INCLUSIVE GROWTH AND RESOURCE CURSE IN OIL-RICH COUNTRIES OF SUB-SAHARAN AFRICA

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ABSTRACT
This study investigates the impact of natural resource dependence on inclusive growth in oil-rich sub-Saharan African countries, addressing the resource curse paradox. The research emphasizes the significance of institutional quality, including regulatory quality, control of corruption, and government effectiveness, in moderating the effects of natural resource exploitation on economic inclusivity. Using the cross-sectional augmented autoregressive distributed lag (CS-ARDL) technique, the study analyzes data from Algeria, Congo Republic, Gabon, Nigeria, South Africa, and Sudan over the period 1991-2022. The findings highlight that natural resource rents and oil resource rents significantly influence inclusive growth, with institutional quality playing a critical role in this relationship. Specifically, the results suggest that weak institutions exacerbate the negative effects of natural resource dependence, leading to increased income inequality and limited economic diversification. Conversely, strong institutional frameworks can mitigate these adverse effects, promoting more equitable economic development. This research provides valuable insights for policymakers and development practitioners, emphasizing the need for robust institutional mechanisms to ensure that natural resource wealth translates into broad-based economic benefits. The study aligns with the UN's Sustainable Development Goals, particularly those related to poverty reduction, good governance, and inclusive growth. The results underscore the importance of governance reforms and effective policy implementation in harnessing natural resources for sustainable and inclusive development in sub-Saharan Africa.
Keywords: Resource curse hypothesis, Natural resource rents, Inclusive growth, Institutional quality, Oil-rich SSA countries.
JEL classification codes: C23; D02; F43; O13

1. INTRODUCTION

Natural resources are critical for economic development, especially in sub-Saharan Africa, where they significantly contribute to fiscal revenue and poverty reduction (Iyiola & Valbo-Jørgensen, 2023; Cust & Zeufack, 2023). However, these resources often lead to the "resource curse," where resource-rich countries face economic and social challenges such as increased income inequality, political instability, corruption, and limited economic diversification (Avom et al., 2022; Auty, 1993; Sachs & Warner, 1999). Inclusive growth, essential for sustainable development and achieving the UN's Sustainable Development Goals (SDGs), aims to ensure that economic benefits are equitably shared, particularly among marginalized populations (Tadadjeu et al., 2023). Despite abundant natural resources, sub-Saharan Africa struggles with poor economic growth and inequality (Collier & Laroche, 2015). The region's oil-rich countries, such as Algeria, Nigeria, and Sudan, exemplify this paradox, where resource wealth does not translate into broad-based economic development.

Recent data underscores these challenges. For example, Nigeria's health outcome indicators remain unacceptably high despite modest improvements. The maternal mortality ratio is 814 per 100,000, and the mortality rate for infants and children under five years is 70 and 104 per

1,000 live births, respectively. In 2023, life expectancy at birth in Nigeria was about 61.79 years. More specifically, this figure equaled 60 years for males and 64 years for females. Life expectancy at birth in Nigeria is among the lowest in Africa as well as in the world. (World Bank, 2024). According to the World Bank, weakened economic fundamentals have led the country's inflation to reach a 24-year high of 31.7% in February 2024, which, combined with sluggish growth, has pushed millions of Nigerians into poverty. Nigeria has the 7th lowest human capital index in the world, with weak job creation and entrepreneurial prospects stifling the absorption of the 3.5 million Nigerians entering the labor force annually. Consequently, many workers choose to emigrate in search of better opportunities. The poverty rate was estimated at 38.9% in 2023, with approximately 87 million Nigerians living below the poverty line, making it the world's second-largest poor population after India. From 2015-2022, growth rates decreased, and GDP per capita flattened, recording 354,611.4, 339,852.3, and 343,872.1 for 2019, 2020, and 2021, respectively (World Bank, 2024).

This study addresses the gap in understanding the resource curse beyond mere economic growth by focusing on its impact on inclusive growth in oil-rich sub-Saharan countries. Studies have considered several aspects of inclusive growth (See Olise et al., 2023; Joseph et al., 2024)

Using data from the Central Bank of Nigeria (CBN), the National Bureau of Statistics (NBS), and the World Development Indicators, we analyze how oil resource rents and total natural resource rents affect inclusive growth, with a particular focus on institutional quality. Institutional quality, measured by regulatory quality, control of corruption, and government effectiveness, plays a crucial role in this relationship. Employing the cross-sectional augmented autoregressive distributed lag (CS-ARDL) technique, the study aims to overcome the common issue of cross-sectional dependence in panel data. This research aligns with SDGs 1 (No Poverty), 3 (Good Health and Well-being), 4 (Quality Education), and 10 (Reduced Inequalities).

The paper is organized as follows: Section 2 reviews the literature on the resource curse paradox, Section 3 details the methodology, Section 4 presents the results and discussion, and Section 5 concludes with policy recommendations.

2. LITERATURE REVIEW

2.1 Theoretical Literature

2.1.1 The Resource Curse Theory and Mechanisms

The resource curse theory, introduced by R. Auty in 1993, elucidates the adverse development outcomes associated with abundant natural resources. It posits that countries rich in non-renewable resources often experience slower economic growth than resource-poor nations due to factors like economic stagnation and political instability (Auty, 1993; Sachs & Warner, 1995). Calain (2008) describes the resource curse as an explanation for the inverse relationship between natural resource dependence and economic growth, particularly in Sub-Saharan Africa (Fosu & Gafa, 2019; Adabor, 2023; Greaker et al., 2022). This theory underscores issues such as waste, corruption, excessive consumption, debt overhang, deteriorating public services, and conflicts (Yuan, 2021). In Sub-Saharan Africa, many oil-rich nations face poor developmental outcomes despite substantial resource wealth. For instance, countries like Nigeria, Angola, and the Democratic Republic of Congo exhibit significant fiscal oil revenues but struggle with poverty and stagnation. This contrasts with nations like Botswana and Indonesia, which manage their resources effectively and achieve better development outcomes (Oduyemi & Owoeye, 2021; Oduyemi, forthcoming).

Several economic models explain the mechanisms of the resource curse, including the Dutch Disease Model, Institutions and Policies (Fiscal) Model, Education and Human Capital Development Model, and Rent-seeking behavior. The Dutch Disease Model argues that exporting primary commodities leads to currency appreciation, which negatively impacts other economic sectors (Krugman, 1987; Wu et al., 2018; Ratha & Moghaddam, 2020; Yuan, 2021). The Institutions and Policies (Fiscal) Model emphasizes the role of governance and policy in resource management, noting that weak institutions exacerbate the resource curse (Ross, 2001; Brunnshweiler & Bulte, 2008; Akacem, 2020). The Education and Human Capital Development Model suggests that resource abundance can reduce incentives for education and skill development, hindering economic growth (Papyrakis, 2006; Savoia & Sen, 2021). Lastly, the Rent-seeking behavior model shows how resource wealth promotes unproductive activities like bribery and corruption, further slowing growth (Torvik, 2002; Desierto, 2018).

