Examining the Effect of Oil Price Shock on Nigeria's Economic Growth in the Light of Vision 2030: A Combination of VCEM and ARDL Models

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DOI: 10.56201/ijasmt.vol.11.no1.2025.pg73.87

Abstract

Nigeria's economy is heavily reliant on oil, with crude oil accounting for a significant share of government revenue and export earnings. This dependence exposes the nation to economic vulnerabilities stemming from global oil price fluctuations, which can disrupt fiscal stability and economic growth. In the context of Nigeria's Vision 2030, which aims to diversify the economy and reduce its reliance on oil, understanding the effects of oil price shocks on economic growth becomes critical for formulating resilient policies and achieving sustainable development. This study investigates the effect of oil price shocks on Nigeria's economic growth in the context of Vision 2030, which emphasizes economic diversification and resilience. The research utilizes annual time series data spanning 42 years (1981–2022) for key macroeconomic indicators: Gross Domestic Product (GDP), Crude Oil Price (COP), Crude Oil Revenue (COR), Exchange Rate (EXR), and Non-Oil Revenue (NOR). Data were sourced from the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), and World Bank. The study adopts a combination of Vector Error Correction Model (VECM) and Autoregressive Distributed Lag (ARDL) models to examine both short- and long-term relationships among the variables. Descriptive statistics revealed significant variability in GDP (mean: 226.68, standard deviation: 169.50) and other variables, reflecting Nigeria's economic volatility. The ARDL Bounds Test confirmed a long-run relationship among the variables, while the short-run estimates revealed that crude oil prices significantly impacted GDP (coefficient: 1.22, $p < 0.05$), and exchange rate fluctuations had both positive and negative short-term effects. Long-run results showed a negative impact of crude oil prices (coefficient: -2.26, $p < 0.05$) and crude oil revenue (coefficient: -0.08, $p < 0.01$) on GDP, emphasizing Nigeria's vulnerability to oil price shocks. Diagnostic tests confirmed the model's stability, with no evidence of serial correlation or heteroscedasticity ($p > 0.05$). We concluded based on the findings that oil price shocks adversely affect Nigeria's economic growth, highlighting the need for diversification to stabilize the economy. It recommends structural reforms to reduce overdependence on oil, increased investment in non-oil sectors, and exchange rate stabilization policies. These measures are critical to achieving Nigeria's Vision 2030 goals of economic resilience and sustainable growth.

Keywords: *Oil Price Shocks, Economic Growth, Vision 2030, Time series, ARDL Model, VECM, Macroeconomic Variables*

1. Introduction

Oil price fluctuations have long been a significant determinant of economic performance in oil-dependent economies like Nigeria. As one of the largest oil producers in Africa, Nigeria's economic growth has been deeply intertwined with oil revenue, which accounts for over 70% of government income and more than 90% of export earnings (Central Bank of Nigeria [CBN], 2021). Consequently, oil price shocks—unexpected and sustained changes in oil prices—pose considerable challenges to macroeconomic stability, affecting fiscal balance, exchange rates, inflation, and overall economic growth. In light of Nigeria's Vision 2030, which seeks to diversify the economy and achieve sustainable development, understanding the impact of oil price volatility on economic growth is crucial to crafting responsive policy measures. This study explores the interplay between oil price shocks and Nigeria's economic growth using a combination of the Vector Correction Error Model (VCEM) and the Autoregressive Distributed Lag (ARDL) model. These econometric tools provide robust insights into both short-term dynamics and long-term relationships, facilitating the evaluation of policies aligned with Vision 2030 objectives (Alzyadat, 2024).

Prior studies have emphasized the significance of oil price dynamics on macroeconomic indicators in resource-rich nations (World Bank, 2022; Elneel & AlMulhim, 2022). However, limited attention has been paid to the contextual implications for Nigeria's Vision 2030, which envisions a shift from an oil-reliant economy to a diversified and resilient one. This research contributes to the existing literature by examining how oil price shocks influence Nigeria's economic growth trajectory within this policy framework. By integrating VCEM and ARDL methodologies, the study captures the dual effect of transitory and persistent shocks, providing actionable insights for policymakers. The findings will highlight the vulnerabilities of Nigeria's economy to oil price volatility while offering pathways for resilience-building and economic diversification in line with Vision 2030 aspirations.

In examining the effect of oil price shocks on Nigeria's economic growth, key variables are considered to capture the multifaceted impact of these shocks. Gross Domestic Product (GDP) serves as the dependent variable, representing the overall economic performance of the country. Crude Oil Price (COP) is the primary independent variable, reflecting fluctuations in global oil markets that directly influence the economy. Crude Oil Revenue (COR) measures the financial inflow from oil exports, highlighting the direct contribution of oil to government earnings and fiscal stability. Additionally, Exchange Rate (EXR) is included as it reflects the responsiveness of the Nigerian Naira to oil price movements, given the economy's reliance on oil for foreign exchange earnings. Non-Oil Revenue (NOR) is incorporated to evaluate the extent of economic diversification and the relative contribution of other sectors to the economy. Together, these variables provide a comprehensive framework for assessing the impact of oil price shocks on Nigeria's economic growth, offering insights into both oil-related vulnerabilities and the progress towards non-oil revenue generation in line with Vision 2030.

