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Posted Date: 6 November 2025

doi: 10.20944/preprints202511.0360.v1

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Article

Resource Dependence and Social Stratification in Sub-Saharan Africa

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Abstract

This study examines the relationship between natural resource rents and income inequality in Sub-Saharan Africa (SSA). The empirical analysis covers 24 countries over the period 1998-2020. Econometric estimations are conducted using both fixed and random effects models to account for country-specific and time-invariant factors. Using the Gini coefficient as a proxy for inequality, the results suggest that total natural resource rents do not have a statistically significant effect on income inequality in the region. In contrast, access to financial services and digital technologies appear to be more influential in reducing inequality. The findings highlight the potential importance of inclusive development policies, such as allocating resource wealth to social programs in education, healthcare, and infrastructure. Additionally, promoting economic diversification and strengthening governance institutions may support more effective management of natural resources. The observed negative and statistically significant associations between information and communication technology (ICT) and financial development with inequality indicate that investments in ICT infrastructure and measures to enhance financial inclusion could contribute to addressing income disparities in the region.

Keywords: inequality; Sub-Saharan Africa; natural resource rents; Gini coefficient

1. Introduction

The 2024 *Poverty, Prosperity, and Planet Report* by the World Bank highlights significant challenges faced by Sub-Saharan Africa (SSA), particularly its high Prosperity Gap, which is the widest among all global regions. The Prosperity Gap measures how far a society's average income falls short of the \$25 per person per day benchmark (adjusted for 2017 purchasing power parity). The report defines the Prosperity Gap as the factor by which incomes must be multiplied to reach this \$25 standard for every member of society. In SSA, this gap is particularly large, with incomes needing to be multiplied by over 12 times to meet the standard. This is in stark contrast to other developing regions such as South Asia (6.2 gap) and Latin America & the Caribbean (3.2), where the required increases are considerably smaller (World Bank, 2025). Furthermore, estimates by the World Bank (2024) show that one in five people globally live in a highly unequal society, with SSA and Latin America & the Caribbean being particularly affected by high levels of inequality. Within SSA, inequality is most pronounced in Southern, Central, and Eastern Africa, while Western Africa exhibits somewhat lower levels of inequality.

A study by Chancel et al. (2023), reinforcing the World Bank's findings, argue that the most significant contributor to SSA's overall inequality is within-country inequality, rather than differences between countries in the region. Further studies, like those by Shimeles & Nabassaga (2018), point to the role of ethnic fractionalization in increasing inequality in Africa, particularly in relation to social issues like child mortality and disease burdens. They state that these negative effects can be mitigated through improved governance, which could help reduce disparities and promote more equitable outcomes.

The high prosperity gap and within inequality levels in Africa scenario introduces an interesting paradox. Thus, considering Africa's vast wealth in natural resources, such as cobalt (70% of global reserves), diamonds (51.6%), and oil (10% of global production), it is surprising that the continent struggles with high inequality. This contradiction raises important questions about how natural resource wealth can contribute to income inequality, a topic that has been underexplored in existing research (Fleming & Measham (2015)). This gap in research suggests the need for further investigation into how resource rents, revenues from the extraction and export of natural resources affect income inequality in SSA. Specifically, we investigate how revenues from natural resource extraction (minerals, oil, natural gas, coal, and forest) influence income inequality in SSA. Thus, we investigate whether these rents exacerbate inequality or have a redistributive effect on inequality in the region.

The paper is structured as follows. The next section reviews the theoretical and empirical literature. Section 2 presents the methodology and the regression modelling approach. Section 3 reports the results and provides analysis. Finally, Section 4 concludes the study, highlighting its contributions and limitations.

2. Theoretical and Empirical Literature

2.1. *Resource-Curse Theory*

The relationship between natural resources and income inequality can be assessed based on the resource- curse hypothesis (Havranek et al., 2016; Parceró & Papyrakis, 2016; Nademi, 2018; Gemicioglu et al., 2024). A key theoretical proposition for the poor economic performance of resource-rich countries despite the natural resource abundance is Dutch Disease theory. The theory describes how the discovery of natural gas in the Netherlands in the 1960s led to a decline in the competitiveness of other sectors. That is, while countries might experience short-term economic gains from the exploitation of natural resources, these benefits can undermine other sectors of the economy in the long term.