The Solow growth model augmented with natural resource dependence (Matsuyama, 1992; Torvik, 2002) offers a better explanation of this relationship:

$$Y = AK^{\alpha}L^{1-\alpha}R^{\beta} \qquad \ldots\ldots\ldots\ldots\ldots \qquad (1)$$

where Y is the total output, A represents technological progress, K is the capital stock, L is labor, and R denotes the natural resource stock. The parameters $\boldsymbol{\alpha}$ *and* $\boldsymbol{\beta}$ represent the output elasticities of capital and natural resources, respectively.
The inclusion of natural resources in the production function captures the direct impact of resource abundance on output. However, empirical evidence suggests that $\boldsymbol{\beta}$ may be negative in resource-rich developing countries due to the resource curse. This can be formalized as:

$$\frac{\partial Y}{\partial R} < 0 \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \qquad (2)$$

This negative partial derivative indicates that an increase in the natural resource stock $\boldsymbol{R}$ may reduce overall economic output $\boldsymbol{Y}$, reflecting the adverse effects of the resource curse. These effects can be attributed to factors like Dutch Disease, where an over-reliance on resource exports leads to currency appreciation, making other sectors less competitive.
Furthermore, the impact of institutions and governance on mitigating the resource curse can be modeled by introducing an institutional quality parameter $\boldsymbol{I}$, where better institutions positively influence productivity:

$$A = A_0(1 + \gamma I)\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \qquad (3)$$

Here, A_0 is the baseline level of technology, and γ captures the effectiveness of institutions in enhancing productivity. Therefore, the production function becomes:

$$Y = A_0(1 + \gamma I)K^{\alpha}L^{1-\alpha}R^{\beta} \qquad \ldots\ldots\ldots\ldots\ldots\ldots \qquad (4)$$

In this extended model, higher institutional quality (I) can offset the negative impact of natural resources ($\boldsymbol{\beta < 0}$) by improving overall productivity. This framework underscores the critical role of governance and institutions in ensuring that resource wealth translates into inclusive growth.

2.2 Empirical Literature

2.2.1 Inclusive Growth and Resource Curse

Empirical studies show that the resource curse hinders inclusive growth through mechanisms like the Dutch Disease, weak institutions, and rent-seeking behavior. Matsuyama (1992) and other studies confirm the negative impact of the Dutch Disease on economic growth (Adabor, 2023; Yuan, 2021). Batkiewicz and Yanikkaya (2010) found that the resource curse exists in developing countries with weak institutions, which leads to corruption and poor human capital development. Mehlum et al. (2006), Zalle (2019), and Badeeb & Lean (2017) emphasize the importance of governance quality in mitigating the resource curse. They argue that weak institutions combined with resource wealth exacerbate income inequalities and hinder inclusive growth. Fagbemi & Kotey (2022) highlight that effective governance and strong institutions are crucial for equitable distribution of resource wealth. More recent studies focus on rent-seeking as a significant factor in the resource curse (Larsen, 2006; Congleton et al., 2008; Fagbemi et al., 2022). These studies show that resource wealth often leads to rent-seeking opportunities, which benefit elites and exclude marginalized communities, thus failing to promote inclusive growth.

2.2.2 Inclusive Growth, Institutional Quality, and Resource Curse

The impact of natural resources on economic growth is indeed mediated by the quality of institutions, as highlighted in various studies (Hodler, 2023; Saeed, 2022). Natural resource abundance can negatively affect growth through corruption and rent-seeking behavior (Saeed, 2022), emphasizing the essential role of good institutions in effectively managing resource wealth. Poor management of resource revenues can lead to volatility and low genuine savings rates, contributing to the resource curse. Empirical studies underscore the importance of governance and institutional quality in fostering inclusive growth (Fagbemi & Kotey, 2022; Keghter et al., 2019; Nwagu et al., 2024). Research has shown a strong correlation between institutional quality and real GDP per capita, with developed countries exhibiting better institutions and economic outcomes (Kansheba, & Marobhe, 2022). Additionally, studies have demonstrated the positive impact of institutional quality on economic performance in West African countries (Iheonu et al., 2017; Mahdavi, 2019) as well as its significant influence on economic growth and inclusiveness in Sub-Saharan Africa (Hodler, 2023; Saeed, 2022). Kebede & Takyi (2017) and Olanrewaju (2018) found that institutional quality significantly influences economic growth and inclusiveness in Sub-Saharan Africa. Studies by Zalle (2019) and Badeeb & Lean (2017) argue that the impact of natural resources on development outcomes depends on the quality of institutions and human capital.

Thus, it is clear that the literature supports the view that resource abundance does not guarantee inclusive growth. The distributional effects of resource wealth depend on governance, institutions, human capital, rent-seeking, and the Dutch Disease. Strong institutions and effective policies are essential for ensuring that resource wealth benefits the broader population and promotes inclusive growth.

This study offers significant contributions to the existing literature on the resource curse and inclusive growth in oil-rich sub-Saharan African countries. Unlike previous research that predominantly examines the impact of natural resources on economic growth, this study specifically investigates how natural resource dependence affects inclusive growth, ensuring that economic benefits are equitably shared among all segments of the population, particularly marginalized groups. This focus aligns with the UN's Sustainable Development Goals

(SDGs), especially those related to poverty reduction, good governance, and reducing inequalities. The study emphasizes the crucial role of institutional quality, including regulatory quality, control of corruption, and government effectiveness, in moderating the effects of natural resource exploitation on inclusive growth. By highlighting the importance of strong institutions, the research underscores the need for governance reforms and effective policy implementation to harness natural resource wealth for sustainable and inclusive development. Very important is the use of the cross-sectional augmented autoregressive distributed lag (CS-ARDL) technique. The study addresses the common issue of cross-sectional dependence in panel data, enhancing the robustness and reliability of the findings and providing more accurate insights into the relationship between natural resources, institutional quality, and inclusive growth. By analyzing data from multiple countries (Algeria, Congo Republic, Gabon, Nigeria, South Africa, and Sudan) over an extended period (1991-2022), the study offers a comprehensive understanding of the resource curse paradox in the context of sub-Saharan Africa, allowing for a comparative perspective that enriches the study's conclusions and policy recommendations. The research provides valuable insights for policymakers and development practitioners, emphasizing the need for robust institutional mechanisms to ensure that natural resource wealth translates into broad-based economic benefits, advocating for governance reforms and effective policy implementation crucial for promoting more equitable economic development and achieving the SDGs. By exploring the impact of natural resource dependence on inclusive growth rather than mere economic growth, the study addresses a critical gap in the existing literature, providing a deeper understanding of how resource wealth can be managed to benefit the broader population, particularly in oil-rich sub-Saharan African countries where the resource curse paradox is prevalent.

