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# IMPACT OF CRUDE OIL PRICES ON ECONOMIC GROWTH IN NIGERIA.

By

[1]Bernard Ojonugwa Anthony, [2]Lawal, Ibrahim Ozomata, & [3]Asma'u Mahmood Baffa
[1]Department of Economics, Airforce Institute of Technology, Kaduna, Nigeria
[2]Department of Economics, Nigerian Defence Academy, Kaduna
[3]Department of Accounting, Airforce Institute of Technology, Kaduna, Nigeria
[1] **Corresponding Author:** [1] **bernarddecobros@gmail.com**

***Abstract.***
The study investigates the relationship between crude oil prices and economic growth in Nigeria to understand their impact on economic resilience and provide insights for policymakers. Using the nonlinear autoregressive distributed lag (NARDL) model, it analyses data from 1981 to 2022, considering both positive and negative oil price shocks and lagged effects. Additionally, it explores the effects of crude oil revenue and exchange rate fluctuations on economic growth. The findings reveal Nigeria's vulnerability to oil price fluctuations, with positive shocks temporarily boosting growth and negative shocks having adverse effects. Lagged crude oil revenue significantly influences growth, while lagged exchange rates do not. To enhance economic resilience, policymakers are advised to prioritize diversification, invest oil revenues transparently, and implement macroeconomic stability measures such as fiscal buffers. Flexible economic policies accommodating oil price shocks are crucial for adaptability. Continuous research and vigilance are emphasized for informed policymaking and sustained economic progress.
***Keywords: Keywords:*** Crude oil price, crude oil revenue, exchange rate, NARDL

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## 1. Introduction

Crude oil plays a crucial role on the global economic stage, exerting significant influence over the prosperity of nations worldwide. Its importance lies in the fact that its by-products serve as primary energy sources for homes, industries, and various sectors, including transportation. The production, supply, and pricing dynamics of crude oil have far-reaching implications, shaping economic activities globally. In the ever-fluctuating global market, crude oil remains a vital energy

commodity, with its supply and demand subject to the globally set market price, susceptible to shifts due to unforeseen global events (Musa, 2015).

Crucial to the production processes and macroeconomics of nations, crude oil holds a pivotal position, impacting both net exporters and importers (Okonkwo & Ogbonna, 2018). For oil-exporting nations, an increase in crude oil prices translates into augmented revenues, leading to positive effects on economic indicators. This rise in income often results in increased consumption and investment, fostering productivity, reducing unemployment rates, appreciating exchange rates, boosting export earnings, creating budget surpluses, expanding external reserves, and facilitating infrastructural development (Bjornland, 2009). Conversely, oil-importing countries face adverse effects, as escalating crude oil prices elevate production costs, contributing to inflation (Filis, 2011).

Nigeria, heavily reliant on crude oil as the linchpin of its economy, experiences profound consequences from fluctuations in global crude oil prices. Since the oil shocks of the early 1970s, characterized by erratic price movements, fiscal policies, infrastructure development, and the economic performance of oil-exporting developing nations have been significantly impacted (Kilian, 2014). Nigeria ranks among the top global producers, making it a prominent member of the Organization of the Petroleum Exporting Countries (OPEC) (OPEC, 2021). While crude oil serves as a major source of energy, revenue, and foreign exchange earnings for Nigeria, the nation's economic fate is intrinsically tied to the fortunes of its oil sector. The discovery and subsequent export of crude oil in 1956 marked a pivotal shift from an agrarian export-focused economy to one heavily reliant on crude oil (Hamdi & Sbia, 2013). This oil dependency has established a direct correlation between Nigeria's economic trajectory and the performance of the oil sector since the 1970s, with fluctuations in international crude oil prices exerting an asymmetrical impact on the nation's economy, given Nigeria's dual role as both a crude oil exporter and importer of its by-products such as petroleum, jet fuel, and diesel.

Over the years, crude oil exports have consistently contributed a substantial share of Nigeria's real gross domestic product (GDP), accounting for an average of 81.1% of the country's overall export revenues (National Bureau of Statistics [NBS], 2020). The share of crude oil revenue in total revenue escalated from 26.3% in 1970 to 78.73% in 2018 but

decreased to 71.97% in 2020 due to a sharp drop in demand, oversupply of crude oil, and the rapid shocks induced by the COVID-19 outbreak and associated lockdown. The resultant decrease in global crude oil prices led to a reduction in export revenue, reinforcing Nigeria's status as an oil-dependent economy (NBS, 2020).

