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Oil Price Volatility and Economic Growth in Nigeria: Evidence from ARCH and GARCH Models

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Abstract

Purpose: This study investigated the impact of crude oil price volatility on Nigeria's economic growth, with emphasis on the magnitude of oil price volatility and its short-run and long-run effects on economic performance.

Methodology: The study adopted a quantitative approach, using annual time-series data for Nigeria. Crude oil price volatility is estimated using the Generalised Autoregressive Conditional Heteroskedasticity (GARCH) model. At the same time, the Autoregressive Distributed Lag (ARDL) bounds testing technique is employed to examine short-run and long-run relationships between oil price volatility and economic growth. Descriptive statistics, unit root tests, cointegration analysis, and diagnostic tests are conducted to ensure the robustness of the model estimates.

Results: The findings revealed substantial volatility in crude oil prices in Nigeria, characterised by persistent shocks and volatility clustering. Short-run ARDL results show that oil price fluctuations significantly affect GDP growth, highlighting Nigeria's vulnerability to external oil price shocks. In the long run, crude oil price volatility significantly reduces economic growth, leading to higher production costs, reduced investment, and sustained economic instability.

Novelty and Contribution: The study contributed to the literature by jointly applying GARCH and ARDL techniques to capture both oil price volatility dynamics and their differential short- and long-term effects on economic growth in an oil-dependent economy.

Practical and Social Implications: The findings underscore the need for robust oil revenue stabilisation frameworks, including effective use of the Sovereign Wealth Fund, and accelerated economic diversification into agriculture, manufacturing, and renewable energy to promote sustainable economic growth.

Keywords: Crude Oil Prices, Economic Growth, Economic Volatility, ARCH and GARCH Model, Price Shock

1 Introduction

Globally, crude oil price volatility remains a critical issue for both oil-exporting and oil-importing nations, influencing economic growth, fiscal stability, and financial market performance. The international oil market is inherently unstable, driven by shifting demand and supply forces, technological advancements in energy production, environmental

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policies, and geopolitical tensions in major oil-producing regions such as the Middle East, Russia, and Africa. For oil-exporting countries such as Nigeria, Venezuela, and Saudi Arabia, fluctuations in oil prices generate recurrent cycles of economic expansion and recession that shape government revenues, exchange rate dynamics, and investment decisions. In contrast, for oil-importing economies, including India, China, and the European Union, oil price volatility poses significant challenges for energy security, rising inflationary pressures, and higher production costs. The global financial crisis, OPEC production decisions, and, most recently, the COVID-19 pandemic have further amplified oil price volatility, underscoring the interconnectedness of energy markets with global economic performance (Abduchakeem & Kilishi, 2024).

Crude oil remains the backbone of Nigeria's economy, serving as the primary source of government revenue, foreign exchange earnings, and a key driver of economic activity. Since the discovery of commercial quantities of oil in Oloibiri in 1956, the country has relied heavily on crude oil exports to finance its development programmes. However, this dependence has also made Nigeria highly vulnerable to fluctuations in international oil prices, which are influenced by global demand and supply dynamics, geopolitical tensions, and market uncertainties (Gwaison et al., 2021). Volatility in crude oil prices poses significant challenges to macroeconomic stability, as it directly affects revenue, exchange rates, inflation, and overall economic growth. Understanding the extent and nature of this volatility is crucial for designing appropriate policies that safeguard Nigeria's economy from external shocks (Gwaison et al., 2021).

The Nigerian economy has experienced both periods of boom and crisis, largely dictated by movements in global crude oil prices. For instance, the oil boom of the 1970s spurred infrastructural development and high government expenditure. In comparison, subsequent oil price collapses in the 1980s and 2014 led to severe fiscal deficits, currency devaluation, and economic recession. These fluctuations demonstrate the strong linkage between oil price volatility and Nigeria's economic performance. The recurring economic expansion and recession cycles highlight the economy's structural weaknesses, particularly its overreliance on oil revenue, poor diversification, and vulnerability to external shocks (Awolaja et al., 2024). This underscores the importance of empirically examining how oil price volatility affects economic growth in both the short and long run (Olayemi & Olaniyan, 2024).

In the face of these dynamics, econometric models such as the Autoregressive Conditional Heteroskedasticity (ARCH) and the Generalised Autoregressive Conditional Heteroskedasticity (GARCH) approaches provide robust frameworks for analysing the nature and magnitude of oil price volatility and its implications for macroeconomic performance. These models are particularly useful because they account for time-varying volatility and can capture periods of heightened uncertainty in oil markets. Previous empirical studies have demonstrated the relevance of ARCH and GARCH methodologies for capturing volatility dynamics, shock persistence, and leverage effects in oil price behaviour. In particular, Abduchakeem and Kilishi (2024) and Chinanuife and Ibeawuchi (2023) provide strong empirical justification for the use of ARCH–GARCH models, as their findings reveal significant volatility clustering, asymmetric responses to shocks, and non-normal price distributions, thereby establishing the suitability of these models for analysing oil price volatility and its macroeconomic implications in this study. By employing ARCH and GARCH models, the study can analyse the persistence and clustering of crude oil price volatility and evaluate how such volatility is transmitted to Nigeria's economic growth indicators. This approach generates robust, evidence-based insights that can help policymakers design effective strategies to mitigate the adverse effects of oil price shocks (Gwaison, 2025).

The volatility of oil prices affects Nigeria's economy through multiple transmission channels (Omolade et al., 2019). Sharp declines in oil prices reduce government revenues, weaken the fiscal position, and limit the state's ability to finance development projects, leading to cuts in public investment and social spending. In addition, volatility affects the external sector by reducing foreign reserves, destabilising exchange rates, and worsening the balance of payments position. On the other hand, sudden increases in oil prices may create inflationary pressures through rising fuel costs and imported inflation (Oduyemi et al., 2025). These dynamics not only complicate macroeconomic management but also undermine investor confidence and long-term economic planning, thereby hindering sustainable growth (Gwaison et al, 2021).

The Resource Curse theory serves as a key foundation for this study, explaining why resource-abundant countries like Nigeria often experience paradoxical outcomes, such as slow economic growth, macroeconomic instability, and weak institutional development, despite substantial natural resource endowments. Pioneering contributions by Auty (1993) and Sachs and Warner (1995) argue that excessive reliance on resource revenues, particularly from oil, exposes economies to external price shocks, rent-seeking behaviour, and fiscal volatility, which undermine long-term development. Closely aligned with this perspective, the Dutch Disease framework advanced by Corden and Neary (1982) explains how resource booms and busts distort exchange rates, weaken the tradable sectors, and crowd out agriculture and manufacturing. In Nigeria's context, oil price volatility affects the economy through multiple transmission channels, including exchange rate fluctuations, unstable government revenues, inflationary pressures, and investment uncertainty, thereby reinforcing the dynamics predicted by the Resource Curse hypothesis (Omolade et al., 2019).

Given the centrality of oil to Nigeria's economic trajectory, analysing the impact of crude oil price volatility on growth has both theoretical and practical relevance. Theoretically, it contributes to the literature on resource-dependent economies and the macroeconomic consequences of commodity price shocks. In practice, the findings of such research will assist policymakers in formulating strategies to mitigate the adverse effects of oil price swings and strengthen the Nigerian economy's resilience. It also reinforces the need for economic diversification and the development of non-oil sectors such as agriculture, manufacturing, and services to reduce vulnerability to oil market instability. Against this backdrop, this study employs ARCH and GARCH modelling to provide empirical evidence on the extent to which crude oil price volatility influences economic growth in Nigeria.

Research Questions

The following questions will guide the study:

i. What is the rate of oil price volatility in Nigeria?

ii. What are the short-term impacts of oil price volatility on economic growth in Nigeria?

iii. What are the long-run impacts of oil price volatility on economic growth in Nigeria?

Objectives of the Study

The main purpose of the study is to examine the Impact of Crude Oil Price Volatility on economic growth in Nigeria. The specific purposes of the study are as follows:

i. To determine the rate of oil price volatility in Nigeria

ii. To examine the short-term impact of oil price volatility on economic growth in Nigeria

iii. To investigate the long-run impact of oil price volatility on economic growth in Nigeria

Hypothesis of the Study

The following null hypotheses were tested at the 0.05 significance level.

H_{01}: There is no significant volatility in crude oil prices in Nigeria over the study period.

H_{02}: Short-term volatility in crude oil prices has no significant effect on Nigeria's economic growth.

H_{03}: Long-run volatility in crude oil price volatility does not significantly influence Nigeria's economic growth.

2 Literature Review

Conceptualising Crude Oil Prices Volatility

Khalid, Zaman, and Ali (2023) define crude oil price volatility as the degree of variation in oil prices over a specific period, often influenced by market dynamics, geopolitical events, and economic conditions. Likewise, Apergis and Miller (2021) explain that the unpredictable changes in oil prices characterise crude oil price volatility due to external shocks and internal market adjustments.