3. METHODOLOGY

3.1 Theoretical Framework

This study hinges on the theoretical foundation of the endogenous growth model of Arrow (1962), Lucas (1988), and Romer (1986). According to Cortright (2001), the construct of the model assumes increasing returns to the scale of technology for long-run knowledge to enhance economic growth. The theory argues that growth is endogenous rather than exogenous savings and capital formation proposed by Solow (1956). Endogenous growth models emphasize technical development as a result of investment rates, capital stock size, and human capital stock. This is an improvement over exogenous growth models since it emphasizes technological factors as a dependent effect on economic growth. Human capital, innovation, and knowledge acquisition, according to Romer, all contribute considerably to economic progress. According to the notion, increased human capital contributes to economic growth through the creation of new technologies and more efficient production methods. It also stresses the positive externalities and spillover effects that occur in a knowledge-based economy and how they contribute to long-term economic growth.

For productivity to rise, the labor force, as well as human, physical, technological, and capital resources, must expand (Agbonkhese & Asekome, 2014). According to Romer, increasing investment in human capital, education, and research development is required to achieve a goal rise in economic growth through time. He went on to say that government policies such as subsidies and other incentives that allow the government to generate technological knowledge should be expanded. In the 1980s, the endogenous theory of growth originated as a counterpoint to the neoclassical theory of development, and it questioned how income disparities could remain between rich and developing nations if expenditures in physical resources, such as infrastructure, yield declining returns (Al-Ubaydli et al., 2000). By relaxing the assumption that exogenous factors determine the level of growth, the theory allows the

inclusion of policy and institutional factors to drive prosperous growth in developing countries (Bassanini, Scarpetta,& Hemmings, 2001). In addition, the framework of the theory further argues that the diminishing returns on physical capital such as investment is the main culprit of the disparities in the growth level between advanced and developing countries. The framework of the study follows the Cobb-Douglas production function pattern specified as follows;

$$Y = AK^{\alpha}L^{1-\beta} \quad (5)$$

Where Y, A, K, and L respectively denote economic growth (GDP); technology, capital accumulation, and Labour. The model assumes that the input factors exhibit increasing returns to scale. Since the focus of this study is based on a time series framework, the time (t) is incorporated into the model as follows;

$$Y(t) = A(t)K(t)^{\alpha}L(t)^{1-\beta} \quad (6)$$

Following the argument of Aghion and Howitt (1992) and Romer (1990), capital can be decomposed into human capital (K_H) and physical capital ((K_P). Thus, the model translates to;

$$Y(t) = A(t)[K_H(t)K_P(t)]^{\alpha}L(t)^{1-\beta} \quad (7)$$

Equation (7) shows that both human and physical capital incorporated into the production function exhibit increasing scale.

The role of natural resources abundance such as land, crude oil, and other non-renewable resources is incorporated into the model following the proposition of Jones (2002), thus, the model is then specified as follows;

$$Y(t) = [K_H(t)K_P(t)]^{\alpha}R(t)^{\beta}T(t)^{\gamma}[A(t)L(t)]^{1-\alpha-\beta-\gamma} \quad (8)$$

At this stage, T represents Land, R denotes natural resources while $\alpha, \beta, and\ \gamma$ respectively denote the share of input factors with the assumption that the combination of $0 < \alpha + \beta + \gamma < 1$. The dynamics of other variables are the same as earlier noted in the above equations. As for the natural resources (*R*), it grows at a negative rate because the total stock reduces with time as it is being used during production processes because its existing quantity is fixed i.e. non-renewable. The derivate with respect to time is denoted as:

$$\dot{R}(t) = -bR(t) \qquad [\text{Note} \quad b > 0] \quad (9)$$

Thus, they $\frac{K(t)}{A(t)L(t)}$ would no longer converge because of the newly introduced natural resource variable as it was supposed before adding the variable. There is an assumption that *A*, *L*, and *R* grow at a constant rate. Also, the capital investment (K) and output (Y) must grow at a constant rate to achieve a balanced growth path. It means that the growth of K and Y must be equal i.e. $\frac{K}{Y}$ must be constant. From equation (3.2), the growth rate of *K* is:

$$\frac{\dot{K}(t)}{K(t)} = sY(t) - \delta \quad (10)$$

Considering the production function of equation (8), the study thereby searches for the balanced growth path of output growth (*Y*) that will be the same as the capital growth rate (*K*). Taking the natural logarithm of the two sides, the equation becomes:

$$\ln Y(t) = \alpha \ln K(t) + \beta \ln R(t) + (1-\alpha-\beta)\left[\ln A(t) + L(t)\right] \quad (11)$$

3.2. Model Specifications

The empirical framework that explains the link between natural resources impact on economic growth is well documented in the augmented Solow growth model designed by Romer (2012).

According to Romer (2012), changes in economic growth can be explained not only by capital, labour, and technology but also by the level of natural resource stock of a particular country. He further states that the impact of natural resource stock on economic growth is negative arguing that the presence of these resources causes the resource curse paradox since most natural resource-dependent economies rely heavily on the exploration of resources for profitable gains without equitable distribution of wealth to benefit both poor and non-poor citizens. This evidence has also been empirically established by numerous studies, including Adekoya (2021); Demissie (2014); and Tsopmo and Messy (2022). By relating this argument to the link between natural resources and inclusive growth, the baseline model of this study is specified as follows;

$$LGDPPPE_{i,t} = \beta_{0i} + \beta_{1i}TNRR_{i,t} + \beta_{2i}LGFCF_{i,t} + \beta_{3i}LLAB_{i,t} + \varepsilon_{it} \qquad i = 1,2,\dots,N;\ t = 1,2,\dots,T \qquad (12)$$

Where $LGDPPPE_{i,t}$, $TNRR_{i,t}$, $LGFCF_{i,t}$, and $LLAB_{it}$ represent the natural log of gross domestic product per person employed, total natural resource rents (% of GDP), natural log of gross fixed capital formation, and the natural log of labour force.