The Nigerian economy witnessed a recession in the early 1990s, triggered by a fall in crude oil prices due to the South-East Asia crisis in 1998. This marked the onset of economic challenges, characterized by a decline in real GDP, crude oil revenue, and foreign exchange earnings. Hamilton's analysis from 1983 indicated a clear link between global crude oil price increases and subsequent recessions, with ten out of eleven U.S. recessions in past decades being preceded by oil price hikes (oil shocks). Since 1980, Nigeria has undergone multiple recessions due to falling crude oil prices, impacting the economy negatively by diminishing oil income, reducing foreign exchange profits, increasing the budget deficit, raising unemployment, and slowing economic growth. Moreover, the macroeconomic impact of oil prices may not follow a linear trajectory, adding complexity to the relationship between crude oil prices and economic growth (Motunrayo & Nicholas, 2021).

Theoretically, an increase in crude oil prices should boost government revenue, as evidenced by the rise in crude oil revenue from ₦8,879.0 billion in 2010 to ₦11,116,9 billion in 2011 when crude oil prices spiked to $107 per barrel. However, the volatile nature of crude oil prices over the years, marked by both highs and lows, presents challenges to Nigeria's economic stability. Thus, the study investigates the impact of crude oil prices on economic growth in Nigeria, focusing on whether the relationship is linear or non-linear, and discerning the trajectory of crude oil prices on the nation's economy. The recent shock induced by the COVID-19 pandemic, leading to a significant drop in crude oil prices, has further highlighted the vulnerability of Nigeria's economy, impacting foreign exchange earnings, foreign reserves, government revenue, and the country's ability to meet financial obligations. The economic repercussions of decreased crude oil prices include reduced revenue, high debt dependence for major expenditures, and a potential hindrance to sustainable projects, contributing to infrastructural neglect and limited investment in other economic sectors (NBS, 2020).

Existing studies in Nigeria have predominantly examined the symmetric impact of crude oil prices on economic growth

without considering the asymmetric nature of this relationship or how the economy responds differentially to variations in crude oil prices (Akarara & Baker, 2023; Joseph, Callistus, & Paschal, 2020; Charles & Oguntade, 2018; Ogbonna & Orlu, 2017). As argued by Mory (1993), the effects of crude oil prices are asymmetrical and should be deconstructed into instances of price increases and declines. Many time-series studies conducted in Nigeria failed to account for this asymmetry, rendering them unable to ascertain both the positive and negative effects of crude oil price variations on economic growth. To address this gap, this study employs advanced econometric methods, particularly the nonlinear autoregressive distributed lag (NARDL) model to examine the impact of crude oil prices on economic growth in Nigeria from 1981 to 2022.

## 2. Literature Review

Akarara and Baker (2023) used the exponential generalized autoregressive conditional heteroskedasticity (EGARCH) model to examine crude oil price volatility in Nigeria. The findings showed that there is a general tendency for oil price shocks to be around 1.83% bigger in declining oil prices than in rising oil prices. The asymmetric shocks to the price of oil completely dominate positive leverage. To minimize the economy's reliance on crude oil exports as its main export (and source of revenue), measures for export promotion and diversification should be put in place. Employing the panel-ARDL estimation technique, Motunrayo and Nicholas (2021) analysed the asymmetric effect of oil prices on economic growth in low-income oil-importing countries. The study suggests that while short-term effects are negligible, long-term effects are negative and considerable, with a rise in oil prices negatively impacting growth and a drop having a positive influence. Similarly, Akinsola and Odhiambo (2020) examined the asymmetric impacts of oil prices on exchange rate volatility in oil-exporting nations. Utilizing a nonlinear ARDL model over the period 1995 to 2018 for 25 oil-exporting nations, the study uncovers both short and long-run asymmetric correlations. Decreasing oil prices exhibit a long-term asymmetric effect on exchange rate volatility while increasing prices do not. A similar study by Joseph, Callistus, and Paschal (2020) made use of the generalized auto-regressive conditional heteroskedasticity GARCH (1,1) model to estimate the effect of oil price fluctuation on economic growth in Nigeria. The data used was quarterly data covering the period from 1984 to 2017. The variables used

in the analysis are gross domestic product (GDP), the dependent variable, while oil price, exchange rate and interest rate were used as the independent variables. Their findings revealed that oil price and exchange rate had positive and significant effects on economic growth in Nigeria. Moreover, fluctuations in oil price had positive and insignificant effect on economic growth.

Charles and Oguntade (2018) employed the OLS estimation technique to examine the impact of oil prices on economic growth in Nigeria. In addition to the oil price as exploratory variable, are exchange rate, external reserve, government revenue and inflation. The research found that there is a significant and positive relationship between oil price changes and economic growth in the short run, but in the long run, the inconsistency of oil prices and lack of diversification of the productive base had not helped the Nigerian economy. In addition, exchange rate, external reserve, government revenue and inflation were found to significantly influence economic growth in Nigeria in the short run and long run. In a study by Okonkwo and Ogbonna (2018) on the effect of oil price fluctuations on the Nigerian economy, they also explored the linear correlation between the Nigerian economy and crude oil prices, exchange rates, and unemployment rates. However, the study overlooked the significant oil events in the country within 1970s and 1980s. The study utilized the NARDL technique to capture the unstable association between oil prices and economic growth.

