



# The role of foreign aids and income inequality in poverty reduction: A sustainable development approach for Africa?

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## Abstract

In the last decades, international interventions mostly through foreign aids have consistently been directed toward sustainable development objectives such as reduction of poverty in African countries. Thus, this study investigates the effect of foreign aids and income inequality in poverty reduction in Africa for 1990–2016. The novelty lies in the investigation of the effectiveness of aid remittances to Africa from the United Nations and Organization for Economic Cooperation and Development (OECD) which has previously been overlooked in extant studies. By using the system Generalized Method of Moments, the study showed that the interaction of inequality with the United Nations Development Programme (UNDP) funds and OECD Official Development Assistance is not statistically significant. Meanwhile, the interventions from the UNDP funds and OECD Official Development Assistance statistically yield significant and expected results of reducing poverty in the poor continent. However, the study surprisingly failed to establish that remittances from the UNDP have significantly mitigated poverty in Africa. Importantly, this study presents a significant policy guide for the governments and the stakeholders and recommends that the donor agencies adopt poverty-reduction, and income distribution-based criteria for the allocation of their resources to reduce poverty in the continent.

**Keywords** Poverty · Income inequality · Foreign aids · Sustainable development · SDGs · Africa

**JEL Classification** I31 · O11 · O55

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## Introduction

How severe are the poverty and the income inequality in Africa? Despite the recent economic growth experienced in some regions or countries in the continent (Asongu and Kodila-Tedika 2018), appropriate answers are yet to sufficiently underpin the seemingly regenerative cause of this dilemma in Africa's poor. The rising profile of poverty and inequality in the poorest region and in some developing countries has been a source of worry for governments, policymakers, and intergovernmental agencies (Choi 2021). Thus, the goal of driving the poverty reduction agenda of the United Nations is paramount in the organization's 2000 Millennium Development Goals (MDG) and 2015 Sustainable Development Goals (SDG) declarations. According to the United Nations (UN) (2000), eight (8) Millennium Development Goals (MDG) were set up. The MDGs rolled out by the UN were committed to building a safer, more prosperous, and more equitable, egalitarian world. From the resolution adopted by the United Nations General Assembly at the 8th plenary meeting in New York, USA, September 8, 2000, the United Nations Millennium Declaration, under the caption (III) envisioned Development and Poverty Eradication where "UN will spare no effort to free people and especially the vulnerable groups such as children from the abject and dehumanizing conditions of extreme poverty, to which more than a billion of them are currently subjected". The declaration roadmap set out eight time-bound and measurable goals achievable by 2015. Goal one (1) was to create No-Poverty world latest by 2015. Others include: achieving universal primary education; promoting gender equality and empowering women; reducing child mortality; improving maternal health; combating HIV/AIDS, malaria, and other diseases; ensure environmental sustainability while goal (8) focus on how to develop a global partnership for development (United Nations 2015a, b).

There is a growing negative relationship between foreign aids and poverty mitigation in the recipient countries (Akobeng 2017; Vacaflores 2018; Gharleghi and Jahanshahi 2020). In contrast, Chong et al. (2009) and Briggs (2017) found that aids are ineffective. While Allen et al. (2021) explored the role of science in sustainable development, the current study is investigating the drive toward attaining sustainable development by looking at the effect of aid and inequality on poverty in fifty African countries. Though with different scope, the closest paper to the study is Vacaflores (2018). Questioning whether remittances are helping to lower poverty and inequality levels in Latin America, Vacaflores (2018) uses dynamic GMM to examine the effectiveness of aids in reducing poverty and inequality and found that increases in aids have a negative and significant impact on poverty and inequality in the region. Additionally, Akobeng (2017) found that aid flow to Africa reduces poverty but the size of the poverty reduction depends on how poverty is being measured. To solve the rigidity of static models, a new dynamic tool was introduced in the 2000s to subdue the endogeneity of variables of models using instrumental variables and to also take charge of heterogeneity of the individuals. In the context of dynamic panel data analysis, mention must be made of Baltagi and Levin (1986) followed by the increasingly popular Baltagi (2005), Baltagi (2008), Arellano and Bond (1991), and Arellano and Bover (1995).

The purpose of the study is to investigate the impact of foreign aids on poverty-inequality in Africa covering fifty selected African countries from 1990 to 2016. The research question is: do United Nations Development Programme funds and OECD's Official Development Assistance matter in poverty-cutting in the poorest region? The quest for answers to this question formed the basis of the research and paved the way for the objective which is to explore the effect of aids on poverty and inequality in Africa. It is crucial to provide

pragmatic answers to these questions because it is projected that many most vulnerable countries are will not achieve any of the SDGs target (Moyer and Hedden 2020), and financing the SDGs is one of the biggest challenges of development today (Barua 2020). The current study is designed to advance a related study of Gharleghi and Jahanshahi (2020). On the novelty, the current study contributes to the literature by examining the effectiveness of aid from the United Nations (UN) and Organization for Economic Cooperation and Development (OECD)'s Official Development Assistance to Africa. Although a handful of studies have examined the potential mitigating drivers of poverty and income inequality in Africa, the conceptual framework adopted in the current study is the first in the literature.