To explain the relation for oil-rich countries, we included a contextual element that tells us the oil abundance of the economies using the crude oil resource rents. Hence, equation (12) is translated to equation (13) below to explain the relationship between natural resource rents and inclusive growth in oil-rich countries of sub-Saharan Africa as follows;

$$LGDPPPE_{i,t} = \beta_{0i} + \beta_{1i}TNRR_{i,t} + \beta_{2i}LGFCF_{i,t} + \beta_{3i}LLAB_{i,t} + \beta_{4i}COR_{i,t} + \varepsilon_{i,t} \qquad i = 1,2,\dots,N;\ t = 1,2,\dots,T \qquad (13)$$

In equation (13), COR_t denotes crude oil resource rents (% of GDP) and β_4 is its coefficient estimates while other variables remain as previously defined. With equation (13), one can easily evaluate how natural resource abundance affects inclusive growth in the presence of specific contextual factors like crude oil resource rent in oil-rich countries of sub-Saharan Africa.

As previously established from existing empirical studies, the role of institutional quality frameworks, such as regulatory quality, control of corruption, and government effectiveness, are captured in the model. To do this, we introduce an interactive term of natural resource rents and each institutional quality, which translates into the following models;

$$LGDPPPE_{i,t} = \beta_{0i} + \beta_{1i}TNRR_{i,t} + \beta_{2i}LGFCF_{i,t} + \beta_{3i}LLAB_{i,t} + \beta_{4i}COR_{i,t} + \beta_{5i}TNRR_{i,t} * RQ_{i,t} + \varepsilon_{i,t} \qquad i = 1,2,\dots,N;\ t = 1,2,\dots,T \qquad (14)$$

$$LGDPPPE_{i,t} = \beta_{0i} + \beta_{1i}TNRR_{i,t} + \beta_{2i}LGFCF_{i,t} + \beta_{3i}LLAB_{i,t} + \beta_{4i}COR_{i,t} + \beta_{5i}TNRR_{i,t} * COC_{i,t} + \varepsilon_{i,t} \qquad i = 1,2,\dots,N;\ t = 1,2,\dots,T \qquad (15)$$

$$LGDPPPE_{i,t} = \beta_{0i} + \beta_{1i}TNRR_{i,t} + \beta_{2i}LGFCF_{i,t} + \beta_{3i}LLAB_{i,t} + \beta_{4i}COR_{i,t} + \beta_{5i}TNRR_{i,t} * GE_{i,t} + \varepsilon_{i,t} \qquad i = 1,2,\dots,N;\ t = 1,2,\dots,T \qquad (16)$$

Where equations (14) to (16) entail the interactive term of total natural resource rents and regulatory quality ($TNRR_{i,t} * RQ_{i,t}$), total natural resource rents and control of corruption ($TNRR_{i,t} * COC_{i,t}$), and total natural resource rents and government effectiveness ($TNRR_{i,t} * COC_{i,t}$), respectively. It is expected that the inclusion of these interactive terms will moderate the effect of natural resource rents on inclusive growth in oil-rich countries of sub-Saharan Africa.

3.3 Estimation Technique

The study employs the cross-sectionally augmented autoregressive distributed lag (CS-ARDL) estimator to address potential cross-sectional dependence, which is common in macroeconomic panel datasets of countries with economic and financial integration. This technique is robust to issues of heterogeneity, endogeneity, omitted variables, and non-stationarity (Chudik et al., 2017; Bindi, 2018), providing both short-run and long-run estimates. Hence, the standard representative framework of the CS-ARDL technique begins with this equation;

$$Y_{i,t} = \sum_{k=1}^{a} \psi_{k,i}\, Y_{i,t-k} + \sum_{k=0}^{b} \phi_{k,i}\, X_{i,t-k} + \varepsilon_{i,t} \tag{17}$$

Where equation (6) represents the simple autoregressive distributed lag (ARDL) model for a single dependent variable ($Y_{i,t}$) and independent variable ($X_{i,t}$). However, estimating this equation in the presence of cross-sectional dependence yields unreliable estimates.

To account for cross-sectional dependence, the CS-ARDL model is:

$$\hat{\pi}_{CS-ARDL_{k,i}} = \frac{\sum_{k=0}^{b} \hat{\phi}_{k,i}^{a}}{1 - \sum_{k=0}^{a} \widehat{\psi_{k,i}}} \tag{18}$$

Hence, the mean group model is generated as follows;

$$\hat{\pi}_{MG} = \frac{1}{N} \sum_{i=1}^{N} \hat{\pi}_i \tag{19}$$

The above model is followed by the error correction model of the CS-ARDL that explains the short-long-run parameter estimates as well as the speed of adjustment mechanism as follows;

$$\Delta Y_{i,t} = \omega_i \left[Y_{i,t-1} - \pi_i X_{i,t} \right] - \sum_{k=1}^{a} \psi_{k,i}\, \Delta_k Y_{i,t-1} + \sum_{k=0}^{b} \phi_{k,i}\, \Delta_k X_{i,t-k} + \sum_{k=0}^{c} \varphi'_{k,i}\, \bar{Q}_{t-k} + \varepsilon_{i,t} \tag{20}$$

Where$Y_{i,t}$ represents the dependent variable of the study ($LGDPPPE$), $X_{i,t}$ denotes the list of regressors employed ($TNRR, COR, LGFCF, LLAB, TNRR * RQ, TNRR * COC, and\ TNRR * GE$), and$\bar{Q}_{t-k}$ stands for the cross-sectional averages of the dependent and independent variables and it is defined as $\bar{Q}_t = (\overline{Y_t}, \overline{X_t})' = \left(\frac{1}{N \sum_{i=1}^{N} Y_{i,t}}, \frac{1}{N \sum_{i=1}^{N} X_{i,t}} \right)$.$\Delta_k$ is the difference operator defined as $t - (t-1)$.ω_i is the coefficient of the error correction term ($ECT(-1)$) of the CS-ARDL model that explains the speed of adjustment to long-run equilibrium. The estimated value of ω_i is defined as follows;

$$\widehat{\omega}_i = -\left(1 - \sum_{k=1}^{a} \widehat{\psi_{k,\iota}}\right) \tag{21}$$

Equation (21) denotes that the coefficient of the error correction term of the CS-ARDL model must satisfy the condition of negativity, less than one in absolute value, and statistically significant at any chosen level of significance to assume the existence of adjustment to long-run equilibrium.
The coefficients of the long-run estimates of the CS-ARDL are estimated as follows;

$$\hat{\pi}_i = \frac{\sum_{k=0}^{b} \widehat{\phi_{k,\iota}}}{\widehat{\omega}_i} \tag{22}$$

