, which can be captured using models like GARCH and statistical techniques for stationarization. Volatility is indicative of the frequent and significant price changes over time, as seen in the costs of petrol, diesel, gas, and kerosene, which directly affect both businesses and households. Rising oil prices increase the cost of production for firms and higher living expenses for households, subsequently reducing consumer purchasing power and business profitability. These effects ripple across key sectors such as manufacturing, agriculture, and transportation, indirectly hindering economic expansion by inflating the costs of goods and services (Eneji, et al., 2016).

Fluctuations in oil prices could have far-reaching implications for Nigeria's economy, which remains heavily reliant on oil revenues. Rising oil prices discourage the production of other goods by escalating production costs and limiting consumer demand. Additionally, the agricultural sector, once a cornerstone of Nigeria's economy, has struggled to meet the population's nutritional needs due to the rising costs of oil derivatives. Global factors such as the Russia-Ukraine conflict in 2022 further complicated the dynamics, driving up crude oil prices and fueling global inflation. Nigeria's crude oil, Bonny Light, saw minor fluctuations in August 2022, underscoring the vulnerability of oil-dependent economies to geopolitical and market forces (Roeben, 2024).

As shown in Figure 2, the relationship between oil price movements and Nigeria's GDP growth rate demonstrates how episodes of rising oil prices often coincide with economic slowdowns, underscoring the vulnerability of the economy to global oil shocks.



Figure 2. Relationship between oil prices and GDP growth in Nigeria (2000 – 2022)

Source: Author's computation based on data obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin (various years) and the World Bank World Development Indicators database.

The correlation between oil price volatility and Nigeria's economic expansion has been widely studied and discussed in academic and policy circles research and debate. While oil is a critical resource for global energy and economic systems, its volatile nature has contributed to economic and political instability in Nigeria. Historical events, such as the 2008 spike in oil prices to nearly $150 per barrel and the subsequent collapse in 2014, highlight the disruptive potential of oil price volatility. These fluctuations have not only impacted macroeconomic stability but also shaped Nigeria's fiscal and monetary policies, with revenues from oil exports comprising nearly 90% of the country's foreign exchange earnings and 80% of its annual government budget (Yasmeen et al., 2019).

Despite the critical role of oil revenues in Nigeria's economy, oil price volatility has constrained the country's fiscal capacity, leading to reduced government expenditures and heightened economic challenges. For instance, the 2016 economic recession, triggered by a sharp decline in global oil prices, resulted in a contraction of GDP growth, decreased government revenues, and elevated inflation and unemployment rates. The economy's heavy reliance on oil exports makes it highly susceptible to global oil price shocks, exposing its structural vulnerabilities and highlighting the urgent need for diversification (Ighosewe & Agbogun, 2021).

This study aims to investigate the following specific objectives:

i. Investigate the impact of volatility in petrol pump prices on Nigeria's real gross domestic product (RGDP).
ii. Analyze the impact of volatility in diesel pump prices on Nigeria's RGDP.
iii. Examine the impact of volatility in gas pump prices on Nigeria's RGDP.
iv. Determine the impact of volatility in kerosene pump prices on Nigeria's RGDP.

LITERATURE REVIEW

Petrol pump price fluctuations in Nigeria are strongly influenced by oil price volatility, given the country's heavy reliance on crude oil exports for revenue and foreign exchange earnings (CBN, 2022). As global oil prices rise, domestic petrol prices tend to increase, particularly following the removal of fuel subsidies, leading to higher transportation and production costs, which in turn contribute to inflationary pressures (IMF, 2023; World Bank, 2023). Conversely, declines in global oil prices often result in revenue shortfalls for Nigeria, thereby straining fiscal budgets and exerting pressure on the exchange rate. This situation weakens the naira and limits the pass-through of lower global oil prices to domestic consumers (Adeniyi, 2011).

These fluctuations could adversely affect economic growth by creating uncertainty for businesses and households, reducing disposable income, and complicating macroeconomic policy planning (Raifu et al., 2020). Furthermore, structural inefficiencies in Nigeria's downstream petroleum sector, coupled with its continued dependence on imported refined petroleum products, exacerbate the impact of oil price volatility on domestic fuel prices and the broader economy (World Bank, 2023). This underscores the urgent need for economic diversification and the development of a more resilient energy and production structure. This study extends the empirical literature by examining the volatility of key petroleum subcomponents and employing advanced econometric techniques capable of capturing both symmetric and asymmetric effects. Empirical evidence on the relationship between oil price volatility and economic growth presents mixed findings across countries and methodologies. For instance, Chien et al. (2026) examined

this relationship in Pakistan using annual time-series data from 1980 to 2018 within an ARDL framework. The study specified economic growth (proxied by sectoral output) as the dependent variable and oil price volatility as the key explanatory variable, alongside sector-specific indicators. Their findings revealed that oil price volatility exerts a predominantly negative effect on economic growth, particularly in manufacturing, electricity, and livestock sectors, although a positive impact was observed in the communication and transportation sectors.

