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IMPACT OF OIL PRICE VOLATILITY AND INFLATION ON ECONOMIC GROWTH IN NIGERIA

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Abstract

This study examines the impact of oil price volatility and inflation on economic growth in Nigeria from 1980-2023. The study employed the Autoregressive Distributed Lag model in the estimation of the specified regression model. The outcome of the bound test revealed evidence of cointegration between oil price volatility, inflation and economic growth. The findings also show that oil price volatility has significant impact on economic growth in the long run period. The findings indicate that a unit increase in the price volatility of oil is associated with 11.83% decline in the growth of the national output. *However, the impact of oil price volatility on economic growth is positive in the short run. Moreover, the study found that exchange rate fluctuations and the rise in the price level depressed economic growth in the long run. The study concludes that volatility in the oil price and inflation are important determinants of economic growth in Nigeria and stressed on the imperative of diversifying the economy to reduce the dependence on crude oil proceeds and weaken the impact of oil price volatility on the growth of national output. Moreover, the study advocates the promotion of local content in oil refining and production, as it would reduce and stabilize the cost of production of domestic industries and mitigate inflationary pressures in the economy.*

Keywords: Oil Price Volatility, Economic Growth, Inflation, ARDL, Brent Price

1. Introduction

Developing countries are particularly concerned about the source(s) of their national income. This is because, compared to developed economies, these avenues may not be much, but they serve as channels for foreign exchange that help grow their economy. Consequently, it is expected that they give close attention to the price of the economic commodities and/or services that enhance their revenue profile. Typical examples are developing economies with huge dependence on oil exports. In these economies, the price of oil has significant importance in the preparation of the annual national budget.

The Nigeria economy is not an exception as the average price of oil in the international petroleum market is an important denominator in Nigeria's national budget projections. For instance, in recent times, a benchmark of $28, $57, and $75 per barrel was used by the government to benchmark the national budgets of 2020, 2022, and 2023, respectively. It is noted that where a certain level of crude oil output is targeted, benchmarking the oil price can help the national government forecast the inflow of foreign exchange from the export of crude oil, stabilize its fiscal environment and effectively plan the development of the economy. However, oil price is a volatile index, and its unpredictability could have serious consequences on the prospects of growth and development in oil-exporting countries.

As a commodity, the price of crude oil is extraneous to the market conditions existing in a particular economy. In fact, the market price is not only determined by the interplay of the forces of demand and supply, but by factors such as global shifts in the international economic outlook and geopolitical tensions that are outside the direct control of one government. Thus, where a developing economy depends heavily on oil revenue in the propagation of its investment activities, the local economy may suffer repercussions due to price volatility. Moreover, fluctuations in the international price of crude oil can distort revenue expectations and stall social investments in the local economy. Eyden et al (2019) corroborate this point as their findings indicate that there is an inverse association between volatility in the price of crude oil and economic growth. Abdelsalam (2023) also found that volatility in the price of oil hurts the economies of crude oil-exporting countries, but further observed that the impact is quite different for oil-importing countries.

Rising oil prices can also lead to the increase in the average price level rise in the local economy and inflation. Inflation refers to the continuing rise in the average price level as measured by a chosen measure of inflation, such as the consumer price index (CPI). High

rates of Inflation slow the growth of aggregate demand and supply activities and harms the domestic economy. This is so since it reduces the value of nominal contracts and imposes an uncertainty cost on future prices, which attracts a higher risk premium. In addition, it is capable of changing the distribution of income in the society.

In the context of Nigeria, oil price volatility and inflation have significant influence on the performance of the financial and real sectors of the economy. For instance, a steady rise in oil prices implies an increase in the nominal amount of money that would be available to the government for investment in development projects. Therefore, oil price volatility could help the government actualize its expansionary fiscal policy goals. However, when there is high inflation in the local economy, it reduces the real value of the increase in total revenue due to the rise in oil price, with implications on its monetary and fiscal outlook (Saddique et al, 2018). On the other hand, continuous dip in oil prices may create a mismatch between price estimates of crude oil used to benchmark the national budget and the actual price in the international petroleum market. This, interacting with low inflation rates over a period, could distort the expectations of consumers and firms. In essence, with the expectations of consumers and firms distorted, it could result to delayed consumption and investment expenditure, reduced profit for businesses and job losses. Which, again, would require the government to employ a judicious mix of monetary and fiscal policies to manipulate the economy towards a desired direction.

Although, empirically studies that have examined this issue in the context of the Nigeria economy are plentiful, they either specifically evaluated the impact of either oil price volatility or inflation on economic growth. For instance, Yakubu and Benedict (2019) employed the vector error correction mechanism to investigate the impact of price volatility in crude oil on economic growth. The study found that volatility in the price of oil depressed the economic growth of Nigeria. Conversely, Anabori et al (2024) evaluated the influence of price volatility in crude oil price on the economic growth of four oil-producing countries in Africa, namely, Algeria Nigeria, Angola, and Egypt. The study utilised the dynamic general moment's method, pooled OLS, and fixed effects methods in the panel data. The study found that inflation volatility positively impacts these oil-exporting countries. Moreover, studies that examined the behaviour of inflation on economic growth conclude that inflation influences the growth of aggregate output (Dikiy, 2019; Sethi, 2015; Kumo, 2015).