4. RESULTS AND DISCUSSION OF FINDINGS

4.1. Preliminary Analysis

The empirical analysis begins with a summary of the statistics for various variables including LGDPPPE, total natural and crude oil resource rents, and institutional quality measures such as regulatory quality (RQ), control of corruption (COC), and government effectiveness (GE). The summary statistics presented in Table 1 indicate that the average value of LGDPPPE is 10.23, with a maximum of 11.30 and a minimum of 9.10, suggesting an average income increase of 10.23% for employed workers in selected oil-rich sub-Saharan African countries from 1991 to 2022. Despite low variation (standard deviation of 0.64), the Jacque-Bera statistic indicates a non-normal distribution. Total natural and crude oil resource rents show positive means with a significant gap between minimum and maximum values, indicating varying levels of resource rents over time and across countries. High dispersion is confirmed by the standard deviation and Jacque-Bera statistics. Institutional quality measures (RQ, COC, GE) have positive means with low standard deviations, indicating low variation. The Jacque-Bera statistic signifies a non-normal distribution. Regulatory quality is stronger compared to corruption control and government effectiveness, highlighting high corruption and poor policy implementation. Control variables such as LGFCF and LLAB have positive mean values, indicating average increases in capital stock and labor force. However, they exhibit low variation and non-normal distribution.

Table 1: Summary Statistics

Variables	Mean	Maximum	Minimum	Std. Dev.	Jarque-Bera	Observations
LGDPPPPE	10.2345	11.2991	9.0968	0.6392	15.0298***	186
TNRR	19.4854	58.6876	0.0018	14.1010	15.0099***	186
COR	16.1141	55.4927	0.0000	13.6991	15.0670***	186
RQ	7.0034	11.0000	1.0000	1.7987	9.9273***	186
COC	1.9434	5.0000	0.5000	0.9778	72.1828***	186
GE	1.5271	4.0000	0.0000	0.7068	71.3393***	186

LGFCF	23.8301	27.3392	20.8953	1.6697	5.2412*	184
LLAB	15.6139	17.9819	12.5557	1.5845	14.2590***	186

Source: Author's computation

Note: *** and * represent significance at 1% and 10%, respectively.

Figures 1-3 depict the trends in LGDPPPE with TNRR and COR, showing a simultaneous upward and downward trend in total natural and crude oil resource rents. The figures suggest that while some countries (e.g., Congo Republic, Gabon, and Sudan) experience reduced inclusive growth with increased resource rents, others (e.g., Algeria, Nigeria, and South Africa) manage to improve inclusive growth despite reduced resource rents. Additionally, the institutional quality indicators reveal better regulatory quality but stagnant government effectiveness and corruption control, particularly declining since around 2010.

Figure 1: Trends in Inclusive Growth and Total Natural Resource Rents in Oil-Rich Countries of Sub-Saharan Africa

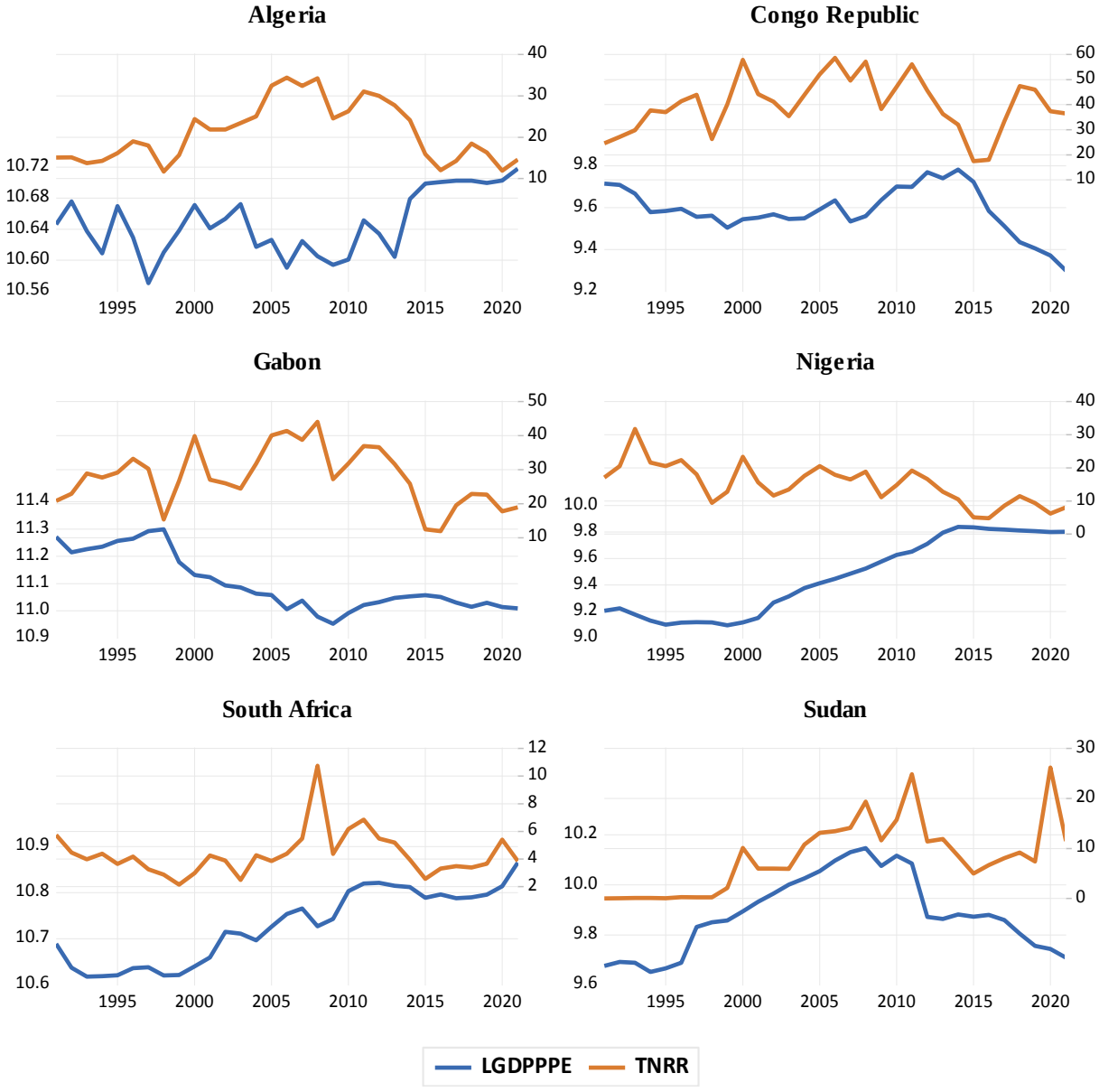


Figure 2: Trends in Inclusive Growth and Crude Oil Resource Rents in Oil-Rich Countries of Sub-Saharan Africa

