Do effective governance and political stability facilitate the promotion of economic growth through natural resource rents? Evidence from Africa

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1. Introduction

Economists and political scientists have long wrestled with the question of which factor(s) are growth-ameliorating. One factor that has generated more heat than light ever since the pioneering work of Sachs and Warner (1995, 1997, 2001) is natural resources. The puzzling thing about this factor is that countries that are relatively rich in natural resources (such as Gabon, Venezuela, Zambia, Congo, and Nigeria to mention just a few) have not performed as well as the countries that are relatively poor in natural resources (i.e., Asian Tigers, China and Korea among others). This paradoxical state of affairs in which resource-rich countries underachieve economically is commonly referred to as resource curse[1]/ paradox of plenty hypothesis. The paradox of plenty hypothesis is a widely-discussed phenomenon and appears to be borne out by several empirical studies in this field (Asif *et al.*, 2020; Khan *et al.*, 2020a, b; Dwumfour & Ntow-Gyamfi, 2018; Sachs & Warner, 1995).

Part of the reason why this is puzzling is that under normal circumstances, one should expect natural resources to stimulate economic growth insofar as it promotes more investment in economic infrastructure as well as human capital development (Kwakwa *et al.*, 2021, Sinha & Sengupta, 2019, and Sachs & Warner, 1999). However, historical experience (coupled with some empirical and anecdotal evidence) seems to suggest otherwise. Historical experience suggest that natural resources are not always a blessing but rather a curse to economic activity in that they appear to weaken the manufacturing sector by the reallocating/reshuffling of production of goods and services away from the manufacturing sector (Gylfason 2000, Zeynalov 2017), prompt widespread rent-seeking conflicts and political instability (Zeynalov 2017). The view taken by Raul Prebisch (1950) and Hans Singer (1950) that prices of natural resources generally display a long-run downward trend, compared to manufacturing prices, also offer some clues regarding the paradox of plenty hypothesis. Frankel (2012) provides two interesting interpretations of this paradoxical phenomenon. He writes "One interpretation is that this phenomenon is cyclical, with the effects reversed when commodity boom turns to commodity bust. Another interpretation is that it can be permanent: countries endowed with natural resources more often develop social structures in which autocratic or corrupt political elites finance themselves through physical control of the natural resources."

Recent scholarship (Auty 2000, 2001; Hassan *et al.*, 2019; Mavrotas *et al.*, 2011; Oyefusi 2007; Stijns 2005, Mehlum *et al.*, 2005), take a different view, arguing that natural resources effect economic activity unfavorably only in countries with poor institutions. This line of research places some emphasis on the local factors (such as economic institutions) that appear to mediate the link between natural resource and economic activity. Building upon this line of research, the resource curse has also been linked to authoritarianism and low levels of democracy (Jensen & Wantchekon, 2004), corruption (Arezki & Gylfason, 2013, Knutsen *et al.*, 2017), conflicts and civil war (Collier & Hoeffler, 2000) and human capital (Butkiewicz & Yanikkaya, 2010, Birdsall *et al.*, 2001; Goldin 2016, Rahim *et al.*, 2021). While others pin it down to financial development (Erdoğan *et al.*, 2020; Tariq *et al.*, 2020).

The discussion above is eloquently summarized by Arezki & van der Ploeg (2007) who writes "there is ample evidence that resource dependence hurts growth prospects, but it is unclear whether this is due to forsaking learning by doing, worsening institutions, or keeping bad policies in place. It is also unclear whether natural resources are the root cause of bad institutions and bad policies or whether they aggravate the adverse effects of bad institutions and bad policies on economic growth. Without more information on the channels by which resources affect growth, the empirical evidence will be of limited use to policy makers". This paper aims to unravel the impact of natural resource rents,

[1] Coined by Auty (1993, 2001)

governance, and political stability on the economic growth of African nations, given the contextual background. The placement of this paper is influenced by three strands of research: (a) the rationale for focusing on African countries, (b) the effect of efficient governance, political stability, and natural resource rents on economic growth, and (c) identification of research gaps.

Although some African countries have seen promising economic growth in recent years, the majority continue to face poverty. The outbreak of COVID-19 in 2020 resulted in an additional 30 million Africans living in extreme poverty (earning less than US$1.90 per day). Prior to the pandemic, 445 million individuals, or 34% of Africa's population, were already living in extreme poverty. The continent serves as a prime example of a wealthy beggar, relying heavily on external aid, loans, and grants rather than its natural resources. The continent's political leaders are frequently criticized for their rent-seeking behavior and ineffective economic policies, which have contributed to the region's underwhelming economic performance over time.

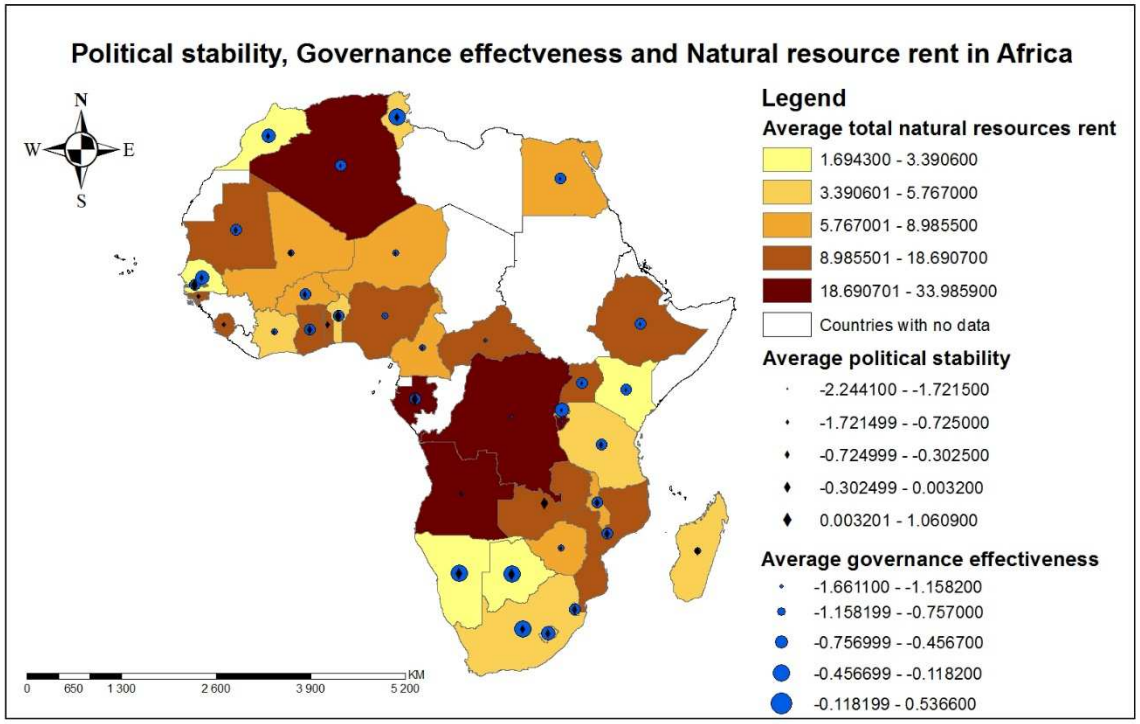
The concept of effective governance refers to a government's ability to fulfill its responsibilities and promote the public good (see Safdar et al., 2022). With governments worldwide seeking innovative economic growth strategies, the importance of effective governance as a crucial tool for achieving this objective has recently gained attention in scientific literature (Safdar et al., 2022; Adika, 2020; Bos & Gupta, 2016). Despite natural resources being owned by the state for national development purposes, political power has become associated with controlling natural resource rents for personal gain. This, along with poor governance of natural resource rents and pervasive corruption, has hindered economic growth in many African countries. Consequently, the complexities of African natural resource politics highlight the need for efficient strategies to govern actions and outcomes, enabling the leveraging of natural resource rents for the benefit of the continent's inhabitants. Empirical literature presents considerable evidence of the critical role that effective governance plays in generating economic growth. Costantini & Monni (2008) examine the impact of governance on sustainable development using a modified version of the Environmental Kuznets Curve (EKC) and the rule of law as a proxy and find evidence of a positive correlation between the two variables.

