



Determinants of Economic Growth in Selected African Oil Producing Countries

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Abstract: This study aims to examine the impact of oil revenue, non-oil revenue, and oil prices on economic growth in five African oil-producing economies, Nigeria, Angola, Algeria, Libya, and Egypt, over the period 1970 to 2020. The study applied second-generation econometric techniques, including the Cross-sectional Im-Pesaran and Cross-sectional Augmented Dickey-Fuller tests, Westerlund panel cointegration, the CS-ARDL model, and Dumitrescu and Hurlin heterogeneous panel Granger causality. The results reveal cross-sectional dependence and slope homogeneity among the countries. Panel unit root tests indicate that all variables are stationary at first difference, while cointegration tests confirm a long-run equilibrium relationship. Empirical evidence shows that oil revenue, non-oil revenue, and oil prices significantly influence economic growth, with bidirectional causality between these variables and growth. These findings highlight the need for economic diversification by expanding non-oil revenue sources and implementing supportive policies to sustain long-term growth. The study recommends that policymakers prioritize investment in non-oil sectors and strengthen domestic participation in oil production to foster inclusive and sustainable development.

Keywords: Economic Growth, Oil Revenue, Non-Oil Revenue, Oil Prices

Introduction

The 2020 global economic slump has led to even greater concerns about the role fiscal policy plays in stimulation of growth, especially in developing countries (Chugunov et al, 2021). For oil-producing countries, achieving sustainable development is still a big problem. A resource-driven economy typically rises more slowly than its diversified counterpart economy (Safronchuk & Sergeeva, 2019). Classical and neoclassical growth theories both stress the importance of trade and foreign demand in influencing economic performance. It is a great challenge for many countries with abundant oil resources, however, to change mineral riches into wide-ranging, strong prosperity. Despite having abundant oil reserves, African oil-producing countries have a low resilience against growth risks and structural problems. Over the past five decades, their GDP growth has often lagged behind that of the world as a whole (World Bank, 2021). For example, between 1970 and 2021, Nigeria recorded the highest average annual real GDP growth at 8.1 percent, followed by Libya (7.6 percent), Egypt (7.02 percent), Algeria (6.65 percent), and Angola (5.2 percent). Yet, per capita GDP growth has consistently lagged, reflecting the dominance of the oil sector and limited diversification (World Bank, 2022) (Awodumi & Adewuyi, 2020).

Volatility in global oil markets further compounds these challenges. The 2014 price slump revealed both the resilience of shale oil and the fragility of exporters. While U.S. shale breakeven prices fell significantly, a price war and demand collapse in 2020 caused benchmark prices such as U.S. West Texas Intermediate to briefly fall below zero (IEA, 2020) (Zhou et al, 2022). The International Energy Agency (IEA) projected a dramatic revenue decline for major producers in 2020, estimating that their net income could drop by 50% to 85% year-on-year (IEA, 2020).

African oil-producing countries have faced significant challenges due to their heavy dependence on oil revenue as a primary driver of economic growth. The volatile nature of oil prices and the resource curse phenomenon raise profound concerns about the sustainability of this growth model, often leading to macroeconomic instability and stifled diversification (Hassan et al, 2022) (Okunlola & Akinlo, 2022). Their inadequate scope of diversification puts the countries' economic performance and macroeconomic indicators, such as GDP growth, at the mercy of fluctuations in the oil market (Adewuyi & Awodumi, 2020) (Badeeb et al, 2020). This reliance creates a vicious cycle where revenue volatility impedes long-term investment in non-oil sectors, thereby perpetuating dependence (Cust & Mihalyi, 2017) (Elalla et al, 2022). Despite persistent warnings about the risks of depletion and price shocks, the majority of African oil producers continue to depend almost exclusively on revenues from natural resources, a situation often entrenched by political economy factors and institutional weaknesses (Ackah et al, 2021) (World Bank, 2020). Consequently, this study examines the impact of oil revenue, non-oil revenue, and oil prices on the economic growth of African oil-producing countries.