Ahmad and Khan (2020) describe crude oil price volatility as variations in crude oil prices caused by market dynamics, speculative activities, and external shocks such as geopolitical tensions. As Yakubu and Akanegbu (2019) assert, crude oil price volatility is the unpredictable fluctuations in crude oil prices over time, driven by changes in global demand, supply shocks, and geopolitical factors.

Furthermore, Kumar, Kumar, and Gupta (2020) conceptualise crude oil price volatility as the variability in oil prices driven by geopolitical tensions, natural disasters, and changes in production levels. Similarly, Sadorsky (2019) defined crude oil price volatility as rapid, unpredictable fluctuations in crude oil prices driven by market forces and external influences.

Sule-Iko and Nwoye (2023) identify crude oil price volatility as the degree of variation of oil prices over time, which can significantly influence economic growth, particularly in oil-dependent economies. Correspondingly, Sabayo and Muthama (2024) define crude oil price volatility as unpredictable changes in the market price of crude oil, driven by factors such as geopolitical tensions, supply disruptions, and shifts in global demand.

Conceptualising Economic Growth

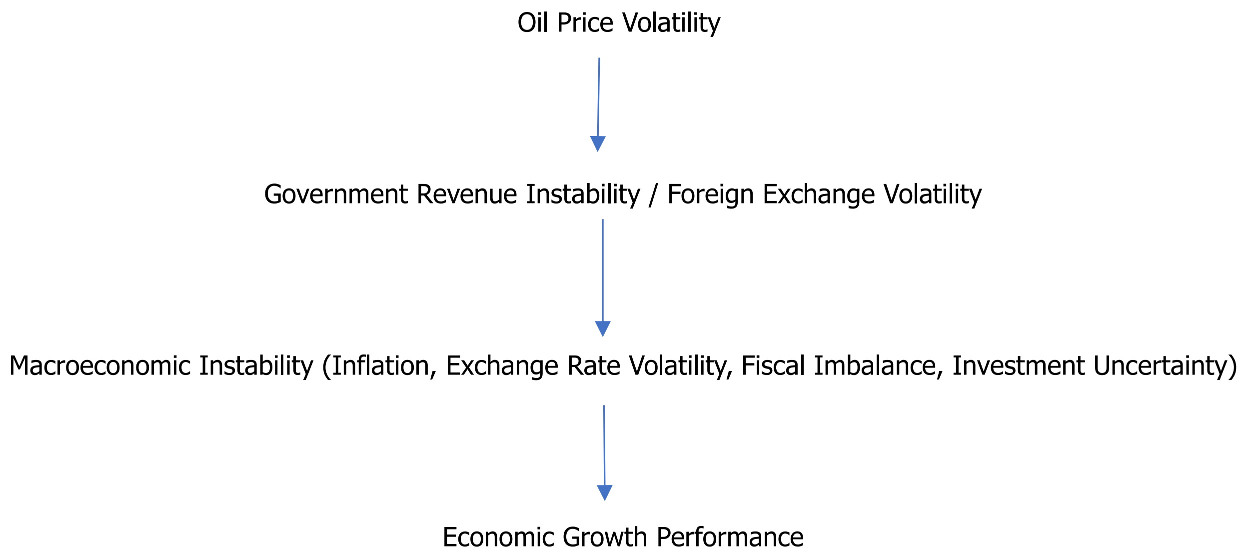
Kuznets (2021) conceptualises economic growth as the adoption of an industrial system that requires minimum levels of skill, literacy, and infrastructure, accompanied by urbanisation and demographic changes. Economic growth is driven by trade policies, government expenditure, and financial market operations, with international conditions influencing divergent outcomes among countries (Rivera-Batiz & Romer, 2023).

The United Nations (2023) refers to economic growth as the increase in a country's output of goods and services, which is essential for improving living standards. Maddison (2022) defined economic growth as the long-term increase in per capita GDP, influenced by industrialisation and structural changes within economies. According to Duflo and Banerjee (2024), economic growth is influenced by policies that strengthen education and health systems, which are crucial for building human capital. This underscores human capital development as a driver of growth. Equally, Rostow (2021) argues that economic growth begins when economies transition from traditional to industrial systems through stages of development.

According to the IMF (2021), economic growth is characterised by an increase in the output of goods and services, reflecting improvements in productivity and efficiency. The World Bank (2019) defines economic growth as the increase in a country's GDP, which reflects its economic performance and capacity to generate wealth. Guterres (2025) stresses that economic growth must be inclusive and sustainable to ensure that all segments of society benefit from increased wealth.

Conceptual Framework of Oil Price Volatility and Economic Growth

Drawing from the Resource Curse hypothesis articulated by Sachs and Warner (1995), this study conceptualises oil price volatility as an external shock that transmits through fiscal and external sectors to influence macroeconomic stability and, ultimately, economic growth. As illustrated in the framework, oil price volatility directly affects government revenue and foreign exchange (FX) earnings, given Nigeria’s heavy dependence on crude oil exports. Volatile revenues and FX inflows lead to macroeconomic instability, reflected in exchange rate fluctuations, inflationary pressures, fiscal imbalance, and heightened investment uncertainty. These macroeconomic distortions weaken productive sectors, discourage private investment, and constrain diversification, thereby harming economic growth. This framework is consistent with seminal research on the Resource Curse and Dutch Disease, which contends that resource-dependent economies are particularly susceptible to external price shocks that may compromise long-term development outcomes (Sachs & Warner, 1995).



Review of Empirical Studies on Crude Oil Price and Economic Growth

Abduchakeem and Kilishi (2024) examined the symmetric and asymmetric characteristics of crude oil price volatility in Nigeria. They utilised GARCH models to analyse monthly and daily price data from January 2006 to September 2022. Data was collected from historical crude oil price data. The results revealed non-normal distributions for both monthly and daily prices, with significant persistence of shocks and volatility clustering. The study found that negative shocks induce greater volatility than positive shocks of the same magnitude, indicating leverage effects.

Dinh and Nguyen (2024) investigated the long-term effects of oil price changes on economic growth using an Auto-Regressive Distributed Lag (ARDL) model analysis across nine different countries. The study collected annual data from 1990 to 2020 from national statistical agencies and international databases across nine countries. Findings revealed that rising oil prices have a significant negative impact on long-run GDP growth, primarily by increasing production costs and thereby raising consumer prices.

Olayemi and Olaniyan (2024) evaluated the long-term effects of crude oil price volatility on economic growth in Nigeria using a Vector Error Correction Model (VECM). Data were collected from secondary sources, including the Central Bank of Nigeria and the World Bank databases. The study established a significant long-run negative correlation between oil price volatility and GDP growth rates. The study further explained that sustained volatility creates uncertainty in investment decisions, undermining long-term economic stability.

Abe, Samaila and Andokari (2024) explored the impact of oil price volatility on economic growth in Nigeria using a VAR analysis covering data from 2000 to 2016 on oil prices and economic growth indicators. The findings suggest that, although oil price volatility negatively affects economic growth, it also underscores the interconnectedness between oil prices and other macroeconomic variables. Kutu and Ohonba (2024) analysed the short-term effects of oil price volatility on economic growth in Nigeria using an Autoregressive Distributed Lag (ARDL) model analysis with annual data from 1985 to 2022. The findings indicated that fluctuations in oil prices significantly impact GDP growth rates in both the short run and long run.

Sabayo and Muthama (2023) examined the long-term relationship between crude oil price fluctuations and economic growth across Sub-Saharan African countries. The study used secondary data from the World Bank and national statistics and examined them using pooled OLS and fixed-effects estimations. The study indicated a significant negative relationship between oil price volatility and GDP growth in the long run. That is, prolonged increases in oil prices lead to higher production costs, which adversely affect economic performance. The study also stated that while oil price increases can boost revenues in exporting countries, they do not translate into sustainable economic growth.

Chinanuife and Ibeawuchi (2023) examined how fluctuations in global oil prices affect agricultural prices in Nigeria. Using GARCH models to analyse monthly data from 2005 to 2022, the study establised that periods of high oil price volatility lead to increased instability in agricultural commodity prices due to rising production costs linked to fuel prices. It explains the interconnectedness between oil markets and agricultural sectors, emphasising the need for policies to stabilise both markets and ensure food security.

Baba and Musa (2020) assessed the dynamic relationship between crude oil price fluctuations and revenue generation in Nigeria over 41 years, from 1981 to 2017. Using a VAR model, the study found that initial GDP growth positively influences current GDP growth while inversely affecting current oil price volatility. The study further noted that fluctuations in oil prices have significant short-term effects on revenue generation and economic growth.

Ige and Obi (2018) scrutinised the impact of crude oil price volatility on the Nigerian economy using Quantitative analysis and Structural Vector Autoregressive (SVAR) models and monthly data from 2000 to 2016. The study applied Structural Vector Autoregressive (SVAR) models to analyse the relationships between crude oil prices and key economic variables, including exchange rates, inflation, and real GDP. The findings revealed that while crude oil price volatility significantly affects exchange rates and oil revenue, its impact on inflation rates and real income is less pronounced. The study concludes that persistent shocks in crude oil prices can destabilise the economy, emphasising the need to diversify into sectors such as agriculture and manufacturing to mitigate these risks.