Therefore, despite the apparent short-term benefits of resource wealth, countries that depend heavily on natural resources can face long-term challenges including deindustrialization, underinvestment in human capital, and economic instability. According to Iimi (2007), the Dutch Disease theory presents the most compelling reason why resource-based development paths can hinder long-term economic growth. It posits that the sudden influx of wealth from natural resources contributes to the neglect of the secondary sector. Due to this neglect, the secondary sector, particularly manufacturing and agriculture become less competitive in the global market (Auty, 2007). This occurs because the thriving resource sector attracts foreign capital and raises the value of the domestic currency, making non-resource sectors more expensive and less competitive in international markets (Gylfason, 2001).

Over time, this dependence on a single sector makes the economy vulnerable to fluctuations in global commodity prices, reducing the resilience needed for sustainable growth (Papyrakis & Gerlagh, 2004; Frankel, 2010). Furthermore, the neglect of the secondary sector limits the potential for job creation, technological advancement, and productivity growth in the broader economy, further hindering long-term economic development (Davis & Tilton, 2005).

On the other hand, scholars such as Collier & Hoeffler (2005); Hodler (2006); Deacon & Rode (2012); and Havranek et al. (2016) trace the genesis of the resource-curse to rent-seeking and weak institutions. Rent-seeking in natural resource sectors is driven by competition over resource revenues by political actors, businesses, and interest groups, resulting in skewed distribution of wealth towards specific groups (Kolstad & Søreide, 2009). Thus, instead of these resources benefiting the broader population, the wealth is often captured by a narrow group, leading to resource wealth misallocation and increased income inequality.

Other scholars, such as Robinson et al. (2006), Mehlum et al. (2006) and Arezki & Gylfason (2011) highlight corruption, stemming from weak institutions as responsible for the resource-curse. In this context, the corruption results in the misallocation of resource revenues, diverting resource wealth

away from productive uses into the hands of a few individuals or groups (Torvik, 2009); (Bhattacharyya & Hodler, 2010).

2.2. Ethnic Polarization

The literature suggests that resource wealth can exacerbate inequality in ethnically polarized societies, where the distribution of resources may favour one ethnic group over others, leading to tensions, conflict, and economic disparities. Key studies suggesting that resource wealth widens inequality in ethnically polarized or unequal societies can be found in Baggio & Papyrakis (2010); Hussain (2015); Wadho & Hussain (2023); Hodler (2006); Alesina & Glaeser (2004).

Baggio & Papyrakis notes that resource wealth can worsen inequality in societies with high ethnic fractionalization. They suggest that when groups are divided along ethnic lines, the benefits from resource wealth are often not shared equally, which intensifies existing inequalities.

Hussain's study delves into how natural resource wealth interacts with ethnic fractionalization, especially in countries where ethnic groups have different access to political power. It highlights that such resource wealth, rather than improving the economic condition of all groups, can increase the political and economic marginalization of certain ethnic communities. Hodler's work offers empirical evidence of the resource curse in relation to ethnic fractionalization, arguing that resource wealth can worsen ethnic tensions, leading to lower growth and political instability in divided societies. Wadho & Hussain's recent work focused on the role of natural resources in contributing to ethnic divisions. They argue that resource wealth in ethnically divided countries can lead to exacerbated inequalities and conflict. Alesina & Glaeser provide a broader discussion on the relationship between ethnic diversity and economic outcomes, suggesting that in ethnically heterogeneous societies, resources are more likely to be captured by one ethnic group, leading to social unrest and economic inefficiency.

In essence, these scholars emphasize the complex relationship between resource wealth, ethnic diversity, and inequality in societies that are already characterized by high levels of ethnic polarization. In these contexts, resource wealth often does not lead to broad-based prosperity but rather magnifies existing disparities, contributing to the resource-curse.

In contrast, scholars such as Caselli & Coleman (2006); Brunnschweiler (2008); Fum & Hodler (2010) argue that ethnically homogeneous societies are less susceptible to the resource-curse, compared to more heterogeneous or ethnically fractionalized societies.

Caselli & Coleman's work discusses how homogeneity can mitigate the negative effects of resource wealth, suggesting that when a society is ethnically homogeneous, there is a higher likelihood that natural resource rents will be shared more evenly. They argue that the lack of competition among ethnic groups for resources reduces the likelihood of political and social tensions.

Brunnschweiler states that in homogeneous societies, the risks of corruption, misallocation of wealth, and political instability are less pronounced because the absence of ethnic competition makes it easier for political institutions to function effectively and ensure that resource wealth is distributed more fairly.