Methodology

This study is grounded in the Endogenous Growth Theory (Romer, 1986; Lucas, 1988), which emphasizes the role of internal factors such as human capital, innovation, and fiscal policy in driving sustained economic growth. Unlike the neoclassical framework, where technological progress is treated as exogenous, the endogenous approach argues that policy decisions and institutional quality fundamentally influence long-run growth trajectories. The baseline production function is specified as:

$$Y=AK \quad (1)$$

Where: Y represents output (real GDP), A denotes total factor productivity, and K symbolizes capital stock. Capital formation is modeled as a function of oil revenue (OR), non-oil revenue (NOR), oil prices (OP), and their interactions:

$$K=f(OR, NOR, OP, OR \times OP, NOR \times OP) \quad (2)$$

The empirical model is specified as follows:

$$LNRGDP_{it} = \pi_0 + \pi_1 LNOR_{it} + \pi_2 LNNOR_{it} + \pi_3 LNOP_{it} + \pi_4 LN(OR \times OP)_{it} + \pi_5 LN(NOR \times OP)_{it} + \varepsilon_{it} \quad (3)$$

In this context, $\ln\text{RGDP}_{it}$ represents the natural logarithm of real gross domestic product, while $\ln\text{OR}_{it}$ denotes the natural logarithm of Oil Revenue. Additionally, $\ln\text{NOR}_{it}$ signifies the natural logarithm of Non-Oil Revenue, and $\ln\text{OP}_{it}$ refers to the natural logarithm of Oil Prices. The term $[\ln(\text{OR} \times \text{OP})]_{it}$ represents the natural logarithm of the interaction between Oil Revenue and Oil Prices, whereas $[\ln(\text{NOR} \times \text{OP})]_{it}$ indicates the natural logarithm of the interaction between Non-Oil Revenue and Oil Prices. Lastly, ε_{it} denotes the random error term, which is presumed to follow a normal distribution with a mean of zero and a predictable variance.

A balanced panel dataset was constructed for five African oil-producing countries (Libya, Nigeria, Algeria, Egypt, and Angola) from 1970 to 2020. Data were obtained from the World Development Indicators (World Bank, 2022) and supplemented by national statistical sources, including central bank reports. The variables are operationalized. Economic Growth (RGDP): Real GDP in constant 2015 US dollars (Dabachi et al, 2020) (Ahmad et al, 2018), Oil Revenue (OR): Oil rents as a percentage of GDP (Hassan, 2021), Non-Oil Revenue (NOR): Customs and excise duties as a proxy (Olayungbo & Olayemi, 2018) and Oil Prices (OP): Ratio of the consumer price index to world crude energy prices (Baumeister & Peersman, 2013; Ahmad et al., 2018). Interaction terms were generated in STATA 16 to capture the moderating effects of oil prices.

Econometric Techniques

The panel structure and potential cross-sectional dependence, second-generation econometric techniques were employed:

1. Tests for cross-sectional dependence include the CD test by Pesaran (2004) and the LM test by Breusch-Pagan (1980).
2. The slope homogeneity test is represented by the delta tilde test developed by Blomquist and Westerlund (2013).
3. Unit root tests encompass the Cross-sectional Im-Pesaran-Shin (CIPS) test and the Cross-sectional Augmented Dickey-Fuller (CADF) test.
4. The cointegration test is exemplified by the panel cointegration test introduced by Westerlund and Edgerton (2007).
5. For long-run and short-run estimation, the Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL) model is utilized.
6. Causality analysis is conducted using the heterogeneous panel Granger causality test proposed by Dumitrescu and Hurlin (2012).

Result and Discussion

Preliminary Tests

Table 1 shows the descriptive statistics of the selected sample of African oil-producing countries from 1970 to 2021. The mean of real GDP ($\ln\text{RGDP}$) is 23.923 with a standard deviation of 6.132. In signifying hefty cross-national and intertemporal variance, this is relatively high. Oil revenue ($\ln\text{OR}$) has a mean of 2.766 and a standard deviation of 0.822, non-oil revenue ($\ln\text{NOR}$) has a mean of 22.025 with a standard deviation of 1.351, and both betray less variability than GDP, as indicated in their mean values. The mean of oil prices ($\ln\text{OP}$) is 2.773, and its standard deviation is 0.524. Therefore, there appears to be

relatively low variability compared with GDPs. Skewness and kurtosis statistics imply departure from normality. With a series that is normally distributed, skewness should be near zero, and kurtosis should closely approximate three (Gujarati & Porter, 2009; Wooldridge, 2016). However, every variable (lnRGDP, lnOR, lnNOR, and lnOP) is negatively skewed, indicating distributions with longer left tails. Similarly, kurtosis values are less than three, indicating platykurtic distributions or curves that are flatter than normal ones. These results are consistent with the Jarque-Bera test, which for all series strongly rejects the null hypothesis of normality.

