





Foreign aid, institutional quality, and income inequality in Africa: A dynamic panel threshold approach



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ABSTRACT

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This study examines the impact of foreign aid and institutions on income inequality in 23 African countries during the period from 2005 to 2017. The study used a newly proposed novel dynamic panel threshold technique. The results of the study found an institutional quality threshold value of 1.622. Below the threshold, foreign aid was found to positively and significantly influence income inequality. However, above the threshold, the coefficient of foreign aid was negative with statistical significance. This implies that foreign aid tends to diminish income inequality in the presence of quality institutions. The study also used the quantile regression method to check for robustness. It showed that the conclusion between aid and inequality is the same in most of the quantiles (0.1 and 0.2). The findings can be worthwhile for sketching proper aid policies to lessen inequality. Policymakers in Africa should prioritize establishing high-quality institutions and developing measures to improve existing ones. Thus, aid could potentially reduce income inequality. This study suggests that it is important to note that aid programs can be effective when tailored to the particular needs and circumstances of each beneficiary country, as one-size-fits-all methods may not produce the anticipated outcomes.

Contribution/ Originality: This study enhances the current body of research on the relationship between foreign assistance and income inequality in Africa. It does so by including institutional quality as a threshold variable and employing the newly created dynamic panel threshold approach.

1. INTRODUCTION

As part of a global development strategy, the world leaders committed to the Sustainable Development Goals (SDGs) in 2015, a set of seventeen goals to be achieved in fifteen years (United Nations, 2015). One of these goals (the 10th SDG) was to minimize inequality within and between nations by 2030. To reach a global inequality reduction objective, rich nations promised to boost their official development assistance (ODA) to deprived countries, donating 0.7% of their gross national income (GNI) (World Bank, 2023). Nevertheless, ODA by donor countries in 2021 amounted to USD 178.9 billion (0.33% of their combined GNI). Despite the ongoing global fight against global poverty, inequality is on the rise because the wealthiest 1% have amassed nearly 20 times more of the global affluence than the impoverished half of the populace (Oxfam, 2022). Moreover, 71 percent of the global

populace lives in the most unequal nation-states. This is very crucial because inequalities within nations are the inequalities people face day to day. Since 1990, inequality has grown in most advanced economies and in some developing countries (United Nations, 2020). However, the goal of minimizing income disparity cannot be attained unless everyone receives a fair income that is spent on satisfying basic necessities and enhancing the quality of life.

Over the past couple of decades, the African continent has experienced an extraordinary revival in terms of economic growth. However, the COVID-19 pandemic impeded lives and means of subsistence. Furthermore, the pandemic pushed 29 million Africans into extreme poverty and was responsible for the loss of approximately 22 million jobs in African countries in 2020 (African Development Bank, 2022). Moreover, there were disparities in growth throughout the African continent, with North Africa taking the lead with around 12% GDP growth, followed by these sub-regions of Africa: West Africa, Southern Africa, and Central Africa, with 4.8%, 4.3%, 4.2%, and 3.4% GDP growth, respectively. According to Boushey (2020), the growth of an economy is hindered when there is inequality. Consequently, African countries would have made greater advancements in poverty alleviation and growth if income disparity was smaller (Batuo, Kararach, & Malki, 2022). Although the mean overall score of the Gini index for Sub-Saharan Africa (SSA) relatively declined by 3.4% between 1991 and 2011, the United Nations Development Programme (2017) reports that SSA, hitherto, continues to be the region with the highest global inequality. However, Northern Africa is home to the lowest levels of inequality on the African continent (Chancel, Gethin, Cogneau, & Myczkowski, 2019). The UNDP further highlighted that ten of the nineteen (52%) countries with the highest global inequality are in Africa. It is imperative to consider that economic growth per person may not necessarily result in improved living conditions for the people; inclusive growth is required to be of long-term advantage to the whole population, affluent and poor alike (Gyamfi, Bokpin, Ackah, & Aboagye, 2019).

Achieving the goal of leaving no one behind and accomplishing and sustaining a higher-than-average rate of income development for the bottom 40 percent of the population is a priority for Africa by 2030. In spite of the growing volume of resource flows in the form of foreign aid to developing nations throughout the years, income disparity remains a huge global problem, particularly in African nations where the gulf between the haves (affluent) and the have-nots (poor) is considerably large. Against this backdrop, the study is intended to investigate how foreign aid influences income inequality in Africa's context. However, one of the most controversial subjects in recent literature has been how foreign aid impacts the alleviation of income inequality. Notwithstanding the fact that a number of empirical studies have demonstrated an inverse link between foreign aid and income inequality (Kasuga & Morita, 2018), some argue that "foreign aid" can only lessen income inequality if indeed the recipient nation has strong policies and institutions (Maqbool & Ali, 2022; Mouneer, Khan, & Safdar, 2022). As a cure for redistributing wealth, African governments, private industry actors, and international bodies need to devote a significant amount of consideration to the right metrics to realize a more inclusive and sustainable development.

