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Oil Price Volatility and Economic Growth in Nigeria: A Dynamic Analysis

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Abstract- ***This study examines the impact of oil price volatility on Nigeria's economic growth. It studies the relationship between oil price changes and economic growth. It also studies the impact of oil price volatility on growth and the contribution of oil price volatility to growth fluctuation. The study is based on the Dutch Disease Hypothesis and is based on data from years 1980 to 2024 from official national and international sources. In this study, oil price volatility was analyzed and measured with the GARCH (1,1) model, while ARDL, VECM, Variance Decomposition, and Impulse Response were conducted. The results of the study show the existence of a stable long-run relationship between oil prices and economic growth. It was found that volatility of oil prices has a negative impact on growth in the short run. This is attributed to increased uncertainty, declined investment, fiscal disturbances, and exchange rate volatility. While oil price volatility explains only a small proportion of GDP forecast variance, direct, oil price volatility explains a small proportion of output variation, when compared to exchange rate volatility. The study offers a comprehensive multi-method econometric framework (ARDL, VECM, IRF, FEVD) for a robust analysis of different effects. The study offers quantification of the indirect and direct transmission channels of volatility in oil prices and extends the period of analysis up to 2024, capturing the recent structural shocks (e.g. COVID-19 shock).***

Keywords: oil price volatility, economic growth, dutch disease, ARDL, VECM, exchange rate, nigeria

I. INTRODUCTION

Crude oil makes up the backbone of Nigeria's economy contributing the majority of foreign and government budgets since the first large-scale export of oil in 1956 which accounts for the domestic economy's performance. Due to Nigeria’s reliance on one product, changing global prices of oil has impacted the fiscal policies, inflation, and stability of the economy, as well overall economic growth (Ibrahim, 2025). Increases in the price of oil result in the government spending more, a stable currency, and positive growth of the economy, while a drop in the price causes fiscal deficits, currency weakening, inflation, and negative economic growth (Mgbomene et al., 2025).

In international terms, volatile oil prices refer to swings caused by many factors such as geopolitical activity, shifts in global supply and demand, decisions by OPEC, technological advancements, speculative markets, and global economic conditions (Wasurum, 2025). Nigeria has been continually trying to diversify its economy, but its high reliance on oil means that it is susceptible to external factors that play a role in the planning of fiscal policies and the performance of the economy as a whole (Adedoyin, 2025).

The trends in Nigeria’s economic development over the years mirror fluctuations in global oil prices. Nigeria’s government expenditure, foreign reserves, and GDP increases during the 1970s oil boom. During the subsequent oil boom of 2003-2008 and at the start of the post-pandemic recovery of 2021-2022, economic activity and government expenditure increased. The reverse was experienced during the economic downturns of the mid-1980s, the 1998 Asian crisis, the 2014 oil crash and COVID-19. During these recessions the Nigerian economy experienced fiscal deficits, currency depreciation, increased debt and slowed economic activity (Omotosho, 2021).

Empirically, weak and inefficient institutions coupled with high levels of corruption and poor governance increase macroeconomic instability in oil-price dependent economies (Akinlo, 2024; Nwosu, 2024). Nigeria's downstream problems, including its heavy dependence on the importation of refined petroleum products, shows that global shocks easily impact

prices and production costs in Nigeria (Osuagwu, 2023; Chuku, 2023).

Despite some relevant policy interventions including the Excess Crude Account (2004), Nigeria Sovereign Investment Authority (2011), subsidy removal, and diversification policies (Omotosho, 2021; Okafor, 2020), Nigeria's managers of the economy continue to grapple with the challenges of oil price shocks. Unless these challenges are addressed, Nigeria will not be able to achieve sustained macroeconomic growth (Mgbomene et al., 2025; Adedoyin, 2025).

The main problem is the prolonged exposure to external oil price shocks resulting from the repeated implementation of diversification policies in Nigeria. Even though there is temporary growth from increases in oil prices, declines in prices always result in revenue shortfalls, a fiscal deficit, unstable exchange rates, and macroeconomic deterioration (Akinlo, 2024; Mgbomene et al., 2025). This indicates weaknesses in economic diversification and fiscal management.

Consequently, in the absence of such analysis, there is a strong case for conducting empirical economic research on the effects of price volatility on economic growth and the channels of such effects. The findings of existing studies are contradictory, mainly due to differences in methods, data, and time periods (Omojolaibi, 2024; Afolabi, 2024). The present study addresses these shortcomings by using data spanning the period 1980-2024 and advanced econometric methods, namely GARCH and ARDL/NARDL, to offer improved policy advice.