Thirdly, political instability is a factor that can potentially impact economic growth (see Ndokang & Tsambou, 2019; Gurgul & Lach, 2013). While there is a general consensus among scholars that political instability has negative consequences on economic growth, there are differing views on how these effects are transmitted. One school of thought suggests that uncertainty is the main channel through which political instability affects economic growth (Barro, 1996; Mauro, 1995; Cukierman et al., 1989). The other school of thought emphasizes that in an environment of instability, productive investments that could promote economic growth are diverted towards unproductive uses. This phenomenon is evident in many African countries with abundant natural resources, such as the Democratic Republic of Congo (DRC), where resource abundance has not translated into economic growth due to political instability. For example, the DRC's economic growth rate has declined from 8.4% in 1961 to 4.03% in 1963, 0.62% in 1977, and 3.5% in 2015 due to political instability (Ayessa et al., 2021). Radu (2015) uses correlation and multivariate regression to demonstrate that political stability is a critical factor in a country's economic growth and that a stable political environment contributes to the development of a coherent and sustained path towards sustainable development.

The fourth point of the discussion is that the current study aims to address the limitations of earlier research. Previous studies have mainly focused on the direct relationship between governance/political stability and economic growth or the interaction between human capital, natural resources, and economic growth. However, there is a gap in the literature regarding how governance and political stability could mediate the natural resource curse hypothesis. Figure 1 demonstrates that

countries with high resource rents generally have high political instability and low levels of governance. Although political instability and ineffective governance have been shown to directly hinder economic growth, their indirect effects through natural resource rents have not been well established. The indirect effects suggest that incorporating political stability and governance into resource utilization can promote growth through backward and forward linkages, leading to more inclusive growth and trickledown effects.

Figure 1: *linkage between natural resource rent, average political stability and average governance effectiveness in Africa*



Source: Authors' compilation

This study contributes to the existing literature in several ways. Firstly, while previous studies have highlighted the importance of political stability and good governance in achieving economic growth, none have explored how these factors indirectly contribute to growth in Africa through natural resource rents. This study fills this gap by examining the role of natural resource rents, effective governance, and political stability in the framework of the natural resource curse hypothesis. Data from 1996 to 2019 on 39 African countries was used for this purpose. To the best of the authors' knowledge, this is the only study that focuses on the direct and indirect economic growth impacts of effective governance and political stability in the African context. The study utilizes the panel Autoregressive distributive lag (ARDL) Pooled Mean Group (AMG) estimator developed by Pesaran et al. (1999) to estimate the long-and-short-run impact of natural resource rents, effective governance, political stability, and other key covariates on the economic growth of African countries. By incorporating the country-specific error correction in the panel dataset, this approach provides a more accurate estimation of the impact of these factors on economic growth.

The rest of the article is organized as follows. The literature review is in section two, and the methodology is covered in section three. Section four presents the results and findings, while Section five presents the conclusion and policy implications.

2. Literature review

This section is categorized into two distinctive perspectives. The first section of the paper discusses the theoretical foundations which underline the various mechanisms through which natural resources rents, governance and political stability affect the growth of an economy. The second section presents empirical evidence pertaining to how natural resources rents, governance and political stability promote the economic growth cited in the literature. The section concludes with discussions of the empirical evidence and summarizes the findings accordingly.

2.1. Theoretical framework

According to Safdar et al. (2022), the neoclassical era regarded the capital stock and labor supply of a country as the primary drivers of economic growth. However, over time, this neoclassical growth assumption was criticized as other macroeconomic variables were deemed to be equally important in determining an economy's growth. One such variable was natural resources, which were initially believed to have a positive impact on economic growth. However, this assumption has been challenged with the emergence of the theory known as the resource curse. The resource curse hypothesis posits that natural resources can be detrimental to resource-rich countries, as they are accompanied by growth-inhibiting effects (Sun et al., 2020). In addition, the resource curse hypothesis seeks to identify variables other than natural resources that can explain why countries with higher resource availability have lower economic growth rates than countries with lower resource availability. Some of the critical factors that contribute to the resource curse theory include technical redundancy, human capital disparities, weak institutions, and other relevant elements (Safdar et al., 2022; Fleming et al., 2015; Mehlum et al., 2006; Robinson et al., 2006).

On the other hand, it is also believed that strong political stability and effective governance across nations could be a crucial factor in explaining the validity of the resource curse theory, especially in Africa. According to the theory on the relationship between political instability and economic growth, this relationship works both ways; that is, political instability can impact the level of economic growth (Persson & Svensson, 1989), while economic growth can also influence the level of political instability (Londregan & Poole, 1990). Economic deterioration can lead to political instability in several ways. When individuals in society feel economically disadvantaged, it can cause frustration and dissatisfaction, leading to a loss of trust in the government and political system. This can result in protests, riots, and other forms of civil unrest. Furthermore, economic downturns can lead to higher levels of unemployment, poverty, and inequality, which can exacerbate social tensions and fuel political unrest. In some cases, economic deterioration can also lead to the rise of extremist ideologies and movements that seek to exploit economic grievances for their own political gain. Therefore, it is crucial for governments to prioritize economic growth and development, promote equal distribution of resources, and address the underlying causes of economic inequality and poverty to prevent political instability and social unrest.

Good governance is essential for economic progress, as it ensures that resources are managed efficiently and effectively, and that policies are implemented in a transparent and accountable manner. Poor governance, on the other hand, can lead to corruption, inefficiency, and instability, all of which can have negative impacts on economic growth and development. Studies have shown that countries with good governance tend to have higher levels of economic growth, as they are able to attract more

investment, create a more favorable business environment, and implement policies that promote economic development. On the other hand, countries with poor governance tend to have lower levels of economic growth, as they are plagued by corruption, inefficiency, and instability (see Fawaz et al., 2021; Chauvet & Collier, 2004). In particular, African countries have faced significant challenges related to governance, including ineffective governments, a lack of rule of law, and major corruption issues. Addressing these issues will be critical to promoting economic development and ensuring a better future for all citizens.