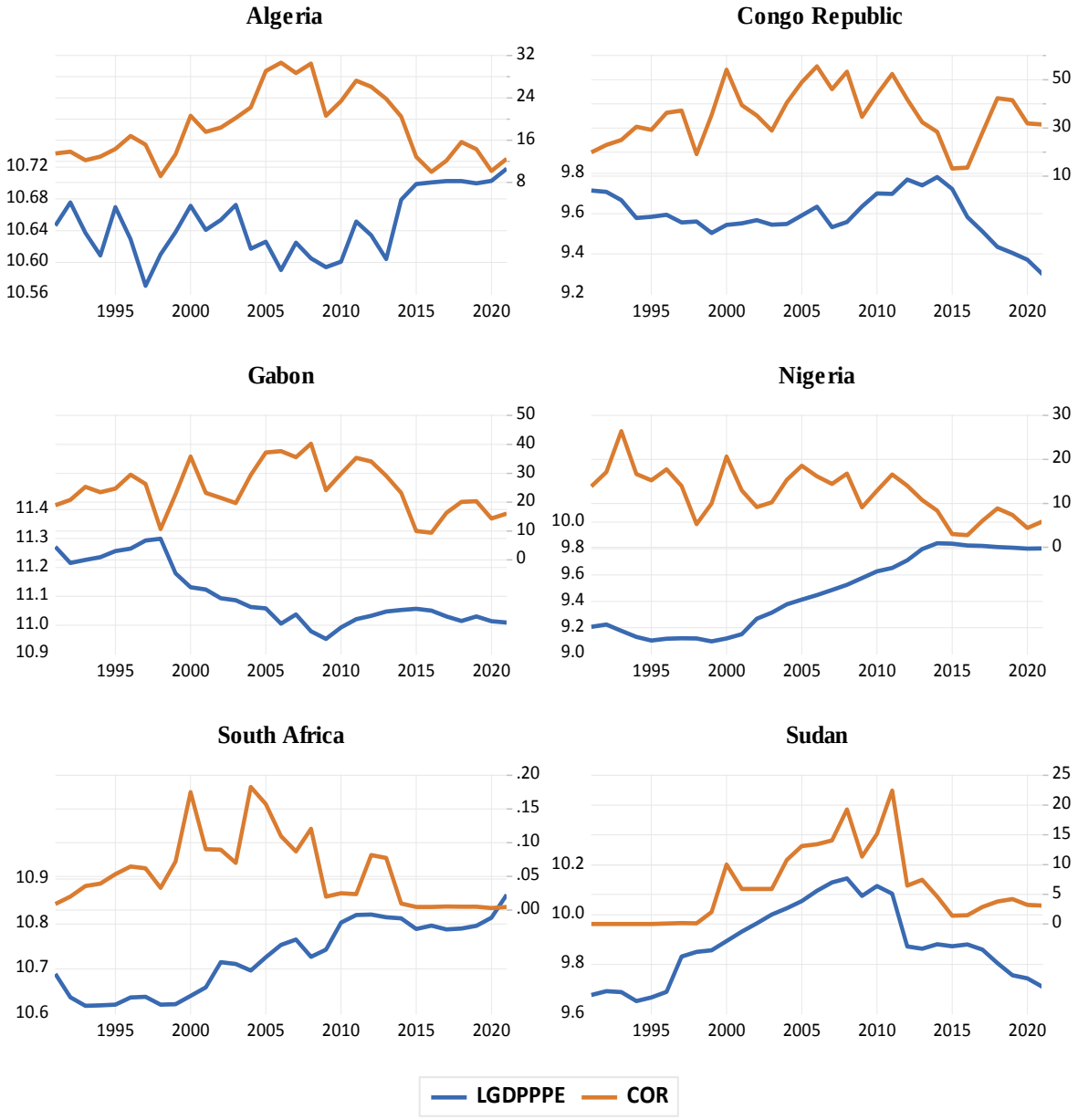
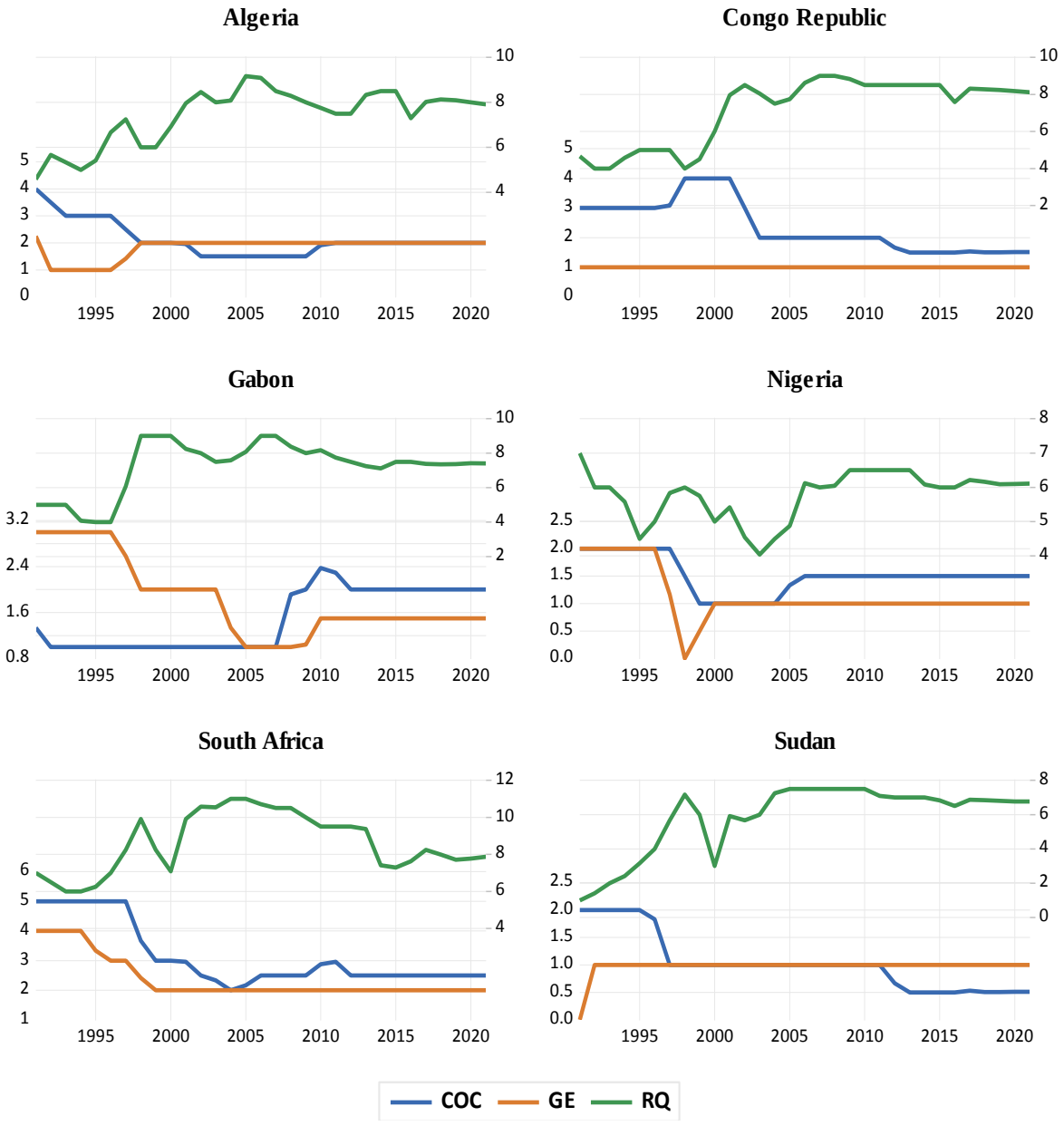