Ogbonna and Orlu (2017) examined the effects of oil price fluctuations on the Nigerian economy from 1970 to 2013 using the error-correction approach. While the study revealed a modest negative impact of PMS price fluctuation on the Nigerian economy, the reliance on vulnerable data sources raises concern about the study's robustness. Meanwhile, Donwa, Mgbame, and Onyeoweni (2015) investigated the link between oil price volatility and the growth of the Nigerian economy from 1970 to 2013. Their study suggested that the fluctuation in world oil prices contributed to the instability in the Nigerian economy within the period. On the other hand, Musa (2015) assessed the effect of oil price shocks on the expansion of the Nigerian economy from 1970 to 2011, utilizing cointegration and the SVAR model. The study identified long-term impacts and emphasized the crucial role of factors such as oil prices, instability, agricultural production, and currency rates in shaping Nigeria's

economic growth. Emphasising the positive influence of petroleum on economic growth, Abdullahi, Ikemefuna, and Fatimah (2015) examined the impact of petroleum on the Nigerian economy. However, the study lacks an analysis of the asymmetric impact of petroleum prices, which could be addressed using the NARDL model.

In essence, numerous scholars have extensively explored the correlation between crude oil prices and economic growth in Nigeria. While many studies employ diverse analytical models, there remains a significant void in applying the non-linear autoregressive distributed lag (NARDL) model to capture the asymmetric impacts of crude oil prices. The existing literature delves into the profound influence of crude oil prices on the economies of major oil-producing nations worldwide. Despite the abundance of research, there exists divergence in findings regarding this relationship, with some studies suggesting reverse causation while others indicate minimal effects. This inconsistency underscores the need for a more thorough investigation into this intricate issue. Moreover, certain studies lack recentness, neglecting to account for the unprecedented economic disruptions caused by the COVID-19 pandemic. Undoubtedly, these disruptions may have asymmetric implications for the Nigerian economy. Addressing these gaps is imperative for achieving a more comprehensive understanding of the intricate dynamics between crude oil prices and economic growth, specifically in Nigeria.

## 3. Methodology

### Model Specification

This study adopts modified versions of the models proposed by Motunrayo and Nicholas (2021) to investigate the influence of crude oil prices, alongside other control variables such as oil revenue and the exchange rate, on economic growth. The functional relationship of the model encompasses four variables. Economic growth serves as the response variable (dependent), while crude oil price, crude oil revenue, and exchange rate function as the independent variables. These variables were carefully chosen based on their relevance to the study. In recognition of the substantial impact of Nigeria's crude oil revenue on the country's OPEC quota as a member, this study incorporates crude oil revenue as a control variable in the model. Therefore, the functional model is elucidated as follows:

$$RGDP = f(COP, COR, EXR) \quad 3.1$$

Where RGDP represents economic growth, COP for the price of crude oil, COR for oil revenue, and EXR for the exchange rate. The

model's econometric function is expressed as follows:

$$RGDP_t = \beta_0 + \beta_1 COP + \beta_2 COR_t + \beta_3 EXR_t + \mu \quad 3.2$$

$$\ln RGDP_t = \beta_0 + \beta_1 \ln COP + \beta_2 \ln COR_t + \beta_3 \ln EXR_t + \mu \quad 3.3$$

Real gross domestic product (RGDP) functions as the dependent variable, representing a proxy for economic growth. Concurrently, crude oil price (COP), crude oil price (COR), and exchange rate (EXR) serve as the independent variables. In this context, β0 denotes the constant, while β1, β2, and β3 represent the coefficients of the independent variables. The error component of the model is denoted by μ.

Due to the substantial magnitudes of the variables involved, it becomes necessary to scale down the figures for practical analysis. Therefore, to achieve this reduction in numerical scale, the natural logarithm of Equation 3.2 is taken (as reported in Equation 3.3). This logarithmic transformation serves the purpose of minimizing the size of the numerical values for more manageable computations.

The NARDL model of Equation 3.3 is specified as:

$$\Delta \ln RGDP_t = \beta_0 + \beta_1 RGDP_{t-1} + \beta_2 \ln COP^{+}_{t-1} + \beta_3 \ln COP^{-}_{t-1} + \beta_4 \ln COR_t + \beta_5 \ln EXR_t + \mu \quad 3.4$$

$$\Delta \ln RGDP_t = \delta_0 + \sum_{i=1}^{n} \delta_1 \Delta RGDP_{t-1} + \sum_{i=1}^{n} \delta_2 \ln COP^{+}_{t-1} + \sum_{i=1}^{n} \delta_3 \ln COP^{-}_{t-1} + \sum_{i=1}^{n} \delta_4 \ln COR_{t-1} + \sum_{i=1}^{n} \delta_5 \ln EXR_{t-1} + \mu \quad 3.5$$

**Estimation Technique**

This study employed both descriptive and analytical tools. The descriptive tools are in the form of trends and descriptive statistics. Descriptive statistics was used to examine the nature of the data employed. In the analytical tool, the study employed NARDL estimation techniques to estimate the times series data of the variables in Equation 3.3. The analytical too was also used to examine the statistical significance of the variables. The data which spanned the period of 1981 to 2022 were sourced from World Development indicators, the OPEC statistical bulletin and the Central Bank of Nigeria (CBN) statistical bulletin.