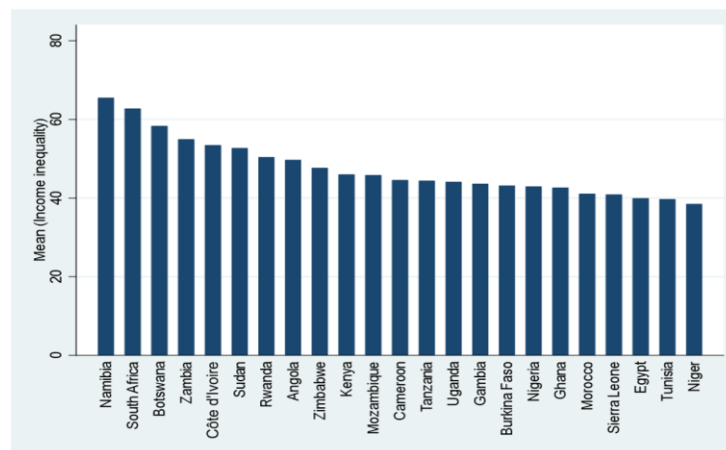


Figure 1. Mean of Gini index of 23 African countries from 2005 – 2020.

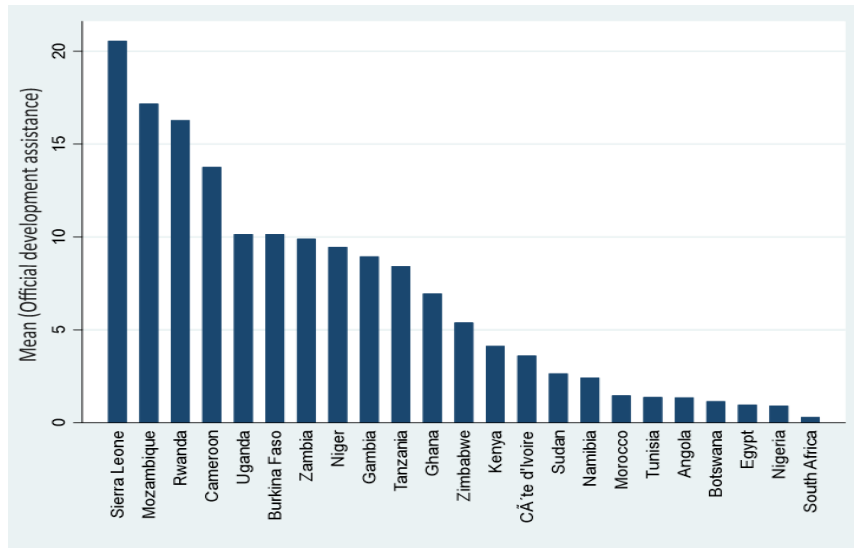


Figure 2. Mean of official development assistance of 23 African countries from 2005 –2020.

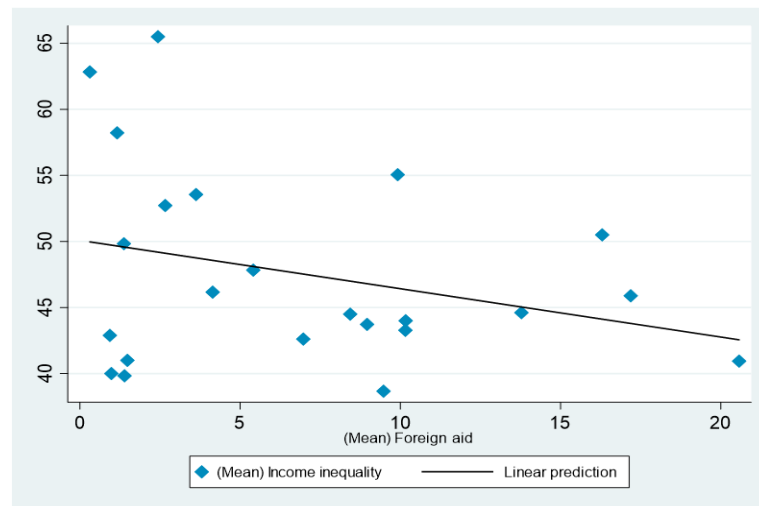


Figure 3. A scatter plot of official development assistance and Gini index, 2005 – 2020.