2. Methodology

Research Design

This study employs a quantitative research design to investigate the effect of oil price shocks on Nigeria's economic growth in the context of Vision 2030. By integrating the Vector Correction Error Model (VCEM) and the Autoregressive Distributed Lag (ARDL) model, the study captures both the short-run and long-run dynamics of the relationship between the dependent variable, Gross Domestic Product (GDP), and the independent variables—Crude Oil Price (COP), Crude Oil Revenue (COR), Exchange Rate (EXR), and Non-Oil Revenue (NOR). The dual-model approach allows for robust estimation of transient shocks, persistent trends, and co-integration among variables.

Data Sources and Collection

The study utilizes secondary data spanning from 1921 to 2022, sourced from Central Bank of Nigeria (CBN), the National Bureau of Statistics (NBS), and the Organization of Petroleum Exporting Countries (OPEC). The variables include annual GDP (proxy for economic growth), average crude oil price (measured in U.S. dollars per barrel), crude oil revenue (in billions of Naira), exchange rate (Naira to U.S. dollar), and non-oil revenue (in billions of Naira). These data are selected to reflect Nigeria's economic structure and capture the interplay between oil price shocks and macroeconomic variables.

Model Specification

The ARDL model is specified to assess the long-run relationship and short-run adjustments among the variables, while the VCEM is employed to examine causality and shock dynamics. The general ARDL equation for the study is specified as:

$$\Delta GDP_t = \alpha_1 + \sum_{i=1}^{p} \beta_i \Delta GDP_{t-i} + \sum_{m=0}^{q1} \varphi_m \Delta COP_{t-m} + \sum_{n=1}^{q2} \vartheta_n \Delta COR_{t-n} + \sum_{p=1}^{q3} \varsigma_p \Delta EXR_{t-p} + \sum_{r=1}^{q4} \delta_r \Delta NOR_{t-r} + \lambda ECT_{t-1} + \varepsilon_t \quad (2.1)$$

where Δ represents the first difference operator, ECT_{t-1} is the error correction term from the co-integration equation, and ε_t is the stochastic error term. The coefficients $\beta_i, \varphi_m, \varphi_m, \varsigma_p, \gamma_p, \delta_r$ capture the short-run dynamics, λ measures the speed of adjustment to the long-run equilibrium (Wang *et al*., 2020)

Estimation Techniques

The analysis follows a stepwise approach. First, the stationarity of the variables is tested using the Augmented Dickey-Fuller (ADF). Second, the ARDL Bounds Test is applied to determine the existence of a long-run relationship. Third, the VCEM is used to analyse the response of GDP to oil price shocks and to trace the causality among variables. Diagnostic tests, including

normality, autocorrelation, and heteroscedasticity tests, are conducted to ensure model validity and reliability.

Unit Root Test

The Unit Root Test for stationarity is tested using, the Augmented Dickey-Fuller (ADF) unit root test, which usually is employed in the analysis of random variables to determine the order of integration of a series. This is considered very important in time series analysis and it is done using the Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979).

The test is based on the assumption that, a series y, is a random walk

$Y_t = b_1 y_{t-1} + \varepsilon_t$ Random walk (2.2)

$Y_t = b_0 + b_1 y_{t-1} + \varepsilon_t$ Random walk with drift (2.3)

$Y_t = b_0 + b_1 y_{t-1}\ b_2 t + \varepsilon_t$ Random walk with drift and trend (2.4)

However, to enhance stationarity we considered if y_{t-1} is subtracted from the Right-Hand Side (RHS) from each of the equation 3.11 – 3.13, we have

$Y_t - Y_{t-1} = b_1 Y_{t-1} - Y_{t-1} + \varepsilon_t$, $\Delta Y_t = \vartheta Y_{t-1} + \varepsilon_t$, Random walk (2.5)

$Y_t - Y_{t-1} = b_0 + b_1 Y_{t-1} - Y_{t-1} + \varepsilon_t$, $\Delta Y_t = b_0 + \vartheta Y_{t-1} + \varepsilon_t$, Random walk with drift (3.5)

$Y_t - Y_{t-1} = b_0 + b_1 Y_{t-1} - Y_{t-1} + b_1 t + \varepsilon_t$, $\Delta Y_t = b_0 + \vartheta Y_{t-1} + b_2 t + \varepsilon_t$, Random walk with drift and trend (3.6)

Where $b_1 Y_{t-1} - Y_{t-1} = (b_1 - 1)\, Y_{t-1}$, let $(b_1 - 1) = \vartheta$,

we have $\vartheta Y_{t-1}\ and\ Y_t - Y_{t-1} = \Delta Y_t$ (2.7)

The null hypothesis is tested as thus:

For pure random walk, we have

$\Delta Y_t = \vartheta Y_{t-1} + \sum_{i-1}^{p} \sigma_i \Delta Y_{t-1} + \varepsilon_i$ (2.8)

H_0: $\vartheta = 0$ and therefore r = 1 against the alternative that H_1: $\vartheta < 0$ and r < 1

similarly, Random walk with drift we have

$\Delta Y_t = b_0 + \vartheta Y_{t-1} + \sum_{i-1}^{p} \sigma_i \Delta Y_{t-1} + \varepsilon_i$ (2.9)