## 4. Presentation and Analysis of Results

### 4.1 Trend Analysis

Trend analysis was employed to examine the behavioural patterns of the variables considered in this study, for a better understanding. The trends in the gross domestic product (RGDP), crude oil revenue

(COR), exchange rate (EXR), and crude oil price (COP) were all analysed presented in Figure 4.1.

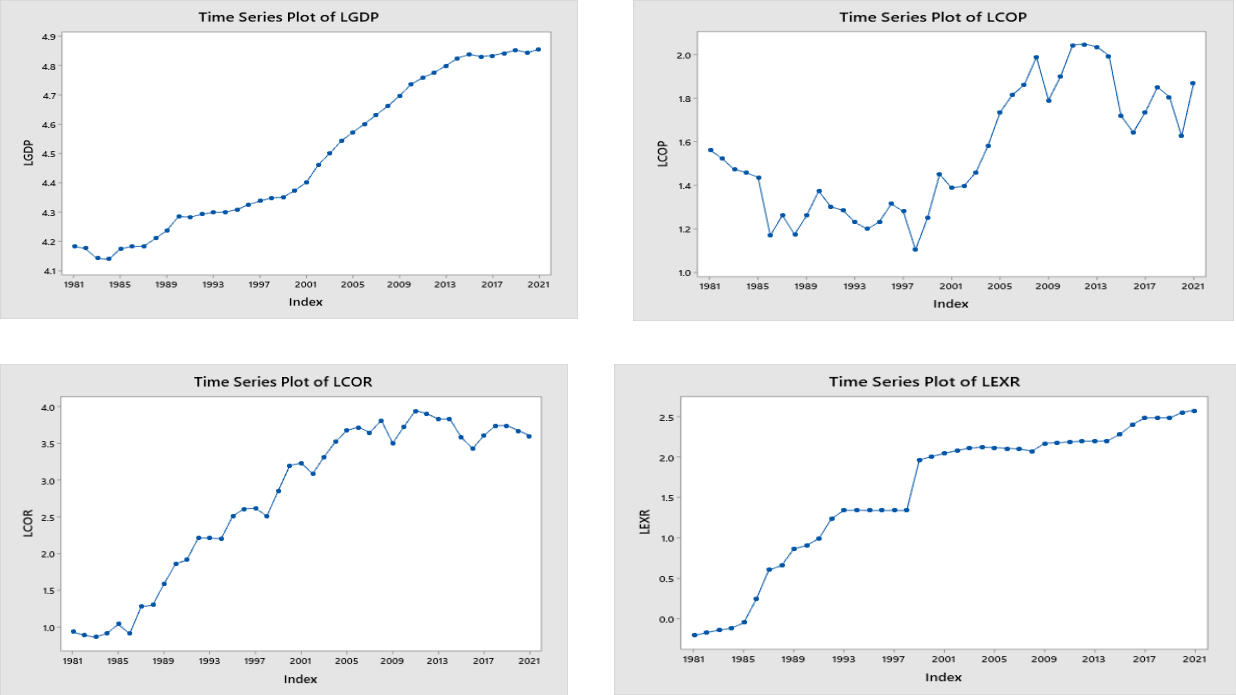


**Figure 4.1: Trend of LRGDP, LCOP, LCOR, and LEXR.**
***Source: Researcher's computation using Minintab19***

The trajectory of real gross domestic product (RGDP) in Nigerian naira exhibited a consistent and gradual increase throughout the study duration. From 1981 to 2000, RGDP sustained a gradual upward movement. Subsequently, before the 2015 downturn in crude oil prices, RGDP experienced a continuous positive trend from 2001 to 2015. The 2015 decline in crude oil prices led to a contraction of RGDP by 1.6% in 2016. The dip in crude oil revenue in the same year was attributed to a sudden global drop in demand, impacting Nigeria's foreign earnings. In 2020, the decline in crude oil revenue was linked to the economic repercussions of the COVID-19 pandemic. Contrary to a steady increase, the behavioural pattern of crude oil revenue in Nigeria exhibited volatility from 1981 to 2012, with a particularly tumultuous period from 1981 to 2010. A notable surge in crude

oil revenue occurred between 2010 and 2014 due to increased oil prices. However, the sharp decline between 2015 and 2020 resulted from plummeting oil prices. Exchange rates fluctuated unexpectedly in an upward trend from 1985 to 2022. Stability was observed between 1981 and 1985, followed by a significant rise from 1986 to 1992 due to the Structural Adjustment Program (SAP). The exchange rate continued to increase steadily until 1999, followed by erratic oscillations from 1997 to 2022, reflecting the Central Bank of Nigeria's use of a flexible exchange rate to address economic challenges.