The present study contributes to these set of studies in two folds: First, the study employs data sequences spanning from 1980 to 2023 to determine whether there is a long run relationship between oil price volatility, inflation, foreign direct investment, exchange rate and economic growth in Nigeria. A priori, it is expected that the former are drivers of output growth. Therefore, the study employs a long period to show the type of relationship that exists between these variables and aggregate output growth. Secondly, the study assessed the magnitude of impact these variables exert on economic growth in Nigeria. Accordingly, the study proposed the following hypotheses:

H_{o1}: N*o significant relationship exists between Oil price volatility, inflation and real output growth in Nigeria.*

In countries where oil export is the mainstay of the economy, the influence of price volatility in crude oil at the international petroleum market has implications on the size of government receipts and the general performance of its fiscal and foreign exchange activities. Fluctuations in oil price may affect the cost of production and lead to imported inflation in the local economy, especially for countries with a significant import sector. Moreover, it could affect its fiscal and monetary policies. Hence, there is the tendency that in such economies, there is an association between volatility in oil prices, inflation, and economic growth.

H_{o2}: *Oil price volatility and economic growth are negatively correlated.*

Lee (1998) posits in his renaissance growth theory that oil price volatility, rather than the absolute price of oil, impacts the economic fortunes of a country. That is, excessive fluctuation in the price of oil could derail planning targets and affect consumer and business activities. Moreover, for oil-exporting countries, this implies that the fluctuation in oil price will impact the government expenditure, income distribution, employment, and economic growth.

H_{o3}: *Inflation and economic growth are negatively correlated.*

The theoretical relationship between inflation and economic growth has been explored by Friedman (1977), who opined that inflation volatility harms economic growth. Empirical studies on the two

macroeconomic variables have also attested to these conclusions (Živkov et al., 2020; Mandeya and Ho, 2021).

This study is significant as it highlights the impact of oil price volatility and inflation on the domestic economy of an oil-exporting country confronting significant inflationary pressures. The rest of the paper is laid out as follows. Section 2 is an exposition on previous scholarly literature on the subject matter, and in Section 3, the sources of data and analytical framework of the study are discussed. The results and discussion of findings are in Section 4, while Section 5 is the conclusion and policy recommendations.

2. Literature Review

2.1 Conceptual Definitions

2.1.1 Concept of Price Volatility

In ordinary parlance, volatility refers to the tendency of a substance to change rapidly. Technically, volatility refers to the degree of fluctuation in the price of a commodity over time. Statistically, price volatility is measured by the standard deviation of percentage price changes.

Price volatility is high in the crude oil market. This is because of the complex nature of the market and its many determinants, which are not limited to the actions of oil-exporting countries alone. Though the basic principle of supply and demand facilitates the market process, factors such as geopolitical issues -war, political standoff between countries, and embargoes- could disrupt the market and cause the fluctuation of crude oil prices. Moreover, events such as unexpected news reports with international ramifications can lead to changes in the price of crude oil in the petroleum market. In addition, price volatility in crude oil can be attributed to the pattern of economic growth globally. That is, where the impetus for growth in the global economy is positive, the oil price would be favourable. The reverse is the case where there is a significant lull in the global economy.

Consequently, in countries where the proportion of foreign exchange from oil exports in the national income is very high, excessive price volatility in crude oil can derail national planning goals and objectives. This is because volatility engenders an air of economic uncertainty, and could cause the mismatch of targets and reality. Moreover, price uncertainty in crude oil could disrupt consumption and investment decisions of households and firms, since it can pass through inflation to raise the general price level in the local economy.

2.1.2 Concept of Inflation

Pappas (2025) asserts that a high average price level is antithetical to the prospect of economic growth. Inflation refers to the general increase in the price level of goods and services. The rate of inflation per time is often measured by the consumer price index (CPI). Thus, where the inflation rate rises faster than nominal income, it would reduce the purchasing power of individuals, and affect their capacity to engage in consumption activities. However, for borrowers, to the extent that inflation is not factored into the nominal lending rate, it may benefit borrowers, rather than lenders. Moreover, instability in the inflation rate could engender an environment of uncertainty that leads to delayed consumption and investment decisions. This could slow down production activities and hurt the local economy. In Nigeria, inflation is computed quarterly, and a distinction is often made between the level of inflation in urban and rural areas of the country.

2.1.3 Concept of Economic Growth

The role of a country's stock of natural resources in engendering economic growth is a topical issue among economists. Okowa (1996) in his definition of the theory of growth as it pertains to developing countries asserts that economic growth is a function of the will to economize, economic institutions, stock of knowledge, capital, labour, natural resources and efficiency of the government. A country's stock of natural resources serves as a veritable channel for fostering its economic prosperity, if well utilised. In the case of fossil fuels, the wide application of its bye-products as sources of energy in industry and transportation helps enliven the global demand for the commodity. Consequently, it is theoretically expected that oil-exporting countries with effective national government and economic institutions, through the proceeds of their exploitation of natural resources will allocate scarce resources more efficiently to engender more investment, foreign exchange, and economic growth.

2.2 Theoretical Framework

Renaissance Growth Theory

This theory is originally attributed to Lee (1998). The renaissance growth theory distinguishes the influence of oil price on economic growth from that of its volatility. Lee (1998) opined that it is the price volatility of oil, rather than the oil price that exerts significant

influence on aggregate output. Renaissance theory asserts that the magnitude of impact that volatility in oil price exerts on the economy may not be the same across countries, as its extent is dependent on the effectiveness of the internal stabilization mechanisms that have been put in place to act as a hedge against external shocks (Ogburu, et al, 2017).

The current study adopts the Renaissance growth theory. The rationale is due to the attention it places on the influence of fluctuations in the price of certain economic commodities on the economic growth of a country. In Nigeria, there are frequent adjustments in the price of petroleum products, in response to fluctuations in the international price of crude oil. This could have significant influence on the scale of aggregate investment and consumption demand, since a sizeable proportion of its industrial and commercial activities still depend on the use of fossil fuels.