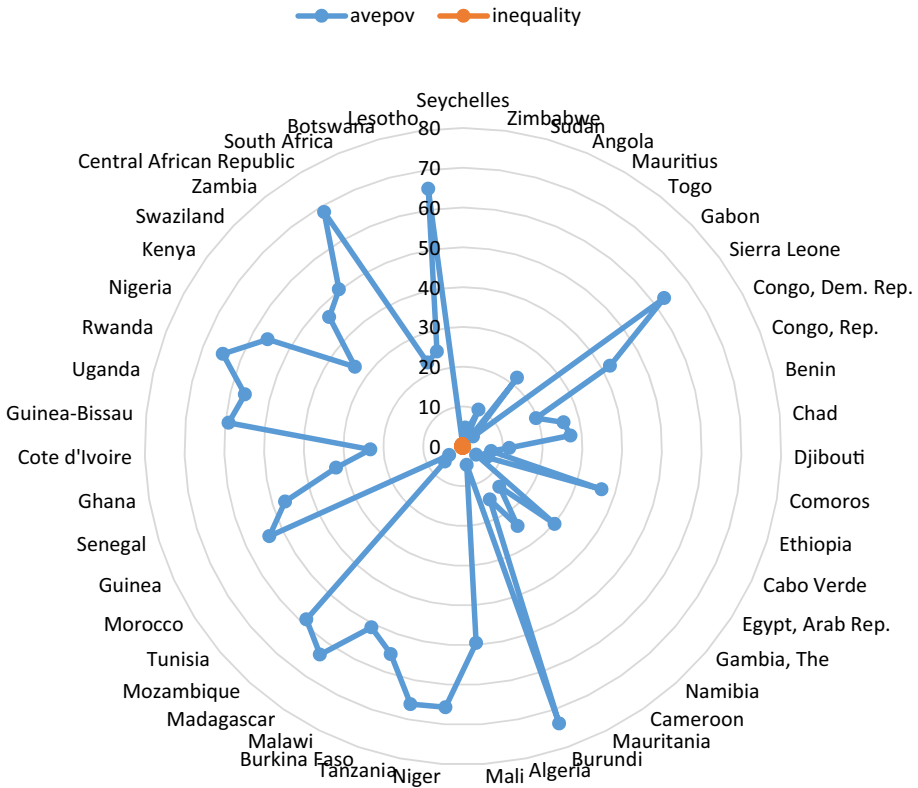
Assessing the effect of aids from different donor agencies is vital. The criteria of aid allocation could be responsible for the kind of relationship between aids and poverty in the recipient countries. This is because both donors and recipients countries are primarily concerned about the optimal allocation of the aids. In this regard, aid agencies set up guidelines, quantitative criteria (formulas), or formal models for the allocation of their resources to different developing countries. Meanwhile, the formula is the most conventional criteria, which corresponds to Performance-Based Allocation (PBA). However, different donors use different formulas. Hence, the difference in criteria might result in the different effects of aid on poverty. This study includes aids from different donors and also accounts for income distribution to evaluate the effects of the aids on poverty in Africa.

The paper is made up of six sections. The other sections are arranged such that “Synopsis of poverty, inequality, and aids in Africa, 1990–2016” section presents a synopsis of variables of interest, “Literature review” section briefly highlights the literature review while the methodology is presented in “Methodology” section. The fifth and sixth sections discuss the results and concluding remarks with policy direction, respectively.