Foreign aid, along with external debt, foreign direct investment (FDI), and remittances, is an additional source of foreign capital for incoming emerging countries (Abate, 2022). However, it is questionable if too much aid is harmful or useful for reducing the rising income inequality among and within African nations. It can be observed that African countries are mostly plagued by relatively higher income inequality, which is represented by the Gini index. Sierra Leone, Mozambique, Rwanda, and Cameroon have the highest level of income inequality, as Figure 2 depicts. It can also be seen that there is diversity among African Countries in terms of the official development assistance they receive from donor countries and organizations, as Figure 1 illustrates. Namibia, South Africa, Botswana, and Zambia are among those aid recipient countries, as shown in the figure. In addition, Figure 3 shows that there is an adverse relationship between income inequality and foreign aid. This scatter plot enables us to discern the overall trend and pattern in the data and obtain insight into the potential impact of foreign aid on inequality in African nations. However, based on the results of other studies, it is difficult to determine how foreign aid would affect income inequality and whether the connection between the variables would be linear or non-linear. Not only are there contradictory findings regarding the impact of foreign aid on the income inequality of recipient nations, but there have also been no recent studies on the influence of institutional quality on the relationship between foreign aid and income inequality. There are three significant areas in which this study advances the literature. Initially, in order to better understand how foreign aid influences income inequality, a threshold

regression model is used in this study, as the quadratic term modelling technique frequently overestimates the threshold level.

Additionally, models that incorporate the square term frequently exhibit issues with multicollinearity or collinearity. Because of this, Seo and Shin (2016) and Seo, Kim, and Kim (2019) implemented the dynamic panel threshold model for the study. The adoption of the Hansen (1999) static approach has been challenged for inconsistency resulting from the persistence of the lagged outcome variable, which may result in erroneous results due to endogeneity bias. Secondly, in the literature, the square term of aid is used to model a nonlinear relationship between foreign assistance and wealth disparity. Because of the threshold impact of foreign aid on income inequality, its effect rises and falls monotonically and symmetrically with foreign aid. However, it is also likely that a certain amount of aid must be reached before it may have an impact on income disparity. In addition, the negative regions of the relationship may have a distinct absolute influence compared to the positive regions. This can, however, be incorporated into a threshold model rather than a quadratic model. In this paper, a threshold-effects-based model of regression illuminates how foreign aid affects income inequality. Thirdly, this study examines the effects of aid on income inequality in the presence of institutional quality as a threshold variable. Prior studies used institutional quality data gathered from world governance indicators (WGI), while this study used data from the International Country Risk Guide (ICRG).

The rest of this paper is distributed as follows: Following the introduction in the first section, the second section reviews the prior research on the link between foreign aid and income inequality; the third section describes the model specification, data, and estimation method; the results are discussed in the fourth section; and finally, the last section concludes the paper and provides limitations and recommendations.

2. LITERATURE REVIEW

2.1. Foreign Aid and Income Inequality

Over the preceding two decades, the usefulness and worth of international aid have been vigorously debated. Castells-Quintana and Larrú (2015) examined the impact of aid on 18 Latin American countries' income distribution over the past 20 years. Despite Latin America having some of the world's most unequal nations, international aid was found to reduce Latin American economic disparity after controlling for covariates. Berrittella (2017) evaluated the effects of foreign assistance agreement stability on income transfers between countries, notwithstanding the limits given by the participation of varied and self-interested donor states in the coordination of foreign aid policies by individual countries. The results showed that foreign assistance policy stability reduced the global income imbalance by moving income from the rich to the poor. Sharma and Abekah (2017) studied how foreign direct investment and foreign aid affected income inequality in 71 African and South American states between 1970 and 2014. The study indicated that foreign direct investment reduces income disparity, whereas foreign aid increases it. Kasuga and Morita (2018) evaluated the hypothesis that pro-poor aid lowers inequality using dynamic panel techniques and panel data from 1996 to 2014. The results showed that pro-poor assistance reduces inequality.

In a study by Younsi, Khemili, and Bechtini (2019), random effects and the system-GMM dynamic panel model were used to analyze foreign aid and income disparity in 16 African states. The results revealed that foreign aid, foreign direct investment, trade openness, and corruption reduce income disparities. The financial sector's development, quality of institutions, and regulations can also lower income disparities and increase growth in the economy, according to Younsi et al. (2019). Akobeng (2020) examined SSA poverty, foreign aid, and institutional democracy using the 2 stage least squares (2SLS) estimator. Foreign aid reduced poverty in various ways. After taking into account household average incomes, GDP per capita, and income inequality, institutional democracy made the effects of foreign aid and its parts on reducing poverty even stronger. This suggests that good political institutions may be necessary to combine foreign aid with the Sustainable Development Goals 2030 and the Africa Union Agenda 2063. Osode, Iheonu, and Dauda (2022) studied the effects of globalization and institutional quality

on income inequality using instrumental variable quantile regression, which accounts for simultaneity and reverse causality.

Trade globalization greatly reduces income disparity in low-income countries with improved institutions, but it also raises income inequality in high-income nations with improved institutions. As institutional quality advances, foreign direct investment and official development aid (financial globalization) increase inequality in income in nations with high- and low-income disparities, respectively.