Figure 3: Trends in Institutional Quality Indicators in Oil-Rich Countries of Sub-Saharan Africa



To ensure the suitability of the econometric technique, cross-sectional dependence, and slope heterogeneity tests are conducted. Results from four cross-sectional dependency tests (Bruesch-Pagan LM, Pesaran Scaled LM, Bias-corrected scaled LM, Pesaran CD) indicate significant cross-sectional dependence for all variables at the 1% level, except for LGDPPPE in the Pesaran CD test. Slope heterogeneity tests by Pesaran and Yamagata (2008) show significant delta and adjusted delta statistics, confirming heterogeneous slope coefficients.

Table 2: Results of Cross-sectional Dependency test and Test of Slope Heterogeneity

Panel A: Cross-sectional Dependency Tests				
Variables	**Bruesch-Pagan LM**	**Pesaran Scaled LM**	**Bias-corrected Scaled LM**	**Pesaran CD**
LGDPPPE	107.6359***	16.9129***	16.8129***	-1.1031
TNRR	138.7423***	22.5920***	22.4920***	10.3672***
COR	206.9372***	35.0428***	34.9428***	13.8555***
LGFCF	227.5300***	38.8025***	38.7025***	7.4372***
LLAB	453.2736***	80.0174***	79.9174***	21.2897***
TNRR*RQ	167.1637***	27.7812***	27.6812***	11.0798***
TNRR*COC	73.7182***	10.7204***	10.6204***	6.0619***
TNRR*GE	98.1136***	15.1744***	15.0744***	3.3293***
Panel B: Test of Slope Heterogeneity				
Models	**Model I**	**Model II**	**Model III**	**Model IV**
Δ	14.211***	11.759***	12.435***	12.584***
Adjusted Δ	15.825***	13.365***	14.133***	14.301***

Source: Author's computation

Note: *** represents significance at 1% level. Models I to IV denote equations (2) to (5).

Unit root tests (CIPS and CADF) are conducted to check the stationarity of the series, while cointegration is tested using Westerlund's (2007) method. The CIPS test shows that TNRR, COR, LGFCF, LLAB, TNRR*RQ, and TNRR*GE are stationary at level, while LGDPPPE and TNRR*COC* are non-stationary. The CADF test indicates only LGFCF, LLAB, and TNRR*RQ* are stationary at level. However, all variables become stationary after the first difference.

Table 3: Results of Unit Root and Cointegration Tests

Panel A: Second Generation Unit Root Tests				
Variables	**CIPS**		**CADF**	
	Level	**First Difference**	**Level**	**First Difference**
LGDPPPE	-0.722	-4.149***	-0.690	-3.443***
TNRR	-2.760***	-5.907***	-2.077	-4.889***
COR	-2.440***	-5.823***	-2.217	-4.631***
LGFCF	-2.260**	-4.625***	-2.456**	-3.984***
LLAB	-2.369**	-2.188*	-2.359*	-2.935***
TNRR*RQ	-3.278***	-5.024***	-2.601**	-4.875***
TNRR*COC	-2.021	-5.073***	-1.923	-4.228***
TNRR*GE	-2.479***	-5.364***	-2.133	-4.359***
Panel B: Westerlund Cointegration test				
Models	**Model I**	**Model II**	**Model III**	**Model IV**
G_t	-2.129**	-2.365***	-2.809***	2.390
G_a	5.665	5.759	5.683	5.451
P_t	5.703	5.581	5.363	5.800
P_a	4.419	4.342	4.238	4.706

Source: Author's computation

Note: ***, **, and * represent significance at 1%, 5%, and 10%levels. Models I to IV denote equations (2) to (5).

The cointegration test results show significant long-run relationships for models I to III but not for model IV. This indicates the presence of cointegrating relationships among the variables in models I to III

4.2 Main Findings and Discussions

The study employs the CS-ARDL model to analyze the impact of natural resources on inclusive growth, incorporating institutional quality indicators for oil-rich sub-Saharan African countries. Four models are examined: the first assesses the direct effect of natural resources, while the others investigate the role of regulatory quality (RQ), control of corruption (COC), and government effectiveness (GE) in this context.

Table 4 demonstrates the presence of cross-sectional dependence (CS-statistic of -2.92, significant at 1%), validating the use of the CS-ARDL approach. The one-time lagged LGDPPPE positively influences the current LGDPPPE, indicating that past inclusive growth enhances current growth. Total natural resource rents (TNRR) negatively impact inclusive growth in both the short and long run, supporting the resource curse hypothesis. Specifically, a 1% increase in TNRR reduces inclusive growth by 0.02% in the short run and 0.03% in the long run.

Table 4: Results of the Effects of Natural Resources on Inclusive Growth in Oil-rich Countries of Sub-Saharan Africa.

Variables	**Short-run Coefficients**	**Standard Error**	**Z-test**	**Probability**
D(LGDPPPE(-1))	0.4050***	0.1123	3.61	0.000
D(TNRR)	-0.0185***	0.0054	-3.39	0.001
D(COR)	0.0167	0.0132	1.26	0.206
D(LGFCF)	0.0006	0.0005	1.26	0.208
D(LLAB)	-1.2053**	0.5139	-2.35	0.019
ECT(-1)	-0.5950***	0.1123	-5.30	0.000
Variables	**Long-run Coefficients**	**Standard Error**	**Z-test**	**Probability**
TNRR	-0.0308***	0.0085	-3.62	0.000
COR	0.0185	0.0316	0.58	0.559
LGFCF	0.0006	0.0010	0.58	0.564
LLAB	-1.7807***	0.5228	-3.41	0.001
Post Estimation Tests				
Test		**Statistic**		**Probability**
Adjusted R-Square		0.96		
Root MSE		0.03		
CD-Statistic		-2.92***		0.0035
F-statistic		0.79		0.84

Source: Author's computation

Note: ***, **, and * represent significance at 1%, 5%, and 10%levels.