In the Nigerian context, Yahaya (2025) employed a Vector Error Correction Model (VECM) using annual data from 1981 to 2023, with GDP as the dependent variable and oil price volatility as the core independent variable, alongside controls such as trade openness, government expenditure, population growth, and technological progress. The study found that oil price volatility has a negative and statistically significant long-run effect on economic growth, while institutional quality moderates this relationship. Similarly, Mgbomene et al. (2025), using quarterly data from 1990:Q1 to 2023:Q4 and a GARCH framework, identified strong volatility persistence and reported that oil price volatility negatively affects GDP, but positively influences government revenue, foreign reserves, and per capita income, with exchange rate and oil revenue playing significant roles.

Other studies provide complementary insights. Sule-Iko and Nwoye (2023), using the ARDL model for the period 1985–2020, found a strong positive short-run relationship between oil prices and real GDP, although the long-run effect of oil price volatility was not statistically significant. Abel et al. (2022) also reported that oil price fluctuations, pump prices, and exchange rates significantly influence economic performance in both the short and long run, while inflation and monetary policy exert long-term effects. Focusing on disaggregated petroleum products, Ighosewe and Agbogun (2021) employed an ARDL approach (1984–2018) and found that oil price volatility has a positive short-run impact on GDP, with kerosene price volatility exerting a significant long-run effect.

At the global level, studies such as Murshed et al. (2020) utilizing GARCH and growth-based frameworks suggest that oil price increases may stimulate income, investment, and GDP growth in oil-exporting economies. However, Mahmood and Zamil (2019) observed that oil price shocks may have limited effects on per capita consumption in oil-dependent economies due to the buffering role of non-oil sectors.

Stylized facts: petrol prices

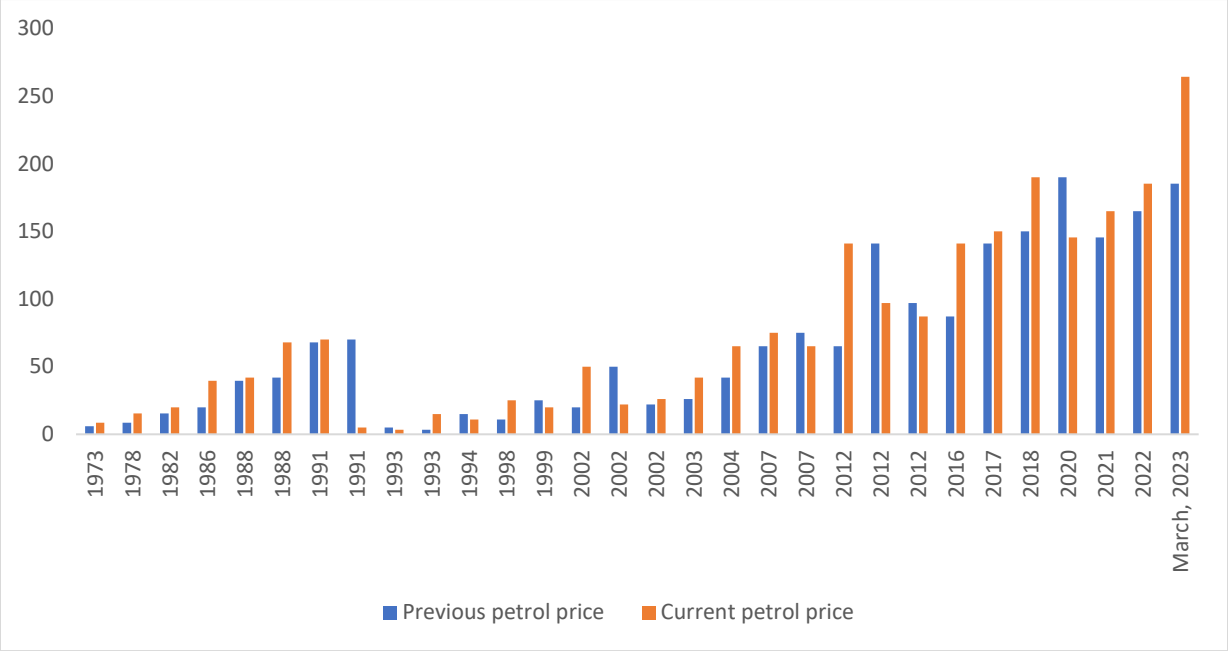


Figure 3. Petrol pump price fluctuations in Nigeria
Source: Author's computation, 2026

Petrol pump price fluctuations in Nigeria, as shown in Figure 3, reveal a consistent upward trend from 1973 to 2021. The chart highlights both previous and current petrol prices, with a gradual increase in the early years (1973–1990s). During this period, the changes in petrol prices were relatively modest, suggesting a more stable pricing regime possibly influenced by government subsidies or controlled market mechanisms. However, from the 2000s onwards, the price hikes became more pronounced, reflecting shifts in economic policies, global crude oil prices, and inflationary pressures. A particularly sharp rise is evident in the later years, especially between 2020 and 2021, where the current petrol price shows a significant jump compared to previous levels. This steep increase likely aligns with subsidy removal policies or economic adjustments driven by fiscal challenges. The widening gap between previous and current prices over time illustrates the growing cost burden on consumers, underscoring the economic implications of fuel pricing policies. These fluctuations highlight the interplay between domestic economic management and global energy market dynamics, which have profound impacts on Nigeria's economy and its citizens.