Political stability and good governance are expected to enhance the contribution of natural resource rents to a country's economic growth. This means that in addition to their direct impact, political stability and effective governance can also indirectly promote economic growth through the management of natural resource rents. It is important for policymakers to analyze these indirect growth transmission mechanisms to ensure that they are effectively utilizing natural resource rents to support economic development.

2.2. Empirical evidence

The resource curse and Dutch disease theories suggest that countries that rely heavily on the extraction and export of natural resources may experience negative economic consequences. The resource curse theory argues that countries with abundant natural resources may be more prone to political instability, corruption, and slow economic growth. This is because these countries may become overly dependent on their natural resources, leading to neglect of other sectors of the economy and a lack of diversification. The Dutch disease theory, on the other hand, focuses on the impact of natural resource exports on a country's currency and overall economy. When a country experiences a surge in natural resource exports, this can cause its currency to appreciate, making its other exports more expensive and less competitive in the global market. This can lead to a decline in the country's non-resource export sectors, resulting in a loss of jobs and economic contraction. The case of the Netherlands in the late 1970s and early 1980s is a classic example of the Dutch disease theory in action. The discovery of natural gas deposits in the Netherlands led to a boom in the country's natural gas industry, which caused the Dutch currency to appreciate rapidly. This, in turn, reduced the country's overall export competitiveness, causing a decline in non-resource export sectors and an economic contraction (see Geurts et al., 2000).

There are numerous studies showing that nations with an abundance of natural resources grow more slowly than nations with less of them. However, in the instance of Africa, the findings have been mixed in the literature. Ampofo *et al.*, (2022) investigates the impact of natural resource wealth on sustainable economic development in the top eight resource-rich sub-Saharan African nations. They show that Equatorial Guinea's economic growth is greatly boosted by a rise in natural resource rents. However, the Congo Republic's increased natural resource rents have a detrimental impact on economic expansion, supporting the theory of the resource curse. In other analyzed nations, there was no discernible impact. In another study, the threshold implications of natural resource reliance on economic growth in sub-Saharan Africa are examined by Dramani et al., (2022). The findings suggest that the rent from natural resources has a double threshold impact on economic growth. Aggregate natural resource rent has a particularly negative impact on economic growth when it is less than 6% of GDP. But as rents rise over 6% of GDP to around 15% of GDP, their negative impact on economic growth sharply declines. Additionally, natural resource rent shows a strong favorable influence on economic growth above 15% of GDP. Similarly, Abdulahi, Shu & Khan (2019) under the hypothesis of natural resource curse, investigated the nonlinear relationship of natural resource rents and

economic growth. The study found a positive relationship between resource rents and economic growth when there is a higher threshold of institutional quality represented by IQ. However, the reverse is the case when the threshold of institutional quality is lower and that emerges as the phenomenon of resource curse which impedes economic growth.

Given the abundance of natural resources, the behavior for rent-seeking activities may be obvious. In this respect, Sarmidi, Hook Law & Jafari (2014) provided substantial evidence by investigating the natural resource and economic growth nexus in 90 countries between the period 1984-2005. Their findings reveal the impact of governance proxied by quality institutions in the natural resource-economic growth nexus. The study shows that resource-endowed economies with higher institutional quality are less likely to experience the resource curse phenomenon. Further findings in this study showed that resource-endowed economies with inadequate institutional quality are likely to fall into the resource-curse trap with subsequent impact on economic growth. Furthermore, Brunnschweiler (2008), investigated the impact of natural resource abundance on economic growth with a sample of 100 countries over the period 1970-2000. The study employed ordinary least square regressions and two-stage least square regressions. The ordinary least square regression estimated the natural resource abundance and institutional quality nexus. The two-stage least square regressions estimated the natural resource abundance and institutional quality nexus in the context of economic growth. Contextualizing institutional quality as rule of law, corruption and state effectiveness, which are fundamental elements of good governance – findings from the study indicate that higher institutional quality has a positive correlation to economic growth in resource-endowed economies. However, this study considered only the linear relationship between governance and economic growth. Our study adds to this study by exploring the non-linear relationship captured by the interaction terms.

Zallé (2019) examined the natural resources and economic growth nexus over the period 2000 – 2015. The study employed a new methodology, Autoregressive Distributed Lag (ARDL) on a sample of 29 countries. Findings reveal that, economic growth increases with efficient human capital development amidst natural resource abundance. Further, that human capital has a very positive influence on economic growth (Park 2006; Savvides & Stengos 2020). Further results from the study showed that resource-endowed African economies must reinforce investment in efficient human capital development whiles intensifying the fight against rent-seeking appropriation by elites to fend-off the natural resources curse phenomenon.

It is important to consider the function of human capital, industrial value added, and trade openness in the economic growth nexus. Zallé (2019) investigated the natural resources and economic growth nexus over the period 2000–2015. The findings reveal that, economic growth increases with efficient human capital development amidst natural resource abundance, and that human capital has a very positive influence on economic growth. Rahim *et al.* (2021) examined the indirect economic growth impact of human capital development through the utilization of natural resources in these Next Eleven countries. Findings reveal that human capital development synthesizes economic growth in the presence of natural resources rents. Another interesting finding in this study shows that human capital and natural resources jointly exert positive impact on economic growth. In respect of the significance of industrial value added, Rahim *et al.* (2021) investigated the impacts of industrialization and financial development on economic growth covering the periods 1990 to 2019, for Next Eleven countries. Results from the study show a positive impact of industry value added on economic growth. Similarly, Ali *et al.* (2016) demonstrated that industry value added had a beneficial impact on economic growth. That is, more industry value added leads to increased economic growth. Without taking trade openness into consideration, the topic of contemporary growth cannot be fully discussed or understood.

Raghutla (2020) examined the impact of trade openness on economic growth in a panel of five emerging market economies from 1993 to 2016. The findings show that trade openness has a positive considerable impact on economic growth. Furthermore, the heterogeneous panel non-causality tests indicate the presence of unidirectional causality that runs from economic growth to trade openness in the short run. For the period 1990 and 2017, Alam & Sumon (2020) used panel cointegration and casualty approaches to examine the relationship between trade openness and economic growth. Empirical results from the study show a positive relationship between trade openness and economic growth. In recent study, Gabriel & David (2021) examined the impacts of trade openness and financial openness on economic growth in sub-Saharan African (SSA) countries from 1980-2017. Findings from the study show that trade openness has significant positive impact on economic growth.

The empirical literature review has indicated the potential methodological heterogeneity which accounts for different inherent problems in panel data analysis ranging from unit root, cointegration, slope heterogeneity and cross-sectional dependency. Therefore, we employ a more robust estimation method which takes into account these problems.

