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Oil Price Shocks and Fiscal Sustainability in Nigeria: An Empirical Assessment

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Abstract

Oil price shocks play a critical and destabilizing role in Nigeria's fiscal operations. This study examines the impact of oil price shocks on fiscal sustainability in Nigeria from 2010 to 2023. A quantitative research design was adopted using annual time-series data obtained from the Central Bank of Nigeria, National Bureau of Statistics, World Bank, and International Monetary Fund. Data were analyzed using descriptive statistics, unit root tests, the Autoregressive Distributed Lag (ARDL) model, and diagnostic tests. The findings indicate that oil price shocks significantly affect fiscal sustainability. Positive oil price movements improve fiscal balance and government revenue, whereas negative shocks widen fiscal deficits and increase public borrowing. Oil price shocks also contribute to expenditure pressures and debt accumulation, reflecting procyclical fiscal behavior. The study concludes that strengthening fiscal institutions, implementing countercyclical fiscal policies, and promoting economic diversification are essential for improving fiscal resilience and ensuring sustainable economic development in Nigeria.

Keywords: *Oil price shocks, Fiscal sustainability, Nigeria*

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Background to the Study

Oil price shocks play a critical and destabilizing role in Nigeria's fiscal operations. Countries that rely heavily on oil revenues, such as Nigeria, Angola, Venezuela, and several Middle Eastern economies, are highly vulnerable to fluctuations in international oil prices because oil exports constitute a significant share of government revenue and foreign exchange earnings (International Energy Agency, 2024; World Bank, 2024). These fluctuations, commonly referred to as oil price shocks, may be positive (price increases) or negative (price declines), both of which have significant implications for fiscal sustainability, public finances, and macroeconomic stability in resource-dependent economies (Arezki et al., 2025; International Monetary Fund [IMF], 2024). Fiscal sustainability refers to the ability of government of a nation to sustain its spending, taxation, and borrowing policies over time without leading to excessive debt accumulation or fiscal crises (IMF, 2022). In oil-dependent economies, government revenues are often closely tied to oil exports, making fiscal outcomes highly sensitive to external price movements. When oil prices rise, these countries typically experience revenue windfalls, enabling increased public spending and investment. Conversely, declines in oil prices often result in substantial revenue shortfalls, widening fiscal deficits, increased public borrowing, and heightened macroeconomic instability, particularly in economies that depend heavily on hydrocarbon exports (IMF, 2024; World Bank, 2024; Organization for Economic Co-operation and Development [OECD], 2023).

Historically, oil price volatility has been a recurring feature of global markets. Episodes such as the oil price collapse of 2014 - 2016 and the sharp decline during the COVID-19 pandemic in 2020 exposed the fiscal vulnerabilities of oil-dependent economies. These shocks often result in procyclical fiscal policies, where governments increase spending during booms and cut expenditures during downturns, thereby exacerbating economic instability (Frankel, Végh, & Vuletin, 2013; IMF, 2024).

Nigeria exemplifies the structural vulnerabilities associated with resource dependence. According to the International Monetary Fund (2022), oil revenues have historically accounted for over 50% of Nigeria's government income and more than 80% of export earnings. This heavy reliance makes the Nigerian economy highly sensitive to oil price shocks. To mitigate these challenges, many resource-rich countries have established fiscal institutions such as stabilization funds, sovereign wealth funds, and fiscal rules to smooth revenue fluctuations, enhance fiscal sustainability, and promote intergenerational equity (IMF, 2024; OECD, 2023; World Bank, 2024). Nigeria, for instance, has implemented mechanisms such as the Excess Crude Account (ECA) and the Nigeria Sovereign Investment Authority (NSIA). However, the effectiveness of these institutions in stabilizing fiscal outcomes remains contested due to issues related to governance, transparency, and policy consistency (IMF, 2022).

Notwithstanding Nigeria's status as one of Africa's largest crude oil producers, fiscal sustainability has remained elusive due to persistent volatility in international oil prices. Although periods of high oil prices have generated temporary fiscal gains, successive oil price

downturns, notably in 2014-2016 and during the COVID-19 pandemic, have resulted in widening fiscal deficits, rising public debt, and increasing budgetary uncertainty (CBN, 2024; IMF, 2024). Existing studies have largely focused on the macroeconomic effects of oil price shocks, with limited attention to its comprehensive implications for fiscal sustainability using recent Nigerian data. This study addresses this gap by examining the impact of oil price shocks on fiscal stability in Nigeria between 2010 and 2023. The study is organized into introduction, materials and methods, results and discussion, conclusion, acknowledgment, and references. The study specifically aims to examine the effect of oil price shocks on fiscal sustainability and provide policy recommendations for strengthening fiscal resilience in Nigeria.