II. LITERATURE REVIEW

Theoretical Framework

Dutch Disease Theory

This study is based on the Dutch Disease Hypothesis. The Dutch Disease Hypothesis is a principle in resource and development economics. It explains how a country's natural resource boom can negatively affect other sectors of the economy, even if that may not be the purpose of the natural resource boom. The term was introduced by an edition of The Economist in 1977. It was describing the loss of manufacturing in the Netherlands after the Dutch natural gas discoveries along the coast of Groningen in the 1960s. The formal model was created later by Corden and Neary in their 1982 paper titled Booming Sector and De-industrialization: A Theoretical Analysis. It was further built upon by Corden in 1984.

In this model, the economy consists of three sectors: a booming sector (natural resources and oil with price surges), a lagging tradable sector (manufacturing and agriculture, which become uncompetitive), and a non-tradable sector (services, construction and real estate, with prices determined locally). The theory contains two primary pathways through which resource booms impact the economy.

The resource movement effect states that as oil prices increase, returns in the oil sector get better. This attracts labor and capital from agriculture and manufacturing, thus decreasing production in the rest of the oil tradeable sector. The spending effect states that an increase in oil income leads to an increase in government and household spending. This creates a demand for goods and services in the economy. As a result, prices increase in the economy and exports from the non-oil tradeable sector become less competitive. The resource movement effect and the spending effect generally lead to a real exchange rate appreciation and a shrinking or less productive manufacturing or export sector. Eventually, this has harmful consequences for the economy that rely on oil trade. It leads to less productive capacity, increases the economy's dependence on oil, and makes the economy susceptible to oil price cycles.

Nigeria shows a perfect example of this framework. Crude oil accounts for 85-90% of Nigeria's total exports, 65-80% of total government revenue, and up to 8-10% of GDP (CBN, 2023; World Bank, 2023). Therefore, an increase in oil prices will be directly reflected in the fiscal budget, the monetary budget, the currency exchange rates and the overall economic situation in Nigeria.

Empirical Review

The GARCH family models, and specifically the GARCH(1,1) model, have been widely used in the

most recent empirical studies of oil price volatility. Time-changing volatility estimates that incorporate volatility clustering and persistence are provided by these models. Standard deviation, as a simple measure of dispersion, is outperformed by these models. The GARCH(1,1) model framework is used by Ibrahim (2025), Mgbomene et al. (2025), and Adedoyin (2025) to obtain time-changing estimates of volatility. Wasurum (2025) extends the framework by using the EGARCH model based on asymmetric volatility effects, in which negative shocks generate a stronger response to volatility compared to positive shocks of the same magnitude.

In the study of long-run and short-run relationships, contemporary empirical studies, including Olayungbo (2024), Afolabi (2024), and Akinlo (2024), apply the Pesaran et al. (2001) Autoregressive Distributed Lag (ARDL) approach. The flexibility of the ARDL technique in handling variables of different order of integration (I(0) and I(1)) makes it useful in small sample studies for estimating both short-run and long-run relationships. Its nonlinear counterpart, the NARDL model, introduces asymmetric effects through positive and negative shocks and is used by Nwosu (2024), Agbo (2023), Ukpong (2025) to evaluate how oil price increases and decreases differently impact the key macroeconomic variables; income, inflation and exchange rates.

Furthermore, Vector Autoregression (VAR) models can treat all variables as endogenous. This allows for the modeling of complex interdependencies of the system without the need for rigid causal interrelationships. Omojolaibi (2024) uses VAR to study the case of the shock transmission of oil prices impulse response functions and variance decompositions.

III. METHODOLOGY

Model Specification

This study aims to design models as specified, and these models are based on the Dutch Disease hypothesis. From this hypothesis, we will develop the general model and identify some major channels through which movements in oil prices impact macroeconomic conditions of Nigeria as follows:

$$GDP = f(OILP, INF, INT, MS, EXC) \quad (3.1)$$

In this model, we used real GDP as a proxy for the overall macroeconomic performance. OILP is international crude oil prices and is the main explanatory variable. INF, INT, MS, and EXC are included as macroeconomic controls and the most important mechanisms of the Dutch Disease. The model is improved with the log of real GDP, (LGDP).