3. Methodology and data

This section introduces the data and various econometric techniques for the variables of interest, including cross-sectional dependence, panel unit root, and cointegration tests. We also describe our estimation process, which introduces panel data estimators and causality tests.

3.1. Data and variables

We use panel data from 1996 to 2019 from the World Bank, World Development Indicators and Penn World Table database covering 39 countries in Africa.

Table 1: *Description for each variable.*

Variable	Measurement	Source
Gross Domestic Product (GDP)	GDP is proxy for economic growth and it is measured in 2010 US Constant dollars.	World Development Indicators (WDI)
Total natural resources rent (TNR)	TNR is the sum of rents as a percentage of GDP obtained from coal, oil, forest, mineral, and gas.	World Development Indicators (WDI)
Political Stability (PS)	PS measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	World Governance Indicator (World Bank)
Effective Governance (Gov)	Gov captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5.	World Governance Indicator (World Bank)
Human Capital (HCI)	HCI is based on years of schooling and returns to education.	Penn World Table (PWT) 10.0
Industry value Added (IVA)	IVA is a measure for industrialization and capital accumulation as a percentage of GDP	World Development Indicators (WDI)
Trade Openness (TO)	TO is the sum of imports and exports to GDP.	World Development Indicators (WDI)

The countries are selected based on the availability of data and includes Algeria; Angola; Benin; Botswana; Burkina Faso; Burundi; Central Africa Republic; Cameroon; Côte d'Ivoire; Democratic Republic of Congo; Egypt; Eswatini; Ethiopia; Gabon; Gambia; Ghana; Guinea-Bissau; Kenya; Lesotho; Madagascar; Malawi; Mali; Mauritania; Mauritius; Morocco; Mozambique; Namibia; Niger; Nigeria; Rwanda; Senegal; Sierra Leone; South Africa; Togo; Tunisia; Uganda; Tanzania; Zambia; and Zimbabwe. We use GDP per capita, expressed in billions of 2010 U.S. dollars, as a measure of economic growth. The explanatory variables in this study are natural resources rent, political stability, effective governance, human capital, industry value added and trade openness (see Table 1). We use logarithmic variables to achieve a robust analysis; avoid heteroscedasticity, and minimize biases caused by variable outliers in the analysis. Descriptive statistics of our variables is provided in Table-A7 in the appendix.

3.2. Model specification

This study aims to identify how natural resource rent, political stability, and governance affect economic growth in Africa. Specifically, we seek to analyse the long-run direct and indirect effect of natural resource rent, governance and political stability on economic growth and the causal relationship between the variables and growth. Our model specification follows the endogenous growth framework of Rahim *et al.*, (2021) and Sun *et al.*, (2020), and controlled for the effects of total natural resources (TNR), governance (Gov), political stability (PS), human capital (HCI), industry value added (IVA), and trade openness (TO) (proxy for international trade). The estimated model is specified as follows:

Model 1

$$GDP_{it} = f(TNR_{it}, HCI_{it}, PS_{it}, Gov_{it}, IVA_{it}, TO_{it}) \quad (1)$$

Model 2

$$GDP_{it} = f(TNR_{it}, HCI_{it}, PS_{it}, Gov_{it}, IVA_{it}, TO_{it}, TNR_{it} * PS_{it}) \quad (2)$$

Model 3

$$GDP_{it} = f(TNR_{it}, HCI_{it}, PS_{it}, Gov_{it}, IVA_{it}, TO_{it}, TNR_{it} * Gov_{it}) \quad (3)$$

In these three models (1, 2 and 3), "*t*" is the time period of the data (i.e., 1996 to 2019) and "*i*" represents the cross-sections (i.e., the 39 countries). As indicated, Table 1 describes all the variables considered in this study. In Model 2, an interaction term between the total natural resource and political stability index (TNR*PS) is considered to ascertain the joint effect of these two variables on economic growth. In Model 3, another interaction term between the total natural resource and governance is also included to determine the joint impact of these two variables on economic growth. The baseline regression for this study is as follows:

$$GDP_{it} = \beta_0 + \beta_1 TNR_{it} + \beta_2 HCI_{it} + \beta_3 PS_{it} + \beta_4 Gov_{it} + \beta_5 IVA_{it} + \beta_6 TO_{it} + \varepsilon_{i,t} \quad (4)$$

$$GDP_{it} = \beta_0 + \beta_1 TNR_{it} + \beta_2 HCI_{it} + \beta_3 PS_{it} + \beta_4 Gov_{it} + \beta_5 IVA_{it} + \beta_6 TO_{it} + \beta_7 TNR_{it} * PS_{it} + \varepsilon_{i,t} \quad (5)$$

$$GDP_{it} = \beta_0 + \beta_1 TNR_{it} + \beta_2\, HCI_{it} + \beta_3\, PS_{it} + \beta_4 Gov_{it} + \beta_5 IVA_{it} + \beta_6 TO_{it} + \beta_7 TNR_{it} * Gov_{it} + \varepsilon_{i,t} \quad (6)$$

Equations (4), (5) and (6) are the main regression models which are tested for empirical analysis. β is a coefficient to be determined, and ε is the error term.

3.3. Estimation strategy

Due to difficulties in using long-term panel data, including non-stationarity, endogeneity, cross-section dependence, and heterogeneity, a more robust econometric approach is needed to address these problems. With this in mind, the study used second-generation econometrics tools that are appropriate for our data set. For empirical results estimation, this study initially determined whether slope coefficients are homogeneity or heterogeneity using tests from Pesaran and Yamagata (2008) and Pesaran (2004) to determine the reliance of cross-sections. For unit root, the Westerlund and Edgerton (2007) test for cointegration is used.

3.3.1. Cross-sectional dependency (CD)

Before delving into the causal relationship between natural resource rents, governance, political stability, and economic growth, we first examine the stationary characteristics of key variables. This is significant since one of the primary issues faced in panel unit root test is whether or not the panel's cross-sections are independent of one another. This study initially investigates the problem of dependency, particularly among cross-section units. Such preparatory investigations are critical because they provide a defined process of employing specific and most applicable econometric techniques to avoid inefficiencies and ambiguity in our research findings (Erdoğan *et al.*, 2020; Kirikkaleli *et al.*, 2020). To determine whether the relevant variables employed in this study exhibit cross-sectional dependency, we use the Pesaran (2004) CD test. Statistics from Pesaran CD tests are computed as follows:

$$CD_{PS} = \sqrt{\frac{2T}{N(N-1)}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{i,j}\right)} \Longrightarrow \mathrm{N}(0,1) \quad (7)$$

The CD_{PS} test examines the following hypotheses:

H_0: no cross-sectional dependence

H_1: has the cross-sectional dependence

3.3.2. Slope heterogeneity test

In empirical work, standard econometric methods can omit individual heterogeneity, resulting in discordant parameter estimates in panel data models. We investigate whether the slopes are homogeneous across panel units or not using the Pesaran and Yamagata (2008) standard test. Pesaran and Yamagata (2008) suggested a test for slope homogeneity for panel data with large N and T based on a standardized version of Swamy's (1970) test. The test makes the assumption that $\varepsilon_{i,t}$ and $\varepsilon_{j,s}$ are independently distributed for $\mathrm{i} \neq \mathrm{j}$ or $\mathrm{t} \neq \mathrm{s}$ or both, but allows for heterogeneous variance. The test statistic is defined by:

$$\tilde{\Delta} = \frac{1}{\sqrt{N}}\left(\frac{\Sigma_i^N = \tilde{a}_i - k_2}{\sqrt{2k_2}}\right) \quad (8)$$

where $\tilde{\Delta} \sim N(0,1)$, $\tilde{d}_i$ denotes the weighted difference between the cross-sectional unit-specific estimate and the pooled estimate. Furthermore, the mean-variance bias-adjusted$\tilde{\Delta}$for normally distributed errors can be written as follows:

$$\widetilde{\Delta_{adj}} = \sqrt{N}\left(\frac{N^{-1}\Sigma_{i=1}^N = \tilde{a}_i - k_2}{\sqrt{Var(\widetilde{Z_i}, T_i)}}\right) \quad (9)$$

Where

$$Var(\tilde{Z}_i, T_i) = \frac{2k_2(T_i-k-1)}{T_i-k_1+1} \quad (10)$$

3.3.3. Panel unit root and cointegration test

Espoir et al., (2021) and Sun et al., (2020) argue that employing a consistent econometric unit root technique that addresses the problem of cross-section dependency is crucial in panel studies. This study employs the Im, Pesaran, and Shin (Pesaran, 2007) second-generation unit root test called the cross-sectionally augmented test. The CIPS considers the problem of dependence between cross-section units and also yields efficient results in the presence of a heterogeneous panel. The Pesaran (2007) method uses the first difference in cross-section averages and lags for every cross-section for augmentation. The main equation for the Pesaran (2007) test is as follows:

$$\Delta X_{i,t} = \emptyset_i + \emptyset_i X_{i,t-1} + \emptyset_i \bar{X}_{t-1} + \sum_{i=0}^{P} \emptyset_{it}\, \Delta \bar{X}_{t-1} + \sum_{t=1}^{P} \emptyset_{il} \Delta X_{i,t-l} + \varepsilon_{it} \quad (11)$$

where, in Eq. (11) $\bar{X}_{t-1}$ and $\overline{\Delta X}_{t-1}$ are the cross-sectional averages of lagged levels and first difference, and ϕ is the lead coefficient. The CIPS is expressed as follows:

$$\widehat{\mathrm{CIPS}} = \frac{1}{\mathrm{N}} \sum_{\mathrm{i}=1}^{\mathrm{n}} \mathrm{CADF_i} \quad (12)$$

The value of the cross-sectionally augmented dickey fuller $(CADF)_i$ in Eq. (12) is derived from the Eq. (11).

3.3.4. Westerlund (2007) Panel cointegration test

This study employs an error correction-based framework proposed by Westerlund and Edgerton (2007) for panel cointegration. This test is built around four core test statistics. Panel test statistics are given by P_a and P_t, whereas Group mean statistics are given by G_a and G_t. The null hypothesis for the Panel test contends that there is no cointegration, while the alternate hypothesis assumes a cointegration relationship for the entire panel. Likewise, the null hypothesis for the Group mean statistics suggest no long-run cointegration while the alternative hypothesis contends that at least one of the cross-sections is cointegrated. The Panel and Group mean statistics can be estimated as follows:

$$P_\tau = \frac{\hat{\xi}_i}{SE(\xi_i)},\ P_a = \mathrm{T}\xi_i \quad (13)$$

$$G_\tau = N^{-1} \sum_{i=1}^{N} \frac{\hat{\xi}_i}{SE(\xi_i)},\ G_a = N^{-1} \sum_{i=1}^{N} \frac{\mathrm{T}\xi_i}{\xi_i'(1)} \quad (14)$$

3.3.5. Pooled mean group (PMG) for long and short-run estimations

This study employs the panel Autoregressive distributive lag (ARDL) Pooled Mean Group (PMG) method developed by Pesaran (1999) to estimate the long-run and short-run relationship between natural resource, governance, political stability and other covariates. The PMG estimates the long-run slope as the weighted average for the entire panel and accounts for heterogeneity and the error correction terms between groups in the short-term period. Let us consider X as a vector of explanatory variables (i.e., TNR, PS, Gov, HCI, IVA and TO). An Autoregressive distributive lag (ARDL) (p, q1, …, qk) dynamic panel specification functional form can be expressed as follows:

$$GDP_{i,t} = \sum_{j=1}^{p} \vartheta_{i,t}\, GDP_{i,t-j} + \sum_{j=0}^{q} \delta_{i,j} X_{i,t-j} + \tau_i + \varepsilon_{i,t} \quad (15)$$

where $GDP_{i,t}$ is the dependent variable and X is a k x 6 vector of explanatory variables; $\vartheta_{i,t}$ are scalars; and τ_i is the country unobserved specific effect. While p and q are, respectively, the lags of the dependent and independent variables that varies between countries. When the variables under consideration are cointegrated of order I(1) and the error terms is I(0), there is a long run relationship among variables. However, there is a possibility that the long-run trajectory will diverge. A vector error correction model (VECM) can be developed in this scenario, and deviations from long-term equilibrium can be determined. As a result, the error correction model can be defined as follows:

$$GDP_{i,t}=\Phi_i(GDP_{i,t-j}-\theta_i X_{i,t})+\sum_{j=1}^{p-1}\vartheta_{i,j}^{*}\Delta GDP_{i,t-j}+\sum_{j=0}^{q-1}\delta_{i,j}^{*}\,\Delta X_{i,t-j}+\tau_i+\varepsilon_{i,t} \quad (16)$$

where $\Phi_i=-\left(\sum_{j=1}^{p}\vartheta_{i,j}\right)$; $\theta_i=\sum_{j=0}^{q}\delta_{i,j}\,/\left(1-\sum_k\vartheta_{i,k}\right)$; $\vartheta_{i,j}^{*}=-\sum_{m=j+1}^{p}\vartheta_{i,m}$ for j=1,2, …, p-1; and $\delta_{i,j}^{*}=-\sum_{m=j+1}^{q}\delta_{i,m}$ for j=1,2, …, q-1.

The coefficient Φ_i represents the speed of adjustment of the error correction coefficient and is expected to be negative and less than 1.

4. Discussion and interpretation of results

We start by examining whether the slope coefficients are homogeneous across countries. The slope heterogeneity test results are shown in Table 2. We apply the Pesaran and Yamagata (2008) slope heterogeneity test in Eq. (8). This test is run on seven distinct models. The findings show that across all panel units and for all seven models, the statistic of $\tilde{\Delta}$ and $\tilde{\Delta}_{Adjusted}$ tests reject the null hypothesis of slope homogeneity at the 1% level of significance. This means that panel regressions that assume slope homogeneity may produce false conclusions and misleading findings. Therefore, in the regressions between GDP per capita, TNR, PS, IVA, GOV, TO and HCI in Africa, our study accounts for country-specific characteristics.