The work of Fum & Hodler explore the idea that ethnically homogeneous societies face fewer problems related to resource wealth distribution. They argue that when there is greater social cohesion within a society, it becomes easier to implement policies that promote inclusive growth and shared prosperity. This reduces the risk of the resource-curse, which often manifests in divided societies where resource rents are captured by one ethnic group at the expense of others.

The core argument in these studies is that ethnic homogeneity fosters social capital, trust, and collective action, which are essential for managing resource wealth effectively and ensuring that it benefits the population at large.

2.3. Empirical Literature

In one of the pioneering empirical studies in this field, Bourguignon & Morrisson (1990) examined the relationship between natural resource wealth and income inequality in developing countries. They used explanatory variables such as factor endowments, ownership structures, and

foreign trade distortions. Their findings revealed that mineral resource wealth was a significant determinant of income inequality, meaning that countries with abundant mineral resources tended to experience higher levels of inequality.

Nademi (2018) investigated the relationship between oil revenues and inequality in Iran from 1969 to 2012. His study found that an increase in oil revenues led to a rise in income inequality in Iran.

Davis (2020) examined the effect of mining and oil revenues on income inequality across a broad range of mining and oil economies. The findings showed that mining production caused higher national income inequality, both on a gross, pre-tax basis and a net, post-tax and post-redistribution basis. On the other hand, oil production did not lead to higher gross or net income inequality.

Goderis and Malone (2011) analysed the time path of income inequality following natural resource booms in resource-rich countries, using data for 90 countries between 1965 and 1999. They found that oil and mineral resources were associated with long-term inequality. They showed that while income inequality initially decreases following a resource boom, it steadily increases over time until the effects of the boom dissipate.

Finally, Reeson et al. (2012) studied the impact of mining activity on income inequality in regional Australia. They found that while personal income is significantly associated with levels of mining employment, income inequality initially increases with mining activity before decreasing at medium to high levels of mining employment.

Alvarado et al. (2021) examined the impact of natural resource rents on inequality, considering the role of the shadow economy and the human capital index. They found that countries with the highest income dependence on natural resources tend to have higher levels of income inequality.

Anyanwu et al. (2021) assessed the relationship between inequality and economic growth in resource-rich and non-resource-rich countries. Their findings confirmed that the negative impact of inequality on economic growth is amplified in countries endowed with abundant natural resources.

3. Data and Methodology

The panel data of 24 SSA countries span from the year 1998 to 2020 and include key economic and social indicators. These include income inequality, total trade, financial development, and information and communication technology. Income inequality is proxied using the Gini coefficient, with data sourced from the World Income Inequality Database (WIID, version X) maintained by the United Nations University World Institute for Development Economics Research (UNU-WIDER).

The WIID harmonizes inequality estimates derived from household surveys, official statistics, and secondary sources, providing one of the most comprehensive and comparable cross-national datasets on income inequality (UNU-WIDER, 2023).

Data on total natural resource rents, which encompass forest, mineral, oil, natural gas, and coal rents, are sourced from the World Bank's *World Development Indicators* database (World Bank, 2023). These rents are estimated as the difference between the market value of resource production and the average cost of production, following the methodology outlined in *The Changing Wealth of Nations* (World Bank, 2011).

Data on foreign direct investment (FDI) are sourced from the World Bank's *World Development Indicators* database. FDI represents net inflows of investment aimed at acquiring a lasting management interest in a foreign enterprise. It includes equity capital, reinvested earnings, and other capital, and is reported as a percentage of GDP, following the IMF's *Balance of Payments Manual* guidelines (IMF, 2009).

Data on financial development are sourced from the World Bank's *Global Financial Development Database*. Financial development is proxied by bank deposits as a percentage of GDP, defined as the total value of demand, time, and savings deposits at domestic deposit money banks relative to GDP, consistent with the methodology outlined by Levine et al. (2012).

Data on information and communication technology (ICT) are sourced from the World Bank's *World Development Indicators* database and proxied by the percentage of individuals using the

Internet. This indicator measures the share of the population that has accessed the Internet within the last three months using any device, including computers, mobile phones, or digital televisions, consistent with definitions provided by the International Telecommunication Union (ITU, 2023).