2.3 Empirical Review

Multiple studies have been carried out by scholars to describe the relationship and impact of oil price volatility and inflation on economic growth. In this review of prior literatures, the focus will be on two strands. The first are studies that assessed the behaviour of the relationship between oil price volatility and economic growth, while the second strand focuses on studies that evaluated the magnitude of impact that crude price volatility in crude oil and inflation exert on economic growth.

On the first strand, Richard and Muba (2024) examined the relationship between oil price fluctuations and growth in the national output of Tanzania from 1988 to 2022. A period of 34 years. The findings show that in the short run, the volatility in the price of crude oil exerts an insignificant impact on real output was insignificant; nonetheless, the outcome revealed evidence of a negative correlation between fluctuation in crude oil price and economic growth in the long run period.

Sabayo et al (2023) evaluated the effect of price volatility in crude oil on inflation and economic growth in Tanzania for 50 years (1970-2020). The study adopted the ARDL estimation method. The findings suggested that volatility in the price of crude oil hurts the growth of the domestic economy in the long run when the effects of imports and exports are controlled. Similarly, it has a positive influence on the inflation rate when the effects of interest rate and exchange rate. Moreover, the study found no evidence of causality between price volatility in crude oil and the growth of the domestic economy. Hence, the authors advocated for the effective monitoring oil price volatility and the management of the exports, imports sectors of the economy, and the exchange rate regime to grow the economy.

In a similar study, Dinh (2022) in a panel study examined how fluctuation in the international price of crude oil affects the economies of selected Asian countries, The study examined the nine countries in Asia. The results showed that the economies of South Korea, Vietnam, and China were significantly impacted by changes in the price of the fossil resource. Yakubu and Akanegbu, (2019) investigated how price volatility in crude oil associates with the economic growth of Nigeria. The scope of the study was from 1985-2016. However, unlike the other studies, this study followed the Vector Error Correction Model (VECM) methodology. The outcome revealed that fluctuation in the international price of crude oil negatively impacts on the economic growth of Nigeria.Also, the empirical findings did not show evidence of causality between oil price volatility and output growth.

Mukhtarov et al (2019) studied the correlation between the price of crude oil and the inflation rate in Azerbaijan. The study spanned from 1995 to 2017 and adopted the VECM econometric approach. The findings indicated that oil price, inflation, and exchange rate have a long run relationship. Moreover, the findings show that the inflation rate is impacted upon by changes in the oil price and exchange rates. In addition, inflation is transmitted to the economy during periods of high and low crude oil prices. Scott (2018) examined how volatility in the price of crude oil in the international petroleum market affects business cycles in Nigeria. The study employed time series data that spanned from 1970 to 2015, and the Autoregressive Distributed Lag Model (ARDL) approach was utilised in the empirical analysis. The outcome show that fluctuations in the price of oil positively affected GDP volatility in the short run. However, in the long run, the impact of the price volatility on GDP was not significant. The study concluded that the dependence of the economy on oil proceeds generates short-run fluctuations in real GDP. Hence, the study suggested diversifying the productive and export base of the economy to reduce the effect of price volatility in crude oil.

Furthermore, there are several scholarly articles on the influence of both oil price volatility and inflation on the growth of economies around the world. However, the outcomes are mixed. For instance, Abiodun and Ismail (2025) estimated the threshold

effects of inflation on the growth of the economy of Nigeria. The study was from 1990 to 2023. The outcome shows that inflation channels through unemployment and poverty to the economy and negatively affects the growth of national output.

Rosnawintang (2021) empirically analyzed how crude oil volatility and inflation impacted the economies of five (5) ASEAN countries. The study employed the ARDL econometric approach. The findings revealed that volatility in the international price of oil crude price affected the selected ASEAN economies, whereas the effect of inflation on economic growth was only evident in Indonesia, the Philippines, Singapore, and Thailand. In the same vein, Adaramola and Dada (2020) studied the causal relationship between inflation and economic growth in Nigeria. The study spanned from 1980 to 2019, and adopted the ARDL econometric approach. The findings revealed that inflation and real exchange rate impacted negatively on the growth of national output during the period of study. Also, the study found no causal relationship between inflation and gross domestic product. The paper advocated the stabilisation of the domestic price level to grow the economy.

Also in consonance with these findings is the study by Mandeya and Ho (2019). The study investigated the impact of inflation, inflation uncertainty on the growth of the economy of South Africa. The empirical findings show that inflation negatively hurts the economy; while inflation uncertainty was not a long-run phenomenon. Sethi (2015) also examined the nexus between inflation, inflation volatility, and growth in India from 1980 to 2014 by following the Granger causality analytical approach. The findings show that high inflation and inflation uncertainty hurt the economy. Moreover, the study found no evidence of causality from consumer price index (CPI) to GDP. However, unidirectional causality running from GDP to CPI was observed when more lags were added to the model.

The empirical literature review suggests that several works have been conducted to quantify separately, the impact of volatility in the crude oil price and inflation (Scott, 2018; Yakubu & Akanegbu, 2019; Adaramola & Dada, 2020; Abiodun & Ismail, 2025) on the national output of Nigeria. However, this study examined the impact of both variables, along with foreign direct investment and exchange rate on econo3/mic growth.

3. Methodology

3.1 Research Design

The ex post facto research design is adopted in the present study. The rationale is due to the fact that the relevant data for estimation are available in a secondary nature, hence, it is devoid of interference by the researcher. The ex post facto research design is ideal for use in the empirical investigation of economic variables as it enables the causal assessment of the relations existing between them, even though data on these variables may be existing before the beginning of the investigation.

3.2 Data and Sources

The broad objective of the study is to estimate the impact of oil price and inflation volatility on economic growth in Nigeria. The study utilised secondary data sources to obtain annual time series on brent price (V_BP), inflation (INF), exchange rate (EXC), foreign direct investment (FDI) and economic growth (GDP) from 1980 to 2023. The data on these variables were obtained from the World Bank Development Indicators, 2023.