Crude oil prices in Nigeria displayed high instability and unpredictability from 1981 to 2013, marked by significant fluctuations until 1997. Between 2000 and 2009, there was a period of heightened volatility, succeeded by a contracted era of lower volatility from 2010 to 2013. From 2013 to 2022, there was a prolonged period of elevated volatility. Overall, the fluctuating and erratic patterns in Nigeria's economic growth, crude oil revenue, exchange rates, and crude oil prices underscore the need for an empirical investigation into how oil price asymmetry impacts Nigeria's economic growth, particularly using the relevant macroeconomic variable (RGDP). The study concludes that Nigeria's crude oil trend is characterized by volatility.

**Table 4.1: Summary of Descriptive Statistics for the Variables**

| Variable | Observation | Mean | Std. Dev. | Skewness | Kurtosis | Jarque-Bera | Prob. |
|---|---|---|---|---|---|---|---|
| **RGDP** | 41 | 4.488 | 0.256 | 0.205 | 1.485 | 4.207 | 0.122 |
| **COP** | 41 | 1.552 | 0.286 | 0.266 | 1.771 | 3.062 | 0.216 |
| **COR** | 41 | 2.746 | 1.066 | -0.607 | 1.889 | 4.626 | 0.098 |
| **EXR** | 41 | 1.561 | 0.871 | -0.808 | 2.383 | 5.118 | 0.077 |

*Source: Researcher's computation using Eviews9*

Table 4.1 presents the descriptive statistics for the variables, aiming to provide a comprehensive insight into the behavioural characteristics of the studied variables. The descriptive statistics encompass key metrics such as the Jarque-Bera statistic, skewness, mean, and kurtosis.

The average values of real gross domestic product (RGDP), crude oil price (COP), crude oil revenue (COR), and exchange rate (EXR)

in Nigeria from 1981 to 2021 are 4.488, 1.552, 2.746, and 1.561, respectively, offering an overview of the variables' typical movements. The small standard deviations for RGDP (0.256), COP (0.286), COR (1.066), and EXR (0.871) imply minimal estimation errors and highlight that the variables exhibit variability over the years rather than being fixed or static.

Skewness result indicate that both RGDP and COP are positively skewed, suggesting a directional movement in the time series. Conversely, COR and EXR exhibit negative skewness, indicating a skewness towards smaller values in the series. However, the skewness values, not substantially positive, imply that the series do not significantly deviate from a normal distribution. Moreover, kurtosis results suggest that RGDP, COP, COR, and EXR display normal distributions. The Jarque-Bera test probability values for all variables are significant at the 5% level, supporting the conclusion that the dataset follows a normal distribution, and thus, the null hypothesis cannot be rejected.

### 4.2 Unit Root Test

In testing for the presence of unit roots in a series, it is more convenient and reliable to employ unit roots with structural breaks (Perron 1987, 1989). A problem common with the conventional unit root tests such as the ADF, DF and PP tests, is that they do not allow for the possibility of a structural break (Perron, 1989). Assuming the time of the break as an exogenous phenomenon, Perron (1997) showed that the power to reject a unit root decreases when the stationary alternative is true and a structural break is ignored. Perron (1989) further argued that the standard test of the unit root hypothesis may not be reliable in the presence of structural change. It is against the background that this study employed the Zivot and Andrews (Z-A) Unit root with a structural break.

Zivot and Andrews proposed a variation of Perron's original test in which they assume that the exact time of the break-point is unknown. Following Perron's characterization of the form of structural break, Zivot and Andrews proceed with three equations to test for a unit root: (i) equation 4.1, which permits a one-time change in the level of the series; (ii) equation 4.2, which allows for a one-time change in the slope of the trend function, and (iii) equation 4.3, which combines one-time changes in the level and the slope of the trend function of the series. Hence, to test for a unit root against the alternative of a one-time structural break, Zivot and Andrews use the following regression equations corresponding to the above three models.

$$\Delta Y_t = c + Y_{t-} + \beta t + \Delta Ut + \sum_{j=1}^{k} d_j \Delta Y_{t-j} + \varepsilon_t \quad 4.1$$

$$\Delta Y_t = c + Y_{t-} + \beta t + \theta \Delta T_t + \sum_{j=1}^{k} d_j \Delta Y_{t-j} + \varepsilon_t \quad 4.2$$

$$\Delta Y_t = c + \alpha Y_{t-1} + \beta t + \theta \Delta Ut + \Delta Ut + \sum_{j=1}^{k} d_j \Delta Y_{t-j} + \varepsilon_t \quad 4.3$$