H_0: $\vartheta = 0$ and therefore r = 1 against the alternative that H_1: $\vartheta < 0$ and r < 1

Also, Random walk with drift and trend

$\Delta Y_t = b_0 + \vartheta Y_{t-1} + \sum_{i-1}^{p} \sigma_i \Delta Y_{t-1} + b_2 t + \varepsilon_i$ (2.10)

H_0: $\vartheta = 0$ and therefore r = 1 against the alternative that H_1: $\vartheta < 0$ and r < 1

The decision that follows will be considered if 'Y_t' is found to be more negative and statistically significant at least 5 percent level of significance, we compare the t-statistic value of the parameter, with the critical value tabulated (Mackinnon, 1991), we reject the null hypothesis and accept the alternative and conclude that the series does not have a unit root level. Conversely, we accept the null hypothesis and reject the proceed with the determination of lag length. Difference stationary refers to the situation where differencing is required to obtain stationarity. If the series is expressed as an AR process and the AR polynomial contains a unit

root, that is if one root of the autoregressive polynomial lies on the unit circle, e.g. for an AR (1), $\alpha = 1$, then differencing is necessary.

Justification for Methodology

The combination of ARDL and VCEM is suitable for this study as it accommodates variables of mixed integration orders (I(0)I(0)I(0) and I(1)I(1)I(1)), provides unbiased estimates for small sample sizes, and effectively models both short-term dynamics and long-term equilibrium relationships. This methodological framework is appropriate for analyzing the impact of oil price shocks on economic growth while aligning with Nigeria's Vision 2030, which emphasizes economic diversification and stability (Hamdi & Mohamed, 2024).

3. Results

Table 4.1: Descriptive Statistics of Variables

Statistic	GDP	COP	COR	EXR	NOR
Mean	226.6842	48.13119	2274.427	132.2586	1426.471
Median	170.0729	33.61500	575.2000	115.2550	500.9050
Maximum	574.1838	116.8800	8879.000	794.5600	7874.550
Minimum	44.00306	14.14000	7.250000	0.610000	2.980000
Std. Dev.	169.5025	32.40105	2662.758	169.1360	1970.954
Skewness	0.519456	0.863141	0.899231	2.196331	1.574513
Kurtosis	1.758888	2.473316	2.504788	8.255677	4.858322
Jarque-Bera	4.584471	5.700534	6.089481	82.10583	23.39701
Probability	0.101040	0.057829	0.047609	0.000000	0.000008
Sum	9520.735	2021.510	95525.92	5554.860	59911.78
Sum Sq. Dev.	1177975.	43042.94	2.91E+08	1172886.	1.59E+08
Observations	42	42	42	42	42

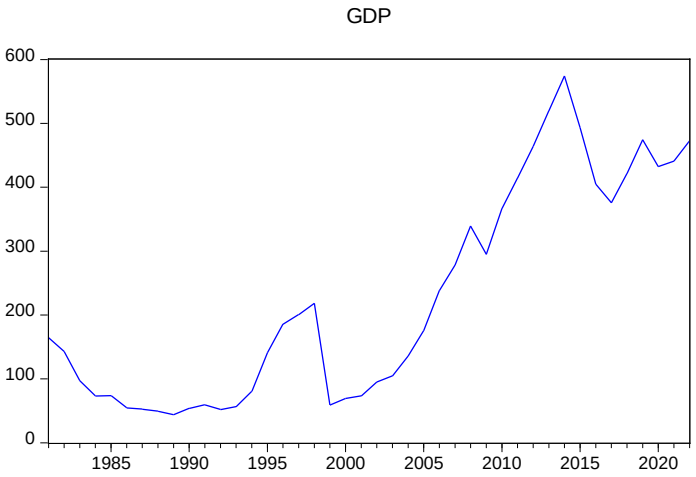

Figure 3.1: Time plot of Annual Nigerian GDP (1981 – 2022)

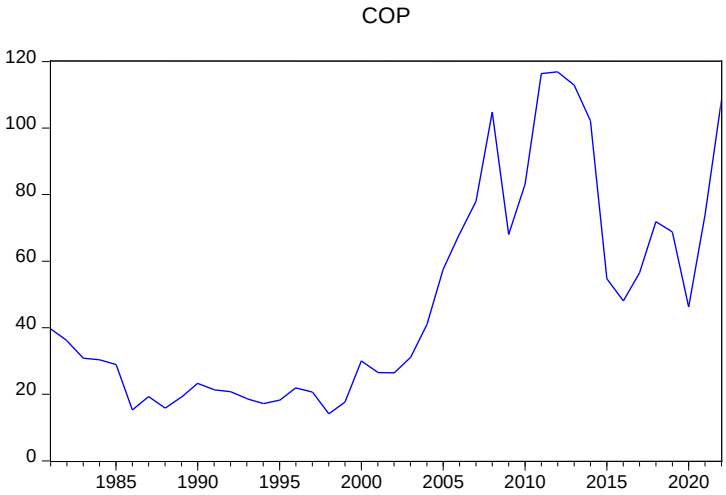

Figure 3.2: Time plot of Annual Nigerian COP (1981 – 2022)