3 Methodology

Research Design

This study adopts an ex post facto research design, which involves investigating possible cause-and-effect relationships by observing existing conditions without manipulating the independent variable (Acharyya & Bhattacharya, 2019). This design enables the researcher to analyse patterns, trends, and the degree of association between crude oil price volatility and economic growth using existing time-series data.

The adoption of this design is justified because it allows the researcher to determine the nature and direction of the relationship between crude oil price volatility and economic growth in Nigeria without affecting the variables involved. Given the macroeconomic nature of the study, experimental manipulation of crude oil prices is neither feasible nor ethical, making an ex post facto design the most appropriate. Additionally, this design facilitates the use of econometric techniques to analyse the data, providing reliable empirical evidence on how fluctuations in crude oil prices impact economic growth in Nigeria over time.

Source and Nature of Data

The data for this study on the impact of crude oil price volatility on economic growth in Nigeria was sourced entirely from secondary data, ensuring the use of reliable, systematically recorded, and publicly accessible information. Specifically, the study utilised quarterly time-series data from 2010 to 2024, providing a comprehensive view of trends and fluctuations in the Nigerian economy over 15 years. The use of quarterly data from 2010 to 2024 is justified because it captures short- and medium-term fluctuations in oil prices and macroeconomic variables more effectively than annual data, thereby enabling a more precise analysis of volatility dynamics and their effects on economic growth. The key data was obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin, which contains detailed records on Nigeria's Gross Domestic Product (GDP) growth rates, crude oil price indices, exchange rates, inflation rates, and other macroeconomic indicators relevant to the study. Additional data were sourced from the National Bureau of Statistics (NBS), the Organisation of the Petroleum Exporting Countries (OPEC) reports, and the World Bank Database to complement the dataset where necessary and enhance its robustness.

Model specification

To examine the impact of crude oil price volatility on economic growth in Nigeria, the study employed the Autoregressive Conditional Heteroskedasticity (ARCH) and Generalised Autoregressive Conditional Heteroskedasticity (GARCH) models to capture the time-varying volatility in crude oil prices and its effect on economic growth. The ARCH model, introduced by Engle (1982), is suitable for modelling volatility clustering in financial and macroeconomic time-series data, while the GARCH model, developed by Bollerslev (1986), extends the ARCH framework by incorporating lagged conditional variances, providing a more parsimonious and flexible approach to volatility modelling.

The mean equation for the relationship can be specified as:

GDPt =α0 +α1 OILPt +α2 EXRt +α3 INFt +ϵt (1)

where:

GDPt = Economic growth (proxied by GDP growth rate) at time t,

OILPt = Crude oil price at time t,

EXRt = Exchange rate at time t,

INFt = Inflation rate at time t,

ϵt = error term.

The conditional variance (volatility) equation in the GARCH(1,1) framework was specified as:

ht=ω+αϵ 2t−1+βht−1

where:

hth_tht = conditional variance of the residuals (volatility) at time t,

ω = constant term,

α = coefficient for the lagged squared residual (ARCH term),

β = coefficient for the lagged conditional variance (GARCH term).

The exchange rate and inflation rates are included as control variables because they capture key channels through which oil price volatility affects economic growth, thereby isolating the independent effect of oil price movements on output (Gwaison et al., 2021).

The use of ARCH and GARCH models enabled the study to capture the volatility clustering in crude oil prices and examine how these fluctuations influence Nigeria's economic growth over the period, providing a robust and clear assessment of volatility's impact on the country's macroeconomic environment.

To examine the impact of crude oil price volatility on economic growth in Nigeria, this study employed the Autoregressive Distributed Lag (ARDL) model developed by Pesaran et al. (2001). The ARDL model is appropriate for investigating both the short-run and long-run relationships among variables, particularly when the variables are integrated of order I(0) and I(1), and it is suitable for small-sample studies.

The general ARDL (p, q, r, s) model for this study is specified as:

$$GDP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_1 GDP_{t-1} + \sum_{j=0}^{q} \alpha_2 OILP_{t-j} + \sum_{k=0}^{r} \alpha_3 EXR_{t-k} + \sum_{i=0}^{s} \alpha_4 INF_{t-1} + \varepsilon_t \quad (2)$$

where:

GDPt = Economic growth (proxied by GDP growth rate) at time t,

OILPt = Crude oil price volatility at time t (obtained from ARCH/GARCH estimates),

EXRt = Exchange rate at time t,

INFt = Inflation rate at time t,

α0 = constant term,

α1 ,α2 ,α3 ,α4 = coefficients to be estimated,

ϵt = error term.

The ARDL bounds test was first used to test for the existence of a long-run relationship among the variables. If cointegration is confirmed, the Error Correction Model (ECM) was estimated to capture the short-run dynamics while incorporating the speed of adjustment towards the long-run equilibrium, specified as:

$$\Delta GDP_t = \beta_0 + \sum_{i=1}^{p-1} \beta_1 \Delta GDP_{t-1} + \sum_{j=n}^{q-1} \beta_2 \Delta OILP_{t-j} + \sum_{k=0}^{r-1} \beta_3 \Delta EXR_{t-k} + \sum_{i=0}^{s-1} \beta_4 \Delta INF_{t-1} + ECT_{t-i} + \mu_t \quad (3)$$

where:

Δ denotes first differences,

ECT_{t-1} is the lagged error correction term from the long-run equation,

λ is the speed of adjustment parameter expected to be negative and significant,

u_t = white noise error term.

This ARDL specification enabled the study to assess both the immediate and long-term impacts of crude oil price volatility on economic growth in Nigeria while controlling for exchange rate and inflation dynamics.

Table 1 Measurement of variables

Variable	Description	Measurement/Proxy	Expected Sign
Economic Growth (GDP)	Growth rate of the Nigerian economy	Quarterly GDP growth rate (%) from CBN	Dependent Variable
Crude Oil Price (OILP)	International crude oil price	Quarterly average Brent crude price (USD/barrel)	Positive/Negative
Exchange Rate (EXR)	Value of Naira relative to USD	Quarterly average exchange rate (Naira/USD)	Negative
Inflation Rate (INF)	General price level changes in Nigeria	Quarterly inflation rate (%) from CBN	Negative
Oil Price Volatility (VOILP)	Volatility in crude oil prices	Conditional variance from ARCH/GARCH estimation	Negative

Source Gwaison (2025)

Methods of data analysis

The data for this study were analysed using a combination of ARCH/GARCH models and the Autoregressive Distributed Lag (ARDL) model to comprehensively capture the impact of crude oil price volatility on economic growth in Nigeria. The ARCH/GARCH models were employed to model and measure the volatility clustering in crude oil prices over time, as these models effectively capture the time-varying conditional variance inherent in financial and macroeconomic data. The analysis started with descriptive statistics and pre-estimation tests, including unit root tests using the Augmented Dickey-Fuller (ADF) method, to ensure data stationarity. The presence of volatility clustering was confirmed through graphical analysis of volatility and the ARCH LM test, justifying the application of ARCH/GARCH models to estimate the volatility of crude oil prices. This volatility series was then used to examine its dynamic influence on economic growth, exchange rates, and inflation within the Nigerian economy.

In addition, the ARDL bounds testing approach was employed to determine the long-run and short-run relationships between crude oil price volatility and economic growth, including exchange rates and inflation as control variables. The ARDL model is suitable for handling variables integrated at I(0) and I(1) and for small-sample studies, making it appropriate for this analysis. The optimal lag length was determined using the Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) to ensure model efficiency and accuracy. After establishing the existence of cointegration through the ARDL bounds test, the long-run coefficients and the error correction model (ECM) for the short-run dynamics were estimated, providing insight into how oil price volatility affects economic growth both immediately and over time. EViews software was utilised for these analyses, ensuring systematic and robust estimation that will guide clear interpretation and policy recommendations from the study findings.

4 Result Presentations

Pre- Estimation Test

Table 1 Descriptive Statistics

Variables	GDP	OILP	EXR	INF	VOILP
Mean	2.989655	75.79310	334.0517	16.67759	-1.813221
Median	3.050000	77.50000	312.5000	15.65000	0.191911
Maximum	6.600000	112.0000	930.0000	29.00000	43.14680
Minimum	-6.000000	30.00000	151.0000	11.80000	-65.92756
Std. Dev.	2.837388	23.06342	206.5641	4.226402	14.53190
Skewness	-0.880935	-0.103131	1.664812	1.322234	-1.986136
Kurtosis	3.711935	1.786954	5.285322	4.108755	12.45553
Jarque-Bera	1.726672	3.658894	3.41363	1.87117	2.1993
Probability	0.412736	0.160502	0.14571	0.23948	0.1974
Sum	173.4000	4396.000	19375.00	967.3000	-105.1668
Sum Sq. Dev.	458.8938	30319.52	2432117.	1018.161	12037.03
Observations	60	60	60	60	60

Source Authors' Computation E-view 12.0

The descriptive statistics show that GDP has a mean of 2.99 with a standard deviation of 2.84, indicating moderate variation around the mean, while OILP (oil price) has a higher mean of 75.79 with a standard deviation of 23.06, reflecting fluctuations in oil prices over the period. EXR (exchange rate) shows a high mean of 334.05 with a large standard deviation of 206.56, indicating significant volatility in the exchange rate, while INF (inflation) has a mean of 16.68 with a lower standard deviation of 4.23, suggesting relatively stable inflation levels. VOILP (volatility of oil price) has a negative mean of -1.81 with a high standard deviation of 14.53, showing high variability in oil price volatility. The Jarque-Bera statistics for all variables (ranging from 1.72 for GDP to 3.41 for EXR) with corresponding probabilities above 0.05 suggest that the data for these variables are approximately normally distributed, indicating no severe deviation from normality that would affect the reliability of subsequent regression analysis.