The adverse effect of natural resources on inclusive growth is attributed to over-reliance on the oil sector, leading to a crowding-out effect on other economic sectors such as industry, health, and education. This finding aligns with Henri (2019) and Adekoya (2021), who highlight that resource abundance leads to poor human capital development and economic instability due to price fluctuations in the global oil market.

Institutional quality indicators (COR, LGFCF, LLAB) show mixed effects. COR positively impacts inclusive growth, albeit insignificantly, suggesting a weak blessing hypothesis where natural resources marginally benefit economic growth. This finding corroborates the submission of Hodler et al. (2023). LGFCF's insignificant contribution to inclusive growth corroborates the resource curse effect, indicating poor management of resource wealth aligning with the findings of Wani et al. (2023). LLAB negatively and significantly affects inclusive growth, emphasizing the detrimental impact of resource dependency on labor force development. This is in tandem with Pradhan (2023).

Table 5 explores the moderating role of RQ, COC, and GE in the resource-inclusive growth relationship. Surprisingly, institutional quality indicators intensify the adverse effect of natural resources on inclusive growth. This is attributed to low levels of corruption control and government effectiveness in the sampled countries, aligning with Ajide et al. (2020) and Adekoya (2021), who argue that weak institutional frameworks exacerbate the negative impact of natural resources.

Table 5: Results of the Role of Institutional Quality in Natural Resources-Inclusive Growth Relation in Oil-rich Countries of Sub-Saharan Africa

Models	Model II	Model III	Model IV
Short-run Estimates			
D(LGDPPPE(-1))	0.1910[0.1793]	0.3035**[0.1288]	0.0916[0.2069]
D(TNRR)	0.0131[0.0100]	-0.0249***[0.0092]	-0.0165***[0.0059]
D(COR)	0.0232[0.0342]	0.0308***[0.0104]	-0.0164[0.0396]
D(LGFCF)	0.0005[0.0007]	0.00001[0.0010]	-0.0002[0.0007]
D(LLAB)	-3.0792**[1.2574]	-0.0388[2.4894]	-0.3860[0.6769]
D(TNRR*RQ)	-0.0005[0.0006]	----------	----------
D(TNRR*COC)	----------	-0.0010[0.0036]	----------
D(TNRR*GE)	----------	----------	0.0013[0.0021]
ECT(-1)	-0.8090***[0.1793]	-0.6965***[0.1288]	-0.9084***[0.2069]
Long-run Estimates			
TNRR	0.0234[0.0217]	-0.0545**[0.0252]	-0.0093[0.0136]
COR	0.0025[0.0405]	0.0590**[0.0241]	-0.1893[0.2090]
LGFCF	-0.0003[0.0013]	-0.0005[0.0013]	-0.0015[0.0014]
LLAB	-5.6083**[2.6874]	1.3278[3.4092]	-0.8787[0.5913]
TNRR*RQ	-0.0006[0.0013]	----------	----------
TNRR*COC	----------	0.0021[0.0044]	----------
TNRR*GE	----------	----------	-0.0033[0.0070]
Post Estimation Tests			
Adjusted R-Square	0.96	0.96	0.97
Root MSE	0.03	0.03	0.03
CD-Statistic	-2.88***(0.0040)	-0.68(0.4987)	-3.61***(0.0003)
F-statistic	0.27(1.00)	0.70(0.87)	0.35(1.00)

Source: Author's computation

Note: ***, **, and * represent significance at 1%, 5%, and 10%levels.

The findings underscore the critical need for stronger institutional frameworks to mitigate the adverse effects of natural resource dependency and foster sustainable, inclusive growth in oil-rich sub-Saharan African countries.

5. CONCLUSION AND POLICY IMPLICATIONS

Natural resources offer opportunities for economic growth and development; however, the benefits are often unevenly distributed, leading to a range of social, economic, and political challenges that hinder sustainable development. This paper evaluates the resource curse hypothesis in relation to inclusive growth in oil-rich countries in sub-Saharan Africa (SSA) towards the realization of SDGs 1 and 10. It focuses on top oil-rich countries in SSA, including Algeria, Congo Republic, Gabon, Nigeria, South Africa, and Sudan, covering the period between 1991 and 2022, and adopts the cross-sectionally augmented autoregressive distributed lag (CS-ARDL) model, which addresses cross-sectional dependence, heterogeneity, omitted variable bias, non-stationarity, and cointegration in panel data sets.

The empirical evidence reveals that natural resources negatively and significantly impact inclusive growth in oil-rich countries in SSA, with higher natural resource wealth accumulation leading to reduced inclusive growth in both the short and long run. This supports the resource curse paradox, where increased revenue from natural resources leads to a decline in development. Furthermore, crude oil resource rents and capital stock contribute insignificantly, while the labor force has a significant adverse effect on inclusive growth in both periods. Institutional quality indicators—regulatory quality, control of corruption, and government effectiveness—intensify the adverse influence of natural resources on inclusive growth in oil-rich SSA countries.

To address these challenges, the following policy implications are recommended.

First, a multidimensional approach is needed that takes into account the specific context of each country. This includes implementing economic diversification policies to enhance inter-sectoral linkages and productive capacity across various sectors. Policies should also promote the adoption of green, renewable, and clean energy resources to reduce overreliance on non-renewable natural energy resources like crude oil, natural gas, and coal, thereby enhancing sustainability and protecting biodiversity.

Second, there is a strong need for the provision of capital resources to private and public sectors to support day-to-day activities, ensuring the allocation of financial resources to salary earners and self-employed individuals involved in government projects. This promotes poverty reduction and reduces income inequality, contributing to the realization of SDGs 1 and 10.

Third, labor force development is crucial for driving inclusive growth. Private and public institutions should incorporate training, seminars, and workshops into their regular work schedules and employment arrangements to foster the development of workers' intellectual capacity, enabling them to contribute sustainably to national growth.

Finally, policymakers should focus on strengthening institutions, promoting good governance, and building effective regulatory frameworks to manage natural resources. Efforts should also be made to promote entrepreneurship and innovation and invest in human capital development.

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