Finally, data on total trade, defined as the sum of exports and imports of goods and services, are sourced from the World Bank's *World Development Indicators* database. This indicator is expressed as a percentage of GDP, reflecting the share of trade in a country's overall economic output during a given period, in line with the System of National Accounts methodology (United Nations, 2009).

3.1. Dependent and Independent Variables

The dependent variable is income inequality, measured using the Gini coefficient. The Gini coefficient is the most widely used and recognized measure of inequality, ranging from 0, representing perfect equality where all individuals earn the same income, to 100, representing perfect inequality where a single individual captures all income. Unlike measures that focus on specific segments of the income distribution, the Gini coefficient incorporates the entire distribution of income, providing a comprehensive assessment of inequality (Jenkins, 2015; UNU-WIDER, 2023).

The main independent variable is total natural resource rents. Natural resource rents represent the economic profits derived from the extraction and utilization of natural resources, including minerals, oil, natural gas, coal, and forests. This indicator reflects the share of a country's gross domestic product (GDP) that is generated from natural resources, providing a measure of the economy's reliance on resource extraction and its potential impact on income distribution (World Bank, 2023).

3.2. Other Explanatory Variables

Building on previous measures of income inequality, this study incorporates additional explanatory variables, including information and communication technology (ICT), foreign direct investment (FDI), total trade, and financial development (Tsaurai, 2021; Dwumfour & Ntow-Gyamfi, 2018; Fleming & Measham, 2015; Loayza & Rigolini, 2016; Sincovich et al., 2018). The role of each of these variables in influencing income inequality is discussed in detail below.

Financial development facilitates access to financial services for businesses and entrepreneurial activities. However, collateral requirements and high borrowing costs often exclude poorer segments of the population (Maimbo et al., 2011; Makina, 2017). Consequently, it is typically the wealthier individuals who are able to leverage financial services for entrepreneurial ventures, which can exacerbate income inequality.

That notwithstanding, financial development facilitates access to financial services for businesses and entrepreneurs, which can lead to increased investment, stimulate economic growth, and reduce poverty and income inequality (Jalilian & Kirkpatrick, 2002; Sehrawat & Giri, 2018). Therefore, we expect a negative relationship between financial development and income inequality.

Foreign direct investment (FDI) can increase income inequality, as the profits made by foreign investors are often repatriated rather than reinvested in the domestic economy (Jaumotte et al., 2013). On the other hand, FDI can promote human capital development, generate employment, and create wealth, which can help reduce income inequality (Gohou & Soumaré, 2012; Fowowe & Shuaibu, 2014; Huynh, 2021). As a result, we expect an inverse relationship between FDI and income inequality.

Information and communication technology (ICT) can enhance quality education, foster innovation, and promote high-income skills, all of which can help reduce poverty and inequality. However, in developing countries, technology-related skills are often more accessible to the rich, who can afford them, leaving the poor at a disadvantage. On the other hand, technological development improves the quality of education, fosters innovative research skills, and creates more employment opportunities, which can reduce inequality (Mushtaq & Bruneau, 2019; Asongu & Odhiambo, 2019).

Trade enables domestic firms to access cheap raw materials and technology from around the world. However, trade openness can also negatively impact local businesses, as they may struggle to compete with inexpensive products from industrialized economies that benefit from lower

production costs, which may not necessarily affect inequality. Despite this, trade openness generally allows domestic firms to acquire affordable raw materials and technology, enhancing their ability to expand, create jobs, and generate wealth. Additionally, it provides consumers with cheaper products, which contributes to reducing poverty and inequality (Balassa, 1978; Bayar & Sezgin, 2017; Dorn et al., 2022). Therefore, we expect a negative relationship between trade openness and income inequality.

4. Hypotheses Development

4.1. Null Hypothesis

Total natural resource rents have no effect on income inequality in sub-Saharan Africa:
We formulate this hypothesis based on the Dutch Disease effect, which suggests that large inflows of resource rents can negatively impact other sectors of the economy. This can exacerbate inequality, particularly when wealth from natural resources is not evenly distributed or invested in broad-based economic development. Furthermore, as is common in many developing regions, natural resource wealth in many SSA countries is often concentrated in the hands of a few elites. This concentration can perpetuate or even deepen income inequality, especially when the wealth generated from resources is not redistributed or used to build essential infrastructure, healthcare, or education.

Finally, given the heavy reliance of many SSA countries on the export of raw commodities, income from natural resources can be volatile, reflecting fluctuations in global prices. This volatility can make it difficult to ensure stable income distribution, further exacerbating inequality, particularly for those who depend on the broader economy rather than resource-based wealth.