3.2.1 Measure of Volatility: Simple Standard Deviation

Depending on the type of data, many measures of volatility - parametric and nonparametric - have been used in the literature. Instances of these measures include expected volatility, realized volatility, stochastic volatility, implied volatility, and conditional volatility. These measures can significantly highlight volatility in high-frequency data such as daily, monthly, and quarterly time series.

However, since the paper employs an annual data sequence, the simple standard deviation of returns is used to measure volatility. This measure of volatility is defined as defined as vol(r_v) = 100*Std[log(bt) – log(bt-*1*)], where Std[.] denotes the standard deviation, while b*t* and b*t-1* represent the current and lagged Brent oil price. Figure 1 depicts *pt and vol(r_v).*

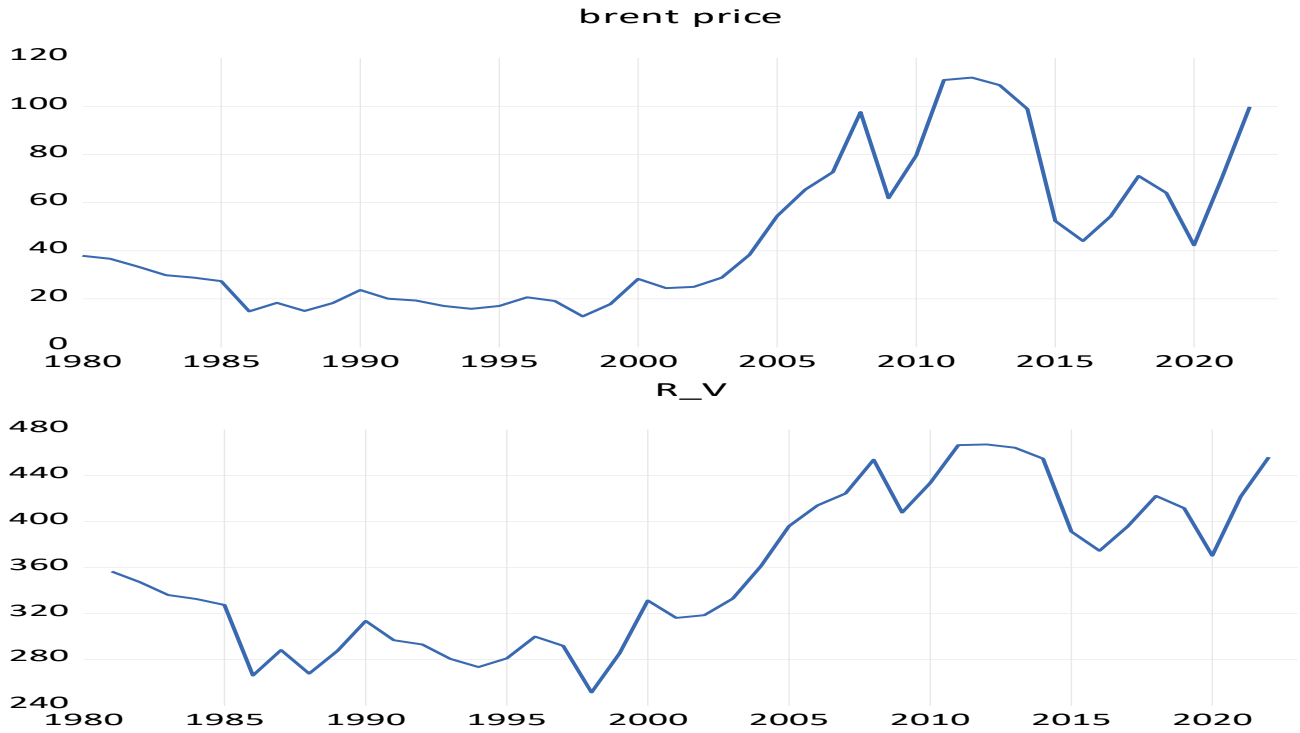

Figure 1.Oil price and oil price volatility

3.3 Model Specification

The study formulates a linear equation specified in the following functional form:

GDP = f (V_BP, INF, *EXC, FDI).* *(*1)

Where:

GDP = Real gross domestic product (proxy for economic growth)

V_BP = Volatility of brent price (proxy for oil price volatility)

INF = Inflation rate (proxied by the growth rate of CPI)

EXC= Exchange rate

FDI = Foreign exchange rate

The econometric specification of the oil price and inflation volatility model in equation 3.1 is stated as:

$GDP_t = \propto_0 + \propto_1 V\_BP_t + \propto_2 INF_t + \propto_3 EXC_t + \propto_3 FDI_t + \propto_4 \mu_t$ . . (2)

The theoretical expectations for the coefficients of equation 2 are $\propto_1 < 0$; $\propto_2 < 0$; $\propto_3 > 0$; $\propto_4 > 0$. Moreover, to decide on the appropriate econometric procedure that would be employed in the estimation of the environmental pollution function, the Augmented Dickey Fuller (ADF) unit root test was used to determine the order of integration of the variables. The result shows a mixed order of integration (See: Table 3). Accordingly, since the Autoregressive Distributed Lag approach (ARDL) permits estimation of variables with mixed order of integration, it was employed in the econometric analysis of the resource depletion model.

Pesaran and Shin (1999) developed the ARDL for the cointegration analysis of models with variables having mixed unit root properties. Improvements in the ARDL method ensures the estimation of the dependent and explanatory variables with different lags as well as the use of fixed regressors, which is impossible in other conventional methods used for the test of cointegration. Moreover, the ARDL gives robust estimates even for small data sets, and is therefore suitable for the present study that spans from 1980 to 2023, a period of 38 years.