Materials and Methods

Study Design, Setting, and Data Handling

The study adopted a quantitative, longitudinal time-series research design to examine the impact of oil price shocks on fiscal sustainability in Nigeria, drawing on annual data from the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), and International Monetary Fund. The Federal Government of Nigeria was the study's primary focus since it is the principal entity responsible for macroeconomic management, fiscal policy formulation, and oil revenue allocation.

Key measurements include 1) oil Price (USD per barrel); a proxy for external shocks, 2) government revenue (₦) i.e. total federally collected revenue, 3) government expenditure (₦) i.e. total federal spending, 4) public debt (₦) i.e. combined domestic and external debt stock, 5) exchange rate (₦/USD) i.e. official average annual rate, and 6) inflation (%) i.e. annual CPI growth rate (the percentage change in the Consumer Price Index over one year). The study undertook triangulation across CBN vs. World Bank to resolve discrepancies. Preference was given to official national data (CBN and NBS) where differences arose. Also, consistency checks for units, base years, and definitions across series were carried out. The analytical framework is based on the Autoregressive Distributed Lag (ARDL) model. The econometric analysis was done with Stata.

Description of the Instrument

The instrument consisted of a data extraction template (spreadsheet) with clearly defined fields for each variable and time period. It included (a) time dimension: Year (2010-2023); (b) independent variable: Oil price (USD/barrel); (c) dependent variables: government revenue (₦), government expenditure (₦), and public debt (₦); (c) control variables: exchange rate (₦/USD), inflation (annual CPI growth rate, %), and GDP (₦).

Sampling Technique

The annual time-series data spanned the period 2010 - 2023, yielding a total of 14 observations for each variable. The chosen timeframe ensures that the sample reflects both periods of oil price stability and volatility, thereby providing a robust basis for analyzing fiscal responses. The study adopted a purposive sampling technique, selecting observations based

on their relevance to the research objectives rather than through random selection, thereby ensuring that only data capable of addressing the research questions were included in the analysis.

Results and Discussion

Descriptive statistics, stationarity tests, cointegration analysis, ARDL regression estimation, diagnostic and stability tests were carried out. A variable was considered statistically significant if its probability value (p-value) is less than 0.05, while the sign and magnitude of coefficients were used to interpret economic relationships. The estimated model is specified as:

$$FS_t = \beta_0 + \beta_1 OP_t + \beta_2 EXR_t + \beta_3 INF_t + \beta_4 DEBT_t + \beta_5 EXP_t + \beta_6 GDP_t + \varepsilon t$$

Fiscal sustainability is proxied by Fiscal Balance as a Percentage of GDP (FS), while oil price (OP), exchange rate (EXR), inflation (INF), public debt (DEBT), government expenditure (EXP), and GDP served as explanatory variables.

Descriptive Statistics

Table 1: Summary Statistics of Nigeria's annual time-series

Variable	Minimum	Maximum	Mean
FS	-5.28	-0.93	-2.79
OP	41.89	113.76	79.05
EXR	148.31	645.92	271.48
INF	8.06	24.52	14.33
DEBT	37.81	112.38	76.26
EXP	4,194.58	19,808.44	8,197.12
GDP	55,469.35	77,936.10	68,691.58

Table 1 is a summary statistics of Nigeria's annual time-series data for the period 2010 to 2023. OP = International Crude Oil Price (US Dollars per Barrel), EXR = Official Exchange Rate (₦/US$), INF = Inflation Rate (%), EXP = Federal Government Total Expenditure, DEBT = Federal Government Public Debt Stock, GDP = Gross Domestic Product at Current Basic Prices. Monetary values are expressed in billions of Naira (₦ billion). The average fiscal balance during the study period was -2.79% of GDP, indicating persistent fiscal deficits. Oil prices averaged US$79.05 per barrel but fluctuated considerably, ranging from US$41.89 during the COVID-19 crisis to US$113.76 during periods of oil market expansion. The exchange rate recorded substantial depreciation, increasing from ₦148.31/US$ in 2010 to ₦645.92/US$ in 2023. Inflation averaged 14.33%, reflecting persistent macroeconomic pressures. Government expenditure and GDP showed continuous growth throughout the study period.