Theoretical Framework

The growth theory derived from the Cobb–Douglas production function, which is implanted within the Solow residual growth framework, is used as the theoretical foundation. An output Y is created by inputs of capital (K) and labour (L), as well as by the economy's level of overall factor productivity (A), which captures technology and efficiency. The standard Cobb-Douglas production function is expressed as:

$$Y = F(K^{\propto}L^{I-\propto}) \qquad (1)$$

Changes in output are therefore driven by variations in capital accumulation, labour input, or improvements in total factor productivity. In the neoclassical growth framework, economic expansion can occur through increased investment or productivity enhancements that sustain long-run growth (Robert Solow, 1956). Growth accounting decomposes output growth into contributions from capital, labour, and total factor productivity. When the level of technology improves, it enhances the productivity of labour, implying labour-augmenting technological progress:

$$Y = F(K, AL) = K^{\propto}(AL)^{I-\propto} \quad (2a)$$

Similarly, technology can augment capital, such that improvements in A raise the productivity of capital inputs:

$$Y = F(AK, L) = (AL)^{\propto}L^{I-\propto} \quad (2b)$$

These formulations are consistent with the extensions of the Cobb-Douglas production function (Charles Cobb & Paul Douglas, 1928). In this study, Y, K, and L are proxied by real gross domestic product (RGDP), gross capital formation (GCAF), and secondary school enrolment (SSE), respectively. Importantly, this framework provides a direct link to the role of oil price volatility in the Nigerian economy. Within the Solow growth structure, oil price volatility can be interpreted as a factor affecting total factor productivity (A) by creating uncertainty, distorting investment decisions, and increasing production costs (Romer, 1996). In an oil-dependent economy like Nigeria, fluctuations in refined petroleum product prices such as petrol and kerosene can disrupt energy supply, reduce efficiency, and lower the productivity of both capital and labour. This justifies the inclusion of petroleum price volatility variables (PVOL, DVOL, GVOL, KVOL) in the model, as they capture external shocks influencing how efficiently inputs are utilized. Thus, the framework supports examining how volatility in energy prices transmits through total factor productivity to affect economic growth.

Furthermore, the inclusion of exchange rate (EXR), gross capital formation (GCAF), and secondary school enrolment (SSE) as control variables aligns with the extended Solow model, which recognizes the roles of macroeconomic stability, capital accumulation, and human capital in growth dynamics (Barro & Sala-i-Martin, 2004). Exchange rate movements influence the cost of imported inputs and macroeconomic stability, while investment and human capital directly enhance productive capacity. This integration ensures that the model captures both traditional growth drivers and external volatility shocks relevant to Nigeria's economic structure.

RESEARCH METHOD AND MATERIALS

Derivation of Volatility

To determine the rate of change in the pump prices of petrol, diesel, gas, and kerosene, each variable was analyzed using the standard GARCH and EGARCH frameworks. This methodology was applied to capture volatility indicators, representing the impact of occasional variations in oil price volatility relative to a reference value such as the mean, a deterministic trend, or a time-varying variable. In essence, this approach allows for a more accurate representation of price movements by recognizing that volatility is not constant but evolves over time in response to past shocks.

The GARCH model is particularly useful in capturing volatility clustering, where periods of high price instability tend to be followed by further instability, and calm periods tend to persist.

This feature is important in the context of Nigeria's petroleum market, where fuel prices are often influenced by both domestic policy decisions and international oil market dynamics. By modeling the conditional variance as a function of past errors and past volatility, the GARCH framework provides a reliable measure of how uncertainty in fuel prices builds up and dissipates over time. In addition, the EGARCH model was employed to account for asymmetric effects in price volatility. This means that positive and negative shocks to fuel prices may not have the same impact on volatility. For example, sudden increases in pump prices or supply disruptions may generate stronger and more prolonged volatility compared to price decreases. Incorporating this asymmetry is crucial for understanding the real economic implications of fuel price changes in Nigeria.

Model Specification

In this particular model, the inclusion of the exchange rate is essential due to the Dutch disease hypothesis, which posits that increased oil earnings leads to currency appreciation, resulting in an increase in consumer goods imports. Ighosewe and Agbogun (2021) utilized the following econometric model, with some modifications, to explore the connection between the variables being investigated.