4.2. Alternative Hypothesis

Total natural resource rents reduce income inequality in Sub-Saharan Africa:
We formulate this hypothesis based on the fact that resource rents provide an additional source of income for economies, as they are in fixed supply and generate returns that significantly exceed their production costs. This is particularly important in SSA, where economies often struggle with limited industrial diversification and high dependence on agriculture. When managed effectively, natural resource rents can be invested in development projects, social programs, infrastructure, education, and healthcare. These investments can create jobs, improve living standards, and reduce inequality by benefiting a broader segment of the population.

Furthermore, the influx of rents from natural resources can drive economic growth and national prosperity, potentially lifting millions out of poverty and reducing income disparity. When resource revenues are used to promote small and medium-sized enterprises, improve infrastructure, or support industries outside the resource sector, they contribute to a more even distribution of wealth.

Finally, large-scale resource extraction can stimulate broad economic growth by linking other sectors such as transportation, construction, and services. This multiplier effect can create more employment opportunities, reducing unemployment and inequality. Additionally, sectors connected to natural resources may experience higher wages and better access to capital, which could further reduce disparities if the benefits are widely distributed across the labour force.

4.3. Model Specification

Equation 1 is the general model specification for the income inequality function:

$$INEQ = f(RENTS, ICT, FDI, TRA, FIN)$$
 (1)

Where, INEQ represents income inequality while RENTS, ICT, FDI, TRA, FIN represent total natural resource rents, information, communication and technology, foreign direct investment, total trade, and financial development respectively.

Equation 2 represents the econometric equation for income inequality:

$$INEQ_{it} = \beta_0 + \beta_1RENTS_{it} + \beta_2ICT_{it} + \beta_3FDI_{it} + \beta_4TRA_{it} + \beta_5FIN_{it} + \varepsilon_{it} \tag{2}$$

Where, $INEQ_{it}$ is the measure of income inequality in country i at time t , β_0 is the intercept, β_1 to β_5 is co-efficient of the independent variables, $RENTS_{it}$ is total natural resource rents in country i at time t , ICT_{it} is information, communication and technology in country i at time t , FDI_{it} is foreign direct investment in country i at time t , TRA_{it} is total trade in country i at time t , FIN_{it} is financial development in country i at time t and ε_{it} represents the error term.

4.4. Descriptive Statistics of Key Variables

Table 1 presents the summary statistics of the key variables, highlighting the considerable variation in income inequality across Sub-Saharan African countries. Inequality, measured by the Gini coefficient, ranges from a low of 36 in some countries to as high as 76 in others, with the regional average standing at approximately 57. Nigeria and Mali report the lowest average inequality, at 39 and 49 respectively, while South Africa and Burkina Faso record the highest, both around 69 (Table 2).

Table 1. Descriptive Statistics.

Variable	Description	Mean	Std. Dev.	Min.	Max.
Income inequality	Gini coefficient (values range from 0 to 100)	56.804	7.373	35.541	76.417
Resource rents	Total natural resource rents (% of GDP)	11.06	9.753	.533	59.684
Financial Dev.	Bank deposits to GDP (%)	21.2	13.435	1.228	70.006
ICT	Individuals using internet (% of population)	9.43	13.659	.003	72.748
FDI	Foreign direct investment, net inflows (% of GDP)	3.716	5.185	-8.73	39.811
Total trade	Exports and imports (% of GDP)	21.237	7.799	2.483	53.67

A similarly wide variation is observed in the share of natural resource rents to GDP. In some cases, resource rents account for nearly 60% of GDP, whereas in others, they contribute less than 1%. The Republic of Congo and Gabon stand out, with resource rents representing about 40% and 29% of GDP, respectively.

Notably, the Republic of Congo, where resource rents account for the largest share of GDP, is also among the countries with the highest levels of inequality. Its inequality score of 60 is substantially above the regional average of 56. In contrast, Mali presents a surprising case: despite having one of the lowest shares of resource rents to GDP (7.2%), it records the second-lowest inequality score at 49, significantly below the regional average.

These descriptive insights suggest that resource wealth does not automatically translate into inclusive growth or reduced inequality. Rather, as the case of the Republic of Congo demonstrates, countries with high resource rents may simultaneously experience some of the highest levels of income inequality in SSA.