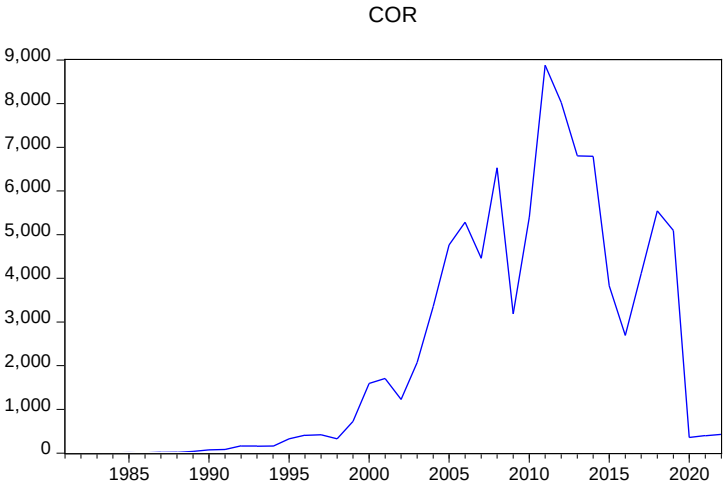

Figure 3.3: Time plot of Annual Nigerian COR (1981 – 2022)

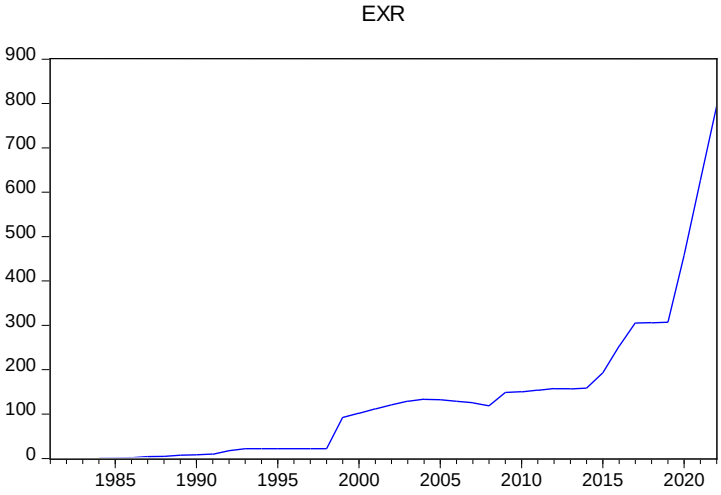

Figure 3.4: Time plot of Annual NGN/USD Exchange Rate (1981 – 2022)

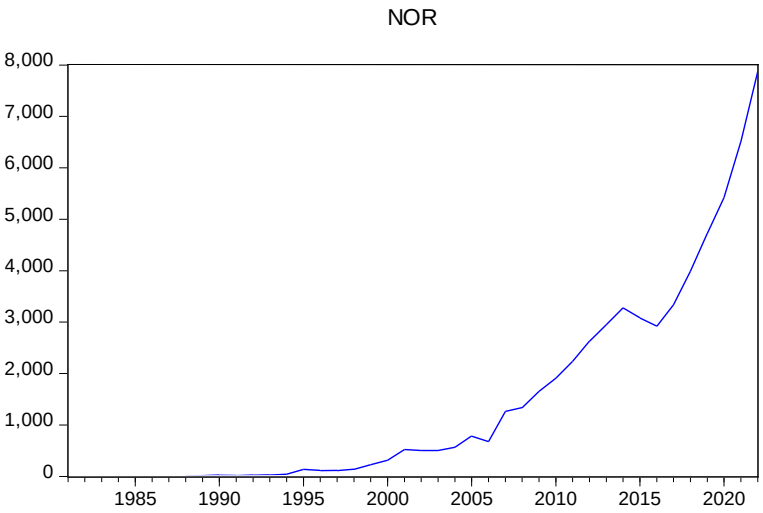

Figure 3.5: Time plot of Annual Nigeria NOR (1981 – 2022)

Table 2: Unit Root Test using Augmented Dickey Fuller (ADF) Test

Variable (s)	Stat. level	t-Statistics 1%	5%	10%	ADFTS	Prob.	Remarks
GDP	I(0)	-3.60	-2.93	-2.60	-0.29	0.917	Not Stationary
	I(1)	-3.60	-2.93	-2.60	-4.89	0.003	Stationary
COP	I(0)	-3.60	-2.93	-2.60	-0.29	0.001	Stationary
COR	I(0)	-3.60	-2.93	-2.60	-6.22	0.065	Not Stationary
	I(1)	-3.60	-2.93	-2.60	-0.29	0.001	Stationary
EXR	I(0)	-3.60	-2.93	-2.60	-5.81	0.054	Not Stationary
	I(1)	-3.60	-2.93	-2.60	-0.29	0.001	Stationary

NOR	I(0)	-3.60	-2.93	-2.60	-7.52	0.312	Not Stationary
	I(1)	-3.60	-2.93	-2.60	-0.29	0.001	Stationary

The results were tested at 1%, 5%, and 10% level of significance respectively
Source: EViews 10 Computation