## Synopsis of poverty, inequality, and aids in Africa, 1990–2016

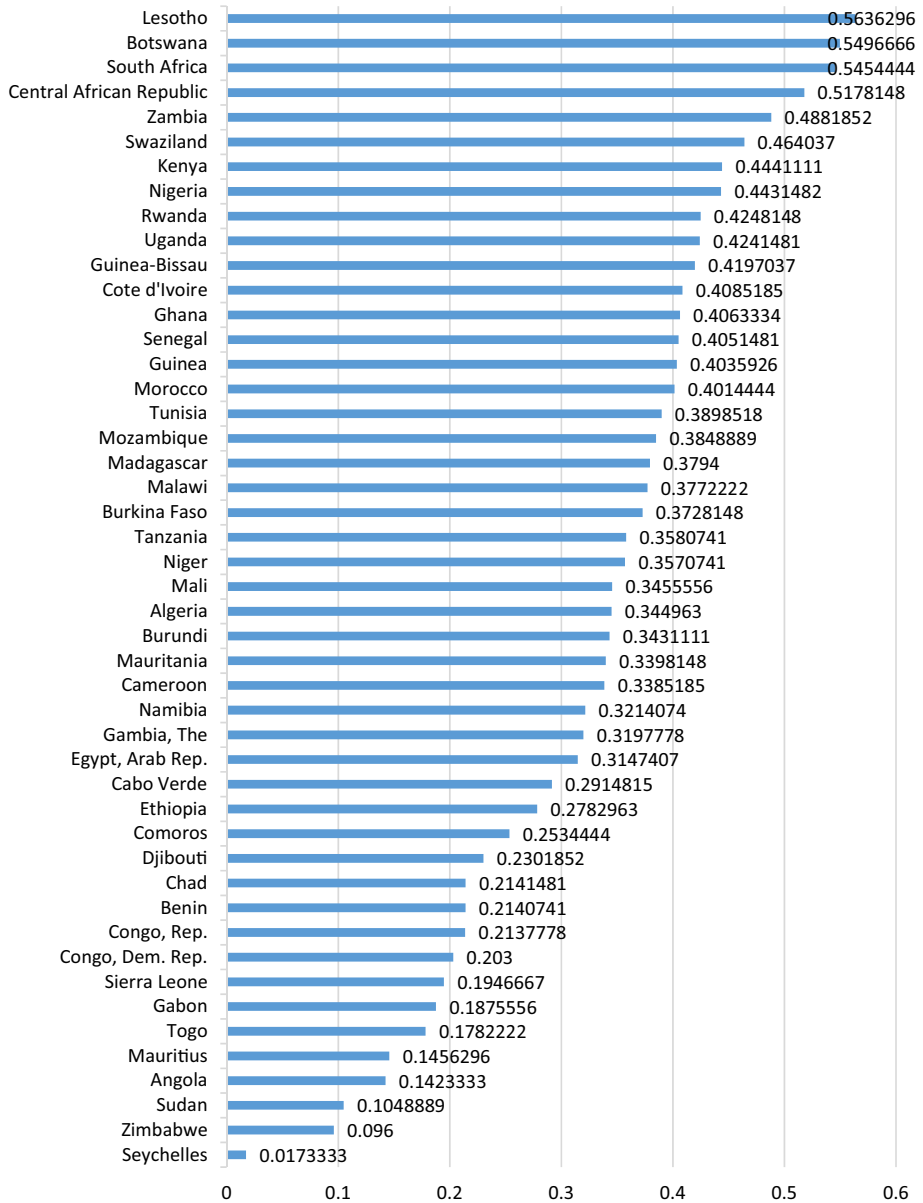
Concerning radar analysis of poverty levels in Africa, Fig. 1 shows countries with different levels of (27 year average) poverty levels. Series point(s) on the radar to the poverty level of each country on or within each circumference as shown in Fig. 2. The outermost circle/layer houses the positional point of Burundi followed by C.A.R. and others. The lower the rate the better the country as shown in the radar value vertical axis. The desired, low seven rates mostly from North Africa are Seychelles (0.04), Mauritius (0.18), Gabon (3.56), Egypt Arab Rep. (3.94), Morocco (4.08), Sudan (4.41), and Algeria (4.76). The highest seven rates which spread across the continents are Burundi (73.71), Central Africa Republic (68.44), Tanzania (66.11), Niger (65.70), Lesotho (65.32), Rwanda (64.66), and Madagascar (63.48) (see Table 1).

The severity of inequality as measured by the Gini index or coefficient was developed by an Italian Statistician named Corrado Gini in 1912 using the Lorenz curve. Gini coefficient ranges from zero (0) or 0% to one (1) or 100%, with 0 representing perfect equality and 1 representing perfect inequality. Countries' Gini coefficients that are close to 0 are referred highly severed inequality while countries whose Gini index is close to 1 are less severed while any coefficient higher than one (1) are theoretically recorded due to negative income or wealth (see Table 1). The movement or deviation from the perfectly equal straight line which characterizes or represents a coefficient of zero (0) maintains that the higher or lower the Gini coefficient the less or more equal the society, respectively.



**Fig. 1** (Mean) Poverty levels in Africa. *Source* Constructed by the author from World Bank Development Indicators (2018)

Figure 2 shows different levels of income inequality severity in Africa (1990–2016) which can be grouped into six, A–F, disregarding rounding off values. Group A of Gini index, g.i. (0.5) contains Lesotho, Botswana, South Africa, and the Central Africa Republic. The A grouped countries represent very high inequality and so more unequal. Group B of the Gini index (0.4) comprises Zambia, Swaziland, Kenya, Nigeria, Rwanda, Uganda, Guinea-Bissau, and Cote d’Ivoire. Others are Ghana, Senegal, Guinea, and Morocco. Numerous group C of g.i. (0.3) covers Tunisia, Mozambique, Madagascar, Malawi, Burkina Faso, Tanzania, and Niger. Others in the C group are Mali, Algeria, Burundi, Mauritania, Cameroon, Namibia, The Gambia, and Egypt. Next is group D of g.i. (0.2) having Cabo Verde, Ethiopia, Comoros, Djibouti, Chad, Benin, Congo Republic, and the Congo Democratic Republic as members. Group E of g.i. (0.1) include Sierra Leone, Gabon, Togo, Mauritius, Angola, and Sudan while the last group F of Gini index (0.0) which is mostly desired contains Zimbabwe and Seychelles (see Table 1).