Overall, while Table 1 highlights the overall variation in inequality and resource rents across the region, Table 2 provides a more detailed picture by ranking countries individually. For example, South Africa and Burkina Faso emerge at the top of the inequality rankings, with scores around 69, well above the regional average of 57. In contrast, Nigeria and Mali appear at the bottom of the inequality rankings, with relatively low scores of 39 and 49, respectively.

Turning to natural resource rents, the Republic of Congo and Gabon occupy the top ranks, with nearly 40% and 29% of their GDP derived from resource rents, while countries such as Mali report much lower levels, around 7%. Interestingly, the Republic of Congo not only has one of the highest shares of resource rents in GDP but also records one of the worst inequality outcomes, with a Gini score of 60, well above the regional average. By contrast, Mali combines one of the lowest resource rent shares with one of the best inequality outcomes, suggesting that abundant natural resources do not automatically translate into equitable income distribution. The Tables illustrate the diverse country experiences across the region, reinforcing the argument that the relationship between resource wealth and inequality is highly context dependent.

Table 2. Scores and Rankings on Gini Coefficient and Resource Rents.

Country	Gini coefficient (Score) (Rank)		Country	Resource rents (Score) (Rank)	
South Africa	69.14	1st	Congo Republic	39.54	1st
Burkina Faso	69.04	2nd	Gabon	28.79	2nd
Namibia	64.52	3rd	Congo Democratic Republic	23.23	3rd
Zambia	63.73	4th	Ethiopia	17.40	4th
Central Africa Republic	63.44	5th	Guinea	14.25	5th
Botswana	62.42	6th	Nigeria	13.07	6th
Zimbabwe	61.06	7th	Zambia	12.87	7th
Congo Republic	60.41	8th	Uganda	12.23	8th
Rwanda	59.47	9th	Ghana	11.25	9th
Cameroon	57.78	10th	Sierra Leone	11.14	10th
Kenya	57.34	11th	Central Africa Republic	10.68	11th
Mozambique	56.86	12th	Mozambique	10.64	12th
Uganda	56.44	13th	Burkina Faso	8.86	13th
Ghana	56.28	14th	Niger	8.03	14th
Congo Demo. Republic	55.97	15th	Mali	7.15	15th
Senegal	54.50	16th	Zimbabwe	6.88	16th
Tanzania	53.75	17th	Cameroon	6.59	17th
Sierra Leone	53.32	18th	Rwanda	6.36	18th
Niger	53.20	19th	Tanzania	5.19	19th
Guinea	52.36	20th	South Africa	5.04	20th
Gabon	49.29	21st	Kenya	3.05	21st
Ethiopia	49.08	22nd	Senegal	2.91	22nd
Mali	48.81	23rd	Botswana	2.06	23rd
Nigeria	39.39	24th	Namibia	1.75	24th

5. Results and Analyses

5.1. Panel Unit Root and Cointegration Analysis

To assess the time-series properties of the data, panel unit root tests were conducted using the Levin–Lin–Chu (LLC) procedure. As reported in Table 3, the dependent variable (Gini coefficient), total natural resource rents, and total trade are stationary at levels, whereas FDI and financial development are non-stationary. ICT was not included in the unit root tests due to missing values, resulting in an unbalanced panel. Given this mixed order of integration, the Westerlund (2008) panel cointegration test was employed to examine the presence of a long-run equilibrium relationship among the variables.

Table 3. Panel Unit Root Test.

Variable	Adjusted t*	p-value	Stationarity
Gini Coefficient	-5.1966	0.0000	Stationary
Natural Resources	-3.0591	0.0011	Stationary
Foreign Direct Investment	-1.1639	0.1222	Non-stationary
Total Trade	-5.9684	0.0000	Stationary
Financial Development	1.6292	0.9484	Non-stationary
Information and Communication Technology	–	–	Not included

The results, shown in Table 4, reveal a highly significant variance ratio ($p < 0.01$), allowing rejection of the null hypothesis of no cointegration. This confirms that despite differences in stationarity, the variables share a meaningful long-run relationship, justifying the use of regression analysis to estimate the effect of the independent variables on inequality. Thus, the combination of unit root and cointegration analyses ensures that the estimated relationships reflect long-term dynamics rather than spurious correlations.

Table 4. Panel Cointegration Test.