In accordance with the extant body of studies regarding income inequality (Hartwell, Horvath, Horvathova, & Popova, 2019; Maddala & Wu, 1999), the primary socioeconomic, political, and cultural factors of income inequality are not, however, consensually agreed upon by the abundant existing literature. Kabir (2020) investigated whether foreign aid lowers disparities in income in emerging economies and smaller samples of nations from South Asia, Africa, and South American countries that generally share social and economic characteristics. Panel data from eight sub-samples showed that foreign aid reduced wealth gaps in most nations that are developing. The efficiency of foreign aid declines when institutional quality is considered, which is perplexing and destructive. Maqbool and Ali (2022) used generalized method of moments (GMM) approach and panel data from 78 recipient nations over 14 years to examine foreign aid, wealth disparities, and corruption control. The study found that total aid raises "income inequality," while economic, production, and humanitarian aid decrease it, multi-sector aid increases it, and social aid has no effect. Avom, Ovono, and Nkoa (2022) employed panel quantile regression (QR) to examine how natural resource rents affected income inequality in 42 SSA nations from 1998 to 2018. Natural resource rents decrease income inequality statistically. Natural resource rents also increase income inequality in all regions, with the exception of Southern Africa, indicating that SSA states should increase the redistribution of income.

2.2. Institutional Quality and Income Inequality

Hartwell et al. (2019) explored how democratic institutions impact the nexus between natural resources and income disparity, hypothesizing that democratic institutions can mitigate resource-induced income inequality. A cross-country regression study based on a literature review demonstrated that democratic institutions moderate the effect of natural resources on income disparity. The results found that natural resources can reduce inequality in countries with good democratic institutions. Kunawotor and Bokpin (2020) looked into institutional quality as a factor in Africa's wealth disparity. Institutions did not affect the gap in income by using a different GMM with standard errors that were robust. Corruption control and law enforcement dramatically reduce economic inequality. Government efficacy, political stability, voice, accountability, and regulatory quality showed no statistically significant effects on income disparity. Kaidi and Mensi (2020) studied financial progress, political institutions, income inequality, and poverty in 93 democratic and 31 autocratic states using different estimating approaches. The findings showed that financial progress and democratic institutions individually reduced income disparity and poverty in democratic countries, unlike authoritarian regimes.

Osode et al. (2022) used instrumental variable quantile regression with correction for simultaneity causality to look at how globalisation and the quality of institutions affect income inequality and how they are related. Trade globalization notably reduces income disparity in low-income nations with increased institutional quality, but it also raises income inequality in high-income countries with improved institutions. There is no consensus on what makes institutions good, yet they help economies run smoothly and increase economic agents' living standards. Madni (2019) examined in what way cultural multiplicity, income disparity, and public investment affect institutional quality in Pakistan using autoregressive distributed lag (ARDL) from 1984 to 2015. The results revealed that public spending improves institutions, while ethnic diversity and wealth inequality deteriorate institutions. Ullah, Kui, Ullah, Pinglu, and Khan (2021) examined how globalization, electronic government, financial development, and institutional quality diminish the income gap and impoverishment in "One Belt, One Road" nations. The research

assessed consistency employing the two-step System GMM and Driscoll–Kraay standard error estimation with 64 One Belt, One Road economies from 2003 to 2018.

Results show that globalization, economic development, digital governance, government spending, and inflation reduce income and poverty, while financial growth, gross capital formation, and population size improve inequality and poverty. Financial and institutional sustainability and institutional quality also diminished economic disparity and poverty in Belt and Road nations. Law and Soon (2020) used GMM (generalized method of moments) to examine how the quality of institutions influences inflation and disparities in wealth in 65 affluent and emerging economies between 1987 and 2014. According to the findings, price increases exacerbate disparities in income, whereas the quality of institutions reduces them. Nonetheless, the marginal consequences demonstrated that rising prices and the quality of institutions minimize income inequality. Berdiev, Goel, and Saunoris (2020) used mediation analysis to assess whether corruption, an essential feature of institutional quality, mediates the effect of cultural differences on economic progress. Findings from a large sample of nations revealed that ethnic inequality negatively impacts growth through corruption. Thus, ethnic and income disparity policies that ignore corruption are unlikely to achieve development goals. Maqbool and Ali (2022) reexamined foreign aid and wealth disparity. They used generalized technique of moment's estimation using panel data from 78 recipient nations over 14 years to study the aid-inequality link and corruption control. The findings revealed that total aid increases income disparity, whereas economic, production, humanitarian, and multi-sector assistance decrease income disparity, but social support has no effect. When corruption is considered, however, international assistance has a negative effect on wealth disparity.