Specification of the functional denotation (Equation 3):

$$RGDP = F(PVOL, DVOL, GVOL, KVOL, EXR, GCAF, SSE) \quad (3)$$

where;

RGDP = growth rate of real gross domestic product
PVOL = petrol pump price volatility
DVOL = diesel Pump Price Volatility
GVOL = gas pump price volatility
KVOL = kerosene pump price volatility
EXR = exchange rate
GCAF = gross capital formation
SSE = secondary school enrollment

The Econometric form is specified in Equation 4.

$$RGDP_t = \beta_0 + \beta_1 PVOL_t + \beta_2 DVOL_t + \beta_3 GVOL_t + \beta_4 KVOL_t + \beta_5 EXR_t + \beta_6 GCAF_t + \beta_7 SSE_t + \mu_t \quad (4)$$

The expanded econometric model is as expressed in Equation 5.

$$\Delta RGDP_t = \alpha_{01} + b_{11} RGDP_{t-1} + b_{21} PVOL_{t-1} + b_{31} DVOL_{t-1} + b_{41} GVOL_{t-1} + b_{51} KVOL_{t-1} + b_{61} EXR_{t-1} + b_{71} GCAF_{t-1} + b_{81} SSE_{t-1} + \sum_{i=1}^{p} \alpha_{1i} \Delta RGDP_{t-1} + \sum_{i=1}^{q} \alpha_{2i} \Delta PVOL_{t-1} + \sum_{i=1}^{q} \alpha_{3i} \Delta DVOL_{t-1} + \sum_{i=1}^{q} \alpha_{4i} \Delta GVOL_{t-1} + \sum_{i=1}^{q} \alpha_{5i} \Delta KVOL_{t-1} + \sum_{i=1}^{q} \alpha_{6i} \Delta EXR_{t-1} + \sum_{i=1}^{q} \alpha_{7i} \Delta GCAF_{t-1} + \sum_{i=1}^{q} \alpha_{8i} \Delta SSE_{t-1} + \mu_{1t} \quad (5)$$

where,

All variables retain their previously defined meanings.
β_0 = intercept of the independent variable
β_1 *to* β_7 are the coefficients of the independent variables
t = trend factor
μ = error term

Amongst these variables, RGDP is specified as the dependent variable, with PVOL, DVOL, GVOL, and KVOL as the core explanatory variables, while EXR, GCAF, and SSE are included as control variables. The control variables are included to account for key macroeconomic and structural factors that influence economic growth and to avoid omitted variable bias. Specifically, exchange rate (EXR) captures external sector dynamics and price transmission effects in Nigeria's import-dependent economy; gross capital formation (GCAF) reflects the role of investment in driving output growth; and secondary school enrolment (SSE) was used as a proxy for human capital development. Their inclusion helps isolate the true impact of petroleum price volatility on RGDP and improves the robustness of the model.

Sources of Data

The source of data used in this study are Central bank of Nigeria statistical bulletin, National Bureau of Statistics (various years), World Bank World Development Indicators, and data generated from the standard GARCH framework.

RESULT PRESENTATION AND DISCUSSION

Unit Root Test and ARDL Model Results

Table 1. Augmented Dickey Fuller (ADF) Unit Root Test Results

Variables	ADF Statistics	Test Critical Values (5%)	Order of Integration	Conclusion
RGDP	-5.808358	-2.918778	I(0)	Stationary
PVOL	-4.370311	-2.919952	I(0)	Stationary
DVOL	-5.428386	-2.919952	I(0)	Stationary
GVOL	-7.646961	-2.919952	I(0)	Stationary
KVOL	-6.033448	-2.919952	I(0)	Stationary
EXR	-6.011133	-2.919952	I(1)	Stationary
GCAF	-6.992294	-2.919952	I(1)	Stationary
SSE	-12.07638	-2.919952	I(1)	Stationary

Source: Author's computation, 2026

Table 2. Phillips–Perron (PP) Unit Root Test Results

Variable	Level PP Stat	Prob.	1st Diff PP Stat	Prob.	Decision (5% level)	Order of Integration
RGDP	-5.820046	0.0000	—	—	Stationary at level	I(0)
PVOL	1.973215	0.9998	-7.299633	0.0000	Stationary at 1st diff	I(1)
DVOL	0.668498	0.9903	-5.426687	0.0000	Stationary at 1st diff	I(1)
GVOL	5.613177	1.0000	-6.316091	0.0000	Stationary at 1st diff	I(1)
KVOL	24.31673	1.0000	-4.061002	0.0126	Stationary at 1st diff	I(1)
EXR	-0.971320	0.9391	-6.600679	0.0000	Stationary at 1st diff	I(1)
GCAF	-2.423757	0.3635	-7.347526	0.0000	Stationary at 1st diff	I(1)
SSE	-3.104620	0.0323	—	—	Stationary at level	I(0)

Source: Author's computation, 2026

The results of the unit root test, as presented in Tables 1 and 2, combine evidence from both the Augmented Dickey-Fuller test and Phillips–Perron test to ensure robustness. The findings reveal a mixed order of integration among the variables. Specifically, RGDP is consistently stationary at level, I(0), across both tests, while SSE is stationary at level under Phillips–Perron approach. However, variables such as PVOL, DVOL, GVOL, KVOL, EXR, and GCAF exhibit stationarity after first differencing, I(1), particularly under the Phillips–Perron test, which is more robust to serial correlation and heteroskedasticity.