Table 1. Descriptive Statistics

Variable	Mean	Std. Dev.	Skewness	Kurtosis	Jarque-Bera (p-value)
LNRGDP	23.923	6.139	2.051	5.623	0.000
LNOR	2.766	0.822	-1.002	4.729	0.000
LNNOR	22.025	1.351	0.609	3.659	0.000
LNOP	2.773	0.524	2.059	5.672	0.000

In the selected African oil-producing countries, the results of pairwise correlation analysis are shown in Table 2. There is a significant positive correlation between lnRGDP (economic growth) and lnOR, lnNOR. Contrarily, we observe both [negative and significant] relationships effectively built up between lnRGDP and lnNOP. The results suggest that while economic growth and oil revenue are positively related, the price trends of oil may adversely affect regional economic performance.

Table 2. Correlation Matrix

Variable	LNRGDP	LNOR	LNNOR	LNOP
LNRGDP	1.000			
LNOR	0.066	1.000		
LNNOR	-0.392*	-0.020	1.000	
LNOP	0.288*	0.110	-0.389*	1.000

The results of the homogeneity test are presented in table 3 as recommended by Blomquist and Westerlund (2013) Both the statistics of delta tilde (Δ) and adjusted delta tilde, $\tilde{\Delta}_{adj}$, all have p-values which strongly reject the null hypothesis (at 1% significance level) of slope homogeneity This finding tells us that among the sampled countries, there really is a significant difference between the slope coefficients. Consequently, parameter heterogeneity implies that the relationship between oil revenue, non-oil revenue, oil prices, and economic growth is not uniform across the chosen African oil-producing countries. This result makes it imperative to use the panel estimation techniques that allow for cross-country variation in parameter estimates.

Table 3. Homogeneity Test Results

Test	Statistic	p-value
Δ _test	14.835	0.000
Δ _adj test	15.604	0.000

Table 4 presents the results of cross-sectional dependency testing. All probability values are significant at the 1% level, refuting the null of independence and offering strong evidence for cross-sectional dependence among selected African oil producers. This result highlights just how closely linked economies are to one another, and thus implies that we need to use more modern panel methods that take account of both heterogeneity and cross-sectional dependency. It is as Phillips and Sul (2003) have pointed out to ignore these facts may lead to losses in efficiency of estimation.

Table 4. Cross-Sectional Dependence Test Results

Variable	CD-test	p-value
LNRGDP	7.135	0.000
LNOR	8.193	0.000
LNNOR	2.308	0.021
LNOP	8.514	0.000

In Table 5, both the Pesaran CADF and CIPS tests are robust in the presence of heterogeneity and cross-sectional correlation (Pesaran, 2007; Pesaran & Yamagata, 2008). The results suggest that lnRGDP, lnOR, lnNOR, and lnOP are not stationary at levels, as the null hypothesis of non-stationarity is not rejected. The null is, however, rejected at the 1% and 5% significance levels. This outcome indicates that the variables become stationary after first differencing, implying integration of order one, I(1) (Baltagi, 2021; Wooldridge, 2016). At the same time, some variables exhibit stationarity in levels, suggesting that they are integrated of order zero, I(0), and therefore do not require differencing (Maddala & Wu, 1999).

Table 5. Panel Unit Root Test Results

Variable	CIPS (Level)	CIPS (First Diff.)	CADF (Level)	CADF (First Diff.)
LNRGDP	-1.293	-4.395*	-1.702	-6.424*
LNOR	-2.838	-6.334*	-2.672	-4.282*
LNNOR	-2.184	-3.458*	-2.310	-3.449*
LNOP	-1.660	-3.868*	-1.604	-5.890*

Table 6, the Westerlund-Edgerton cointegration test results for the first objective. The findings under the constant specification are such that two of the four statistics (Gt and Pt) reject the null hypothesis of no cointegration in this case at a 1% significance level, while Ga and Pa do not. This is evidence of a long-run equilibrium relationship among these variables and is consistent with previous studies (Ahmad et al., 2018; Al-Mulali et al., 2015).