3. METHODOLOGY

3.1. Empirical Model and Data

The current study used the Chong, Gradstein, and Calderon (2009) model to examine how foreign aid affects income inequality and the role of institution quality as a threshold variable. Then, the following equation represents the study's model specification.

$$IIQ_{it} = \beta_0 + \beta_1 AID_{it} + \beta_2 INSQ_{it} + \beta_3 AID * INSQ_{it} + \beta_4 X_{it} + \varepsilon_{it} \quad (1)$$

Where IIQ_{it} denotes income inequality and is a proxy for the Gini coefficient gathered from Standardized World Income Inequality Data (SWIID). Foreign aid is denoted by the Official Development Assistance (ODA) acquired as a percent of Gross National Income collected from world development indicators (WDI), and it is the primary regressor variable in the study. The other variables of interest are $INSQ$ (institutional quality) gathered from international country risk guide (ICRG) and the $ODA * INSQ$ which also denotes the interaction term. On the other hand, X represents the control variables like trade openness, real GDP, foreign direct investment, and education. While ε_{it} stands an error term. Table 1 presents the study's variables: income inequality, foreign aid, institutional quality, trade openness, economic growth, and foreign direct investment. The table summarizes these variables and their study relevance. The table also provides details like variable-specific measurements, sources of the data, and expected signs to help understand each variable's characteristics in the study.

Table 1. Summary of data description.

Variables	Descriptions	Measurement	Sources	Exp. sign
Foreign aid	Official development assistance (ODA)	Net ODA % GNI	WDI	-
Inequality	Income inequality	Gini coefficient	SWIID	
Institutions	Institutional quality	Index	ICRG	-
Economic growth	GDP per capita	Current US\$	WDI	+
Trade openness	Ratio of exports and imports to GDP	% of GDP	WDI	-
FDI	Foreign direct investment	% of GDP	WDI	+

3.2. Estimation Technique

This study uses Equation 2a to look into the previously suggested nonlinear link between foreign aid and income inequality. This equation is best for finding the occurrence of contingent effects. In the study, a novel econometric method, the dynamic panel threshold, is used, which is founded on the works of Hansen (1999). In modern times, it has become more prevalent as it is used in different areas such as public debt studies, financial development studies, inflation research, etc. The panel threshold strategy that Hansen (1999) created is only applicable to static models in which both the covariates and threshold variables must be exogenous. Kremer, Bick, and Nautz (2013) are a good example of an effort that has been made in order to expand the previous study of Hansen (1999) into a dynamic panel threshold. Yet, an issue in their research is the burden of over preventive notions about the exogeneity of threshold variables despite the prior and also the covariates in the event at the end. Seo and Shin (2016) finally suggested a dynamic panel threshold that restrains the essence of covariates and threshold variables. This method is appropriate even in the presence of an endogeneity issue. As the problem of endogeneity and inverse causation is supposed to be normal with regard to some studies. For calculating the linearity test's bootstrapping, Seo et al. (2019) introduced the most recent version of the dynamic panel threshold method, which makes use of a time-efficient bootstrapping algorithm. Therefore, the current study employs this approach to investigate the relationship between foreign aid and income inequality with the threshold effects of institutional quality. This designates how foreign aid affects inequality below as well as above a certain value of institutions.

$$IIQ_{it} = \mu_i + \beta_1 Aid_{it} I(Aid_{it} \leq \lambda) + \delta 1 I + (Aid_{it} \leq \lambda) + \beta_2 Aid_{it} I(Aid_{it} > \lambda) + \alpha X_{it} + \theta_t + \varepsilon_{it}$$

(Equation 2a)

Then, the impact of the quality of institutions in influencing foreign aid and income inequality below and above a definite point of a threshold with respect to aid is as follows:

$$IIQ_{it} = \mu_i + \beta_1 Aid_{it} I(INS_{it} \leq \gamma) + \delta 1 I(INS_{it} \leq \gamma) + \beta_2 Aid_{it} I(Aid_{it} > \gamma) + \alpha X_{it} + \theta_t + \varepsilon_{it}$$

(Equation 2b)

Income inequality (IIQ), foreign aid (Aid), institutions (INS), and the control variables (X) are represented in Equation 1. The country-fixed effect denoted by (μ_i) describes the heterogeneity of the cross-sectional unit's diverse regulations and conclusions, whereas the effect of time is denoted by (θ_t). These are the variables of interest in the two equations. The "indicator function" ($I(\cdot)$) stands for the quality threshold of an institution in this context.

This study utilized the descriptive statistics of variables in Table 2 and the analysis of the correlation of variables in Table 3. First- and second-generation panel unit root tests of Im, Pesaran, and Shin (2003) and Pesaran (2007) were employed, as shown in Table 5. Finally, it used first- and second-generation cointegration tests (Kao, 1999; Pedroni, 1999) and Westerlund (2007).

4. RESULTS AND DISCUSSION

The variables summary statistics of the current study are presented in Table 2.