Test	Statistic	p-value	Conclusion
Variance Ratio	4.6082	0.0000	Reject H0

5.2. Results from OLS-Regression

The OLS-regression results reported Table 5 reveal several significant relationships between the explanatory variables and income inequality, proxied by the Gini coefficient. Natural resource rents have a negative and statistically significant effect on income inequality with a -.077 coefficient, suggesting that higher resource rents are associated with a modest reduction in inequality.

Contrarily, total trade exhibits a strong positive effect, with a large coefficient of .251, implying that increased trade openness tends to exacerbate income disparities.

Information and communication technology shows a negative and statistically significant relationship with the Gini coefficient, indicating that greater ICT penetration contributes to reducing income inequality in terms of enhancing access to information and economic opportunities. Conversely, financial development is positively linked to inequality with a coefficient of .156, reflecting the tendency for financial services to disproportionately benefit wealthier segments of society.

Finally, FDI shows a statistically significant negative relationship with the Gini coefficient, suggesting that FDI inflows may promote a more equitable distribution of income across the population.

The results generally support existing studies on the role of these variables in reducing income equality.

Table 5. Dependent Variable: Gini Coefficient.

Variable	OLS-regression		Variance inflation factor	
	Coef.	P-value	VIF	1/VIF
Natural Resource Rents	-.077**	.023	1.276	.784
Total Trade	.251***	.000	1.823	.549
Information and Communication Technology	-.172***	.000	1.346	.743
Financial Development	.156***	.000	2.384	.419
Foreign Direct Investment	-.159***	.008	1.12	.893
Constant	51.222***	.000	Mean VIF	1.59

Note: Asterisks indicate significance at 10% (*), 5% (**) and 1% (***).

Specifically, the negative relationship between FDI and inequality aligns with findings from Soumaré (2012), Fowowe and Shuaibu (2014), and Huynh (2021), which indicate that FDI can contribute to human capital development and employment creation. These channels may support poverty and inequality reduction, although the extent of these effects is likely to depend on contextual and institutional factors.

Similarly, the negative relationship between ICT and inequality is consistent with previous studies, such as those by Mushtaq & Bruneau (2019) and Asongu & Odhiambo (2019), which emphasize the role of technological advancements in improving education quality, fostering innovation, and creating jobs, factors that are crucial for addressing inequality.

Furthermore, the positive relationships observed between total trade, financial development, and inequality contrast with earlier findings by Jalilian and Kirkpatrick (2002) and Sehrawat and Giri (2018), which suggest that these variables play important roles in poverty reduction. In the SSA context, these outcomes may in part reflect structural constraints, such as unequal access to financial services and limited integration into global markets.

5.3. Multicollinearity Diagnosis

To assess multicollinearity, both pairwise correlations and Variance Inflation Factor (VIF) were analysed. Multicollinearity occurs when independent variables in a model are highly correlated with each other, making it difficult to isolate the individual effects of each variable on the dependent variable (Shrestha, 2020). The VIF results, presented in Table 5 alongside the OLS-regression indicate that multicollinearity is unlikely to bias the regression estimates, with values ranging from 1.12 for FDI to 2.38 for financial development, and a mean VIF of 1.59, well below the commonly cited threshold of five (Menard, 2002). The pairwise correlation matrix, reported in Table 6 also shows a generally weak correlations among the independent variables, with the strongest correlation of .64 observed between total trade and financial development. Although this reflects the expected association between trade integration and financial system development, it remains below the .8 threshold (O'Brien, 2007), indicating that multicollinearity does not pose a serious concern. Collectively, these diagnostics confirm that the independent variables are sufficiently distinct, supporting the robustness and reliability of the regression results.

Table 6. Pairwise Correlations.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) Gini coefficient	1.000					
(2) ICT	-0.069	1.000				
(3) FDI	-0.038	-0.043	1.000			
(4) Total Trade	0.333	0.313	0.209	1.000		
(5) Financial Dev.	0.321	0.499	0.096	0.641	1.000	
(6) Natural Resources	-0.185	-0.201	0.211	-0.077	-0.360	1.000

5.4. Results from Fixed and Random Effects Regression

The dataset covers a 22-year period across 24 SSA countries, raising potential concerns about unobserved time-invariant and country-specific characteristics that may not be adequately captured by a standard OLS-regression. Therefore, to strengthen the robustness of the results, fixed effects (FE) and random effects (RE) estimations were applied in examining the effects of the explanatory variables on inequality.