Table 2 Correlation Matrix

Covariance Correlation	GDP	OILP	EXR	INF	VOILP
GDP	7.911962				
	1.000000				
OILP	53.17027	522.7503			
	0.326760	1.000000			
EXR	-142.3391	-74.43757	41933.05		
	-0.247118	-0.015899	1.000000		
INF	-1.177818	6.803983	718.3994	17.55450	
	-0.099941	0.071027	0.337324	1.000000	
VOILP	1.657533	44.62432	273.8979	2.760875	207.5350
	0.040905	0.135481	0.092846	0.045741	1.000000

Source Authors' Computation E-view 12.0

Table 2 presents the correlation matrix showing the linear relationships among GDP, oil price (OILP), exchange rate (EXR), inflation (INF), and oil price volatility (VOILP). The results indicate a moderate positive correlation between GDP and oil price ($r = 0.327$), suggesting that increases in oil prices are associated with higher economic output, reflecting Nigeria's dependence on oil revenues. GDP is negatively correlated with exchange rate ($r = -0.247$) and inflation ($r = -0.100$), implying that exchange rate depreciation and rising inflation tend to dampen economic performance. Oil price exhibits a very weak negative relationship with exchange rate ($r = -0.016$) and a weak positive relationship with inflation ($r = 0.071$), while oil price volatility shows weak positive correlations with GDP ($r = 0.041$), oil price ($r = 0.135$), exchange rate ($r = 0.093$), and inflation ($r = 0.046$), indicating limited direct linear association. Overall, the relatively low correlation coefficients suggest the absence of multicollinearity among the variables, making them suitable for further econometric analysis.

Table 3 Augmented Dickey-Fuller (ADF) Unit Root test

Variables	ADF Statistics	P-value	Order of integration	Remark
GDP	-5.761942	0.0004	1(0)	Stationarity at the level
OILP	-5.938730	0.0000	1(1)	Stationarity at first difference
EXR	-3.871599	0.0197	1(1)	Stationarity at first difference
INF	-7.023264	0.0004	1(0)	Stationarity at the level
VOILP	-7.763149	0.0000	1(0)	Stationarity at the level

Source Authors' Computation E-view 12.0

Table 3 illustrates the results of the Augmented Dickey–Fuller (ADF) unit root test used to examine the stationarity properties of the variables. The findings indicate that GDP, inflation rate (INF), and oil price volatility (VOILP) are stationary at the level, as evidenced by their statistically significant ADF statistics and p-values less than 0.05, implying integration of order zero I(0). In contrast, oil price (OILP) and exchange rate (EXR) are non-stationary at the level but become stationary after first differencing, indicating that they are integrated of order one I(1). The mixture of I(0) and I(1) variables justifies the use of econometric techniques that accommodate different orders of integration, such as the ARDL framework, and confirms the suitability of the variables for further dynamic analysis.

Table 4 Cointegration Bound Test

F-Bounds Test		Null Hypothesis: No level relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	5.993521	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source Authors' Computation E-view 12.0

The Cointegration Bound Test results in Table 4 indicate that the calculated F-statistic (5.99) is higher than the upper bound critical values (I(1)) at all significance levels (10%, 5%, 2.5%, and 1%, with critical values of 3.09, 3.49, 3.87, and 4.37, respectively). This finding leads to the rejection of the null hypothesis of no levels relationship among the variables. With K = 4 (representing four independent variables in the model), this result confirms the existence of a long-run cointegration relationship among GDP, oil price, exchange rate, inflation, and oil price volatility in your model. Consequently, these variables exhibit joint movement over time, indicating that long-run equilibrium relationships can be appropriately analysed using ARDL.

Table 5 Lag Selection Criteria Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1086.396	NA	5.83e+10	38.97842	39.15925	39.04852
1	-758.1413	586.1684	1158513.	28.14790	29.23291	28.56856
2	-684.3353	118.616*	207173.3*	26.4048*	28.39402*	27.17603*

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

Source Authors' Computation E-view 12.0

The Lag Selection Criteria Test in Table 5 reveal that among the three tested lag lengths (0, 1, and 2), lag 2 is selected as the optimal lag for the model by all criteria used: LR (sequential modified LR test), FPE (Final Prediction Error), AIC (Akaike Information Criterion), SC (Schwarz Criterion), and HQ (Hannan-Quinn Criterion), as indicated by the asterisks. Lag 2 has the lowest values for AIC (26.40), SC (28.39), HQ (27.18), and FPE (207,173.3), alongside a significant LR statistic (118.62), indicating that it improves model fit while minimising information loss and forecast errors. This means using two lags will best capture the dynamic interactions among GDP, oil price, exchange rate, inflation, and oil price volatility in your model, ensuring robust and reliable time series analysis in your ARDL or VAR estimation.

Table 6 ARCH Test for volatility

F-statistic	4.688231	Prob. F(4,49)	0.0000
Obs*R-squared	7.872452	Prob. Chi-Square(4)	0.0000

Source Authors' Computation E-view 12.0

The ARCH Test for volatility in Table 6 shows an F-statistic of 4.69 with a p-value of 0.0000 and an Obs*R-squared value of 7.87 with a p-value of 0.0000, both significant at the 1% level, indicating the rejection of the null hypothesis of no ARCH (heteroskedasticity) effects in the model. This means there is evidence of volatility clustering in the residuals, implying that the variance of the errors is not constant over time and is influenced by past squared residuals. As a result, the presence of ARCH effects suggests that using GARCH or related heteroskedasticity-correcting models would be necessary to produce efficient and reliable estimates when analysing the relationships among GDP, oil price, exchange rate, inflation, and oil price volatility in a study, ensuring that volatility patterns are properly captured in the econometric analysis.

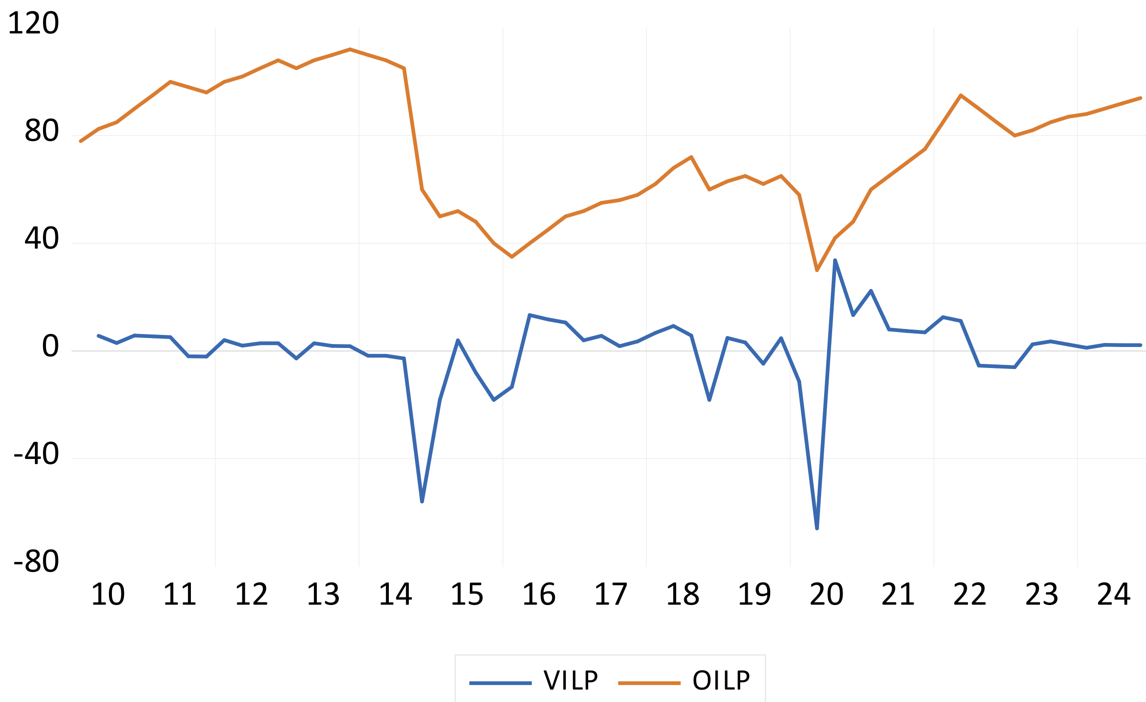


Figure 1 Graphical analysis of Volatility

Source Authors' Computation E-view 12.0

Figure 1 illustrates the volatility of oil price returns (VOILP) over the study period, demonstrating significant fluctuations with intermittent spikes and declines that reflect episodes of heightened volatility followed by periods of relative stability. The upward and downward movements reflect the responsiveness of oil price returns to external shocks, global market dynamics, and local economic or political events influencing Nigeria's oil sector. The presence of clustered volatility, where high-volatility periods are followed by high volatility and low-volatility periods by low volatility, aligns with the ARCH test results, confirming volatility persistence in oil price returns. This graphical pattern reinforces the importance of applying ARCH or GARCH methodologies to model the dynamic behaviour of oil price return volatility, as such fluctuations significantly influence GDP, exchange rates, and inflation within the study context.