Although the ADF results suggest that PVOL, DVOL, GVOL, and KVOL are stationary at level, the PP results indicate otherwise, showing that these variables become stationary only after first differencing. This discrepancy is not uncommon, given the methodological differences between the two tests, especially in handling serial correlation and heteroskedasticity. Nonetheless, greater reliance is often placed on the PP results due to their robustness properties. Importantly, the overall evidence from both tests confirms that none of the variables is integrated of order two, I(2). This satisfies the fundamental requirement for the application of the Autoregressive Distributed Lag (ARDL) framework. Consequently, the presence of a mixture of I(0) and I(1) variables justifies the use of the ARDL model, which is well-suited for estimating both short-run and long-run relationships among the variables.

GARCH and EGARCH

Table 3. Summary of ARCH effect determination, using lagrange multiplier (LM) test

No	Generated series	obs*R-squared prob. Values	Values of b_1 coefficients	Values of R^2	Decision
1.	PVOL	0.0019	0.439157	0.192882	Presence of ARCH effect
2.	DVOL	0.9429	-0.010125	0.000103	No ARCH effect
3.	GVOL	0.7494	-0.045182	0.002041	No ARCH effect
4.	KVOL	0.8785	-0.021625	0.000468	No ARCH effect

Source: Author's Computation, 2026

The summary of ARCH effect determination in Table 3 reveals mixed results across the variables using the Lagrange Multiplier (LM) test. The presence of an ARCH effect is confirmed for PVOL, as its obs$*R^2$ p-value (0.0019) is statistically significant, indicating volatility clustering in this series. However, no ARCH effect is detected for DVOL, GVOL, and KVOL, as their obs$*R^2$ p-values (0.9429, 0.7494, and 0.8785, respectively) are insignificant. Additionally, the negative $b_1$coefficients and near-zero R^2 values for these series reinforce the absence of volatility clustering, suggesting stable variances over time.

Table 4. Summary Result for EGARCH model

Generated series	Method	Value of lambda	Decision
PVOL	ML ARCH - Normal distribution (Marquardt / EViews legacy)	-0.641319	A negative shock leads to higher volatility compared to an equally-sized positive shock.

Source: Author's Computation, 2026

The summary result for the EGARCH model in Table 4 indicates that the PVOL series exhibits an asymmetric volatility response. Using the Maximum Likelihood (ML) ARCH method with a normal distribution, the value of lambda (λ=−0.641319) is negative. This suggests that negative shocks have a greater impact on volatility than positive shocks of the same magnitude. Such asymmetry is typical in financial or economic data, where adverse events tend to cause larger fluctuations, reflecting heightened sensitivity to negative news in the PVOL series. The EGARCH model result for PVOL highlights the asymmetric nature of petrol pump price volatility in Nigeria, where negative shocks (such as sudden price drops or adverse market conditions) lead to higher volatility compared to positive shocks of the same magnitude. This finding is significant for understanding the impact of oil price volatility on Nigeria's economic growth. As an oil-dependent economy, heightened volatility in petrol prices, especially driven by negative shocks, can destabilize economic planning, increase uncertainty in investment decisions, and disrupt key sectors reliant on stable fuel prices. Such volatility may also exacerbate inflationary pressures and reduce consumer purchasing power, ultimately hindering economic growth. The result underscores the need for robust economic policies to mitigate the adverse effects of price volatility and ensure long-term stability.

Bounds Testing Approach to Autoregressive distributed lag

The results from the unit root tests guided our selection of the ARDL estimation method as the most suitable approach. Consequently, an ARDL bounds co-integration test was conducted to determine the presence of long-run or equilibrium relationships among the variables in the model. The null hypothesis of no co-integration among the variables is rejected if the computed F-statistic exceeds the 5 percent critical value of the I(1) bound. Conversely, if the computed F-statistic is lower than the critical value of the I(0) bound at the 5 percent level, the null hypothesis is accepted.

Table 5. ARDL Bounds Test

Dependent Variables	Values of F- statistic and t-statistic	Co-integration	Decision
RGDP	$F_{RGDP} = 5.385766$ $t_{RGDP} = -5.834448$	Yes	Estimate the ARDL long-term structure and determine the model of error correction

Source: Author's Compilation, 2026

The adoption of the ARDL long-run structure and error correction model is justified based on the results in Table 5. The F-statistic ($F_{RGDP} = 5.385766$) exceeds the critical bounds at a 5% significance level, and the t-statistic (t_{RGDP}= −5.834448) is significant, confirming the presence of co-integration among the variables. This indicates a stable long-run relationship between the dependent variable (RGDP) and the independent variables. Consequently, the ARDL model should be used to estimate the long-run structure, and an error correction model (ECM) is essential to capture short-run dynamics while maintaining equilibrium adjustments in the long-run.