**Fig. 2** (Mean) Income Inequality Severity Index in Africa. *Source* Constructed by the author from the World Bank Development Indicators (2018)

**Table 1** Twenty-seven (27) year mean of poverty headcount, inequality, OECD's, aid and UNDP funds. *Source* Authors' calculation (mean), using data from the World Bank WDI (2018)

Country	POV	INEQ	ODA(\$m)	UNDP(\$m)
Algeria	4.76	.3450	285	944,074
Angola	10.03	.14.23	410	4,377,037
Benin	26.00	.2141	416	4,250,000
Botswana	24.72	.5497	130	719,259
Burkina Faso	55.25	.3728	716	6,443,334
Burundi	73.71	.3431	358	7,151,852
Cabo Verde	6.56	.2915	166	766,667
Cameroon	24.28	.3385	740	2,367,037
Central African Republic	68.44	.5178	209	3,651,482
Chad	27.17	.2141	362	5,560,000
Comoros	7.18	.2534	49	1,281,111
Congo, Dem. Rep	42.16	.2030	1620	12,800,000
Congo, Rep	19.69	.2138	271	1,181,482
Cote d'Ivoire	23.28	.4085	900	3,312,593
Djibouti	11.64	.2302	126	881,852
Egypt, Arab Rep	3.94	.3147	2610	3,384,445
Ethiopia	36.51	.2783	2120	14,900,000
Gabon	3.56	.1876	82	471,852
The Gambia	30.20	.3198	89	2,630,000
Ghana	32.31	.4063	1090	5,576,297
Guinea	53.63	.4036	374	4,577,408
Guinea-Bissau	59.19	.4197	126	3,017,037
Kenya	33.69	.4441	1280	6,881,482
Lesotho	65.32	.5636	137	1,923,333
Madagascar	63.48	.3794	591	7,564,445
Malawi	50.97	.3772	722	8,299,630
Mali	49.52	.3456	760	6,543,334
Mauritania	14.97	.3398	305	2,357,037
Mauritius	0.18	.1456	63	585,926
Morocco	4.08	.4014	1080	1,887,407
Mozambique	58.63	.3849	1630	9,540,370
Namibia	13.70	.3214	208	1,305,185
Niger	65.70	.3571	528	7,331,852
Nigeria	55.96	.4431	1570	11,700,000
Rwanda	64.66	.4248	690	6,575,556
Senegal	46.77	.4051	792	3,836,667
Seychelles	0.04	.173	23	82,593
Sierra Leone	62.80	.1947	373	4,769,630
South Africa	22.87	.5454	736	1,262,593
Sudan	4.41	.1049	1050	7,302,963
Swaziland	46.73	.4640	63	704,074
Tanzania	66.11	.3581	1900	10,300,000
Togo	21.97	.1782	190	3,977,778
Tunisia	5.91	.3899	413	899,259
Uganda	56.33	.4241	1250	8,681,852
Zambia	50.27	.4882	1030	4,832,593
Zimbabwe	4.76	.960	530	4,507,778

## Literature review

A plethora of papers has unwrapped studies on poverty and measures to be taken to subdue poverty in the region which usually tagged poverty reduction strategy papers (PRSP). This paper, following the PRSP but departs to step up to adopt a sustaining poverty-inequality reduction strategy (PIRS). Early research on Panel data methodology commenced in the 1900s focused on linear regressions and static models at a time when time series and pool data analysis were ineffective in preferring solutions to endogenous problems. To solve the rigidity of static models, a new dynamic tool was invented in the 2000s to subdue the endogeneity of variables of the models using many instrumental variables and to also take charge of the issue of heterogeneity of the individuals.

Notable among the pioneer dynamic panel data (DPD) modelers are Balestra and Nerlove (1966) and in the seventies, Nerlove (1971) and Madalla (1971, 1975) while the nineties noted Arellano and Bond (1991), Arellano and Bover (1995), Blundell and Bond (1998) as well as Roodman (2008) and Ruiz-Porrás (2012) in the 2000s to upgrade the knowledge of complex economic models and processes through empirical works. Dynamic panel data is usually adopted to solve some limits of micro-panel especially when panels are formed from databases with short observations/time ( $t$ ) and long cross sections/large numbers of individuals ( $n$ ). The paper, therefore, justified in using a dynamic panel data system due to its short time  $t$  (27 observations) and long  $n$  (50 cross sections).