Table 2. Descriptive statistics of the variables.

	IIQ	ODA/GNI	INSQ	TRADE	GDPPC	FDI	ODA*INSQ
Mean	47.544	6.862	4	62.889	1872.95	14.857	1.691
Median	45	4.613	3.964	57.838	1173.15	13.657	1.812
Maximum	66.1	43.702	7.304	152.547	8810.93	50.456	5.158
Minimum	37.16	0.014	0.683	1.377	138.699	0.274	-5.612
Std. dev.	7.277	6.624	1.324	26.042	1808.07	4.815	1.823
Skewness	0.989	1.328	0.148	0.493	1.506	3.442	-0.354
Kurtosis	3.116	5.408	2.533	2.710	4.710	20.678	2.578
Jarque-Bera	1.9e-15	6.6e-49	0.071	1.1e-04	1.1e-45	0	0.002
Observations	414	414	414	414	414	414	414

Note: The *represents the multiplication sign which can be written in different ways e.g., (ODAXINSQ).

The value of the dependent variable in the study ranges between 37 and 66, with an average of 47. For the sample nations included in the investigation, the average annual rate of foreign aid over the course of the study's 17-year period was 6.8 billion dollars, the GDP per capita accounted for 1,872 dollars, FDI was responsible for 14.8% of the GDP, and trade openness accounted for 62.8% of the average yearly increase in economic activity.

According to Table 3, the associations between foreign aid and income inequality are negative (-0.2585), whereas institutional quality is positively related to income inequality (0.1763), and the interaction variable (foreign aid * institutional quality) has a negative link with inequality. (-0.2798). However, control variables such as per capita gross domestic product (GDP) and trade openness are positively linked with inequality, whereas foreign direct investment is adversely related to income inequality.

Table 3. Correlation analysis.

Variables	IIQ	ODA/GNI	INSQ	TRADE	GDPPC	FDI	ODA*INSQ
IIQ	1.0000						
ODA/GNI	-0.258***	1.0000					
INSQ	0.176***	-0.062	1.0000				
TRADE	0.198***	-0.116**	0.353***	1.0000			
GDPPC	0.541***	-0.534***	0.314***	0.408***	1.0000		
FDI	-0.042	0.205***	0.148***	0.350***	-0.124**	1.0000	
ODA*INSQ	-0.279***	0.835	0.120***	-0.098	-0.636**	0.298*	1.0000

Note: The notations ***, **, and * denote degrees of significance that are 1%, 5%, and 10%, respectively.

The cross-sectional dependence (CD) findings are presented in Table 4. The CD test has advantages for establishing if the first-generation (Im et al., 2003) or second-generation unit root tests (Pesaran, 2007) are valid for the study variables, considering that the data set incorporates cross-sectional dependence.

Table 4, moreover, presents the results of the slope homogeneity test. Using the bias-adjusted version of the slope homogeneous test, we find that the null hypothesis that the slopes in the panel data are all the same is not true. It cannot, however, deny the existence of country-specific heterogeneity in African economies. This method acknowledges that, in the long term, the regressors of cross-sections are either heterogeneous or homogenous. Then, it is useful for determining if panel data exhibits cross-sectional homogeneity or heterogeneity.

Table 4. Cross-sectional dependence and slope homogeneity test.

Cross-sectional dependence test results			Slope homogeneity test results	
Variables	Pesaran CD	P-value	Delta	Bias-adjusted delta
IIQ	-0.35	0.726	-----	-----
ODA/GNI	5.91	0.000	12.877***	14.106***
INSQ	14.74	0.000	8.238***	9.024***
GDPPC	56.76	0.000	30.285***	33.175***
TRADE	6.44	0.000	13.629***	14.930***
FDI	2.89	0.004	8.864***	9.710***
ODA*INSQ	7.41	0.000	14.033***	15.372***

Note: Standard errors in parentheses: *** p<0.01, * p<0.1.

In order to exclude any possibility of erroneous inferences, the study utilized both first-generation and second-generation unit root testing. Table 5 displays the findings obtained from Im et al. (2003) first-generation panel unit root testing. It shows that all of the variables are stationary when compared to the first difference; however, the great majority of the variables are not stationary when compared to the level, with ODA/GNI and FDI being the exceptions. But this study used a second-generation Pesaran (2007) CIPS panel unit root test, which allows cross-sectional dependence on the series and gives more accurate results than first-generation tests. Thus, Table 5 shows that the parameters are steady at the level and when first-differenced based on the results of the second-generation

unit root tests. Kao (1999) and Pedroni (1999) cointegration tests demonstrated that there is a suggestion of a long-run association among the variables of the study. The findings of these tests are provided in Table 6, and they support the existence of a long-standing connection among the variables. However, first-generation panel cointegration tests cannot handle structural breaks, serial correlations, heteroscedasticity and cross-sectional dependency of the countries, so these tests may provide misleading findings. But the Westerlund (2007) test of cointegration deals with all the aforementioned issues and provides robust results compared with old cointegration tests. Considering the estimated p-value of less than 0.05 (Table 6), therefore we reject the null hypothesis of no cointegration, meaning that there is a long-run association among the variables.