Table 6. ARDL Long-Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Probability
Constant (C)	-0.0752	7.9205	-0.0095	0.9925
RGDP(-1)	0.2043	0.1704	1.1990	0.2373
PVOL(-1)	-0.0080	0.6703	-0.0119	0.0406**
DVOL(-1)	9.2419	20.8257	0.4438	0.6595
GVOL(-1)	6.2002	25.5552	0.2426	0.8095
KVOL(-1)	-1.5878	41.6052	-0.0382	0.0397**
EXR(-1)	0.0035	0.0088	0.3939	0.6956
GCAF(-1)	-0.0273	0.0465	-0.5869	0.5604
SSE(-1)	0.0440	0.0499	0.8816	0.3830

Source: Author's computation, 2026

Table 7. ARDL Model Diagnostics

Statistic	Value
R-squared	0.5259
Adjusted R-squared	0.4406
F-statistic	0.7560
Prob (F-statistic)	0.6425
Durbin–Watson Stat	2.0061

Source: Author's computation, 2026

The ARDL long-run results provide important understanding into the relationship between oil price shocks and economic growth in Nigeria, while also aligning with the broader empirical literature that reports mixed but largely negative long-run effects of oil price volatility, particularly in oil-dependent economies. Specifically, petrol pump price volatility (PVOL) exerts a negative and statistically significant effect on real GDP (RGDP) (coefficient = -0.007973; p = 0.0406), indicating that instability in petrol prices constrains economic growth. Similarly, kerosene pump price volatility (KVOL) has a significant negative impact on RGDP (coefficient = -1.587770; p = 0.0397), with a relatively larger magnitude, suggesting a stronger adverse effect on economic performance. These findings are consistent with Chien et al. (2026), who documented that oil price volatility depresses economic activity in key productive sectors, as well as Yahaya (2025), who found a negative and statistically significant long-run relationship between oil price volatility and GDP in Nigeria. In the same vein, Mgbomene et al. (2025) showed that although oil price volatility may improve certain macroeconomic indicators such as government revenue, it tends to destabilize aggregate output, reinforcing the negative growth implications observed.

In contrast, diesel pump price volatility (DVOL) and gas pump price volatility (GVOL) are found to be statistically insignificant, with coefficients of 9.241881 (p = 0.6595) and 6.200199 (p = 0.8095), respectively. Although their estimated coefficients are positive, the lack of statistical significance implies that fluctuations in diesel and gas prices do not exert a reliable long-run influence on RGDP within the model. This outcome aligns with Sule-Iko and Nwoye (2023), who reported that oil price effects may be significant in the short run but insignificant in the long run, as well as Abel et al. (2022), who argued that the impact of oil price movements often depends on interactions with other macroeconomic variables such as exchange rates and inflation.

Furthermore, the significant negative effect of kerosene price volatility is supported by Ighosewe and Agbogun (2021), who emphasized its long-run importance, reflecting the sensitivity of household consumption and informal sector activities to kerosene price fluctuations.

Regarding model performance, the R-squared value of 0.525879 indicates that approximately 52.59% of the variation in RGDP is explained by the included variables, while the adjusted R-squared of 0.440620 shows that about 44.06% is explained after accounting for model complexity. Despite this moderate explanatory power, the overall model is not statistically significant, as indicated by the F-statistic (0.756032) and its associated p-value (0.642513). This suggests that, collectively, the explanatory variables do not sufficiently account for variations in economic growth. This outcome is consistent with the broader literature, including Murshed et al. (2020) and Mahmood and Zamil (2019), which emphasizes that oil price volatility alone cannot fully explain economic performance, as growth dynamics are also shaped by structural and institutional factors such as economic diversification, fiscal policy, and the strength of the non-oil sector.

Finally, the analysis underscores that petrol and kerosene price volatilities have significant negative effects on Nigeria's economic growth, whereas diesel and gas price volatilities do not exhibit meaningful long-run impacts. While these findings are consistent with existing empirical evidence, the moderate explanatory power and lack of overall statistical significance highlight the need to incorporate additional macroeconomic and structural variables to achieve a more comprehensive understanding of the determinants of RGDP in Nigeria.

Error Correction Model

Table 8. Error Correction Term (ECM) Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECM(-1)	-0.755874	0.218441	-3.460306	0.0013

Source: Author's computation, 2026

The error correction term reported in Table 8 provides strong evidence of a stable long-run relationship among the variables included in the model. The coefficient of ECM(-1) is negative and statistically significant (–0.755874; p = 0.0013), which confirms the existence of convergence toward long-run equilibrium following short-run disturbances. The magnitude of this coefficient suggests that approximately 75.6% of any disequilibrium in real GDP is corrected within one period, indicating a relatively fast speed of adjustment. In practical terms, this implies that although short-run shocks such as fluctuations in petroleum product prices may temporarily disrupt economic performance, the system has a strong tendency to self-correct and return to its long-run growth path within a short time frame. The statistical significance of the error correction term further reinforces the reliability of the model, demonstrating that the adjustment mechanism is not only theoretically valid but also empirically meaningful. Overall, the result reflects a well-behaved dynamic system, suggesting that the model is robust and suitable for capturing both the short-run dynamics and long-run equilibrium relationships in Nigeria's economic growth process.