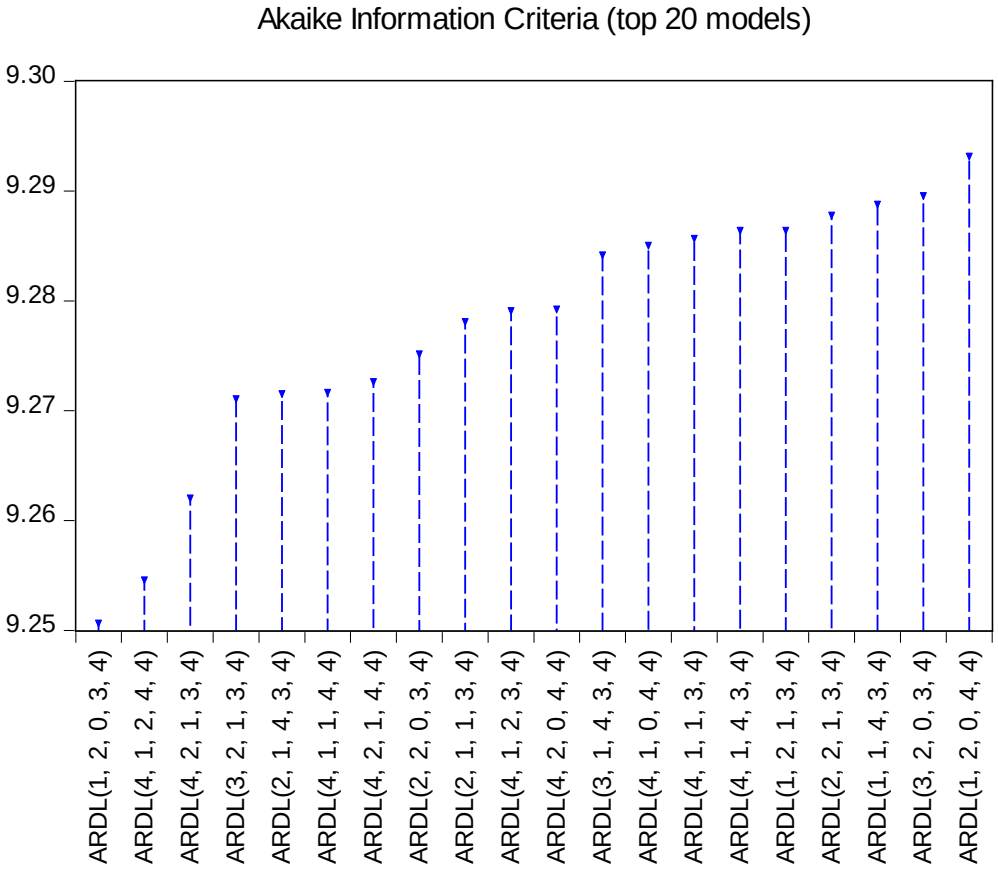

Figure 3.6: ARDL Model Selection (Using GDP as Dependent Variable)

Source: EViews 10 Computation

Table 3.3: ARDL (1,2,0,3,4) Model Estimation using GDP as Dependent Variable

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP(-1)	0.903981	0.099563	9.079463	0
COP	1.222892	0.587195	2.082599	0.0486
COP(-1)	-0.60565	0.493558	-1.22712	0.2322
COP(-2)	-0.83405	0.469344	-1.77705	0.0888
COR	-0.00743	0.006142	-1.21004	0.2386
EXR	-1.77291	0.245941	-7.20868	0
EXR(-1)	1.693822	0.354428	4.779032	0.0001

EXR(-2)	-0.30381	0.330054	-0.92049	0.3669
EXR(-3)	0.59152	0.228432	2.589482	0.0164
NOR	0.041381	0.027305	1.515483	0.1433
NOR(-1)	0.001571	0.036404	0.043146	0.966
NOR(-2)	0.021348	0.043411	0.491773	0.6275
NOR(-3)	0.074115	0.043714	1.695452	0.1035
NOR(-4)	-0.1214	0.036428	-3.33256	0.0029
C	22.49778	13.38865	1.680362	0.1064

R-squared	0.990625	Mean dependent var	237.9713
Adjusted R-squared	0.984918	S.D. dependent var	174.1356
S.E. of regression	21.38538	Akaike info criterion	9.250673
Sum squared resid	10518.69	Schwarz criterion	9.897089
Log likelihood	-160.763	Hannan-Quinn criter.	9.480663
F-statistic	173.5898	Durbin-Watson stat	1.792102
Prob(F-statistic)	0		

Table 3.4: ARDL Bound Test

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	3.708909	10%	2.45	3.52

Table 3.5: Vector Error Correction of the ARDL(1,2,0,3,4) Model (Short Run) using GDP as Dependent Variable.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	22.49778	6.013906	3.740959	0.0011
D(COP)	1.222892	0.296372	4.126204	0.0004
D(COP(-1))	0.834046	0.322145	2.589041	0.0164
D(EXR)	-1.77291	0.186928	-9.48446	0
D(EXR(-1))	-0.28771	0.207948	-1.38357	0.1798
D(EXR(-2))	-0.59152	0.189452	-3.12226	0.0048

D(NOR)	0.041381	0.020946	1.975584	0.0603
D(NOR(-1))	0.025936	0.021157	1.225837	0.2327
D(NOR(-2))	0.047284	0.025861	1.828415	0.0805
D(NOR(-3))	0.121399	0.02819	4.30642	0.0003
CointEq(-1)*	-0.09602	0.020579	-4.6658	0.0001