As posited in the extant literature, there is a consensus on the poverty-inequality positive relation with either of the two vices or interaction of both suffers negative effect on economic growth (Asongu et al. 2020). Works of Ncube et al. (2014) in the case of the Middle East and North Africa (MENA) for the period 1985–2009, shows how income inequality increases poverty but reduces economic growth. The recent finding of Majeed and Breunig (2020) followed Ncube et al. (2014) but of more concentration among countries with high poverty and advocated for policies aimed at alleviating poverty rather than distribution. This paper sees to an improvement in measuring of poverty rates in the world. This is done by estimating poverty from the Space using high-resolution satellite imagery (HRSI) to extract objects vis-à-vis its textures. The extractable may include the number and density of buildings, roof materials, the prevalence of shadows, number of cars, density and length of roads, types of agriculture and degree of climate change.

This proposal is in accord with a World Bank working paper by Engstrom et al. (2017). Estimates from HRSI will confirm or otherwise the measurements of poverty through poverty headcounts or from survey to survey. For over five decades, foreign aids have been used by the developed world and aid donors/agencies to alleviate poverty, reduce the disparity of income inequality and stimulate growth in Africa but quite surprisingly controversial, the remittances miss targets of poverty cutting in Africa and another developing world. Burnside and Dollar (2000) maintain that foreign aid favors the presence of good macroeconomic policies and so also Collier and Dollar (2002) agree that aids reduce poverty. In contrast, Easterly (2003) and Kirikkaleli et al (2021) submit that foreign aid does not have any significant effect on growth, even if good policies are implemented in recipient countries. From the latter assertion, it is evident that there are many factors responsible for aids to miss the target of reducing poverty facts of which include poor management of aids through bad leadership and misplacement of priority in Africa.

In general, most studies, especially all the listed research on poverty, inequality, and growth usually find out that inequality increases poverty and vice versa while both inequality and poverty reduce economic growth (Adebayo et al. 2020). The novelty of the study

and the gap to fill in the literature is to confirm the usual relation of the trio of poverty-inequality-growth and above all appraise the effectiveness of Official Development Assistance (ODA), UN, and other donor institutions remittances to Africa which many previous studies adequately fail to do.

## Methodology

We estimate the following equations using dynamic GMM due to “small  $T$ , large  $N$ ” panels, meaning few periods and many cross sections. We specified Eqs. (1) and (2) on the interaction of ODA’s aid and FUNDP with inequality in Eq. (1).

$$\text{Pov}_{i,t} = \alpha_0 + \alpha_1 \text{Pov}_{i,t-n} + \alpha_2 \text{Ineq}_{i,t} + \alpha_3 \text{Aid}_{i,t} + \alpha_4 \text{FUNDP}_{i,t} + \alpha_5 \ln(\text{rgdppc})_{i,t} + \alpha_6 X_{i,t} + \varepsilon_i + u_{i,t} \quad (1)$$

$$\begin{aligned} v_{i,t} = & \alpha_0 + \alpha_1 \text{Pov}_{i,t-n} + \alpha_2 \text{Ineq}_{i,t} + \alpha_3 \text{Aid}_{i,t} + \alpha_4 \text{FUNDP}_{i,t} + \alpha_5 \left( \text{Ineq}_{i,t}^* \text{Aid}_{i,t} \right) \\ & + \alpha_6 \left( \text{Ineq}_{i,t}^* \text{FUNDP}_{i,t} \right) + \alpha_7 \ln(\text{rgdppc})_{i,t} + \alpha_8 X_{i,t} + \varepsilon_i + u_{i,t} \end{aligned} \quad (2)$$

where Poverty ( $\text{Pov}_{i,t}$ ) is the dependent variable of country  $i$  in time  $t$ ;  $\text{Pov}_{i,t-n}$  is lag of dependent variable of countries  $i$  in time  $(t-n)$ ;  $\alpha_0$  is constant;  $\alpha_i$  is the coefficient of the variable  $i$ ;  $\text{Ineq}_{i,t}$  is inequality/Gini index;  $\text{Ineq}_{i,t}^* \text{Aid}_{i,t}$  and  $\text{Ineq}_{i,t}^* \text{FUNDP}_{i,t}$  depicts the interaction of inequality with ODA and UNDP aids;  $\ln(\text{rgdppc})_{i,t}$  is log of real GDP per capita;  $X_{i,t}$  is contemporaneous variables;  $\varepsilon_i$  is error terms and  $u_{i,t}$  is unobserved time-invariant heterogeneity. Differentiating Eq. 2 concerning  $\text{Ineq}_{i,t}$ , we thus obtain Eq. (3). The  $\alpha_2$ ,  $\alpha_5$ , and  $\alpha_6$  capture the extent to which aid and UNDP funds affect poverty in Africa.