Stationarity Tests

Table 2: Augmented Dickey-Fuller Unit Root Test

Variable	Order of Integration	Level	First Difference
FS	I(1)	Non-Stationary	Stationary
OP	I(1)	Non-Stationary	Stationary
EXR	I(1)	Non-Stationary	Stationary
INF	I(0)	Stationary	-
DEBT	I(1)	Non-Stationary	Stationary
EXP	I(1)	Non-Stationary	Stationary
GDP	I(1)	Non-Stationary	Stationary

Table 2 is the ADF results which reveal a mixture of I(0) and I(1) variables. All other variables became stationary after first differencing except inflation that was stationary at Level. Since none of the variables are integrated of order two [I(2)], the ARDL technique is appropriate (Pesaran et al., 2001).

Cointegration Analysis

The ARDL Bounds Testing approach was used to determine whether a long-run relationship exists among the variables.

Table 3: Autoregressive Distributed Lag (ARDL) Bounds Test Result

Test Statistic	Value
F-Statistic	5.67
Lower Bound (5%)	2.27
Upper Bound (5%)	3.28

Table 3 shows the calculated F-statistic (5.67) exceeds the upper critical bound value (3.28), indicating the existence of a long-run relationship among fiscal sustainability, oil prices, exchange rate, inflation, public debt, expenditure, and GDP. This result confirms cointegration and justifies estimation of the long-run and short-run Autoregressive Distributed Lag models.

ARDL Regression Results
Long-Run Estimates
Table 4: Long-Run Autoregressive Distributed Lag Estimates

Variable	Coefficient	t-Statistic	Probability
OP	0.028	3.42	0.011
EXR	-0.006	-2.95	0.020
INF	-0.041	-2.33	0.048
DEBT	-0.017	-2.12	0.062
EXP	-0.00012	-3.07	0.018
GDP	0.00005	2.51	0.037

$R^2 = 0.87$, Adjusted $R^2 = 0.81$, F-statistic = 14.82, Prob(F-statistic) = 0.001

Table 4 shows Oil price has a positive and statistically significant effect on fiscal sustainability. A one-dollar increase in oil prices improves fiscal balance by approximately 0.028 percentage points. Exchange rate depreciation significantly worsens fiscal sustainability, suggesting that macroeconomic instability amplifies fiscal pressures. Inflation negatively affects fiscal balance, indicating that rising prices increase government spending obligations and reduce real revenue values. Government expenditure exhibits a negative relationship with fiscal sustainability, implying that higher spending contributes to wider fiscal deficits. GDP exerts a positive effect, suggesting that economic growth enhances fiscal performance.

Short-Run Error Correction Model (ECM)
Table 5: Error Correction Results

Variable	Coefficient	Probability
D(OP)	0.014	0.032
D(EXR)	-0.004	0.041
D(INF)	-0.023	0.052
ECM(-1)	-0.73	0.000

Table 5 shows the error correction coefficient (-0.73) is negative and statistically significant. This indicates that approximately 73% of deviations from long-run equilibrium are corrected within one year.

Diagnostic Tests

Table 6: Diagnostic Test Results

Test	Probability	Decision
Breusch-Godfrey Serial Correlation	0.51	No Serial Correlation
Breusch-Pagan Heteroskedasticity	0.62	Homoskedastic
Jarque-Bera Normality	0.44	Normally Distributed
Ramsey RESET	0.38	Correct Specification

Table 6 diagnostic tests indicate that the assumptions of classical regression are satisfied by the model. The residuals are normally distributed, free from serial correlation, and homoskedastic.

Stability Tests: The CUSUM plot remains within the 5% significance boundaries throughout the study period, indicating parameter stability. The CUSUMSQ plot also remains within the critical bounds, confirming the stability of the estimated model.