Where ΔUt is an indicator of the dummy variable for a mean shift occurring at each possible break-date (TB) while $\Delta T_t$ is the corresponding trend shift variable. The null hypothesis in all three models is $\alpha = 0$, which implies that the series $\{y_t\}$ contains a unit root with a drift that excludes any structural break, while the alternative hypothesis $\alpha < 0$ implies that the series is a trend-stationary process with a one-time break occurring at an unknown point in time. The Zivot and Andrews method regards every point as a potential break-date (TB) and runs a regression for every possible break-date sequentially. From amongst all possible break-points (TB), the procedure selects as its choice of break-date *(TB* ) the date which minimizes the one-sided t-statistic for testing $\alpha$ **(** $\alpha$ =1).

Perron (1997) suggested that most economic time series can be adequately modelled using either equation 4.1 or equation 4.3. As a result, the subsequent literature has primarily applied Equation 4.1 and/or Equation 4.3. In a recent study, Sen (2003) shows that if one uses Equation 4.1 when in fact the break occurs according to Equation 4.3 then there will be a substantial loss in power. However, if the break is characterized in Equation 4.1, but Equation 4.3 is used then the loss in power is minor, suggesting that Equation 4.3 is superior to Equation 4.1. Based on these observations, we chose Equation 4.3 for our analysis of unit roots. Therefore, the results of the unit root test are presented in Table 4.2

**Table 4.2: Z-A Test for Stationarity.**

| Variable | Level Z-A Test Statistic | First Difference Z-A Test | MacKinnon Critical Value at at 5% level | Prob. | Order Of Integration | Stationary | Identified Breakpoint |
|---|---|---|---|---|---|---|---|
| **RGDP** | 3.796575 | 5.418911 | 4.93 | 0.0004 | I(1) | Stationary | 2000 |
| **COP** | 3.820350 | 6.55612 | 4.93 | 0.0315 | I(1) | Stationary | 2009 |
| **COR** | 2.356347 | 6.500760 | 4.93 | 0.0154 | I(1) | Stationary | 1989 |
| **EXR** | 3.655825 | 5.624060 | 4.93 | 0.0006 | I(1) | Stationary | 2001 |

*Source: Researcher's computation using Eviews 10*

In Table 4.2, Zivot and Andrew's (1992) unit root test was applied to assess the variables, examining both their levels and first differences. The results indicate that the null hypothesis of a unit root is rejected for all variables. Specifically, for real gross domestic product (RGDP), crude oil price (COP), crude oil revenue (COR), and exchange rate (EXR), the rejection of the unit root hypothesis suggests that these series become stationary after a single differencing (I(1)). Additionally, structural breaks in the data were identified, occurring in the years 2000 for RGDP, 2009 for COP, and 1989 for both COR and EXR. The outcome of the Z-A unit root test is premised on the fact their respective Z-A test statistics were less than their MacKinnon critical values at a 5% significant level. Once more, their p-values were greater than the 5% level of significance.

Table 4.2 presents the outcomes of the Z-A test considering a structural break, aiming to pinpoint critical periods that may influence the time series characteristics of the model's variables. For the variables RGDP, COP, COR, and EXR, the test identifies four significant structural breaks occurring in 1989, 2000, 2001, and 2009. In 2000, Nigeria experienced an economic resurgence due to heightened government expenditure by the new administration and a substantial upswing in crude oil prices. Real GDP growth surged to 3.8% in 2000, suggesting that increased government investment and a robust oil industry might have temporarily alleviated the economic challenges. Hence, the identified structural break in 2000.

The crude oil price plummeted from a peak of $133.88 in June 2008 to a low of $39.09 in February 2009, primarily due to the adverse effects of the financial crisis on the sector. The break identified in 2009 was a consequence of a sharp drop in global demand for crude oil in the international market, contributing to the 2009 economic recession (Ogboru, Rivi & Idisi 2017). Conversely, the 2014 break marked a period of global economic activity slowdown triggered by the crude oil market's supply and demand imbalance. The 2020 break may have resulted from the COVID-19 pandemic. The Exxon Valdez oil spill, which released 11 million US gallons of crude oil into the ocean, led to increased demand for crude oil, causing the structural break in 1989. The announcement of the spill and potential shortages prompted a rise in crude oil prices, elevating the earnings from crude oil sales from $19.83 billion in 1988 to $39.13 billion in 1989 and $71.89 billion in 1990 (IMF, 2020).

In 2000, the official exchange rate of the naira increased by 13% in real effective terms due to the effects of the expansionary fiscal policy, leading to the break identified in 2001. A surge of 71% in crude oil prices from a deficit of 10% of RGDP in 1999 to a surplus of 5% of RGDP in 2000 aided the current account. This, in turn, resulted in a rise in gross international reserves from $5.4 billion to $9.4 billion, strengthening the exchange rate in 2001.