The general specification of the ARDL(p,q) is as follows:

$$\Delta y_t = a_0 + \sum_{i=1}^{p} a_{1i} \Delta \gamma_{t-1} + \sum_{j=1}^{q} \gamma_j X_{t-j} + \varepsilon_t \quad (3)$$

where y_t is the dependent variable, X_t is a vector of the dynamic explanatory variables which and ε_t is the error term that should be normally distributed with zero mean and constant variance $\varepsilon_t \sim N(0, \sigma^2)$, p and q are the number of lags for dependent and explanatory variables; respectively.

To test for whether there is long-run relationship (cointegration) between y_t and X_t, the bound test equation is specified as follows:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta \gamma_{t-1} + \sum_{j=1}^{q} \varphi_{1i} \Delta X_{t-j} + \omega_0 \gamma_{t-1} + \omega_1 X_{t-1} + \vartheta_t \quad (4)$$

where β_1, and φ_1 are the parameters of the short-run relationship; ω_0 and ω_1 are the parameters of long-run relationship. Accordingly, cointegration between y_t and X_t exists if the null hypothesis, H_0: $\omega_0 = \omega_1 = 0$ is rejected against the alternative H_1: $\omega_0 \neq \omega_1 \neq 0$.

In addition, the existence of cointegration relationship in the models, also necessitates an evaluation of the error correction model (ECM). The equation of the ECM is specified as follows:

$$\Delta y_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta \gamma_{t-1} + \sum_{j=1}^{q} \varphi_{1i} \Delta X_{t-j} + \emptyset_0 ECM_{t-1} + \vartheta_t \quad (5)$$

In actual fact, the term of the ECM_{t-1} is derived from the lagged value of the error term (μ_{t-1}) of the following long-run relationships:

$$y_t = a_0 + \sum_{j=1}^{q} \gamma_j X_t + \mu_t \quad (6)$$

$$ECM_{t-1} = \mu_{t-1} = y_{t-1} - \sum_{j=1}^{q} \gamma_j X_{t-1} \quad (7)$$

and $\emptyset_0 < 0$ is the parameter of the error correction model ECM_{t-1} that measures the speed of adjustment from any shocks in the short-run back towards the long-run.

4. Results and Discussion

4.1 Descriptive Statistics

As a summary of the basic properties of the dependent and independent variables used in the model specification, Table 1 shows their descriptive statistics. The table shows that the variables have positive mean and median values, respectively. Oil price volatility (V_BP) has the highest maximum value at 218191.9, whereas foreign direct investment (FDI) has the lowest minimum value at -7.39E+08. In addition, the standard deviation of each variable in the model highlights the level of dispersion. The table shows that the rate of change in inflation (INF) has the lowest standard deviation close to the mean. Oil price volatility (V_B) has the largest dispersion from the mean. Moreover, the probability values of the Jarque Bera statistic at the 5% level of significance suggest the rejection of the null hypothesis of normal distribution for all the variables except oil price volatility (V_BP).

Table 1. Preliminary Statistics of Parameters

	GDP	V_BP	INF	EXC	FDI
Mean	3.068566	131230.1	0.161804	112.9787	2.39E+09
Median	3.449434	116772.8	0.128766	111.2313	1.35E+09
Maximum	15.32916	218191.9	0.728355	425.9792	8.84E+09
Minimum	-13.12788	63172.39	-1.000000	0.546781	-7.39E+08
Std. Dev.	5.197308	48458.13	0.243588	119.0566	2.56E+09
Skewness	-0.862635	0.406117	-1.894184	1.050324	1.160096
Kurtosis	4.964869	1.831172	14.01446	3.278607	3.264625
Jarque-Bera	12.53499	3.545297	243.0756	8.045202	9.770528
Probability	0.001897	0.169882	0.000000	0.017906	0.007557
Sum	135.0169	5511665.	6.957582	4858.084	1.03E+11
Sum Sq. Dev.	1161.517	9.63E+10	2.492067	595327.5	2.75E+20
Observations	43	43	43	43	43

Source: Author's Computation, 2025.

4.2 Covariance and Correlation Matrix

Correlation and covariance matrix is a useful technique that could be used to ascertain the movement and relationship among variables used in the specified model. The Table 2 is the highlight of the covariance and correlation matrix. The correlation matrix suggests that a negative and weak correlation between the growth of national output (GDP) and inflation (INF); whereas, a positive correlation between economic growth (GDP) and oil price volatility (V_BP) is observed. Also, Table 2 indicates that there is a negative association between volatility in the oil price and inflation (INF). The covariance statistics suggest a positive direction of movement between the growth of national output (GDP) and oil price volatility (V_BP), whereas the direction of movement between volatility in the oil price (V_BP) and inflation (INF) is negative.

Table 2. Matrix of Covariance and Correlation

Variables	GDP	V_BP	INF	EXC	FDI
GDP	27.62290				
	1.000000				
V_BP	52119.79	2.29E+09			
	0.207126	1.000000			
Cpi_Grth_R	-0.130837	-5470.756	0.059283		
	-0.102243	-0.469299	1.000000		
EXC	90.62233	3751865.	-13.83529	13866.32	
	0.146427	0.665476	-0.482552	1.000000	
FDI	4.77E+09	8.97E+13	-31971044	9.01E+10	6.30E+18
	0.361570	0.746859	-0.052325	0.304743	1.000000

Source: Author's Computation, 2025.

4.3 Unit Root Test

Table 3 highlights the result of the test for stationarity of the model variables. The stationarity test was conducted at levels and first difference using the Augmented Dickey Fuller (ADF) unit root test. The ADF Test was conducted at the intercept levels. The outcome shows that the variables were all integrated at first difference, except for economic growth (GDP) which is integrated at levels.