Table 6. Westerlund Cointegration Test Results

Test Type	Constant	p-value	Constant + Trend	p-value
Gt	-4.061	0.000	-4.855	0.000
Ga	-29.604	0.000	-28.655	0.000
Pt	-8.758	0.000	-9.929	0.000
Pa	-46.465	0.000	-49.360	0.000

Table 7 demonstrates a long-run stable relationship explained by the negative and highly significant error correction term (ectt-1). It means that deviations from the equilibrium level adjust to it by about 63% every year, indicating rapid convergence to stability over time. While oil revenue has a positive and significant relationship with economic growth, both in the short and long run. When oil revenues increase by 1%, so similarly does economic growth: 0.449% over time and 0.269% per year initially for growth. These results are consistent with 2020's resource-curse literature, such as Musikavanhu et al. (2021) and Elalla et al. (2021), emphasizing Africa's dependence on fossil fuels for economic performance. Non-oil revenue is also a contributor to growth. A 1% rise in non-oil revenue goes along with a 10.4% increase in short-run growth and a 0.527% long-term increase. This supports the idea that expanding non-oil revenues strengthens growth prospects in developing and oil-dependent countries (Shili & Panjwani, 2020). Likewise, changes in oil prices have a strong influence. An increase of 1% in oil prices makes economic growth taller by 49.4% in the short run and 28.6% over the long term, underscoring Africa's vulnerability to oil price shocks (Akinsola & Odhiambo, 2022).

Table 7. CS-ARDL Estimates (Without Interaction Terms)

Variable	Long-Run Coeff.	Short-Run Coeff.	p-value
LNOR	0.449*	0.269*	0.000
LNNOR	0.527*	0.104*	0.000
LNOP	0.286*	0.494*	0.001
ECM (-1)	-	-0.625*	0.000

In Table 8, Cross-sectional ARDL estimates with interaction show that oil prices augment the impact of oil revenue on economic growth. The coefficient on ln(OROP) is positive (0.149) and statistically significant at the 1% level, implying that a 1% increase in oil revenue when oil income is rising, alongside higher oil prices, leads to nearly a 15% increase in economic growth. This conclusion is consistent with evidence that oil price increases, when transmitted through fiscal channels, can raise non-oil growth by expanding government expenditure (Sadeghi, 2017) and with panel findings showing that oil price effects on growth are stronger where institutional quality is higher (Musikavanhu et al.,

2021). The interaction between non-oil revenue and oil prices is also positive (coefficient = 0.138): a 1% increase in NOR*OP corresponds to a 13.8% rise in growth, highlighting that oil prices make fiscal diversification important for growth. In the short run, the interaction model of oil revenue and oil prices initially dampens growth, but the interaction of non-oil revenue and oil prices increases it. The Error Correction Term (ECM-1) is negative and highly significant (-0.911), implying rapid adjustment – about 91% of disequilibrium is corrected per year. Pesaran CD tests reveal cross-sectional dependence, R² (0.66) indicates strong explanatory power, and the F-statistic (9.24) is significant at 1%. Overall, these results suggest that rising oil prices play a catalytic role in African oil producers’ economies by amplifying the development contributions of both oil and non-oil revenues.

Table 8. CS-ARDL Estimates (With Interaction Terms)

Variable	Long-Run Coeff.	Short-Run Coeff.	p-value
LNOR	0.171**	0.415	0.021
LNNOR	0.538**	1.105**	0.042
LNOP	0.420*	0.864*	0.000
LN(OR×OP)	0.149**	0.476*	0.000
LN(NOR×OP)	0.138*	0.300**	0.011
ECM (-1)	-	-0.911**	0.006

Causality Analysis

Table 9 presents the results of the causality test for the dynamic panel data model. Findings reveal bidirectional causality between oil revenue and economic growth, non-oil revenue and economic growth, and oil prices and economic growth. These results align with prior studies, including Akinsola & Odhiambo (2021). This suggests that, whereas more advanced economies may foster growth through technological adoption, less developed economies often expand by strengthening existing productive capacities via research and technological imitation (Dauda et al, 2023).