Table 5. First-generation and second-generation unit-root tests.

Im-Pesaran-Shin unit-root			CIPS unit root	
Variables	Level	First difference	Level	First difference
IIQ	-1.093	-2.241***	-1.855***	-2.990***
ODA/GNI	-1.823***	-3.054***	-2.818***	-4.391***
INSQ	-1.459	-2.591***	-2.288***	-3.401***
GDPPC	-1.009	-2.355***	-2.186***	-3.138***
TRADE	-1.339	-2.698***	-1.582***	-3.537***
FDI	-1.959***	-2.957***	-2.593***	-4.478***
ODA*INSQ	-1.500	-2.794***	-2.248***	-3.716***

Note: Parentheses indicate the standard errors: *** p<0.01 and * p<0.1.

Table 6. First and second generation cointegration tests.

Kao cointegration test		
	Statistic	P-value
Modified Dickey-Fuller t	2.194**	0.014
Dickey-Fuller t	1.123	0.130
Augmented Dickey-Fuller t	1.752**	0.039
Unadjusted modified Dickey-Fuller t	3.184***	0.000
Unadjusted Dickey-Fuller t	2.389***	0.008
Pedroni cointegration test		
	Statistic	P-value
Modified Phillips-Perron t	6.503***	0.000
Phillips-Perron t	-4.891***	0.000
Augmented Dickey-Fuller t	-3.658***	0.000
Westerlund cointegration test		
	Statistic	P-value
Variance ratio	5.717***	0.000

Note: Parentheses indicate the standard errors: *** p<0.01 and ** p<0.05.

The findings of evaluating Equation 2b by employing the quality of institutions as a threshold variable along with a variety of control factors that are acknowledged in the literature are presented in Table 7. The upper portion of the table displays institutional quality values that fall below the threshold, while the lower portion of the table displays institutional quality values that exceed the threshold. The empirical findings indicated that the institutions' threshold value is 1.622. The findings further demonstrated that foreign aid is beneficial and has a substantial impact on the degree to which economic disparities exist below the threshold of five percent. However, when the threshold is exceeded, foreign aid has a tendency to reduce income inequality; yet, the slope of the coefficient changes to a value that is negative with statistical significance at the 5% level. Comparing to prior research on aid and income inequality, some of the studies (Castells-Quintana, Larrú, & Lacalle-Calderón, 2019; Kabir, 2020; Osode et al., 2022) found similar findings as aid reduces inequality despite their differences in sample years, estimation techniques, and context. However, one of the recent studies conducted in Africa in this area of research is Younsi et al. (2019) who revealed a contrary results as foreign aid positively influences income inequality in 16 African nations from 1990–2011 by employing Random Effects (RE) and System GMM. On the reverse side, the results showed that the control variables, such as GDP per person, have an adverse and substantial impact on disparity

when they are under the threshold of institutions, which was used to assess the validity of the threshold estimations. Openness to trade is one more control variable in this study, which shows a positive and insignificant effect on inequality below the threshold and a statistically significant and positive effect at the above threshold value. The last control variable in the study is foreign direct investment (FDI), which is negative but significant at 10 percent below the threshold, while the coefficient is insignificant above the threshold estimates.

Table 7. Results of dynamic panel threshold analysis (Threshold variable: Institutions).

Variables	Below limit	Above limit
Lag Y	0.799***	0.312**
LODA/GNI	0.001**	-0.008**
LGDPPC	-0.002*	0.004
LTRADE	0.000	0.012*
LFDI	-0.004*	0.003
Constant	-1.259**	-1.259**
Threshold estimates (r)	1.622***	1.622***

Note: Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

4.1. Robustness Checks

Table 8 presents the estimation results of the Quantile Regression (QR) as the robustness model. The QR results from 200 bootstrapping repetitions indicate that “foreign aid” has an adverse but significant influence on “income inequality.” In cases where the quantile level is low (0.1 and 0.2 quantiles), increases in the amount of assistance have a higher impact on inequality. As the levels of the quantile increase, the influence of foreign aid on inequality decreases. This implies that, at the low quantile value (0.1), a 1% rise in aid reduces “income inequality” by 0.092%. The index of institutional quality also has a negative but substantial impact on “inequality”. This shows that, as the quantile levels increase from (0.1 to 0.4), the effect of institutional quality increases. On the other hand, Table 8 shows that the most significant control variable in the study is the GDP per person, as it has a positive correlation with income inequality in all the quantiles. The elasticity of GDP per person on “income inequality” is valued at 0.025, 0.037, and 0.039 in the 0.1, 0.2, and 0.3 quantiles, respectively. This depicts that, at the low quantile level (0.1), a 1% rise in GDP per person diminishes inequality by 0.025%. Results show that this effect is greater at higher quantile values. The lower quantiles of income inequality are likewise impacted favorably by foreign direct investment (0.1 and 0.2). Figure 4 shows the coefficients of foreign aid from the 10% quantile to the 90% of the quantile regression analysis plotted, and the coefficients showed an increased trend, especially from the 50 % quantile. In light of this, it may be said that the effects of foreign aid on inequality will diminish after the 50% quantile.