Table 3: ADF Unit Root Test

TEST	**GDP**	**V_BP**	**INF**	***EXC***	***FDI***
ADF_I^*	-2.933158	-2.935001	-2.33158	-2.933158	-2.933158
	(0.0545)	(0.7903)	(0.3858)	(1.0000)	(0.4043)
ΔADF_I^*	-2.933158	-2.938987	-2.935001	-2.935001	-2.935001
	(0.0000)	(0.0002)	(0.0064)	(0.0017)	(0.0000)

Source: Author's Computation, 2025.

4.4 Cointegration Analysis

The mixed levels of integration suggested by the ADF unit root test attest to the applicability of the ARDL cointegration approach. However, before the application of the cointegration technique, the optimal lag length must be verified. Accordingly, Figure 2 is the result of the optimal model selection as chosen by the Akaike Information Criteria (AIC). Figure 2 shows that the ARDL model 1.3.4.0.1 is preferred among other models. The reason is because this ARDL model has the lowest AIC value relative to the models of the AIC.

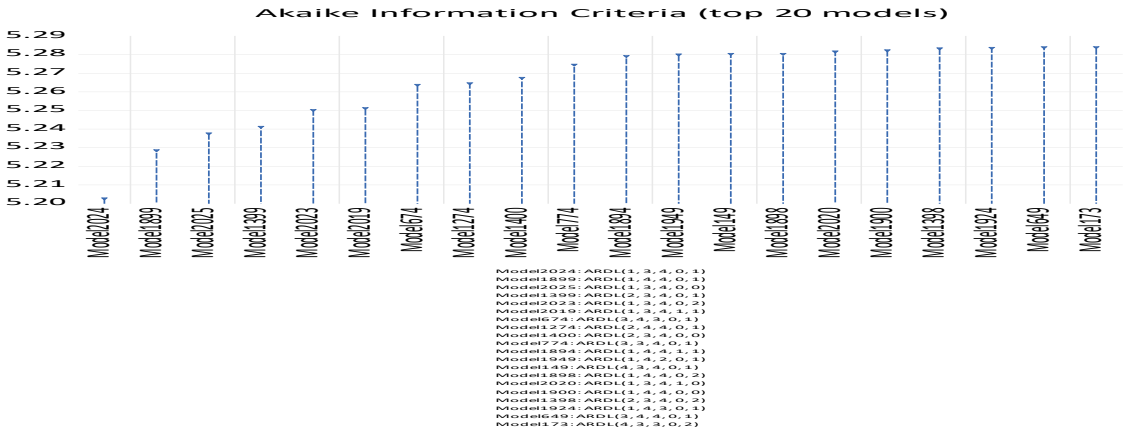

Figure 2 Akaike Information Model Order Selection

4.5 ARDL Bound Test

Upon ascertaining the preferred ARDL model, the study further investigated the existence of cointegration between variables in the ARDL model 1.3.4.0. Table 4. is the output of the bound test.

Table 4. ARDL Bound Test Output

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	12.04389	10%	2.2	3.09
K	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

Source: Author's Computation, 2025.

The null hypothesis of the bound test states that no level relationship among the variables. This hypothesis is rejected if the computed F-statistic exceeds the critical lower I(0) and upper I(1) bounds at conventional significance levels. Accordingly, since the F-statistic value (12.04389) exceeds all the significant levels of both the lower and upper bounds, it suggests evidence of a long-run cointegration relationship between economic growth, price volatility in crude oil, inflation, exchange rate, and foreign direct investment over the study period.

4.6 ARDL Long-run Output

Table 5 presents the coefficients of the ARDL model 1.3.4.0.1 in the long run period. The result indicates that fluctuations in the international price of crude oil hurts economic growth in Nigeria. Specifically, a 1% increase in oil price volatility is associated with 11.83% decline in the growth of the national output. This outcome implies that volatility in crude oil price depresses Nigeria's aggregate output growth in the long run. This finding is corroborated by the conclusions of Fengsheng et al (2021) in a similar study on crude oil volatility and economic growth. Also, Hayder et al (2022), using a VAR methodology, also observed that volatility in crude oil price is interconnected with fluctuation in economic growth. Moreover, the outcome shows that inflation exerts a negative effect on economic growth in the long run. The result suggests that a unit rise in the price level leads to 35.52% decline in aggregate output. This result may be attributable to the negative impact that prolonged changes in the general price level may have on business and household planning. It is argued that frequent changes in the average price level could reduce the level of confidence of consumers and investors, thereby affecting the performance of the economy. Similar results on the impact of inflation uncertainty on economic growth were obtained by Sethi (2015). However, this outcome differs from the conclusions of Shelton et al (2021), whose study of the economy of South Africa concluded the duration of inflation uncertainty is in short-run period. Moreover, the coefficient of foreign direct investment (FDI) is positive and statistically significant at the 5% level. This outcome supports the proposition of the endogenous growth theory, which suggests that FDI channels human and material resources to the domestic economy and thus contributes to economic growth.

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Table 5: Long-run Output of ARDL Model 2.4.4.4

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(V_BP)	-11.82828	3.910764	-3.024545	0.0076
Cpi_Grth_R	-32.51793	6.768289	-4.804454	0.0002
LOG(EXC)	-1.020033	0.423497	-2.408595	0.0276
FDI	9.56E-10	3.21E-10	2.972607	0.0085
C	151.6679	46.35096	3.272163	0.0045

Source: Author's Computation, 2025.