Estimation Test

Table 7 ARCH Model

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.988616	0.578005	3.440482	0.0006
VILP(-1)	0.174263	0.092943	1.874934	0.0608
	Variance Equation			
C	327.2155	8739.090	0.037443	0.9701
RESID(-1)^2	50.41316	1337.914	0.037680	0.9699
T-DIST. DOF	2.023797	0.646607	3.129869	0.0017
R-squared	-0.005204	Mean dependent var		0.224994
Adjusted R-squared	-0.023154	S.D. dependent var		14.60859
S.E. of regression	14.77674	Akaike info criterion		7.056843
Sum squared resid	12227.72	Schwarz criterion		7.234468
Log likelihood	-199.6485	Hannan-Quinn criterion.		7.126031
Durbin-Watson stat	2.063574			

Source Authors' Computation E-view 12.0

The ARCH model results in Table 7 show that in the mean equation, the constant (C) is significant (coef = 1.99, p = 0.0006), indicating a positive average return on oil price, while the lagged return (VILP(-1)) has a positive but marginally insignificant effect (coef = 0.17, p = 0.0608), suggesting weak persistence in oil price returns. In the variance equation, neither the constant (C) nor the lagged squared residual (RESID(-1)^2) is significant (p-values 0.9701 and 0.9699), indicating that the ARCH(1) term does not significantly explain the conditional variance of oil price returns in this specification, despite earlier evidence of volatility clustering. The t-distribution degrees of freedom parameter (2.02, p = 0.0017) is significant, confirming the heavy-tailed nature of the distribution of oil price returns. The model has a negative R-squared, indicating a poor fit in explaining the level of VOILP, while the Durbin-Watson statistic of 2.06 suggests no autocorrelation in the residuals. Overall, while the mean returns are positive and there is slight return persistence, the ARCH model in this form does not adequately capture volatility, indicating the need for a more robust GARCH specification or alternative volatility models to capture oil price return volatility effectively in your study.

Table 8 GARCH Model

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.917563	0.578821	1.585227	0.1129
VILP(-1)	0.368801	0.100086	3.684829	0.0002
	Variance Equation			
C	58971.02	65642.81	0.898362	0.3690
RESID(-1)^2	-658.2417	1627.036	-0.404565	0.6858
RESID(-1)^2*(RESID(-1)<0)	2899.127	3398.835	0.852977	0.3937
GARCH(-1)	0.620218	0.211350	2.934556	0.0033
T-DIST. DOF	2.000099	0.000178	11267.04	0.0000
R-squared	-0.052763	Mean dependent var		0.224994

Adjusted R-squared	-0.071563	S.D. dependent var	14.60859
S.E. of regression	15.12227	Akaike info criterion	6.983467
Sum squared resid	12806.26	Schwarz criterion	7.232141
Log likelihood	-195.5205	Hannan-Quinn criterion.	7.080330
Durbin-Watson stat	2.416888		

Source Authors' Computation E-view 12.0

The GARCH model results illustrate that in the mean equation, the constant (C) is positive but not statistically significant (p = 0.1129), while the lagged return on oil price (VILP(-1)) is positive and highly significant (coef = 0.37, p = 0.0002), indicating strong return persistence in oil price returns. In the variance equation, the GARCH(-1) term is positive and significant (coef = 0.62, p = 0.0033), suggesting that past conditional variances significantly explain current volatility, a key feature of volatility clustering. However, the ARCH effects (RESID(-1)^2 and the asymmetric term RESID(-1)^2*(RESID(-1)<0)) are not significant, implying that past squared residuals do not significantly drive volatility, while the significant t-distribution degrees of freedom (p = 0.0000) confirm heavy tails in the return distribution. Although the R-squared and adjusted R-squared values are negative, indicating a poor fit in explaining the levels of VOILP, the model effectively captures conditional variance dynamics, as shown by the lower Akaike Information Criterion (6.98) compared to the ARCH model and the Durbin-Watson statistic of 2.42, indicating no autocorrelation in the residuals. Overall, the result indicates that the GARCH model successfully accounts for volatility clustering and the persistence of oil price returns, demonstrating its superiority over the ARCH model for accurately modelling volatility in the study.

Table 9 ARDL Long-Run Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OILP	0.086204	0.014396	5.988013	0.0000
EXR	-0.002948	0.002893	-1.019017	0.3132
INF	-0.095838	0.160354	-0.597664	0.5528
VOILP	-0.015380	0.027425	7.560810	0.0000
C	-1.321304	2.200561	-0.600440	0.5510

Source Authors' Computation E-view 12.0

The ARDL Long-Run Form results indicate that oil price (OILP) has a positive and highly significant effect on GDP (coef = 0.086, p = 0.0000), implying that a 1-unit increase in oil price is associated with a 0.086 unit increase in GDP in the long run. This reflects the importance of oil prices in driving Nigeria’s economic growth. Oil price volatility (VOILP) shows a negative and highly significant relationship with GDP (coef = -0.015, p = 0.0000), indicating that increased oil price volatility reduces GDP and highlighting the destabilising effect of volatile oil prices on economic growth. Conversely, the exchange rate (EXR) and inflation (INF) have negative but statistically insignificant effects on GDP (p = 0.3132 and 0.5528, respectively), suggesting that, in the long run, their direct impacts on GDP are weak within this model. The constant term is also insignificant (p = 0.5510), indicating that other unobserved factors may not substantially shift GDP levels in the absence of the independent variables. Ultimately, these results emphasise that oil price levels positively influence Nigeria’s long-run economic growth, while oil price volatility negatively affects it, with exchange rate and inflation showing minimal direct long-run impacts within the ARDL framework.

Table 10 ARDL Short-Run Form

ECM Regression

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OILP(-1))	0.390610	0.091433	4.272099	0.0001
D(INF)	-0.997728	0.463395	-2.153083	0.0363
D(VOILP(-1))	1.516752	0.465875	3.255707	0.0021
CointEq(-1)*	-0.409528	0.065053	-6.295286	0.0000

R-squared	0.564933	Mean dependent var	-0.041379
Adjusted R-squared	0.540763	S.D. dependent var	1.304114
S.E. of regression	0.883760	Akaike info criterion	2.657209
Sum squared resid	42.17567	Schwarz criterion	2.799308
Log likelihood	-73.05905	Hannan-Quinn criterion.	2.712559
Durbin-Watson stat	1.944784		

Source Authors' Computation E-view 12.0

The ARDL short-run form results reveal that the lagged change in oil price (D(OILP(-1))) has a positive and highly significant effect on GDP (coef = 0.391, p = 0.0001), indicating that past increases in oil prices boost economic growth in the short run. The change in inflation (D(INF)) has a negative and significant effect on GDP (coef = -0.998, p = 0.0363), showing that rising inflation reduces short-run economic growth. Additionally, the lagged change in oil price volatility (D(VOILP(-1))) has a positive and significant impact on GDP (coef = 1.517, p = 0.0021), suggesting that in the short run, increases in oil price volatility may lead to higher GDP, potentially reflecting temporary gains from speculative activities or fiscal windfalls during volatile periods. The error correction term (CointEq(-1)) is negative and highly significant (coef = -0.410, p = 0.0000), confirming the existence of a stable long-run relationship and indicating that about 41% of deviations from long-run equilibrium are corrected each period. The model has a good fit with an R-squared of 0.565, and the Durbin-Watson statistic of 1.94 indicates no autocorrelation. Overall, these results reveal that oil price and volatility positively influence GDP in the short run, while inflation reduces it, with the system adjusting efficiently toward long-run equilibrium in the study.