Table 2: *Slope heterogeneity & dependence tests*

Pesaran and Yamagata (2008) slope heterogeneity test						
Models				$\tilde{\Delta}$		$\tilde{\Delta}_{Adjusted}$
Model 1 (GDP=*f*(TNR))				16.312***		17.449***
Model 2 (GDP=*f*(PS))				35.854***		38.327***
Model 3 (GDP= *f*(IVA))				32.086***		34.420***
Model 4 (GDP= *f*(GOV))				33.896***		36.234***
Model 5 (GDP= *f*(TO))				30.258***		32.345***
Model 6 (GDP= *f*(HCI))				53.703***		57.406***
Model 7 (GDP=*f*(TNR, PS, IVA, GOV, TO, HCI))				-0.904		-5.791***
Pesaran (2004) Cross-section Dependence (CD) test						
GDP	TNR	PS	IVA	GOV	TO	HCI
119.45***	30.01***	1.79**	56.05***	3.28***	13.86***	114.34***

Note. *** p<0.01, ** p<0.05, * p<0.1, respectively.

Despite the fact that the coefficients are heterogeneous, one variable may still have considerable effect on other variables. We therefore used the (Pesaran, 2004) test to determine the cross-section dependence of our variables across countries. As can be seen from the results in Table 2, the null hypothesis that there is no cross-sectional dependence is rejected at 1% level of significance for six out of the seven variables (i.e., GDP per capita, TNR, IVA, GOV, TO and HCI), and 10% significance level for PS. On the contrary, the results show that our variables are cross-sectionally dependent, with a possible spillover impact over the same cross-sectional variables. Cross-sectional dependence may arise from the fact that most countries are interconnected in today's globalized economy. As a result, a positive or negative shock in one of the variables in one country has a considerable impact on the other country. The CD finding suggests that economic growth, natural resource rent, political stability, industry value added, governance, trade openness and human capital are likely to follow identical transmission processes in Africa, with a significant neighbouring interaction effect. High economic growth in one country is likely to have an impact on its neighbours. As a result, we must account for this reliance in our regressions in order to obtain unbiased marginal effects.

Next, we test for stationarity of our time-series since our empirical objective in this study is to investigate the short- and long-term effects of TNR on growth as well as whether political stability and good governance mitigate this effect. Panel cointegration is made possible by unit root testing, as we emphasize in the methodology section. The findings of the CD test show that there is varying

reliance between the panel units. Furthermore, for a time series in particular, it is necessary to explore for stationarity or unit root, because the discontinuity in the panel causes problems resulting in biased econometric estimations (Rahim *et al.*, 2021). This prompts an examination of time-series stationarity using a suitable test that takes cross-section dependence into account. As a result, we run the Pesaran (2007) CD test; the results are shown in Table 3.

Table 3: *Pesaran (2007) CIPS unit root test*

	At level I(0)		First difference I(1)	
Variables	Intercept	Intercept and trend	Intercept	Intercept and trend
GDP	-1.022	-1.271	-2.847***	-3.897***
TNR	-2.166**	-2.435	-4.386***	-4.310***
PS	-1.757	-2.663**	-4.379***	-4.370***
IVA	-1.530	-1.806	-3.501***	-4.106***
GOV	-2.475***	-2.540	-4.595***	-4.787***
TO	-1.736	-2.422	-4.318***	-4.385***
HCI	-1.871	-2.403	-3.889***	-4.548***

Note. *** p<0.01, ** p<0.05, * p<0.1, respectively. The critical values of CIPS test at 10%, 5% and 1% levels of significance are −2.04, −2.11 and−2.23 for constant, and−2.54, −2.61 and−2.73 for constant plus trend, respectively.

The results of the unit root test show that the null hypothesis of the presence of a unit root cannot be rejected for all seven variables at level I(0) (i.e., for the model with intercept and, intercept with trend). However, the results further show that the null hypothesis is rejected at the 1% level of significance when we look at the data at the first difference. As a result, we draw the conclusion that all variables are found to be stationary while refuting the null hypothesis that a unit root exists at I(1).This shows that there is at least one relationship between GDP per capita, TNR, PS, IVA, GOV, TO, and HCI that is cointegrating. Therefore, the error-correction term-based panel cointegration test suggested by Westerlund & Edgerton (2007) is the suitable test to look into the current long-run equilibrium relationship among our variables because it takes CD of the time-series into consideration.

Table 4: *Westerlund and Edgerton (2007) cointegration test*

Test	Model (1)		Model (2)		Model (3)	
	value	p-value	value	p-value	value	p-value
P_τ	-14.619***	0.000	-16.149***	0.000	-14.027***	0.000
P_a	-7.732***	0.000	-9.672***	0.000	-4.462***	0.000
G_τ	-1.631*	0.069	-1.926***	0.000	-1.579***	0.000
G_a	-6.102	0.375	-7.848***	0.000	-4.433	0.193

Note. The estimated models include a constant in the cointegration relationship. The '***', '**' and '*' denotes the rejection of the null hypothesis of no cointegration at the 1%, 5% and 10% levels. The Akaike criterion is used to select the lags and the leads in the errors correction test. As previously stated, the Westerlund & Edgerton (2007) test investigates whether the error correction term in a conditional panel error correction model (ECM) is zero. According to Model-1, Model-2 and Model-3 in Table 4, the error correction values for the mean group statistics (i.e., G_a and G_t) and the panel statistics (i.e., P_a and P_t) were statistically significant at P<0.01 and P<0.1 respectively. As a result, the criteria for rejecting the null hypothesis of no cointegration among variables has been satisfied. Thus, it can be said that the variables for Model-1 – GDP per capita, TNR, GOV, and PS – have a long-term cointegration relationship. Additionally, it is found that all of the aforementioned Model-1 variables, along with the interaction terms between GOV and TNR as well as PS and TNR, have a long-term cointegration amongst them, corresponding to Model 2. With the exception of the interaction terms, all the variables that have been mentioned, together with TO, IVA, and HCI, are cointegrated in Model 3. Given that the aforesaid cointegration test indicates that our variables have

a long-run relationship, we use the PMG estimator to investigate the long-run effects of our explanatory variables and possible mediators on economic growth in Africa. For comparability and robustness, we also report estimates using the DFE estimator. The long-run estimates from the PMG estimator are presented in Table-5.