$$\frac{\partial \text{Pov}}{\partial \text{Ineq}} = \alpha_2 + \alpha_5 \text{Aid}_{i,t} + \alpha_6 \text{FUNDP}_{i,t} \quad (3)$$

Due to limited space, only two models were specified—Eqs. (1) and (2), results of which were presented in columns 15 and 16 in Table 2 while others 1–14 estimates were meant for consistency cross-checks. Making use of World Development Indicators (2018), the following data were sourced. They include poverty headcount \$1.90 per day, which was measured as the percentage of the population living on less than 1.9 USD per day, inequality coefficient/Gini index, external debts, trade openness, mineral rents, inflation, unemployment, exchange rate, real gross domestic product per capita and total population. Others are OECD’s ODA and funds from the United Nations Development Programme, UNDP. The model also made use of dummies for African regions. The GDP per capita and official exchange rate in actual values and so log-transformed while other unlogged variables were already in percentages.

## Results and discussion

Table 2 reports dynamic GMM estimates and shows that inequality significantly increases poverty. The study finds that a one-unit change in income inequality would result in a 0.82% increase in the poverty level in Africa. A positive and significant Gini coefficient indicates that greater inequality is associated with higher poverty in Africa therefore



**Table 2** Dynamic GMM estimates. *Source* Author's calculation

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
Dependent variable: Poverty headcount ratio (\$1.90)																	
Previous poverty rate	0.79*** (0.026)	0.70*** (0.032)	0.69*** (0.032)	0.69*** (0.032)	0.69*** (0.032)	0.68*** (0.032)	0.68*** (0.032)	0.68*** (0.032)	0.67*** (0.032)	0.66*** (0.032)	0.66*** (0.032)	0.65*** (0.032)	0.65*** (0.032)	0.70*** (0.034)	0.71*** (0.035)	0.71*** (0.0345)	
Inequality	0.72*** (0.032)	0.74*** (0.030)	0.74*** (0.030)	0.74*** (0.030)	0.74*** (0.030)	0.75*** (0.030)	0.75*** (0.030)	0.75*** (0.030)	0.75*** (0.030)	0.76*** (0.030)	0.76*** (0.030)	0.76*** (0.030)	0.76*** (0.030)	0.80*** (0.032)	0.82*** (0.032)	0.684*** (0.0407)	
Inequality * ODA																7.3e-11** (0.000)	
Inequality * FUNDP																	2.0e-1*** (4.95e-09)
Log (RGDPPC)		-6.67*** (1.46)	-5.93*** (1.52)	-4.99*** (1.58)	-4.98*** (1.58)	-4.97*** (1.58)	-5.15*** (1.57)	-5.10*** (1.62)	-4.98*** (1.61)	-5.23*** (1.60)	-5.23*** (1.60)	-5.44*** (1.59)	-5.74*** (1.61)	-8.19*** (1.72)	-8.82*** (1.89)	-8.069*** (1.873)	
External debt (extd)		0.011 (0.0071)	0.011 (0.0071)	0.011 (0.0071)	0.011 (0.0075)	0.0095 (0.0078)	0.0058 (0.0080)	0.0071 (0.0082)	0.0041 (0.0083)	-0.00039 (0.0085)	-0.00039 (0.0085)	-0.00058 (0.0085)	0.00071 (0.0085)	-0.0040 (0.0089)	-0.0030 (0.0090)	2.05e-05 (0.00885)	
Trade open (openness)				-0.03*** (0.013)	-0.03*** (0.013)	-0.03*** (0.013)	-0.026*** (0.013)	-0.027*** (0.013)	-0.024* (0.013)	-0.026*** (0.013)	-0.026*** (0.013)	-0.026*** (0.013)	-0.028*** (0.013)	-0.031** (0.013)	-0.030** (0.013)	-0.0305** (0.0133)	
Mineral rents(mrent)				-0.010 (0.10)	-0.010 (0.10)	-0.085 (0.11)	-0.062 (0.11)	-0.058 (0.11)	-0.046 (0.11)	-0.026 (0.11)	-0.026 (0.11)	-0.016 (0.11)	-0.027 (0.11)	0.12 (0.12)	0.12 (0.12)	0.0790 (0.118)	
Log (exchange rates)						-0.58** (0.29)	-0.53* (0.29)	-0.51* (0.29)	-0.43 (0.30)	-0.34 (0.30)	-0.34 (0.29)	-0.48 (0.30)	-0.49 (0.30)	-0.12 (0.32)	-0.30 (0.33)	-0.451 (0.331)	
Aid from Net Official Development Assistance (ODA)							-1.1e-09** (5.3e-10)	-1.2e-09** (5.3e-10)	-1.0e-09* (5.3e-10)	-8.1e-10 (5.4e-10)	-8.1e-10 (5.4e-10)	-7.9e-10 (5.4e-10)	-7.9e-10 (5.4e-10)	-6.4e-10 (5.6e-10)	-6.9e-10 (5.6e-10)	-2.88e-09** (1.27e-09)	