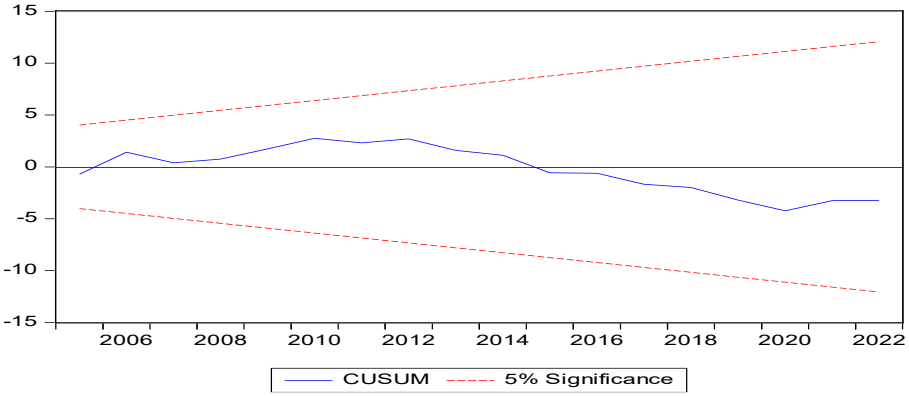


Figure 4. Diagnostic Testing 1 – CUSUM

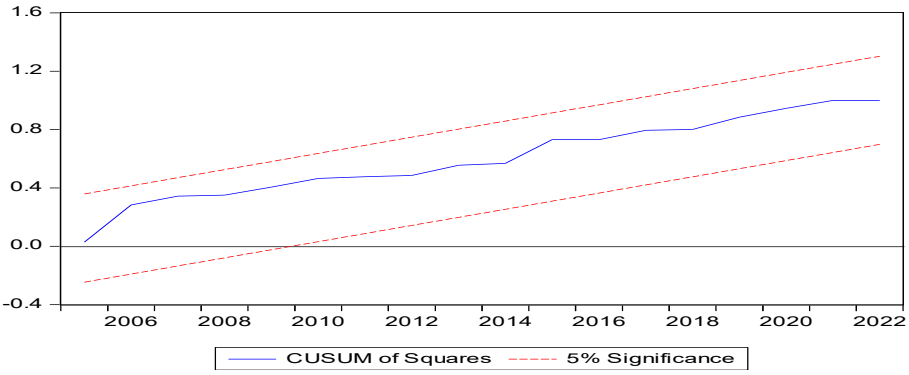


Figure 5. Diagnostic Testing 2 – CUSUMSQ

The CUSUM and CUSUMSQ test results indicate that the model is stable over the sample period, as the blue recursive line remains within the 5% critical bounds. This suggests that there are no significant structural breaks or parameter instabilities affecting the model, and that the estimated coefficients are consistent over time. In essence, the relationship captured by the model is reliable, and its results can be considered robust for policy analysis and inference.

Table 9. Summary of Diagnostic Test Results

Test	Statistic / Value	Probability	Decision/Interpretation
Ramsey RESET Test	F-stat = 0.1081	0.0714	Model correctly specified (Stable)
Leverage Plots	—	—	Functional relationship confirmed
Correlogram of Residuals	ACF & PACF within CL	Q-stat > 5%	No autocorrelation
Serial Correlation (BG LM)	F-stat = 0.614273	0.5466	No serial correlation
Normality Test (Jarque-Bera)	JB = 0.82339	0.649686	Residuals normally distributed
Multicollinearity (VIF)	VIF < 10; Tol > 0.1	—	No multicollinearity
Durbin-Watson Statistic	DW = 2.006112	—	No serial correlation

Source: Author's Computation, 2026

The diagnostic test results in Table 9 indicate that the model is well-specified in terms of its stability, autocorrelation, normality, and multicollinearity. The linearity of the model was tested using Ramsey's RESET test, and all statistics, including the t-statistic, f-statistic, and likelihood ratio, show that the model is well-specified with no significant deviations from linearity. Additionally, the leverage plots confirm a functional relationship between the predicted and predictor variables. The autocorrelation tests, including the Q-statistics from the correlogram and the Breusch-Godfrey LM test, show no significant serial correlation, with p-values above 5%, suggesting that residuals are not correlated over time.

Regarding the normality of the residuals, the Jarque-Bera test reveals a probability value of 0.649, indicating that the residuals follow a normal distribution. The multicollinearity check using the Variance Inflation Factors (VIF) shows that VIF values are under 10, which is within an acceptable range, and the tolerance values exceed 0.1, confirming that multicollinearity is not a problem. Finally, the Durbin-Watson statistic of 2.006112 supports the absence of serial correlation.