Table 5: *Pooled mean group (panel ARDL) model*

Variables	Model (1) coefficient	Model (2) coefficient	Model (3) coefficient
Long-run (LR) effect			
TNR	-0.952***	-0.852***	-0.713***
	(0.248)	(0.228)	(0.269)
PS	0.331**	0.195	0.056
	(0.169)	(0.227)	(0.167)
IVA	0.0007	0.0009	0.001
	(0.0007)	(0.0006)	(0.0007)
GOV	0.708*	0.835**	1.214***
	(0.373)	(0.362)	(0.345)
TO	0.005	0.0006	0.0001
	(0.003)	(0.0005)	(0.0005)
HCI	0.004***	0.005***	0.005***
	(0.0007)	(0.0007)	(0.0007)
TNR*PS	--	0.688***	--
		(0.198)	--
TNR*GOV	--	--	0.573**
	--	--	(0.176)
Short-run (SR) effect			
ECT(-1)	-1.390***	-1.399***	-1.307***
	(0.104)	(0.106)	(0.105
ΔTNR	-4.002**	-3.936**	-2.340*
	(1.586)	(1.576)	(1.256)
ΔPS	0.464	0.449	0.408
	(0.973)	(0.978)	(0.706)
ΔIVA	0.022	0.022	0.009
	(0.018)	(0.018)	(0.016)
ΔGOV	0.025	0.010	1.622
	(1.294)	(1.275)	(1.280)
ΔTO	0.005	0.005	0.004**
	(0.003)	(0.003)	(0.001)
ΔHCI	0.092	0.084	0.059
	(0.061)	(0.061)	(0.057)
Constant	8.103***	8.513***	9.617***
	(0.776)	(0.832)	(0.803)

Note. *** p<0.01, ** p<0.05, * p<0.1

Table 5 is divided into two sections. We present the long-run relationship's coefficients in the first section (i.e., the top of the table). We present the coefficients of the short-term relationship in the second section (i.e., the lower portion of the table). The computed coefficients can be directly understood as elasticities because both our dependent and independent variables are in logarithmic form. To begin with the long-run results, the estimated slope coefficient of the effects of natural resources in Model-1 show a detrimental impact on economic growth. This is apparent from the slope coefficient's negative sign, which is statistically significant at a 1% level of significance. The GDP level of African countries is observed to fall by 0.952% for every 1% increase in the share of total natural resource rent in the GDP. Thus, in the case of the African countries, this particular finding supports the veracity of the resource curse theory. Therefore, it can be claimed that these countries' natural

resources are not being used effectively enough to provide economic benefits. The natural resource curse has long been linked to Africa, where countries' natural resource wealth hasn't resulted in robust economic progress and has caused contraction in some cases (Chachu *et al.*, 2021; Ziaba, 2020). Resource income flows encourage corruption by making it easy for authorities and bureaucrats to embezzle funds for their own benefit. Natural resource revenues also provide wealth that supports patronage networks and corruption in most African countries (Sterwart, 2012). Furthermore, in most instances, the government is given ownership of natural resources in many African nations, and it also receives all of the revenue gained from resource extraction. This concentration of funds in the hands of the government could result in a number of issues, including corruption, and efficiency losses due to poor management. Resource income in developing economies like Africa may lead to ineffective and unproductive government behavior. Individuals in government direct a large portion of resources to activities that help them remain in power and also focus on initiatives that are not pro-developmental (Baldwin, 2017; Lewin, 2011). As it has been the case in some African countries such as the Democratic Republic of Congo (DRC), and Sudan among others, in many instances, natural resource revenue increases the authority of established elites and supporters of the ruling regime, hence escalating income inequality and inhibiting political reforms. This makes it possible to argue that resource abundance degrades institutional quality and thus enables governments to shirk responsibility to its citizens. On the other hand, economic growth is positively impacted by human capital, a thorough index for gauging labour market information that is also adjusted for the returns to schooling. The coefficient estimate reveals a positive and statistically significant influence of human capital development on economic growth at the 1% level. This shows that increasing the human capital index by one percent boosts economic growth of African countries by 0.004%. In accordance with the human capital theory, our finding underlines the essential role of human capital to economic growth in Africa. Political stability is found to increase economic growth. At a 5% level of significance, the positive sign of the associated slope coefficient validates this assertion. As can be observed, a 1% change in political stability results in a 0.331% increase in GDP. In the African literature, empirical research (Fosu,1992; Gyimah-Brempong & Traynor, 1999) has indicated that political instability, particularly instability in regimes, accounts for a significant decline in economic growth rate through its negative impact on investment. At the same time, effective governance is found to positively increase economic growth in Africa at 10% significance level. A 1% increase in effective governance yields a corresponding increase of 0.708% in GDP respectively. However, even though industrial value added and trade openness are found to have positive coefficients, they are not statistically significant in model-1.

Similar to Model-1, Model-2 also includes the interaction term between political stability and total natural resources in addition to the explanatory factors considered of in Model-1. The findings show that human capital, total natural resources, and effective governance all have a similar impact on economic growth across African nations. The main conclusion of this model is that political stability and total natural resources have a joint positive impact on economic growth. This claim is supported by the slope coefficient of the interaction term, which is statistically significant at the 1% level. Consequently, it can be said that political stability not only directly contributes to the continent of Africa's economic growth but also significantly reduces the constraining effects of resource exploitation and usage on growth. This is a crucial finding for formulating policy because many African countries with natural resource wealth are politically unstable and prone to coups d'état.

Table 6: *Dynamic fixed effect (DFE) model results*

Variables	Model (1) coefficient	Model (2) coefficient	Model (3) coefficient
Long-run (LR) effect			
TNR	-0.673**	-0.448***	-0.307
	(0.294)	(0.259)	(0.325)
PS	0.329	0.337	0.204
	(0.205)	(0.252)	(0.212)
IVA	0.00005	0.0005	0.045***
	(0.0006)	(0.0007)	(0.016)
GOV	0.834**	0.987***	1.308***
	(0.410)	(0.383)	(0.415)
TO	0.001*	0.001**	0.001**
	(0.0006)	(0.0007)	(0.0006)
HCI	0.002***	0.002***	0.001
	(0.0008)	(0.0008)	(0.0009)
TNR*PS	--	0.896***	--
		(0.207)	--
TNR*GOV	--	--	0.544***
	--	--	(0.211)
Short-run (SR) effect			
ECT(-1)	-1.686***	-1.693***	-1.695***
	(0.101)	(0.103)	(0.100)
ΔTNR	-5.603**	-4.979**	-4.973**
	(2.282)	(2.224)	(2.276)
ΔPS	0.044	0.005	0.199
	(1.392)	(1.397)	(1.378)
ΔIVA	0.047***	0.045***	0.045***
	(0.017)	(0.017)	(0.016)
ΔGOV	2.504	2.278	1.943
	(2.046)	(2.044)	(2.038)
ΔTO	0.005	0.006*	0.005
	(0.003)	(0.003)	(0.003)
ΔHCI	0.107	0.091	0.084
	(0.070)	(0.200)	(0.066)
Constant	7.243***	8.047***	7.780***
	(0.961)	(1.003)	(0.960)

Note. *** p<0.01, ** p<0.05, * p<0.1z

Our findings show that, with all other factors being constant, sustaining political stability can turn natural resources from being a curse to a blessing for African countries. Last but not least, in addition to the variables stated in Model-1, we also include an interaction term between effective governance and total natural resources in the framework of Model 3. Similar outcomes are demonstrated. In particular, we discover that effective governance, like political stability, indirectly contributes to the transformation of natural resources to support economic growth in Africa. This assertion is supported by the positive sign of the corresponding slope coefficient of the interaction term at the 1% level of significance. Natural resource extraction has the potential to change the economic fate of African citizens. However, if not managed properly, it has the potential to spark a wide range of violent conflicts, such as from low-intensity everyday tensions in Zambia's copper belt to large-scale insurgencies in Nigeria's oil-rich Niger Delta. Our findings support the need for and motivation to build credible and sustainable governance systems for natural resource revenue management and utilization in Africa to benefit especially, frontline communities.