Based on the theory mentioned, we estimate the long-run cointegration relationship as follows:

$$LGDP_t=\beta_0+\beta_1 OILP_t+\beta_2 INF_t+\beta_3 INT_t+\beta_4 MS_t+\beta_5 EXC_t+\varepsilon_t \quad (3.2)$$

where:
LGDPt is the Natural logarithm of Nigeria's real GDP at time t (dependent variable),
OILPt = Global crude oil price (USD per barrel) at time t,
INFt = Domestic inflation rate (%) at time t,
INTt = Nominal interest rate / monetary policy rate (%) at time t,
MSt = Broad money supply as a percentage of GDP (%) at time t,
EXCt = Official nominal exchange rate (Naira per USD) at time t.

The VECM specification for the LGDP equation is given as:

$$\Delta LGDP_t=\alpha_0+\alpha_1 ECT_{t-1}+\Sigma\phi_i\Delta LGDP_{t-i}+\Sigma\delta_i\Delta OILP_{t-i}+\Sigma\gamma_i\Delta INF_{t-i}+\Sigma\lambda_i\Delta INT_{t-i}+\Sigma\mu_i\Delta MS_{t-i}+\Sigma\theta_i\Delta EXC_{t-i}+v_t \quad (3.3)$$

Sources of Data

This study is based on time-series annual data for the period 1980 to 2024 (45 observations). The data were obtained from the World Bank's World Development Indicators (WDI) and from the Central Bank of Nigeria (CBN) and the International Monetary Fund (IMF) as published in the International Financial Statistics (IFS).

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Table 1: Variable Description and Data Sources

Variable	Description	Frequency	Period
LGDP	Log of Real GDP	Annual	1980-2024
OILP	Crude Oil Price (USD per barrel)	Annual	1980-2024
INF	Inflation Rate (% change in CPI)	Annual	1980-2024
INT	Interest Rate/Monetary Policy Rate (%)	Annual	1980-2024
MS	Money Supply - M2 (% of GDP)	Annual	1980-2024
EXC	Exchange Rate - Official (Naira per USD)	Annual	1980-2024

IV. RESULTS AND DISCUSSION

Descriptive Statistics

Table 2: Descriptive Statistics of Study Variables

Statistic	LGDP	OILPVO	EXC	INF	INT	MS
Mean	12.8747	45.7796	1.5949	19.0106	0.3677	22.9442
Median	13.0608	36.3579	2.0740	13.0070	2.3432	18.8211
Maximum	14.3937	86.4004	2.6947	72.8355	18.1800	87.7614
Minimum	10.7013	16.4165	-0.2622	5.3880	-65.8572	-0.7942
Std. Dev.	1.1293	25.3363	0.9211	15.9916	13.6104	17.3909
Skewness	-0.3317	0.2571	-0.7897	1.8902	-2.8191	1.5113
Kurtosis	1.7170	1.4611	2.3422	5.6429	14.0371	5.9429
Jarque-Bera	3.9117	4.9364	5.4884	39.8935	288.0123	33.3696
Prob.	0.1414	0.0847	0.0643	0.0000	0.0000	0.0000
Observations	45	45	45	45	45	45

The descriptive statistics show that the mean for the variable LGDP is 12.8747 and the median is 13.0608, with a range of 14.3937 to 10.7013. The low standard deviation of 1.1293 shows limited growth over time, with a broad stable pattern of growth. For OILPVO, the mean, 45.7796, is greater than the median of 36.3579, showing a situation of right-skewness evident from a positive skewness value of 0.2571. The high range of 86.4004 to 16.4165 shows large price variations through the time period.

Unit Root Test

Table 3: ADF Unit Root Test Results

Variable	Level t-Stat (C)	Prob.	1st Diff t-Stat (C)	Prob.	Order
LGDP	-1.2834	0.6288	-8.5150	0.0000	I(1)
OILPVO	-1.5275	0.5096	-2.0715	0.2568	I(0)*
EXC	-2.1191	0.2384	-5.6128	0.0000	I(1)
INF	-2.6387	0.0935	-3.1161	0.0337	I(1)
INT	-4.8663	0.0003	-4.5307	0.0010	I(0)
MS	-4.0368	0.0029	-5.7210	0.0000	I(0)

The ADF test results indicate that the variables exhibit different orders of integration. LGDP and EXC are integrated of order one, I(1), while INT and MS are stationary in their level forms and are therefore classified as integrated of order zero, I(0). This mixed integration structure supports the use of the Autoregressive Distributed Lag (ARDL) bounds testing methodology.

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Long-Run Relationship (ARDL Bounds Test)

Table 4: ARDL Bounds Test for Long-Run Relationships

Test	F-Statistic	Significance	I(0) Bound	I(1) Bound
ARDL Bounds Test	10.4356	10%	2.26	3.35
		5%	2.62	3.79
		2.5%	2.96	4.18
		1%	3.41	4.68

The computed F-Statistic of 10.4356 exceeds the upper bound critical values for all common levels of significance. This shows that there is a stable long-run equilibrium relationship between oil price volatility and volatility in Nigeria's economy.