Table 9. Granger Causality Results

	LNOR -/→ LNRGDP	LNOR ←/- LNRGDP
W ^{Hnc}	6.537*	9.806*
Z _{NT} ^{Hnc}	7.317	12.348
Z̃ _N ^{Hnc}		
	LNNOR -/→ LNRGDP	LNNOR ←/- LNRGDP
W ^{Hnc}	4.439*	5.924*
Z _{NT} ^{Hnc}	9.513	7.785
Z̃ _N ^{Hnc}		
	LNOP -/→ LNRGDP	LNOP ←/- LNRGDP
W ^{Hnc}	6.409*	6.535
Z _{NT} ^{Hnc}	8.553	5.745
Z̃ _N ^{Hnc}		

Discussion

The results of the cross-sectional ARDL models indicate that oil revenue (lnOR) consistently emerges as a driver of growth in African oil-producing countries. In the short run, oil revenue exerts a significant positive effect on growth, both independently and in interaction with oil prices. The negative and statistically significant error correction term (ECT) confirms the existence of a stable long-term relationship, while the causality test establishes a bidirectional relationship between oil revenues and GDP. This view is supported by Hassan et al. (2022) and Okunlola and Akinlo (2022), who report a positive direct impact of resource rents on macroeconomic output in the short term.

The empirical findings support the endogenous growth theory that assuming the allocation of resource revenues to human capital development, infrastructure modernization, and technological innovation could promote long-term economic growth. This observed positive association is consistent with research by Ackah et al. (2021) and Ilala et al. (2022), who identified a significant relationship between oil revenues and increased fiscal allocation to public investment. The findings also support Okoro et al. (2021), who show that oil revenues significantly increase infrastructure spending in Nigeria. Furthermore, the analysis is consistent with Hassan et al. (2022), who argue that oil revenues expand fiscal capacity, facilitating capital spending, and with Muhangi and Ujah (2020), who identify the transfer mechanisms through which resource revenues are channeled into the national budget to finance development projects, despite significant differences in efficiency.

These findings highlight the significant role of oil revenue and could be an important driver of growth, but its effectiveness depends on three critical factors: fluctuations in global oil prices, severe economic crises, and the quality of domestic institutions. This captures the paradox of resource wealth, while, as Endogenous Growth Theory suggests, oil has the potential to drive economic growth expansion, but it could also lead to instability of economic and even turn resource wealth into a curse of poverty (Ross, 2015) (Badeeb et al, 2017) (Muhangi & Ojah, 2020). This dualism is self-evident, as sudden monetary windfalls frequently result in expansionary fiscal policy and Dutch disease, which in turn crowd out the non-oil sector and compromise long-term growth prospects (Cust & Mihalyi, 2017) (World Bank, 2020).

Conclusion

Oil Revenue is a major factor in the economic growth of selected countries in this study in both the short and long term. However, the results also highlight the paradox of resource wealth. Oil dependence makes economies more vulnerable to external shocks, boosts macroeconomic instability in times of crisis, and exposes institutional weaknesses that may hinder long-term growth. This finding also provides important policy insights for the selected African oil-producing countries, as the powerful influence of oil dependency underscores the urgent need for economic diversification. Therefore, prioritize targeted investments in agriculture, manufacturing, and services, while creating enabling environments for private sector development. Enhancing infrastructure, improving the

business climate, and providing incentives for innovation and entrepreneurship will be crucial in reducing dependence on oil and achieving sustained growth.

Future research should examine extending the analysis to include non-African oil-producing economies to strengthen the generalizability of the findings. Moreover, comparative studies across regions such as the Middle East, Latin America, and Asia could provide additional insights into the global applicability of the resource growth nexus. In future research, it will be important to include institutional quality, governance, and political stability as mediating or moderating variables since an underpinning of the Rentier State Theory is the dependence of the institutions on the revenue garnered from oil. It could help answer why some resource-cursed economies do not diversify. Lastly, in the context of the global energy transition, future studies on the interaction between fossil fuel reliance, renewable energy uptake, and sustainable growth are essential, especially.

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