In the following section, we will examine the outcomes in the short term, which have been evaluated using pooled mean group (PMG) and are presented in the lower part of Table 5. The PMG estimation method offers the advantage of permitting short-term assessments to vary across units. This feature is essential because adjustments in the short term could be impacted by various factors specific to each country, such as political regimes, economic shocks, among other factors (see Ben-Salha et al., 2021). In brief, our analysis of short-term outcomes using country-specific error correction modeling indicates that there are variations in the short-term dynamics of total natural resource and economic growth among African countries. This result is reasonable given the diverse set of countries included in our study, which encompasses African nations with different economic and political structures. From Model-1, the results suggest a negative link between total natural resources and economic growth. In contrast, we find no short-run relationship between economic growth and any of the other variables in Africa. In Model-2, we find similar results. However, in Model-3, we find a short-run relationship between total natural resources and economic growth, and trade openness and economic growth at $P< 0.1$ and $P<0.05$ significance level respectively.

Our long-run result is consistent with Rahim et al., (2021), that examined the influence of natural resources, human capital, financial development, industrialization, technical progress, and international trade on Next Eleven countries' economic growth between 1990 and 2019. The authors validate the resource curse hypothesis by discovering that greater natural resource rents impede economic growth in the Next Eleven nations. Human capital, on the other hand, was discovered to have a favorable impact on economic growth when combined with natural resources. Similarly, the resource curse hypothesis is supported by Sun et al. (2020) who discovered a negative relationship between natural resource rent and financial development in the economies of the so-called emerging seven (E-7) countries. In a recent study, Erdoğan et al. (2020) discovered that greater oil exports, as a proxy for natural resource abundance, have no statistically significant impact on economic growth in Next-11 economies.

We also conducted a thorough analysis to assess the robustness of our findings by using the Dynamic Fixed Effects (DFE) estimator. The purpose of this analysis was to determine whether dynamic interactions could improve the estimated marginal impacts and compensate for any endogeneity among the selected variables. However, it is crucial to note that we also conducted a Hausman test to compare the PMG estimator to the DFE estimator. The Hausman test is a statistical test used to determine whether the coefficients in two different regression models are significantly different from one another. The results of this test indicated that the PMG estimator was better suited for this analysis than the DFE estimator. The estimated marginal effects of the PMG and DFE models are presented in Table 6. We found that the differences between the two models were not particularly significant. However, the PMG model was deemed more appropriate since it took into account the heterogeneity between African countries and, as a result, minimized estimation bias.

5. Conclusions and policy implications

In recent years, there has been a focus on the role of governance and political stability in shaping the relationship between natural resource abundance and economic growth. While these factors are recognized as having direct effects on economic growth and natural resource abundance, this paper aims to explore their indirect impacts as intermediaries in the relationship between these variables. The main contribution of the paper is therefore to provide an empirical analysis of these indirect effects. By examining the role of governance and political stability as intermediaries in the relationship between natural resource abundance and economic growth, the paper aims to deepen our understanding of this complex relationship and provide insights for policymakers and researchers.

This study investigated the relationship between governance, political stability, natural resource rent utilization, and economic growth within the framework of the natural resource curse hypothesis. The study utilized data from 39 African countries between 1996 and 2019. The first objective was to determine if the variables were cross-sectionally dependent across the countries, and the results indicated that there was no cross-section dependence for the variables of interest. However, the findings also revealed that there was cross-sectional dependence for other variables, which could potentially lead to spillover effects on the same cross-sectional variables in Africa. Additionally, the study examined whether the slope coefficients were consistent across countries, and the results showed that the relationship between economic development and natural resource abundance was not consistent across different countries. This challenges previous research that has assumed country homogeneity in this relationship.

In this study, the pooled mean group estimator has been utilized to calculate both short- and long-term slope coefficients of the variables. This constitutes the second unique feature of the study. The PMG method accounts for short-term heterogeneity and enables the pooling of error correction terms among groups. Additionally, it computes the long-term slope coefficient as a weighted average for the entire panel. Based on the outcomes of the PMG, it can be inferred that natural resource rents have a detrimental impact on economic growth in Africa over the long term, and this result is statistically significant. Our findings show that effective governance has a significant positive direct impact on economic growth. Moreover, our empirical findings have shown that when governance effectiveness is interacted with total natural resource rent, the total effects are more profound compared to direct governance effects. Similarly, the results on political stability show that the variable has positive direct impact on economic growth. Furthermore, we found evidence that the interaction between political stability and total natural resource rents has significant effects, which adds more total effects to economic growth.

The findings provide more intriguing policy implications especially for the natural resource rich countries. Political stability and good governance are important factors in transforming natural resource rich countries and foster their economic growth, despite the direct effects which work through the investment and attraction of foreign direct investment (FDI). These variables have indirect benefits which we found to have significant contribution to economic growth when they are linked to natural resource utilization. Therefore, the focus in the natural resource curse hypothesis should be on improving both the direct and indirect impact of these variables for transforming natural resource abundance into prosperity for resource-endowed economies. The empirical findings suggest three (3) strong policy recommendations for policy makers: 1) Strengthening governance systems: Policies should focus on improving governance systems to ensure transparency, accountability, and participation. This includes strengthening institutions such as anti-corruption agencies, improving budget transparency, and promoting citizen participation in decision-making processes. 2) Natural resource revenue management and utilization: Policies should aim to promote responsible and sustainable management of natural resources. This includes promoting value addition, diversification, and investments in the local economy to create jobs and stimulate economic growth. 3) Political reforms: Policies should focus on building political systems that discourage the development of social structures in which autocratic or corrupt political elites can finance themselves and have physical control of the natural resources. This can be achieved through measures such as promoting political competition, strengthening democratic institutions, and increasing citizen participation in the political process.

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Appendix 1

Table A7: Descriptive statistics

Variable	Mean	Std. dev.	Min	Max
GDP	4.00e+10	8.07e+10	6.21e+08	4.77e+11
TNR	10.009	8.927	0	55.85
PS	-0.511	0.848	-4.038	2.028
IVA	9.27e+09	2.31e+10	0	1.11e+11
GOV	-0.618	0.569	-2.781	1.056
TO	61.026	30.654	0	175.8
HCI	1.722	0.513	0	2.940