R-squared	0.871737	Mean dependent var	10.50369
Adjusted R-squared	0.824232	S.D. dependent var	47.07921
S.E. of regression	19.73781	Akaike info criterion	9.040147
Sum squared resid	10518.69	Schwarz criterion	9.514185
Log likelihood	-160.763	Hannan-Quinn criter.	9.208806
F-statistic	18.35049	Durbin-Watson stat	1.792102
Prob(F-statistic)	0		

Table 3.6: Estimated Long Run Coefficients Using ARDL (1,2,0,3,4) Model

Dependent Variable : GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
COP	-2.25795	6.770831	-0.33348	0.0351
COR	-0.0774	0.118506	-0.65313	0.0052
EXR	2.172705	3.346122	0.64932	0.3154
NOR	0.177212	0.142733	1.241564	0.2269

EC = GDP - (-2.2580*COP -0.0774*COR + 2.1727*EXR + 0.1772*NOR)

Table 3.7: ARDL(1,2,0,3,4) Serial Correlation and Heteroscedasticity

Test	**F-statistic**	**P-Value**	**Decision**
Breusch-Godfrey Serial Correlation LM Test	0.743363	0.4876	No Serial Correlation
Breusch-Pagan-Godfrey for Heteroskedasticity	0.627317	0.8156	No Heteroscedasticity

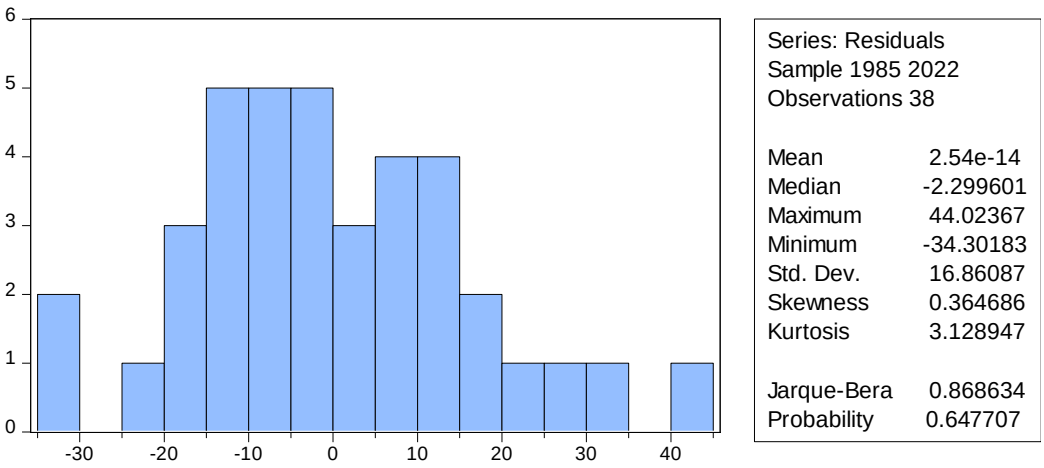

Figure 3.7: Histogram Normality Test of Residuals of the ARDL(1,2,0,3,4)

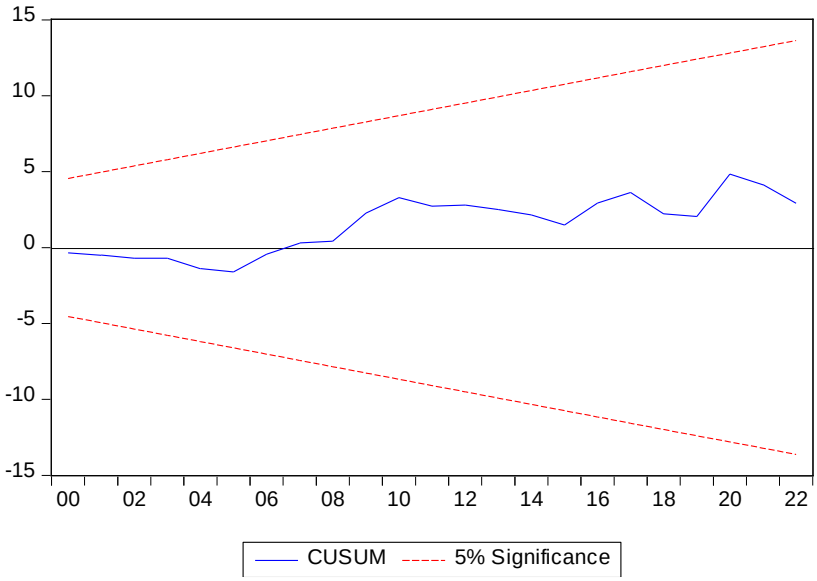

Figure 3.8: CUSUM Stability Test for ARDL (1,2,0,3,4)

4. Discussion

The descriptive statistics in Table 4.1 provide an overview of the key variables used in the study, offering insights into their central tendencies, variability, and distributional properties over the sample period. The mean values indicate that GDP averaged 226.68 billion Naira, with Crude Oil Price (COP) at $48.13 per barrel and Crude Oil Revenue (COR) at 2,274.43 billion Naira, reflecting Nigeria's dependency on oil as a major economic driver. The Exchange Rate (EXR) averaged 132.26 Naira to the U.S. dollar, showcasing the evolution of the Naira over time, while Non-Oil Revenue (NOR) averaged 1,426.47 billion Naira, underscoring the growing importance of non-oil sectors. The high standard deviations for GDP, COR, EXR, and