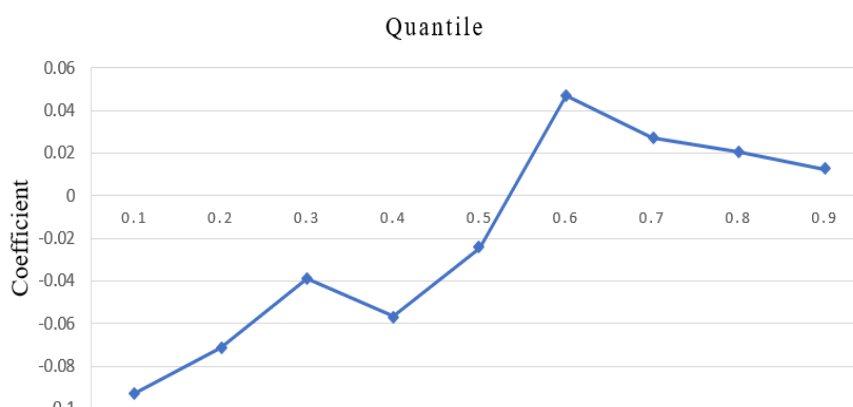


Figure 4. Coefficients of foreign aid at various quantiles.

Table 8. Robustness check: Quantile regression analysis.

Variables	Q 0.1	Q 0.2	Q 0.3	Q 0.4	Q 0.5	Q 0.6	Q 0.7	Q 0.8	Q 0.9
LODA/GNI	-0.092***	-0.071***	-0.039	-0.056	-0.024	0.047	0.027	0.020	0.012
LINSQ	-0.052***	-0.075***	-0.067**	-0.101*	-0.035	0.051	0.026	0.037	0.091***
LTRADE	-0.003	-0.006	-0.020	-0.0171	-0.009	-0.014	0.000	0.003	-0.002
LGDPPC	0.025***	0.037***	0.039***	0.033*	0.035	0.072**	0.092***	0.105***	0.074***
LFDI	-0.034**	-0.035*	-0.032	-0.013	0.002	0.005	-0.000	0.025	0.020
ODA*INSQ	0.084***	0.074***	0.050**	0.052	0.006	-0.044	-0.025	-0.014	-0.010
Constant	3.672***	3.647***	3.695***	3.762***	3.688***	3.382***	3.255***	3.092***	3.321***
Observations	414	414	414	414	414	414	414	414	414

Note: 200 bootstraps are carried for every estimation.
Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

5. CONCLUSION AND RECOMMENDATIONS

Utilizing balanced panel data from 23 countries in Africa between 2005 and 2017, this study investigated how foreign aid affected income inequality. In this study, Seo et al. (2019) employed dynamic panel threshold estimation to study the influence of foreign aid on income inequality and establish the threshold value of the quality of institutions.

Foreign aid reduces inequality below and above the threshold at the 5% significance level, based on the dynamic panel threshold technique. This suggests that there will be fewer disparities in income in African countries if there is a rise in the amount of foreign aid supplied, given that the threshold value for these institutions is 1.622. In addition, the study has shown that an increase in foreign aid over a certain level is associated with a substantial and negative impact on income inequality, but an increase in foreign aid below that level is associated with a favorable impact that is both substantial and beneficial. Lastly, the study suggests that African states should fortify and advance their valuable institutions to take advantage of and utilize foreign aid in proper and productive ways, which in turn reduces income inequality.

5.1. Policy Implications

Given the aim of foreign aid, improving wellbeing and enhancing economic development in general have become contemporary issues, more specifically its effectiveness in reducing inequality. In this context, policymakers in Africa could emphasize the importance of establishing quality institutions and developing mechanisms that can enhance the existing ones. Then, aid may perhaps have an adverse impact on income inequality.

5.2. Limitations and Areas for Future Studies

This research was conducted in Africa with a limited number of countries due to a lack of data availability during the period of study; therefore, it used only 23 African economies. Moreover, it was difficult to find some of the main variables' data series after 2017, which led the sample years to be 2005–2017. For future studies, using recent data on aid, institutional quality, inequality, and poverty, researchers can potentially investigate this topic by employing dynamic panel models in developing countries, as this could extend the scope.

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