**Table 2** (continued)

Dependent variable: Poverty headcount ratio (\$1.90)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Funds transfer from United Nations Development Programme (FUNDP)								1.7e-08 (9.8e-08)	2.3e-08 (9.8e-08)	6.5e-08 (9.9e-08)	6.5e-08 (9.9e-08)	5.7e-08 (9.9e-08)	7.0e-08 (9.9e-08)	9.9e-08 (1.0e-07)	1.3e-07 (1.0e-07)	-6.21e-07** (2.12e-07)
Total population									-1.e-07*	-8.6e-08	-8.6e-08	-8.4e-08	-8.9e-08	-1.9e-08	-2.5e-08	-1.2e-07*
Inflation rate								(6.5e-08)	(6.7e-08)	(6.7e-08)	(6.7e-08)	(6.7e-08)	(6.7e-08)	(7.0e-08)	(7.1e-08)	(7.15e-08)
								-1.3e-07**	-1.3e-07**	-1.3e-07**	-1.3e-07**	-1.2e-07**	-1.0e-07	-1.8e-07**	-1.2e-07	-3.48e-05
Unemployment rate								(6.2e-08)	(6.2e-08)	(6.2e-08)	(6.2e-08)	(6.2e-08)	(6.5e-08)	(6.9e-08)	(7.2e-08)	(0.00026)
								-1.8e-06	-1.8e-06	-1.8e-06	-1.8e-06	-8.3e-06	-8.3e-06	-0.000013	-0.00002	0.114**
Central African dummy								(0.00025)	(0.00025)	(0.00025)	(0.00025)	(0.00025)	(0.00025)	(0.00026)	(0.00026)	(0.0572)
														0.11*	0.11*	56.72***
East African dummy														(0.057)	(0.058)	(15.70)
														6.59*	5.07	9.37**
North African dummy														(3.58)	(3.82)	(4.02)
														-4.60	-0.24	42.4e***
South African dummy														(4.12)	(4.33)	(15.0)
														67.4e***	64.9e***	41.85e**
														(11.5)	(23.7)	(17.26)

**Table 2** (continued)

Dependent variable: Poverty headcount ratio (\$1.90)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
WestAfrican dummy																
Constant	-15.6*** (1.16)	38.9*** (12.0)	32.6*** (12.5)	27.0** (12.8)	27.0** (12.8)	29.5** (12.9)	31.6** (12.9)	31.1** (13.4)	30.2** (13.4)	34.3*** (13.3)	34.3*** (13.3)	35.8*** (13.3)	39.4*** (13.6)	45.3*** (14.2)	42.2** (17.5)	51.62*** (14.87)
AR(2)	-0.310 [0.75]	-0.348 [0.727]	-0.377 [0.706]	-0.355 [0.723]	-0.350 [0.725]	-0.351 [0.726]	-0.327 [0.744]	-0.348 [0.727]	-0.899 [0.369]	-0.334 [0.738]	-0.742 [0.458]	-0.710 [0.478]	-0.319 [0.750]	0.508 [0.611]	-0.212 [0.832]	0.508 [0.611]
Sargan (P-value)	0.8401	0.440	0.4065	0.4712	0.4752	0.4802	0.4882	0.4189	0.4185	0.3419	0.3460	0.3246	0.3152	0.6682	0.6931	
Observations	1300	1293	1293	1293	1293	1284	1284	1284	1284	1284	1284	1284	1284	1284	1284	1284
Number of cid	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50

Standard errors in parentheses. \*\*\*, \*\*, \* denotes 1%, 5%, and 10% level of significance, respectively

income inequality is harmful to the poor continent. The study also finds that a one percent change in real GDP per capita reduces poverty by 8.82% which is in accord with the literature. Other factors fuelling Poverty in Africa include mineral rents, funds from UNDP, unemployment rate while dummy variables of central, west, north, east, and southern Africa have a significant and positive effect on poverty. However, the interaction of inequality with aids as shown in Table 2 column (16) estimates exonerated the duo and so yields expected results of reducing poverty in the region. In a related study, Park implied that financial development is correlated with lower poverty and income inequality in 176 countries. However, Noonan and Sadiq (2018) found that there is a significant impact of the Community Rating System (CRS) on poverty and income inequality in the USA.