4.7 ARDL Short-run Output

The ECM and short-run estimates of the ARDL model are shown in Table 6. The findings show that the parameters are statistically significant at various lags. The ECM is correctly signed, and its value (-0.993892) indicates rapid adjustment to equilibrium within a period. This also suggests that the system might oscillate for some time before equilibrium is restored. Interestingly, the table shows the significant impact of fluctuation in oil price volatility (V_BP) and inflation (INF) on economic growth in the short run. Precisely, the findings suggest that a 1% increase in oil price volatility exerts positive pressures on economic growth by as much as 4.22% and 7% in the current lag and third lag, respectively. The outcome also revealed that an increase in inflation has a mixed effect on economic growth in the short run. The table suggests that a unit rise in the inflation rate exerts a negative influence on the growth of aggregate output in the current period by as much as 60%, but this is counteracted in the succeeding lags, respectively. The negative coefficients of foreign direct investment (FDI) in the short run period are counteracted in the long run as increased investment inflow lead to the growth of the domestic economic growth. Moreover, Table 6 shows that 83% of variation in the dependent variable is explained by the independent variables employed in the ARDL model 1.3.4.0.1. Also, the presence or absence of serial correlation in the model is determined by the closeness of the Durbin Watson Statistic (D.W) to 2. Thus, the D.W statistic (1.764) attests to the absence of serial correlation in the estimated regression model.

Table 6. Short-Run Output

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DLOG(V_BP)	4.222748	2.330786	1.811727	0.0877
DLOG(V_BP(-1))	11.19336	3.271763	3.421202	0.0033
DLOG(V_BP(-3))	7.118511	2.518638	2.826334	0.0116
D(Cpi_Grth_R)	-0.604365	2.002504	-0.301805	0.7665
D(Cpi_Grth_R(-1))	21.96724	4.287461	5.123601	0.0001
D(Cpi_Grth_R-2))	16.59314	3.176680	5.223421	0.0001
D(CPI_Grth_R(-3))	6.010306	3.610842	1.664517	0.1143
DLOG(EXC)	-8.055947	1.499114	-5.373805	0.0001
DLOG(EXC(-1))	-5.544815	1.624808	-3.412597	0.0033
DLOG(EXC(-2))	-0.532904	1.618013	-0.329357	0.7459
DLOG(EXC(-3))	5.113361	1.266854	4.036266	0.0009
D(FDI)	-4.74E-10	2.91E-10	-1.630268	0.1214
D(FDI(-1))	-8.01E-10	3.26E-10	-2.455092	0.0252
CointEq(-1)*	-0.993892	0.102776	-9.670434	0.0000
R-squared	0.901540	Mean dependent var		0.114929
Adjusted R-squared	0.834408	S.D. dependent var		4.478571
S.E. of regression	1.822463	Akaike info criterion		4.333816
Sum squared resid	73.07018	Schwarz criterion		5.023326
Log likelihood	-66.34251	Hannan-Quinn criter.		4.579139
Durbin-Watson stat	1.764024			

Source: Author's Computation, 2025.

4.8 Diagnostic Tests

Table 7 displays the findings from the Breusch-Godfrey (BG) serial correlation LM test and the heteroscedasticity test. Highlights from Table 7 indicate that the null hypotheses of no serial correlation in the residuals and no heteroscedasticity cannot be rejected, as the p-values from the F-test and the Obs.*R-Square statistic are greater than the 5% significance level, respectively. Figure 3 shows that the Jarque-Bera (J.B) test for normality. The J.B. probability value (0.23) exceeds the 5% significance threshold and affirms the apriori expectations for normality

Table 7. Diagnostic Test Output

Breusch-Godfrey (LM) Test for Serial Correlation			
F-statistic	0.435771	Prob. F(2,21)	0.6525
Obs*R-squared	1.514234	Prob. Chi-Square(2)	0.4690
Breusch -Pagan-Godfrey Test for Heteroscedasticity			
F-statistic	0.972770	Prob. F(20,17)	0.5283
Obs*R-squared	20.27971	Prob. Chi-Square(20)	0.4406
Scaled explained SS	3.572085	Prob. Chi-Square(20)	1.0000

Source: Author's Computation, 2025.

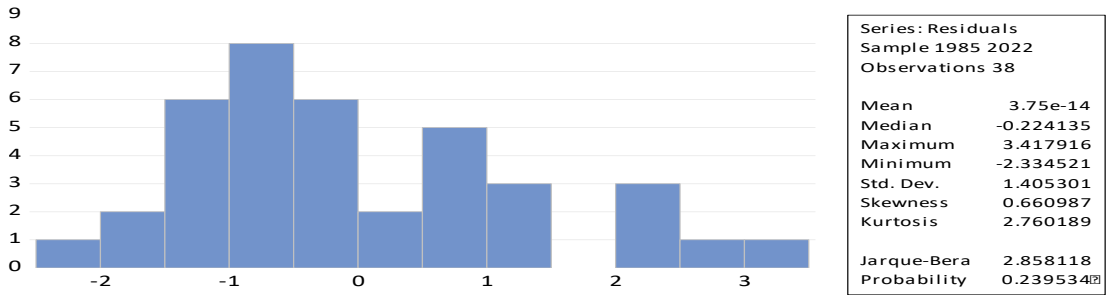

Figure 3 Normality Chart

4.8.1 Stability Test

Figure 4. shows the output of the cumulative sum of squares (CUSUM) and the cumulative Squares (CUSUM of Square) tests for parameter stability. The output indicates that the CUSUM and CUSUM of Squares are largely within the 5% critical values. Although in certain periods they move slightly beyond the band lines, they return to the critical bandwidths. Therefore, Figure 4 suggests that the model parameters are stable over time.