Discussion of Findings

The results obtained from the long-run ARDL model indicate that petrol and kerosene price volatilities exert significant negative effects on Nigeria's real GDP, while diesel and gas price volatilities do not have statistically meaningful impacts. Specifically, the negative coefficients for PVOL (–0.0080) and KVOL (–1.5878) suggest that fluctuations in petrol and kerosene prices significantly ($p < 0.05$) undermine economic growth. In the Nigerian context, this outcome is economically intuitive: petrol is a critical input for transportation, production, and distribution, while kerosene remains widely used by households and small-scale enterprises. Consequently, instability in these prices raises operating and living costs, reduces disposable income, and disrupts productive activities, thereby constraining output growth. This evidence aligns with existing empirical literature, which largely reports a negative long-run relationship between oil price volatility and economic growth in oil-dependent economies. Studies such as Chien et al. (2026) and Yahaya (2025) similarly document that oil price volatility depresses economic performance, while Mgbomene et al. (2025) highlight its destabilizing effect on aggregate output despite potential gains in government revenue. In contrast, the insignificance of diesel (DVOL) and gas (GVOL) price volatilities (p-values of 0.6595 and 0.8095, respectively) suggests that their fluctuations do not exert a direct or consistent influence on aggregate economic growth, possibly due to substitution effects, sectoral insulation, or policy buffers. This finding is consistent with Sule-Iko and Nwoye (2023), who reported insignificant long-run effects of oil price volatility, and Abel et al. (2022), who emphasized that the impact of such volatility often depends on interactions with other macroeconomic variables.

In terms of model performance, the R-squared value (0.525879) indicates moderate explanatory power, with about 52.6% of the variation in RGDP explained by the included variables, while the adjusted R-squared (0.440620) confirms this after accounting for model complexity. However, the overall model is not statistically significant (F-statistic = 0.756032; p = 0.642513), implying that additional macroeconomic and structural factors such as fiscal policy, exchange rate dynamics, and institutional quality may play important roles in shaping Nigeria's economic growth. The diagnostic test results further confirm the robustness and reliability of the

model, as it satisfies key assumptions relating to linearity, absence of serial correlation, normality of residuals, and lack of multicollinearity. The stability tests (CUSUM and CUSUMSQ) also indicate that the model is stable over time, with no evidence of structural instability.

Furthermore, the Error Correction Model (ECM) result shows a negative and statistically significant ($p < 0.05$) coefficient (–0.755874), indicating a strong speed of adjustment toward long-run equilibrium. This implies that about 75.6% of short-run disequilibrium is corrected within one period, reflecting the economy's capacity to recover relatively quickly from shocks. From a Nigerian perspective, this suggests that although oil price volatility may generate short-term disruptions, the economy tends to revert to its long-run growth path over time. Additionally, the EGARCH results for petrol price volatility reveal asymmetric behaviour, where negative shocks generate larger volatility than positive shocks. This reflects the structural vulnerability of the Nigerian economy, where adverse oil price movements such as sudden price drops or market instability tend to have more severe economic consequences than positive shocks. Overall, these findings underscore the need for policy measures aimed at stabilizing petroleum product prices, diversifying the economy, and strengthening macroeconomic resilience to mitigate the adverse effects of oil price volatility on economic growth in Nigeria.

CONCLUSION

This study highlights the significant negative impact of petrol and kerosene price volatilities on Nigeria's economic growth, with both showing statistically significant adverse effects on real GDP. While diesel and gas price volatilities were found to be statistically insignificant, the overall findings suggest that fluctuations in fuel prices, particularly petrol and kerosene, play a crucial role in hindering economic stability. The moderate explanatory power of the model and the lack of statistical significance in the overall model indicate that there are other factors not captured in this study that also impact Nigeria's economic performance. Additionally, the asymmetric nature of petrol price volatility, as revealed by the EGARCH model, underscores the disproportionate effects of negative shocks on economic stability, which could lead to greater uncertainty and inflationary pressures.

Based on these findings, it is recommended that the Nigerian government implement robust and context-specific economic policies aimed at reducing the volatility of petrol and kerosene prices. Such policies should include the establishment of strategic petroleum reserves and targeted price stabilization mechanisms. In light of the recent fuel subsidy removal in Nigeria, policymakers should prioritize the design of well-targeted social protection measures such as transport subsidies or conditional cash transfers to cushion the immediate welfare effects of rising fuel prices on households and small businesses. Furthermore, the operationalization of the Dangote Refinery presents a critical opportunity to reduce dependence on imported refined petroleum products; however, effective regulatory oversight and competitive pricing policies are necessary to ensure that domestic refining translates into price stability rather than market concentration or price distortions.

Additionally, given the asymmetric volatility response observed, it is crucial to develop contingency frameworks that can respond swiftly to adverse price shocks, particularly those arising from global oil market disruptions or domestic supply constraints. This may include strengthening the Nigerian Midstream and Downstream Petroleum Regulatory Authority (NMDPRA) to enhance monitoring, transparency, and market discipline in the downstream sector.

Policymakers should also focus on accelerating energy diversification by investing in alternative energy sources such as gas and renewables to reduce overreliance on petrol and kerosene. Finally, there is a need to identify and address other macroeconomic factors influencing growth such as exchange rate instability and inflation while future research should explore additional determinants to provide a more comprehensive framework for managing oil price volatility in Nigeria.

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