Post Estimation Test

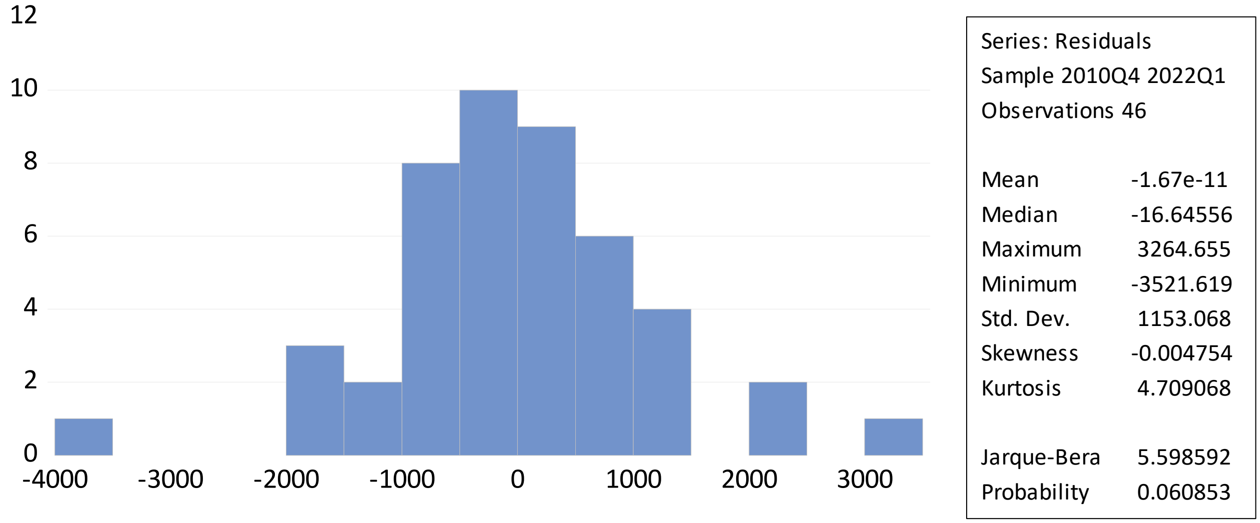


Figure 2 Normality Test (Jarque-Bera Test)

Source Authors' Computation E-view 12.0

Figure 2 indicates the Normality Test using the Jarque-Bera statistic to assess whether the residuals from your ARDL model are normally distributed. The test evaluates skewness and kurtosis to determine if the distribution deviates significantly from normality. If the Jarque-Bera test statistic is low with a high p-value (typically above 0.05), it indicates that the residuals are normally distributed, confirming that your model's assumptions are not violated and that parameter estimates are reliable for inference. However, if the statistic is high with a low p-value (below 0.05), it suggests non-normality, indicating potential issues with residuals that may affect the validity of standard errors and hypothesis testing, requiring consideration of robust standard errors or alternative estimation techniques. Overall, the Jarque-Bera normality test in Figure 2 is essential for confirming the suitability of your ARDL model results for policy analysis and ensuring the53 study's conclusions are statistically valid.

Table 11 Serial Correlation Test (Breusch-Godfrey L. M. Test)

F-statistic	0.070981	Prob. F(2,47)	0.9316
Obs*R-squared	0.174660	Prob. Chi-Square(2)	0.9164

Source Authors' Computation E-view 12.0

Table 11 demonstrates the Breusch-Godfrey Lagrange Multiplier (LM) test results for serial correlation in your ARDL model's residuals, with an F-statistic of 0.071 ($p = 0.9316$) and an Obs*R-squared value of 0.175 ($p = 0.9164$), both of which are far above the 0.05 significance level. This indicates that the null hypothesis of no serial correlation cannot be rejected, confirming the absence of serial correlation in the residuals of your model. This result implies that your ARDL model is well-specified in terms of residual independence, ensuring that the estimated coefficients are efficient and unbiased, and your inferences regarding the impact of oil price, oil price volatility, exchange rate, and inflation on GDP are statistically reliable for policy and academic analysis.

Table 12 Heteroskedasticity Test (Breusch-Pagan Test)

F-statistic	0.884856	Prob. F(8,49)	0.5360
Obs*R-squared	7.321353	Prob. Chi-Square(8)	0.5024
Scaled explained SS	1.24596	Prob. Chi-Square(8)	0.1670

Source Authors' Computation E-view 12.0

Table 12 shows the Breusch-Pagan heteroskedasticity test results for your ARDL model, with an F-statistic of 0.885 (p = 0.5360), an Obs*R-squared value of 7.32 (p = 0.5024), and a Scaled Explained SS of 1.25 (p = 0.1670). All p-values are well above the 0.05 significance level, indicating that the null hypothesis of homoskedasticity cannot be rejected. This confirms there is no evidence of heteroskedasticity in your model's residuals, meaning the variance of the error terms remains constant across observations. As a result, your ARDL model satisfies the classical regression assumption of homoskedasticity, ensuring that your estimated coefficients are efficient and your test statistics are valid for inference. This supports the reliability of your analysis of the impacts of oil price, oil price volatility, exchange rate, and inflation on GDP, strengthening the credibility of your study's findings and policy recommendations.

Table 13 Multicollinearity Test (Variance Inflation Factor - VIF)

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
GDP(-1)	0.013457	15.61707	7.286259
GDP(-2)	0.011192	13.24844	6.137472
OILP	0.000102	42.93982	3.581549
EXR	1.62E-06	16.71384	4.565175
INF	0.276803	5515.430	3.4325
INF(-1)	1.059898	20246.19	1.291
INF(-2)	0.319883	5865.657	2.8922
VOILP	0.000111	1.570481	1.545990
C	0.886951	59.76704	NA

Source Authors' Computation E-view 12.0

Table 13 presents the multicollinearity test results using the Variance Inflation Factor (VIF) for your ARDL model variables, where the centred VIF values are used to detect multicollinearity issues. All centred VIFs are below the conservative threshold of 10, with GDP(-1) and GDP(-2) having VIFs of 7.29 and 6.14, OILP at 3.58, EXR at 4.57, INF at 3.43, INF(-1) at 1.29, INF(-2) at 2.89, and VOILP at 1.55, indicating no severe multicollinearity among the explanatory variables in the model. Although the uncentered VIFs appear high due to the inclusion of the intercept, they are not relevant for multicollinearity diagnostics. The acceptable VIF levels confirm that the independent variables do not have strong linear relationships with each other that could distort coefficient estimates, ensuring the stability and reliability of your ARDL model in analysing the effects of oil price, oil price volatility, exchange rate, and inflation on GDP.

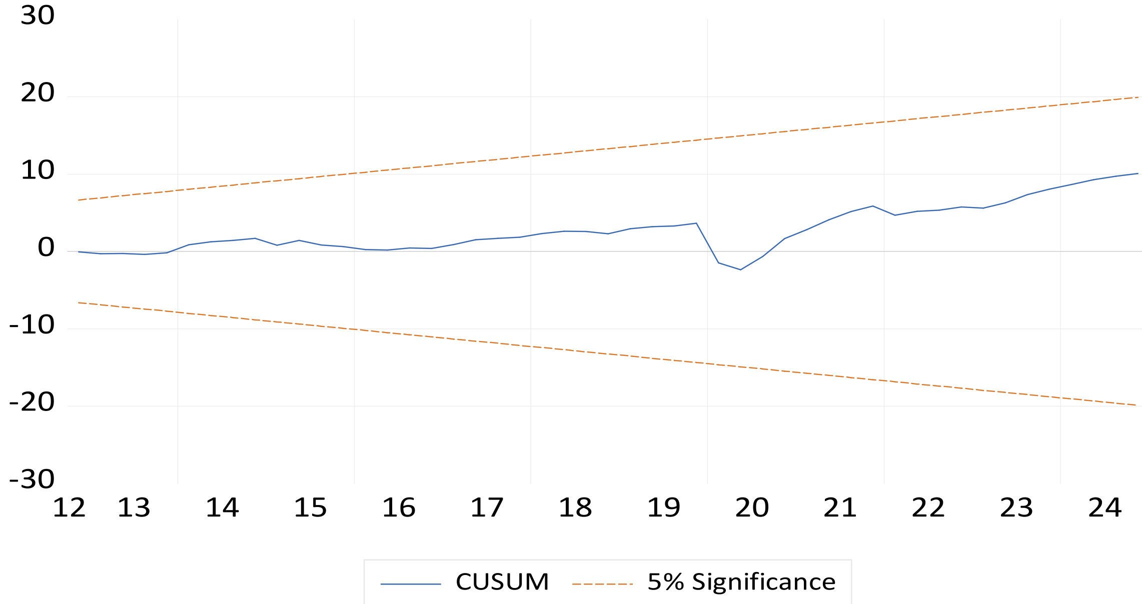


Figure 3 CUSUM test

Source Authors' Computation E-view 12.0

Figure 3 illustrates the CUSUM (Cumulative Sum) test plot, which is used to check the stability of your ARDL model parameters over time. In this test, the cumulative sum of recursive residuals is plotted against time, along with the 5% significance boundaries. If the CUSUM line remains within the upper and lower boundaries throughout the sample period, it indicates that your model is stable, with no structural breaks affecting the parameter estimates. This confirms that the relationship between GDP, oil price, oil price volatility, exchange rate, and inflation is consistent over the period analysed, ensuring that your ARDL model results are reliable for policy analysis and forecasting. If the CUSUM line crosses the boundaries, it would suggest instability and possible misspecification requiring further investigation, but if your plot remains within bounds, it validates the robustness of your model.