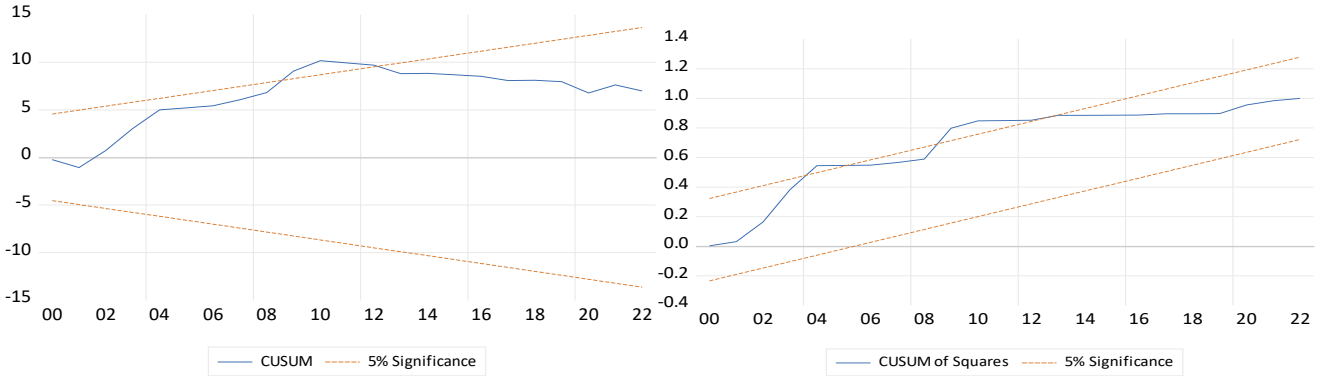

Figure 4. Model Stability

4.9 Discussion of Major Findings

This research empirically examined the impact of price volatility in crude oil and inflation on aggregate output growth in Nigeria. Findings from the bound test approach reveals the existence of cointegration among the variables in the specified model. The outcome shows evidence of a long-run relationship between price volatility in crude oil, inflation, exchange rate, foreign direct investment, and aggregate output growth in Nigeria. The result suggest that these variables are

core predictors of growth in national output. Hence, the study rejects the null hypothesis of no relationship between oil price volatility, inflation and economic growth in the period under review.

Furthermore, the findings of the study reveal that crude oil price volatility exerts a significant impact on the growth of Nigeria's economy in the long run. The negative sign of the coefficient of oil price volatility (V_BP) suggests that fluctuating crude oil prices impose an external shock on the domestic economy that depresses the growth of aggregate output. The study argues that this is not unconnected to the use of an estimate of crude oil price to benchmark the national budget by the government. Therefore, in the event of prolonged fluctuation oil prices at the international petroleum market, a gap between expected and real oil price emerges, with adverse consequences on the projected oil revenue and performance of the economy. However, the results show that in the short run, the impact of crude oil is positive and statistically significant. This result attests to the fact that oil price volatility as an external factor is an important determinant of volatility in the performance of the Nigerian economy. Moreover, it suggests that since Nigeria is a fossil fuel exporting country, persistent volatility in the long run may diminish national income, affect foreign exchange earnings, and the prospects of growth in the economy. Consequently, the study does not reject the null hypothesis of a negative correlation between oil price volatility and economic growth in Nigeria. The outcome aligns with the findings of Yakubu and Akanegbu, (2019). However, it does not conform with the conclusion of Scott (2018), which observed that volatility in the price of crude oil has an insignificant impact on economic growth.

Furthermore, highlights of the findings also show the mixed impact of inflation on the growth of the domestic economy in the short-run and long-run periods. In the former period, the findings revealed that inflation does not dampen economic activity. However, this could be counteracted in the long run due to the increase in the price level which imposes a negative effect on the prospect of growth in the national output. Thus, the outcome implies that though inflation is an important variable, it may be detrimental to the macroeconomic objective of growth in the long run when its rate is high. A similar outcome on the differential impact of inflation in both time periods was observed by Mandeya and Ho (2019). Thus, the study affirms the proposition that inflation and economic growth are negatively correlated. Moreover, the findings indicate the impact of external investment inflow and exchange rate on the Nigerian economy. The results show that in the long run, foreign direct investment positively engenders economic growth, whereas the exchange rate devalues the magnitude of economic growth. The study argues that persistent devaluation of the Naira in the face of an imbalance in the ratio of exports to imports is unfavourable to the country. Moreover, it leads to a weaker currency with an adverse effect on the domestic economy.

5. Conclusion and Policy Recommendations

This study provides analytical insight on how volatility in the price of crude oil and the inflation rate impact on the Nigerian economy. The study is imperative because as an oil-exporting country, the government is hugely dependent on the contributions of crude oil exports to its net receipts for development plan actualization; yet this objective is often constrained not only by the price volatility of crude oil in the international petroleum market, but also by an increasing domestic price level. Accordingly, in estimating the crude oil and inflation model, four variables - volatility in the price of crude oil, inflation, foreign direct investment, and exchange rate - were considered. The paper assessed the volatility in the oil price, inflation, and real GDP using a historical sequence from 1980 to 2022.

The study concludes that the pursuit of stability in crude oil production and the domestic price level are important macroeconomic goals that are pursued by oil-exporting economies. However, since oil prices are negotiated in the international petroleum market, factors that precipitate its volatility may be external to the local economy, yet, they may pose adverse consequences on economic growth, if left unchecked. Consequently, the study recommends that the government should reduce its heavy dependence on foreign exchange proceeds from the sale of crude oil by encouraging the diversification of the economy. This would create more jobs and ensure a stable revenue stream. In addition, the study advocates for the prioritization of local content in crude oil refining, and value addition in locally produced consumer and investment goods. This will help reduce imports and the effect of external shocks that add to the cost of goods in the economy.

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