NOR indicate significant variability, with EXR showing extreme fluctuations (minimum of 0.61 and maximum of 794.56), reflecting periods of exchange rate volatility. The skewness and kurtosis values highlight that most variables, except GDP and COP, deviate from normality, as confirmed by the Jarque-Bera test, which shows significant probabilities for COR, EXR, and NOR. These results suggest that while GDP and COP are relatively stable, COR, EXR, and NOR exhibit pronounced volatility, emphasizing the susceptibility of Nigeria's economy to external shocks and underscoring the need for policies aimed at stabilizing non-oil revenue sources and exchange rates in line with Vision 2030 objectives.

The results of the unit root test in Table 2, conducted using the Augmented Dickey-Fuller (ADF) test, reveal the stationarity properties of the study variables, which are crucial for selecting appropriate econometric techniques. Gross Domestic Product (GDP) is not stationary at levels (I(0))(I(0))(I(0)), as the ADF t-statistic of -0.29 falls above the critical values at 1%, 5%, and 10% significance levels, with a probability of 0.917, indicating the presence of a unit root. However, it becomes stationary after first differencing (I(1))(I(1))(I(1)), with an ADF t-statistic of -4.89, significant at the 5% level ($p = 0.003$). Similarly, Crude Oil Revenue (COR), Exchange Rate (EXR), and Non-Oil Revenue (NOR) exhibit non-stationarity at levels but achieve stationarity at first differences, confirming their integration of order one. Conversely, Crude Oil Price (COP) is stationary at levels (I(0))(I(0))(I(0)), with an ADF t-statistic of -0.29 and a significant p-value of 0.001, indicating it is integrated of order zero.

These findings suggest that the variables in the model exhibit mixed integration orders, with some being I(0)I(0)I(0) and others I(1)I(1)I(1). This justifies the use of the Autoregressive Distributed Lag (ARDL) model, which accommodates variables with mixed integration levels (Hamdi & Mohamed, 2024).). Additionally, achieving stationarity through differencing for most variables highlights the dynamic nature of Nigeria's macroeconomic environment, characterized by frequent shocks and adjustments. These results align with existing studies on oil-exporting economies, which emphasize the volatile nature of key economic indicators such as oil revenue, exchange rates, and GDP (Rahman *et al*., 2024). By ensuring stationarity, the study avoids spurious regression results and lays a solid foundation for accurate estimation of short-run and long-run relationships among variables.

The ARDL (1,2,0,3,4) model estimation results in Table 3.3 reveal significant short-run and long-run dynamics between the dependent variable (GDP) and the independent variables. The lagged GDP variable (GDP(-1)) is highly significant ($p = 0.000$) with a coefficient of 0.9039, indicating strong persistence in economic growth. Crude Oil Price (COP) has a positive contemporaneous impact on GDP (1.2229, $p = 0.0486$), although its lagged effects are not statistically significant at the 5% level, suggesting that oil price shocks primarily affect GDP in the short run. Exchange Rate (EXR) shows a significant negative contemporaneous effect on GDP (-1.7729, $p = 0.000$), while its lagged values reflect a mix of positive and insignificant impacts, emphasizing the sensitivity of GDP to exchange rate volatility. Non-Oil Revenue (NOR) exhibits mixed effects, with NOR(-4) showing a significant negative impact (-0.1214, $p = 0.0029$), underscoring the importance of revenue diversification for sustainable growth. The model demonstrates excellent goodness of fit ($R^2 = 0.9906$, Adjusted $R^2 = 0.9849$), and diagnostic tests, such as the Durbin-Watson statistic (1.7921), suggest no serious autocorrelation issues. These findings align with existing literature emphasizing the dual

impact of oil price shocks and exchange rate dynamics on Nigeria's economic performance (Adebayo *et al*., 2021; Olomola & Adejumo, 2006).

The findings of the ARDL (1,2,0,3,4) model have critical implications for Nigeria's economic policy within the framework of Vision 2030, which aims to diversify the economy, enhance macroeconomic stability, and achieve sustainable growth. The strong persistence of GDP, reflected in the significance of GDP(-1), underscores the importance of building on past economic trends to stabilize growth amidst external shocks. The positive short-run effect of Crude Oil Price (COP) on GDP highlights Nigeria's continued reliance on oil exports, but the absence of significant lagged effects indicates that these benefits are temporary, reinforcing the need to reduce oil dependency in line with Vision 2030's diversification goals. The significant negative impact of Exchange Rate (EXR) volatility on GDP demonstrates the economy's vulnerability to currency fluctuations, underscoring the need for effective exchange rate management and policies promoting export-led growth. Furthermore, the mixed effects of Non-Oil Revenue (NOR), particularly the significant negative lagged impact, highlight inefficiencies in revenue mobilization and utilization, emphasizing the necessity of improving non-oil sector productivity and fiscal transparency. These findings collectively stress the urgency of implementing structural reforms to reduce oil dependence, stabilize exchange rates, and enhance non-oil revenue generation to achieve inclusive and sustainable economic growth as envisioned in Vision 2030.