Discussion of Findings

Oil Price Shocks and Fiscal Sustainability: The results support the argument that fluctuations in global oil prices directly affect government revenue and fiscal performance in resource-dependent economies. When oil prices rise, government revenues increase, improving fiscal balances and reducing borrowing needs. In contrast, when oil prices decline, revenue shortfalls emerge, leading to larger fiscal deficits and increased fiscal stress. This finding is in line with recent researches demonstrating that that oil-exporting countries experience significant fiscal volatility as a result of fluctuations in international commodity prices. These economies continue to face unstable government revenues, widening fiscal deficits, and increased macroeconomic uncertainty during periods of oil price decline (Arezki et al., 2025; IMF, 2024; World Bank, 2024). The findings also support the Resource Curse Theory, which posits that excessive dependence on natural resource revenues exposes countries to persistent economic and fiscal instability unless supported by strong institutions and sound fiscal management (Triggs, 2023; World Bank, 2024). In spite of the decades of policy efforts aimed at economic diversification, evidence suggests that Nigeria's fiscal performance remains highly vulnerable to external oil market developments, reflecting the country's continued dependence on oil revenues for government financing (IMF, 2024; OECD, 2023).

Exchange Rate and Fiscal Sustainability: The empirical results suggest that exchange rate depreciation negatively affects fiscal sustainability. This relationship can be explained by the fact that depreciation increases the domestic cost of servicing external debt, raises the cost of imported goods and services, and contributes to inflationary pressures. The findings align with studies that identify exchange rate instability as a major transmission channel through which oil price shocks affect fiscal performance in oil-exporting economies (IMF, 2024; World Bank, 2024; African Development Bank [AfDB], 2024). In Nigeria, declining oil

export earnings reduce foreign exchange inflows, exert downward pressure on the naira, increase debt-servicing costs, and weaken fiscal sustainability, particularly during periods of prolonged oil price volatility (IMF, 2024; AfDB, 2024).

Inflation and Fiscal Sustainability: The empirical results suggest that inflation negatively affects fiscal sustainability by increasing government expenditure requirements while reducing the real value of public revenues. High inflation increases the cost of public sector wages, infrastructure projects, and social programs, thereby placing additional pressure on government finances. Furthermore, inflation often necessitates higher interest rates, which increase debt-servicing costs and further weaken fiscal balances. These findings align with the work of the IMF (2022) and Alharbi (2023), who argue that inflationary pressures can significantly undermine fiscal sustainability in developing economies. The results also indicate that inflation in Nigeria is closely linked to exchange rate depreciation and external shocks, reinforcing the interconnected nature of macroeconomic instability and fiscal performance.

Public Debt and Fiscal Sustainability: The descriptive analysis shows that widening fiscal deficits were accompanied by rising debt obligations, particularly following the 2014 oil price collapse and the COVID-19 pandemic. This finding supports the argument that debt accumulation often serves as a countercyclical response to revenue shortfalls in resource-dependent economies (IMF, 2024; World Bank, 2024; OECD, 2023). However, while borrowing may provide short-term fiscal relief, excessive dependence on debt financing can undermine long-term fiscal sustainability through increased debt-servicing obligations. The findings therefore suggest that Nigeria's fiscal resilience remains constrained by its reliance on both oil revenues and public borrowing. Government Expenditure and Fiscal Sustainability: One of the most significant findings of the study is the continuous increase in government expenditure despite fluctuations in oil revenues over the study period. This trend suggests that fiscal expenditure in Nigeria has not adjusted proportionately to changes in revenue, particularly during periods of oil price decline. Instead, expenditure commitments remained high, contributing to larger fiscal deficits and increased borrowing. This finding supports the theory of procyclical fiscal policy, which posits that governments in resource-dependent economies often increase spending during periods of economic booms but fail to sufficiently reduce expenditure during downturns (IMF, 2024; OECD, 2023; Talvi & Végh, 2005). The result also corroborates the findings of Okonjo-Iweala and Osafo-Kwaako (2007), who argued that weak fiscal discipline and expenditure management contribute significantly to Nigeria's vulnerability to oil price shocks.

Conclusion

This study examined the impact of oil price shocks on fiscal sustainability in Nigeria between 2010 and 2023, with the aim of assessing how fluctuations in global oil prices influence fiscal outcomes in a resource-dependent economy. The findings demonstrate that oil price shocks remain a key determinant of fiscal performance, affecting government revenue, expenditure, fiscal balance, and public debt. The study contributes to the literature by providing updated

empirical evidence using recent Nigerian data and offers practical insights for strengthening fiscal management. Although limited by the study period and reliance on secondary data, it recommends stronger fiscal institutions, countercyclical fiscal policies, and economic diversification. Future studies should undertake cross-country comparative analyses to enhance understanding of fiscal resilience in resource-dependent economies.

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