Table 5: ARDL Long-Run Coefficient Estimates (Dependent Variable: LGDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OILPVO	0.0044	0.0017	2.5228	0.0207
EXC	1.1328	0.0306	37.0774	0.0000
INF	0.0060	0.0023	2.6355	0.0163
INT	-0.0276	0.0027	-10.1935	0.0000
MS	-0.0018	0.0007	-2.6150	0.0170
C	11.5736	0.1105	104.7359	0.0000

The long-run ARDL estimates show that OILPVO has a positive coefficient and is statistically significant ($t = 2.5228$, $p = 0.0207$). This suggests that for every percent increase in oil price volatility, LGDP is expected to increase by .0044 percent in the long run. The model shows that the most important factor is the exchange rate. In the model, the positive coefficient of great importance is of great significance ($t = 37.0774$, $p < 0.001$). The estimated elasticity is that a 1 percent devaluation of the naira increases LGDP by 1.1328 units in the long run.

Short-Run Dynamics (ARDL-ECM)

Table 6: ARDL Error Correction Model Short-Run Dynamics

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LGDP(-1))	-0.6747	0.1452	-4.6463	0.0002
D(OILPVO)	0.0391	0.0146	2.6670	0.0152
D(OILPVO(-1))	-0.1443	0.0409	-3.5330	0.0022
D(OILPVO(-2))	0.0549	0.0142	3.8768	0.0010
D(EXC(-2))	-0.1219	0.0258	-4.7288	0.0001
D(INT)	-0.0023	0.0004	-5.7641	0.0000
D(INT(-1))	0.0016	0.0008	2.0936	0.0499
CointEq(-1)	-0.2538	0.0369	-6.8754	0.0000

The term for error correction is correctly signed with a value of −0.2538 and a t-value of −6.8754 and is significant with a p-value of less than 0.001. Thus, there is a long-run equilibrium relationship that is stable. The size of the coefficient implies that convergence to the long-run equilibrium happens at an annual rate of approximately 25.38%. This means that the long-run equilibrium is attained in approximately four years.

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Vector Error Correction Model (VECM)

Table 7: VECM Estimates (Dependent Variable: D(LGDP))

Variable	Coeff.	Std. Err.	t-Stat.	R^2	F-stat
CointEq1 (ECT)	-0.1573	0.0321	-4.8938	0.638	8.574
D(OILPVO(-1))	-0.0203	0.0095	-2.1342		
D(OILPVO(-2))	0.0179	0.0090	1.9897		
D(EXC(-1))	-0.0768	0.0566	-1.3565		
D(EXC(-2))	-0.0943	0.0507	-1.8619		
Constant	0.0888	0.0165	5.3775		

Error correction is negative and statistically significant (-0.1573; t = -4.8938) indicating a stable long-run cointegrating relationship. That means there is a tendency for GDP to return to its equilibrium at a speed of about 15.73% per year, meaning that the process towards this equilibrium is slow.

Impulse Response Functions

Table 8: Impulse Response Functions - Response of LGDP

Period	Response LGDP→LGDP	Response LGDP→OILPVO	Response LGDP→EXC	Response OILPVO→LGDP	Response OILPVO→OILPVO
1	0.031858	0.000000	0.000000	-0.030854	0.168651
2	0.029119	-0.001610	0.013431	-0.122186	0.486143
5	0.009686	-0.002154	0.058204	-0.764999	2.068517
7	-0.002250	-0.000311	0.079067	-1.411456	3.349738
10	-0.009795	0.000904	0.090784	-2.427968	4.992606

Impulse response analysis shows oil price volatility (OILPVO) shocks create a gradually contracting effect on output (LGDP) that is weak and persistent. It is expected that an increase in uncertainty in oil prices would cause LGDP to contract. Impulse responses show that LGDP shows a monotonic increase to changing shock in the exchange rate in a zero to positive range, from 0 at period 1 to 0.0908 at period 10.

Variance Decomposition

Table 9: Variance Decomposition of LGDP (%)

Period	S.E.	LGDP (%)	OILPVO (%)	EXC (%)	Total (%)
1	0.0319	100.00	0.000	0.000	100
2	0.0452	91.06	0.127	8.818	100
4	0.0716	51.26	0.429	48.31	100
6	0.1164	20.17	0.209	79.62	100
10	0.2084	6.77	0.070	93.16	100

The forecast error variance decomposition shows that by period 10, exchange rate shocks contribute 93.2% of GDP variance, while the impact of OILPVO is 0.07% and LGDP's shocks are 6.77%. This implies that although oil price volatility is significant, its impact on GDP forecast variability is negligible across all periods.