The ARDL Bounds Test presented in Table 3.4 demonstrates that the F-statistic (3.7089) exceeds the lower bound critical value (I(0) = 2.45) but lies below the upper bound critical value (I(1) = 3.52) at the 10% significance level. This result indicates a potential long-run equilibrium relationship among the variables, though it is not conclusively established at stricter significance levels. This finding suggests that while the variables may move together over time, the relationship is relatively weak, reflecting the challenges of maintaining economic stability in an environment characterized by volatility in key indicators like crude oil prices and exchange rates. The presence of this weak long-run relationship aligns with Nigeria's ongoing struggles to achieve macroeconomic stability in line with Vision 2030's objectives for sustainable economic growth (Adediran *et al*., 2021).

Table 3.5 further reinforces these insights through the short-run dynamics captured by the Vector Error Correction Model (VECM). The coefficient of the error correction term (CointEq(-1)) is negative and statistically significant (-0.096, $p < 0.01$), confirming the existence of a long-run adjustment mechanism, albeit slow. Crude Oil Price (COP) has a significant positive short-run impact on GDP, highlighting Nigeria's persistent reliance on oil revenue for economic growth, while the significant negative effect of Exchange Rate (EXR) volatility reflects its destabilizing influence on the economy. The mixed short-run effects of Non-Oil Revenue (NOR), with some lags showing significance, emphasize inefficiencies in revenue diversification efforts. These results imply that to achieve Vision 2030 goals, Nigeria must focus on reducing its dependency on oil, stabilizing exchange rate fluctuations, and improving non-oil revenue mobilization to sustain long-term economic growth (Adewuyi *et al*., 2022).

The long-run coefficients presented in Table 3.6 provide critical insights into the relationship between GDP and the independent variables in the ARDL(1,2,0,3,4) model. Crude Oil Price

(COP) shows a statistically significant negative impact on GDP (p = 0.0351), which highlights the adverse effects of oil price shocks on Nigeria's economic growth, likely due to the economy's over-reliance on oil exports and price volatility (Mohammed, 2024). Similarly, Crude Oil Revenue (COR) has a significant negative coefficient (p = 0.0052), suggesting inefficiencies in channeling oil revenues into productive sectors. On the other hand, the Exchange Rate (EXR) and Non-Oil Revenue (NOR) show positive but statistically insignificant effects on GDP, emphasizing the need for stronger diversification efforts and exchange rate stability to bolster economic performance. Furthermore, Table 3.7 confirms the robustness of the model, with no evidence of serial correlation (p = 0.4876) or heteroscedasticity (p = 0.8156), ensuring the reliability of the estimated coefficients. These results underscore the importance of economic diversification and stable macroeconomic policies to mitigate oil price shocks and drive sustainable growth, as envisioned in Nigeria's Vision 2030 framework (Alam & Hossain, 2024).

Figure 3.7, which presents the Histogram Normality Test of residuals for the ARDL(1,2,0,3,4) model, confirms that the residuals are approximately normally distributed, as evidenced by the symmetric bell-shaped distribution and the associated probability value that does not indicate significant deviation from normality. This result validates the assumption of normality required for reliable inference in ARDL models. Additionally, Figure 3.8, the CUSUM Stability Test, confirms the structural stability of the ARDL model. The CUSUM plot lies within the 5% critical bounds, indicating that the model parameters are stable over the sample period. Together, these diagnostic tests affirm the robustness and reliability of the ARDL(1,2,0,3,4) model in capturing the relationship between the variables under study.

5. Conclusion

This study examined the effect of oil price shocks on Nigeria's economic growth using Vector Error Correction Model (VECM) and ARDL modelling approaches, with Vision 2030 as the contextual framework. The descriptive statistics revealed significant variations in GDP, crude oil prices, crude oil revenue, exchange rate, and non-oil revenue, underscoring the volatility of Nigeria's macroeconomic environment. The unit root tests confirmed stationarity of variables at first difference, ensuring the validity of subsequent analyses. The ARDL Bound Test indicated a long-run relationship among the variables, validating the appropriateness of the ARDL framework.

The long-run estimates demonstrated that crude oil price and crude oil revenue negatively influence GDP, signifying the vulnerability of Nigeria's economy to oil price shocks. In contrast, exchange rate and non-oil revenue exhibited positive but statistically insignificant effects, highlighting the need for improved diversification of revenue sources. The short-run analysis revealed significant contributions of crude oil price and exchange rate changes to GDP fluctuations, alongside the stabilizing impact of non-oil revenue. Diagnostic tests confirmed the model's stability, with no evidence of serial correlation or heteroscedasticity, and the normality and CUSUM tests affirmed the robustness of the results.

These findings emphasize the pressing need for Nigeria to reduce its overdependence on oil revenues by strengthening non-oil sectors, stabilizing exchange rates, and enhancing

macroeconomic resilience to achieve sustainable growth under Vision 2030. Policy recommendations include structural reforms, improved fiscal transparency, and investment in human capital and infrastructure to mitigate the adverse impacts of oil price shocks and foster economic diversification for long-term growth.

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