Thus, while the FE model controls for unobserved country-specific factors that may bias the estimates, the RE model improves efficiency and allows the inclusion of time-invariant regressors. This dual approach aims to enhance confidence in the validity of the conclusions and provide a more nuanced understanding of inequality dynamics in the region.

Results from the FE and RE estimations are presented in Table 7. The findings provide consistent evidence regarding the relationship between the explanatory variables and inequality in the region over the study period. ICT exhibits a negative and statistically significant association with inequality in both the FE and RE models, with coefficients of -.092 and -.095, respectively.

Total trade is positively associated with inequality in both specifications, with coefficients of .125 for the FE model and .126 for the RE model. This relationship may reflect structural trade imbalances, suggesting that the distributional effects of trade openness depend on complementary policies and broader structural conditions.

Financial development is consistently negatively associated with inequality, with coefficients of -.079 and

-.068 in the FE and RE models, respectively. This indicates that more developed financial systems may help reduce income disparities, although the magnitude of the effect varies slightly between models.

In contrast, natural resource rents and FDI are insignificant under both estimators, implying that their effects on inequality are neither stable nor robust over the period considered.

The consistency of results across the FE and RE models reinforces the reliability of the findings and suggests that ICT, trade, and financial development are among the more influential structural factors associated with income inequality in SSA. Overall, the results indicate that total natural resource rents do not have a statistically significant effect on income inequality in the region. Accordingly, there is no empirical basis to reject the null hypothesis in favour of the alternative.

Table 7. Dependent Variable: Gini Coefficient.

Variable	Fixed effects		Random effects	
	Coef.	P-value	Coef.	P-value
Natural Resource Rents	-.031	.299	-.039	.181
Total Trade	.125***	.000	.126***	.000
Information and Communication Technology	-.092***	.000	-.095***	.000
Financial Development	-.079***	.004	-.068**	.024

Foreign Direct Investment	-.006	.818	.012	.922
Constant	57.062***	.000	56.959***	.000

Note: Asterisks indicate significance at 10% (*), 5% (**) and 1% (***).

6. Conclusions

The primary objective of this study was to examine the effect of natural resource rents on income inequality in SSA, using a sample of 24 countries with sufficient data between 1998 and 2020. Applying both FE and RE estimations to account for country-specific and time-invariant factors, the analysis suggests that natural resource rents do not have a statistically significant effect on inequality in the region.

In contrast, ICT and financial development are associated with negative and statistically significant coefficients, pointing to a potential role of digital technologies and financial services in reducing inequality.

Total trade shows a statistically significant effect, though the direction of influence appears mixed, which may indicate that the distributional outcomes of trade openness depend on complementary policies and structural conditions.

The absence of evidence linking natural resource rents to reductions in inequality may be associated with features discussed in the resource-curse literature, where resource dependence can expose economies to global commodity price volatility and limit long-term growth and employment creation.

In settings characterized by limited governance capacity, low transparency, and insufficient investment in human capital, resource wealth may not necessarily contribute to more equitable outcomes and may, in some cases, reinforce disparities.

Overall, the results suggest that the relationship between natural resource rents and inequality may be influenced by broader institutional and structural factors. This indicates that outcomes are likely shaped less by the presence of resource wealth alone and more by how such wealth is managed, as well as by the extent to which economies diversify and create opportunities in other sectors.

This study is limited by data availability, as only 24 SSA countries had sufficient data for the analysis, with many countries lacking comprehensive records, especially during the earlier years. Moreover, the analysis does not account for possible lagged effects of natural resource rents, which may shape inequality dynamics over time. In addition, the use of aggregate resource rents may conceal important differences across resource types. Finally, political and institutional factors, which are likely to influence the relationship between natural resource rents and inequality, were also not incorporated.

Future research could address these limitations by utilizing more recent and comprehensive data, examining disaggregated measures of natural resources, and incorporating institutional factors to provide a more nuanced understanding of the determinants of income inequality.

Author Contributions: Conceptualization, GAA; methodology, GAA and IOM; validation, GAA and IOM; formal analysis, GAA; investigation, GAA and IOM; writing-original draft preparation, GAA; writing-review and editing, GAA and IOM; supervision, IOM. All authors have read and agreed to the published version of the manuscript.

Funding: There was no funding obtained for this study.

Informed Consent Statement: This article does not contain any studies with human participants performed by any of the authors.

Data Availability Statement: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Acknowledgments: Not applicable.

Conflicts of Interest: The authors declare no competing interests.

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