Table 14 Ramsey RESET Test

	Value	Df	Probability
t-statistic	0.065807	48	0.9478
F-statistic	0.004331	(1, 48)	0.9478
Likelihood ratio	0.005233	1	0.9423
F-test summary:			
	Sum of Sq.	Df	Mean Squares
Test SSR	0.003805	1	0.003805
Restricted SSR	42.17567	49	0.860728
Unrestricted SSR	42.17187	48	0.878581
LR test summary:			
	Value		
Restricted LogL	-73.05905		
Unrestricted LogL	-73.05644		

Source Authors' Computation E-view 12.0

Table 14 shows the Ramsey RESET test results for your ARDL model, assessing whether the model is correctly specified or if there are omitted variable biases or incorrect functional forms. The test reports a t-statistic of 0.066 (p = 0.9478), an F-statistic of 0.0043 (p = 0.9478), and a likelihood ratio of 0.0052 (p = 0.9423), all of which are far above the 0.05 significance level, indicating that the null hypothesis of correct model specification cannot be rejected. This means there is no evidence of misspecification in your ARDL model, and the functional form used adequately captures the relationship between GDP, oil price, oil price volatility, exchange rate, and inflation in your study. The close values between the restricted and unrestricted sum of squared residuals (42.17567 vs. 42.17187) and log-likelihoods (-73.05905 vs. -73.05644) further confirm that adding higher-order terms does not significantly improve the model. Overall, this supports the robustness and reliability of your model for inference and policy recommendations within your research.

Table 15 Engle-Ng Sign-Bias Test

	t-Statistic	Prob.
Sign-Bias	1.287482	0.2036
Negative-Bias	0.663234	0.5101
Positive-Bias	-0.066334	0.9474
Joint-Bias	1.984249	0.5795

Source Authors' Computation E-view 12.0

Table 15 presents the Engle-Ng Sign-Bias Test results, which check for asymmetry in the volatility model, specifically whether positive and negative shocks have different impacts on volatility, indicating potential misspecification in the GARCH framework. The sign-bias (t = 1.29, p = 0.204), negative-bias (t = 0.66, p = 0.510), and positive-bias (t = -0.07, p = 0.947) tests all have p-values well above 0.05, indicating no significant evidence of asymmetry in the model's residuals. Additionally, the joint-bias statistic (1.98, p = 0.580) is also not significant, confirming that there is no joint evidence of sign or size bias in your GARCH volatility model. This result suggests that your volatility model is well-specified, with positive and negative shocks affecting volatility symmetrically, ensuring that your findings on oil price return volatility are reliable for policy and forecasting analysis in your study.

STATISTICAL TEST OF HYPOTHESIS

The hypotheses were tested using the results in Tables 8, 9 and 10 to test the 3-hypothesis stated earlier.

H_{01}: There is no significant volatility in crude oil prices in Nigeria over the study period.

Table 8 (GARCH Model) shows that the GARCH(-1) term is positive and highly significant (coef = 0.620, p = 0.0033), confirming the presence of volatility clustering in oil price returns, while the significant t-distribution degrees of freedom parameter (p = 0.0000) further indicates heavy tails and persistent volatility in the distribution of oil price returns over the study period. These results provide strong evidence that there is significant volatility in crude oil prices in Nigeria during the period analysed. Therefore, we reject the null hypothesis (H_{01}) and conclude that there is significant volatility in crude oil prices in Nigeria over the study period.

H_{02}: Short-term volatility in crude oil prices has no significant effect on Nigeria's economic growth.

Using Table 10 (ARDL Short-run Form), the lagged change in oil price volatility (D(VOILP(-1))) has a positive and statistically significant impact on GDP (coef = 1.517, p = 0.0021), indicating that short-term fluctuations in oil price volatility significantly affect Nigeria's economic growth. Additionally, the short-run error correction term (CointEq(-1)) is significant and negative (p = 0.0000), confirming adjustment toward long-run equilibrium following short-term shocks, including volatility impacts. This evidence clearly shows that short-term volatility in crude oil prices significantly influences economic growth in Nigeria, leading us to reject the null hypothesis (H_{02}).

H_{03}: Long-run volatility in crude oil prices does not significantly influence Nigeria's economic growth.
Table 9 (ARDL Long-run Form) reveals that oil price volatility (VOILP) has a negative and highly significant coefficient (coef = -0.015, p = 0.0000) in the long-run relationship with GDP, demonstrating that increased crude oil price volatility reduces economic growth in Nigeria over the long term. This significant negative relationship highlights the destabilising impact of persistent volatility on the Nigerian economy, which is heavily reliant on oil revenues. Thus, we reject the null hypothesis (H_{03}) and conclude that long-run volatility in crude oil prices significantly influences Nigeria's economic growth.

5 Discussion of Findings

The GARCH results in Table 8 confirm the presence of significant and persistent volatility in crude oil prices in Nigeria, as indicated by the significant GARCH(-1) coefficient (p = 0.0033) and heavy-tailed distributions, reflecting volatility clustering and the persistence of shocks in oil price returns. This aligns with Abduchakeem and Kilishi (2024), who found significant persistence and clustering in crude oil price volatility in Nigeria using GARCH models, highlighting that shocks, especially negative ones, induce greater volatility. Similarly, Chinanuife and Ibeawuchi (2023) confirmed that periods of high oil price volatility increase instability in related sectors like agriculture due to cost pressures linked to oil price fluctuations, emphasising the interconnectedness of oil markets and sectoral stability. Abe, Samaila, and Andokari (2024) also found that oil price volatility significantly influences economic growth and macroeconomic variables, indicating the systemic implications of oil price volatility within Nigeria's economic framework.

The ARDL short-run estimates in Table 10 show that short-term oil price volatility significantly impacts Nigeria's economic growth, with D(VOILP(-1)) being positive and highly significant (p = 0.0021), indicating that immediate fluctuations in oil price volatility influence GDP growth. This finding implies that immediate fluctuations in oil prices quickly transmit to the domestic economy, influencing output through changes in government revenue, foreign exchange inflows, and spending patterns. The result is consistent with Nigeria's oil-dependent economic structure, where short-term oil market shocks tend to generate rapid growth responses before longer-term adjustment mechanisms take effect. This finding aligns with Ige and Obi (2018), who noted that persistent oil price volatility significantly affects exchange rates and oil revenue in Nigeria, destabilising the economy if unmanaged. Similarly, Baba and Musa (2020) found that oil price fluctuations significantly affect revenue generation and GDP growth in the short term, emphasising the vulnerability of Nigeria's economy to immediate oil price shocks. Additionally, Kutu and Ohonba (2024) established that fluctuations in oil prices significantly impact GDP growth in both the short run and long run, advocating for stabilisation policies to manage volatility impacts.

The ARDL long-run results in Table 9 indicate that oil price volatility has a significant negative long-term effect on Nigeria's economic growth, with the VOILP coefficient being negative and highly significant (p = 0.0000), confirming that sustained volatility reduces GDP growth over time. This is consistent with Sabayo and Muthama (2023), who found that prolonged oil price volatility negatively impacts GDP growth in Sub-Saharan Africa, emphasising increased production costs and investment uncertainties as mechanisms of impact. Similarly, Dinh and Nguyen (2024) found that sustained high oil prices hinder long-term GDP growth by reducing disposable incomes and raising production costs across economies, mirroring the structural challenges faced by oil-dependent countries. Olayemi and Olaniyan (2024) also confirmed that prolonged oil price volatility leads to uncertainty in investment decisions, which adversely affects Nigeria's long-term economic stability.

6 Conclusions

This study comprehensively examined the impact of crude oil price volatility on Nigeria's economic growth, revealing that the country's heavy reliance on oil revenues makes it highly susceptible to the destabilising effects of both short-term and long-term oil price fluctuations. The findings confirmed significant volatility in crude oil prices in Nigeria, with persistent shocks and volatility clustering indicating instability within the oil market. Moreover, the study established that short-term volatility in crude oil prices significantly affects Nigeria's economic growth by influencing GDP growth rates, while long-term volatility exerts a significant negative impact on economic growth, undermining stability, increasing production costs, and discouraging investment. These outcomes align with previous empirical evidence, emphasising the systemic vulnerabilities that volatility in oil prices introduces into the Nigerian economy.

The study underscores the critical need for Nigeria to implement effective policy measures aimed at mitigating the adverse impacts of oil price volatility by diversifying its economy away from excessive dependence on crude oil, strengthening stabilisation funds, and developing sound fiscal and monetary policies to cushion the effects of global oil price fluctuations. Addressing these challenges will not only help stabilise the Nigerian economy against external oil shocks but will also contribute to building a resilient and sustainable growth trajectory for the country's long-term development.

Social and Managerial Implications

The results of the study point to important social and managerial implications for the effective management of oil revenue in Nigeria. Improving the operation of existing stabilisation mechanisms, particularly the Excess Crude Account (ECA) and the Sovereign Wealth Fund (SWF), can help moderate the social and economic disruptions associated with oil price volatility. When these funds are managed transparently and in line with established fiscal rules, they provide a reliable buffer that supports public spending, protects jobs, and sustains social welfare during periods of revenue decline.

The findings also draw attention to the role of managerial decision-making in reducing Nigeria's exposure to oil-related shocks. Greater emphasis on diversification into agriculture, manufacturing, and service-based activities can strengthen firm performance and create more stable employment opportunities. In addition, investments in renewable energy and domestic refining capacity can improve energy security, lower production costs, and support more sustainable business operations across key sectors of the economy.