The study employed the non-linear autoregressive distributed lag (NARDL) model to assess the asymmetric impact of oil prices on economic growth in Nigeria, building upon the unit root test results. The findings of the unit root test justified the criteria for determining long-term relationships between variables, prompting the utilization of the ARDL Bounds test approach.

### 4.3 Cointegration Test

**Table 4.3: F-Bounds Test of Co-Integration**

Ho: no Co-integration

| Test Statistic | Value | K |
|---|---|---|
| **F- Statistic** | **7.43** | **3** |
| | **Critical Value Bounds** | |
| **Significance** | **Lower Bound** | **Upper Bound** |
| **10%** | **1.99** | **2.94** |
| **5%** | **2.27** | **3.28** |
| **1%** | **2.88** | **3.99** |

*Source: Researcher's computation using Eviews10*

The study employed the F-bounds testing approach for cointegration to determine the existence of a long-term relationship, particularly between crude oil price and economic growth. The results of the Bounds test are detailed in Table 4.3. The F-bounds cointegration test examines the null hypothesis, asserting the absence of a sustained connection between crude oil prices and Nigeria's economic growth. The findings indicate that, at a 5% significance level, the null hypothesis of no cointegration is rejected. This is attributed to the F-statistic surpassing both the lower and upper critical value bounds at the 5% level. Consequently, the variables scrutinized in this study exhibit a significant long-term relationship. Hence, there exists a

direct and enduring association between the price of crude oil and Nigeria's economic growth.

### 4.4 Non-Linear Autoregressive Distributive Test

The results of the long-run estimates of the nonlinear ARDL model are presented in Table 4.4.

**Table 4.4: Estimated NARDL Model of Asymmetric Long-Run Impact**

| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
|---|---|---|---|---|
| **LCOP_POS** | 0.534 | 0.118 | 4.525 | 0.000 |
| **LCOP_NEG** | -0.524 | 0.315 | 3.574 | 0.007 |
| **LCOR** | 0.112 | 0.108 | 2.557 | 0.038 |
| **LEXR** | 0.292 | 0.200 | 1.463 | 0.155 |
| **C** | 4.430 | 0.182 | 24.354 | 0.000 |

*Source: Researcher's computation using Eviews9*

The positive coefficient suggests that an increase in lagged crude oil prices during periods of positive asymmetry is associated with a positive impact on economic growth. The t-statistic indicates that this relationship is statistically significant, as the p-value is very low (0.0001). The negative coefficient implies that a decrease in lagged crude oil prices during periods of negative asymmetry is associated with a negative impact on economic growth. Similar to LCOP_POS, this relationship is statistically significant, as the p-value is relatively low (0.0072). This result is in line with the findings of Joseph, Callistus, and Paschal (2020) which revealed that economic growth response to positive and negative shocks to crude oil prices in oil-exporting countries are asymmetric. The results refute the findings of Motunrayo and Nicholas (2021) who posited a negative impact of crude oil prices on economic growth. The positive coefficient for lagged crude oil revenue suggests that an increase in crude oil revenue has a positive impact on economic growth. This relationship is statistically significant with a p-value of 0.0375. These results conformed with expectations as the essence of oil revenue is to enhance infrastructural development that could stimulate economic growth. The coefficient for the lagged exchange rate is positive, indicating that an increase in the exchange rate has a positive impact on economic growth. However, this relationship is not statistically significant as the p-value is relatively high (0.155).

In summary, the estimated model suggests that lagged crude oil prices, particularly during periods of positive and negative asymmetry, as well as lagged crude oil revenue, significantly influence economic growth in Nigeria. The constant term is also highly

significant in explaining the overall relationship. The lagged exchange rate, while positive, does not reach statistical significance at the conventional levels. An increase in lagged crude oil prices during periods of positive asymmetry is associated with a positive impact on economic growth. This implies that when there is a favourable environment with rising crude oil prices, it tends to stimulate economic growth. The significance of this relationship (low p-value) suggests a robust statistical association. Conversely, a decrease in lagged crude oil prices during periods of negative asymmetry is associated with a negative impact on economic growth. This indicates that economic downturns related to declining crude oil prices can adversely affect economic growth. The statistical significance (low p-value) reinforces the credibility of this relationship. The positive coefficient for lagged crude oil revenue suggests that an increase in crude oil revenue positively influences economic growth. This aligns with the expectation that oil revenue, when used for infrastructural development, can stimulate economic growth. The statistical significance (p-value of 0.038) supports the robustness of this relationship.