V. DISCUSSION OF FINDINGS

The ARDL bounds testing and long-run results show a positive, stable, long-run relationship between oil price volatility and economic growth of Nigeria whereby oil price volatility has a positive and significant long-run impact on economic growth. The positive long-run relationship between OILPVO and GDP growth (0.0044) concurs with the expected impact of a net oil-exporting country where a positive impact of oil price shock strengthens government finances and stimulates GDP growth. This result endorses the empirical studies documented in Mgbomene et al. (2025) and Ozokede and Awogbemi (2025) which support the impact of volatility of crude oil prices on Nigeria's macroeconomic growth.

While the impact of oil price shocks is positive and growth enhancing, the small size of the impact indicates that oil price shocks have a weak impact on real economic activity bringing structural inefficiencies and Nigeria's overreliance on oil revenues. In contrast, the impact of the exchange rate (1.1328) is dominant in the long-run and emphasizes the volatility of the exchange rate and the Dutch Disease where the impact of volatility of oil prices is dominant through inflows and macroeconomic impact.

The VECM results also show that volatility of oil prices has a negative short-run dynamic impact on growth, with a significant negative impact of its first lag on growth (D(OILPVO (-1)) = -0.0203, $p < 0.05$), as would be expected from a transmission mechanism of uncertainty that discourages investment and complicates fiscal planning and increases macroeconomic uncertainty. These results are supported by recent studies showing that oil shocks are transmitted through inflation, exchange rate instability, and fiscal and monetary channels in Nigeria (Igbinovia & Ogiemudia, 2021; Onwioduokit et al., 2026).

Additional insights are provided by the variance decomposition results. These results show that in the forecast error of GDP, oil price volatility accounts for less than 0.5% through all horizons, while the exchange rate accounts for up to 93.2% by period 10. This suggests that the indirect channel of the exchange rate is the main channel for the impact of changes in oil prices on the Nigerian economy. These findings are in line with the evidence that the predominant Nigeria channels through which oil price shocks are transmitted include the exchange rate, inflation, fiscal balance, and monetary policy, as opposed to a direct effect on output (Igbinovia & Ogiemudia, 2021; Onwioduokit et al., 2026).

VI. CONCLUSION

The study investigated the impact of volatility of oil prices on growth in the Nigerian economy between 1980 and 2024. The study concludes that volatility of oil prices has a statistically significant but an economically negligible direct impact on growth in the Nigerian economy in the long run, but can be expected to have an important indirect impact of the exchange rate. There is a cointegrating relationship in the long-run between changes in volatility in the price of oil and Nigeria's GDP. By the long-run, we identify a positive association between an increase in the price of oil and an improvement in the fiscal balance and foreign exchange account, which is expected to fuel improved economic growth. That association, however, is very weak, and is indicative of the resource curse. The negative short-run effect of oil price volatility on growth is confirmed by the VECM. Volatilities, rather than the levels of oil prices, are considered the main destabilising factors. That effect is believed to be achieved through delayed investment, uncertain fiscal plans, and macroeconomic instability. The FEVD results show that volatility in oil prices explains less than 0.5% of the variation in GDP forecasts, while movements in the exchange rate account for more than 93%. Therefore, volatility in oil prices has the least effect of all the exchange rate movements on Nigeria's economy.

VII. RECOMMENDATIONS

B
ecause exchange rate management accounts for around 85 percent of GDP variability, it should take precedence in the context of a credible managed float with associated sovereign buffers or commodity-linked stabilization. The Nigeria Sovereign

Investment Authority (NSIA) ought to have explicit counter-cyclical guidelines in order to stabilize oil revenue during the savings phase and support fiscal stability during the drawdown phase. In the case of the effects of interest rate and money supply, there is a need for a balanced monetary framework, allowing for a credit input to stave off inflation within a regulated inflation targeting framework. The need for shock absorption implies reconstruction of the non-oil funding base through reform of tax systems, Value Added Tax (VAT) and Corporate Income Tax (CIT), and industrial diversification. Macroeconomic resilience should also include long-term voluminous investments in industry and infrastructure coupled with the employment-centered build-up of the human capital base. Inflation should be held steady in a low band or range in order to maintain real incomes and prevent undermining the social and economic growth objectives.

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