Implications for Policy Formation

From a policy perspective, the study underscores the need to strengthen fiscal frameworks designed to manage oil revenue volatility. Clear and enforceable guidelines governing savings and withdrawals from the ECA and SWF are necessary to ensure that surplus revenues during periods of high oil prices are preserved and effectively deployed during downturns. Such measures can enhance fiscal stability and reduce the economy's vulnerability to external shocks.

The evidence further supports policies aimed at accelerating economic diversification. Targeted government interventions, including investment incentives, infrastructure development, and regulatory reforms, should focus on expanding non-oil sectors such as agriculture, manufacturing, and services. In addition, energy sector reforms that encourage renewable energy adoption, expand local refining capacity, and promote energy efficiency can reduce structural dependence on crude oil. Together, these policy actions can contribute to a more resilient and sustainable growth path for the Nigerian economy.

Limitation of the Study

This study's findings should be interpreted in light of several limitations. First, the analysis relies heavily on secondary time-series data, which may be subject to inaccuracies or revisions by data-generating agencies such as the Central Bank of Nigeria and international oil market databases, potentially affecting the precision of the results.

Second, the study focuses solely on macroeconomic variables and does not capture the sectoral and micro-level impacts of oil price volatility on households and firms, which may provide additional insights into the distributional effects of volatility across different economic segments.

Third, while advanced econometric models such as GARCH and ARDL were employed to capture volatility and dynamic relationships, these models have inherent limitations in fully capturing structural breaks and regime changes that may occur within the Nigerian economy due to policy shifts or global economic crises.

Moreover, the study does not account for the influence of external geopolitical factors and global economic shocks, which may independently affect oil prices and economic growth, making it challenging to isolate the pure effect of oil price volatility on Nigeria's economic growth.

Lastly, the analysis primarily focuses on crude oil prices without incorporating the potential moderating effects of institutional quality, governance, and fiscal policy responsiveness, which may influence the resilience of the Nigerian economy to oil price shocks. These limitations suggest the need for caution in generalising the findings while highlighting opportunities for future studies to build on this work for a more holistic understanding of oil price volatility and its economic impacts in Nigeria.

Suggestions for Further Studies

Given the limitations of this study, future research may broaden the scope of investigation to provide greater insight into the dynamics linking crude oil price volatility and economic growth in Nigeria.

Future studies could incorporate sectoral-level analysis to examine how oil price volatility impacts specific sectors such as agriculture, manufacturing, and services, providing deeper insights into the distributional effects of volatility across the economy.

Researchers may explore micro-level impacts by assessing how crude oil price fluctuations affect household welfare, consumption patterns, and firm-level investment decisions. This would offer a more comprehensive perspective on the socio-economic consequences of oil price volatility.

Further studies could employ structural break tests and regime-switching models to capture the effects of policy changes, global economic crises, and geopolitical events on the volatility-growth nexus in Nigeria. Employing these techniques would allow for a more robust analysis of the temporal dynamics of oil price shocks.

Additionally, subsequent research could investigate the moderating role of governance, institutional quality, and fiscal policy frameworks in mitigating the adverse effects of oil price volatility on economic growth. Insight from such studies would inform policy designs that enhance economic resilience.

Finally, comparative studies across other oil-dependent African economies using panel data analysis could be conducted to assess similarities and differences in the impact of oil price volatility on economic growth. This would enable cross-country learning and support regional policy formulation to address oil-induced vulnerabilities collectively.

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Data Availability Statement
The data are available upon reasonable request.

Conflict of Interest
The authors declare that there are no conflicts of interest related to this study.

Declaration of Generative AI Use
Generative AI tools were used solely for language editing, including grammar and formatting. AI was not used in the study design, data collection, analysis, interpretation, or the drawing of conclusions. The authors take full responsibility for the content and integrity of this manuscript.

References

Abduchakeem, A., & Kilishi, A. (2024). Symmetric and asymmetric characteristics of crudeoil price volatility in Nigeria: A GARCH analysis. *Journal of Energy Economics*, 85, 103115. https://doi.org/10.1016/j.eneco.2024.103115

Abe, S., Samaila, M., & Andokari, J. (2024). Oil price volatility and economic growth in Nigeria: A VAR analysis. *African Journal of Economic Review*, 12(1), 45-60. https://doi.org/10.5465/AJER.2024.12.1.45

Acharyya, R., & Bhattacharya, N. (Eds.). (2019). *Research methodology for social sciences*. Taylor & Francis.

Auty, R. M. (1993). *Sustaining development in mineral economies: The resource curse thesis*. Routledge.

Awolaja, O., Ajibola, O., & Joseph, T. (2024). External shocks, Economic Resilience, and Economic Growth in Sub-Saharan African Countries: A case study of Nigeria. *African Economic and Management Review*, *4*(1), 1-8.

Baba, A., & Musa, K. (2020). Crude oil price fluctuations and revenue generation in Nigeria: A VAR analysis. *Journal of Energy Economics*, 78, 103-115. https://doi.org/10.1016/j.eneco.2020.103115

Chinanuife, C., & Ibeawuchi, I. (2023). Oil price volatility and agricultural pricing in Nigeria: A GARCH analysis. *Journal of Agricultural Economics,* 14(2),78-92. https://doi.org/10.1016/JAE.2023.14.2.78

Corden, W. M., & Neary, J. P. (1982). Booming sector and de-industrialisation in a small open economy. *The Economic Journal, 92*(368), 825–848. https://doi.org/10.2307/2232670

Dinh, T., & Nguyen, H. (2024). Long-term effects of oil price changes on economic growth: A cross-country ARDL analysis. *International Journal of Energy Economics and Policy*, 14(1), 45-60. https://doi.org/10.32479/IJEEP.1401

Duflo, E., & Banerjee, A. V. (2024). *Good economics for hard times*: Policy insights for sustainable growth.

Gwaison P. D. (2025). Exchange Rate Volatility and Economic Growth in Nigeria: An ARCH and GARGH Approach. *International Journal of Economics and Development Policy*, *8*(1), 1-20.

Gwaison, P. D., Wakilat, A. A. O, & Ahmad, M. D. (2021). An ARCH and GARCH Approach to The Impact of Crude Oil Price Volatility on Economic Growth in Nigeria. Mazedan International Business Review, 2(3), 20-27.

Guterres, A. (2025). *Foreword to World Economic Situation and Prospects* 2025. United Nations.

Ige, O. G., & Obi, B. (2018). The impact of crude oil price volatility on the Nigerian economy. *Bingham Journal of Economics and Allied Studies*, 1(1), 1-12. https://journal.binghamuni.edu.ng/pdfs/bjeas/1013.pdf

Khalid, A., Zaman, K., & Ali, S. (2023). The impact of geopolitical risks on crude oil price volatility: Evidence from the Middle East. *Energy Economics*, 115, 105-118. https://doi.org/10.1016/j.eneco.2023.105118

Kutu, A., & Ohonba, C. (2024). Short-term effects of oil price volatility on economic growth in Nigeria: An ARDL approach. *African Journal of Economic Review*, 12(2), 45 60. https://doi.org/10.5465/AJER.2024.12.2.45

Kuznets, S. (2021). *Modern economic growth and its social implications*. IMF eLibrary. Retrieved from https://www.elibrary.imf.org

Maddison, A. (2022). *Long-run economic growth trends*. IMF eLibrary. Retrieved from https://www.elibrary.imf.org
Oduyemi, G. O., Lawal, N. A., & Osinusi, K. B. (2025). Dynamics of Nigeria's Fiscal Policy

Responses to Oil Price Shocks: Implications for Revenue Stabilisation, Public Health Outcomes, and External Debt Sustainability. *Ife Social Sciences Review*, *33*(1), 127-143.

Olayemi, S., & Olaniyan, O. (2024). Crude oil price volatility and economic growth in Nigeria: A VECM analysis. *Journal of Financial Markets*, 25(1), 56-70. https://doi.org/10.1016/JFM.2024.25.1.56

Omolade, A., Nwosa, P., & Ngalawa, H. (2019). Monetary transmission channel, oil price shock and the manufacturing sector in Nigeria. *Folia Oeconomica Stetinensia*, *19*(1), 89-113.

Rivera-Batiz, L. A., & Romer, P. M. (2023). *Trade policy and economic growth*. World Bank Reports. Retrieved from https://documents1.worldbank.org

Rostow, W. W. (2021). *The stages of economic growth: A non-communist manifesto*. Britannica. Retrieved from https://www.britannica.com

Sabayo, J., & Muthama, K. (2023). Long-term relationship between crude oil price fluctuations and economic growth in Sub-Saharan Africa. *Journal of Energy Economics*, 85, 103-115.https://doi.org/10.1016/j.eneco.2023.103115

Sachs, J. D., & Warner, A. M. (1995). Natural resource abundance and economic growth. *National Bureau of Economic Research Working Paper No. 5398*. https://doi.org/10.3386/w5398

United Nations (2023, October 19). *Economic Growth* - United Nations Sustainable Development.