**Table 5: NARDL Model of Asymmetric Short-Run Impact**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| **C** | 0.929 | 0.383 | 2.424 | 0.033 |
| **LGDP(-1)** | -0.210 | 0.093 | -2.245 | 0.033 |
| **D(LCOP_POS)** | 0.101 | 0.040 | 2.546 | 0.017 |
| **D(LCOP_POS(-1))** | 0.074 | 0.043 | -1.744 | 0.092 |
| **D(LCOP_NEG)** | -0.037 | 0.036 | 2.624 | 0.022 |
| **D(LCOR)** | 0.023 | 0.017 | -2.828 | 0.034 |
| **D(LEXR)** | 0.018 | 0.023 | 0.349 | 0.730 |
| **Ect** | 0.989 | 0.196 | 5.058 | 0.000 |

*Source: Researcher's computation using Eviews9*

Table 5 presents the results of the NARDL model for the asymmetric short-run impact of crude oil prices on economic growth in Nigeria. The results indicate that the coefficient of LGDP(-1) is -0.210, and it is statistically significant at the 5% level (p-value = 0.0328). This suggests that there is a negative short-run relationship between lagged real GDP and current real GDP, implying some persistence or adjustment

dynamics in the short term and a 1% increase in the past period of economic growth contributes about 21% to the fall in the economic growth of the current period.

Also, the coefficient of D(LCOP_POS) is 0.101, and it is statistically significant at the 5% level (p-value = 0.0167). This indicates that a positive shock to crude oil prices in the short run has a positive impact on economic growth. That a 1% positive change in the crude oil price (COP) contributes to about a 10% increase in economic growth (GDP) in Nigeria. This is in tandem with Joseph, Callistus, & Paschal (2020) who revealed that economic growth responds to positive and negative shocks to crude oil prices in oil-exporting countries**.** Similarly, The coefficient of D(LCOP_POS(-1)) is 0.074, but it is not statistically significant at conventional levels (p-value = 0.0921). This suggests that the impact of a positive shock to crude oil prices in the previous period on economic growth in the current period is not robustly established. These findings support Motunrayo and Nicholas (2021) who posited a negative impact of crude oil prices on economic growth. This means a positive change in COP in the past period, though not significant contributed to about a 7% increase in GDP in Nigeria. The coefficient of D(LCOP_NEG) is -0.037, and it is statistically significant at the 5% level (p-value = 0.022). This implies that a negative shock to crude oil prices in the short run harms economic growth. The negative shock contributes to about a 4% decrease in economic growth in the study period.

The coefficient of D(LCOR) is 0.023, and it is statistically significant at the 5% level (p-value = 0.034). This suggests that an increase in lagged crude oil revenue positively influences economic growth in the short run. That is, a 1% increase in crude oil revenue contributes significantly to about a 2 per cent increase in economic growth in Nigeria. The coefficient of D(LEXR) is 0.018, but it is not statistically significant at conventional levels (p-value = 0.7299). This indicates that the short-run impact of a change in the exchange rate on economic growth is not robustly established. Regarding the Error Correction Coefficient (ECM), an expected negative sign of -0.989 was obtained, indicating that approximately 99% of the disequilibria from the previous year's shocks converged to their long-run equilibrium in the current period. The significance of the ECM coefficient confirms the existence of a long-run relationship between the dependent and independent variables.

Finally, the results of the short-run dynamics indicate that both positive and negative shocks to crude oil prices have significant short-run impacts on economic growth in Nigeria. Lagged crude oil revenue positively influences short-term economic growth, while the influence of the lagged exchange rate is not statistically significant in the short run. These findings provide insights into the dynamic and asymmetric nature of the relationship between crude oil prices and economic growth in the short term.

## 5. Policy Implication and Recommendations

The research findings carry crucial policy implications for Nigerian policymakers and stakeholders. Key recommendations include prioritizing economic diversification to reduce dependence on oil revenues and stimulating non-oil sectors for increased resilience to oil price fluctuations. Additionally, leveraging the positive impact of lagged crude oil revenue on economic growth through transparent investments in infrastructure is advised. Policymakers are urged to ensure macroeconomic stability during oil price volatility, employing fiscal buffers, prudent fiscal policies, and effective monetary measures to cushion against adverse shocks. The importance of flexible economic policies that consider both positive and negative oil price shocks is highlighted for robust planning. Long-term investment strategies should focus on sectors benefiting from positive oil price effects, fostering sustained economic growth. While the short-run impact of exchange rates may not be statistically significant, policymakers are encouraged to monitor and manage exchange rate movements for a stable economic environment. Creating a business-friendly environment to attract investments in non-oil sectors is stressed, emphasizing the need for improved infrastructure and regulatory measures. Finally, the dynamic nature of the relationship between crude oil prices and economic growth underscores the necessity for continuous research and monitoring. Implementing these recommendations can enhance Nigeria's economic resilience, reduce vulnerability to oil price shocks, and foster sustainable and inclusive economic growth.

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