Sargan test was carried out to verify the overall validity/efficacy of the instruments and the result was found to be sufficiently valid. The  $p$ -value must be less than 0.1 or 0.05 to reject, so we are far from having any indicated problems with the instruments and therefore over-identification does not hold or exist. With all Sargan  $p$ -values higher than 0.05, it quite clearly indicates that one cannot reject the null hypothesis,  $H_0$  which states that overidentifying restrictions are valid, and so is a good result. On the contrary, if the  $p$ -values fall below 5%, then the instruments are invalid and so one can reject  $H_0$  so the Sargan tests are boon and reliable. In addition, the results of the Arellano–Bond test for zero autocorrelation in first-differenced errors, AR(2), show that there is no problem of autocorrelation in the model. This is indicated by the  $p$ -values of the AR(2), which are greater than 0.05 as reported in Table 2.

## Concluding remarks

This study examined the effect of aid on poverty-inequality in Africa. The paper concludes that inequality, as expected, responds positively to increases in poverty levels. Other factors fuelling poverty include mismanagement/underutilization of mineral resources, high unemployment rate with basic education. The results further illustrate a high rate of poverty across African regions, thus indicating the reason the UNDP is geared toward reducing poverty and poor-rich gap in Africa. But, aids can only reduce poverty when the donor agencies adopt poverty-reduction, and income distribution-based criteria for the allocation of their resources. Additionally, allocation criteria that minimize income inequality would reduce poverty in the African continent. Currently, most of the donor agencies are using a formula or formal models that account of GDP per capita but fail to adequately capture income distribution. Consequently, funds from the donors promote income inequality and aggravate poverty in the recipient countries in Africa. This is indicated by the interaction terms between income inequality and aids, which eliminated the positive nexus between aids and poverty (see Table 2).

Given that poverty and income inequality are reportedly linked with other noneconomic (such as social and environmental) factors (Asongu and Kodila-Tedika 2018; Morse 2018), the policies of the governments especially toward poverty and income inequality reduction could be further driven by inclusive development (Asongu and Odhiambo 2019). Additionally, due to the high level of forms of corruption, the intergovernmental interventions especially that are designed to tackle the challenges of poverty and income inequality in Africa should be adequately supervised. As such, the supervision of the process of interventions should cover the execution to implementation and the evaluation stage.

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**Data availability** The dataset will be made available upon request.

## Declarations

**Conflict of interest** There is no associated conflict of potential conflicts of interest.

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## References

- Adebayo TS, Beton KD (2020) Ongoing debate between foreign aid and economic growth in Nigeria: a wavelet analysis. *Soc Sci Q* 101(5):2032–2051
- Akobeng E (2017) Gross capital formation, institutions and poverty in Sub-Saharan Africa. *J Econ Policy Reform* 20(2):136–164
- Allen C, Metternicht G, Wiedmann T (2021) Priorities for science to support national implementation of the sustainable development goals: a review of progress and gaps. *Sustain Dev* 29:635–652
- Arellano M, Bover O (1995) Another look at the instrumental variable estimation of error-components models. *J Econom* 68(1):29–51
- Arellano M, Bond S (1991) Some tests of specification for panel data: monte carlo evidence and an application to employment equations. *Rev Econ Stud* 58(2):277–297
- Asongu SA, Kodila-Tedika O (2018) Institutions and poverty: a critical comment based on evolving currents and debates. *Soc Ind Res* 139(1):99–117
- Asongu SA, Odhiambo NM (2019) How enhancing information and communication technology has affected inequality in Africa for sustainable development: an empirical investigation. *Sustain Dev* 27(4):647–656
- Asongu SA, Nnanna J, Acha-Anyi PN (2020) Inequality and gender economic inclusion: the moderating role of financial access in Sub-Saharan Africa. *Econ Anal Policy* 65:173–185
- Balestra P, Nerlove M (1966) Pooling a cross-section and time series in the estimation of a dynamic model: the demand for natural gas. *Econom J Econom Soc* 34(3):585–612
- Baltagi B (2008) *Econometric analysis of panel data*. Wiley, New Jersey
- Baltagi BH (2005) *Econometric analysis of panel data*, 3rd edn. Wiley, New Jersey
- Baltagi BH, Levin D (1986) Estimating dynamic demand for cigarettes using panel data: the effects of bootlegging, taxation and advertising reconsidered. *Rev Econ Stat* 68:148–155
- Barua S (2020) Financing sustainable development goals: A review of challenges and mitigation strategies. *Bus Strategy Dev* 3(3):277–293
- Blundell R, Bond S (1998) Initial conditions and moment restrictions in dynamic panel data models. *J Econom* 87(1):115–143
- Breunig R, Majeed O (2020) Inequality, poverty and economic growth. *Int Econ* 161:83–99
- Briggs RC (2017) Does foreign aid target the poorest? *Int Organ* 71(1):187–206
- Burnside C, Dollar D (2000) Aid, policies, and growth. *Am Econ Rev* 90(4):847–868
- Choi G (2021) Individuals' socioeconomic position, inequality perceptions, and redistributive preferences in OECD countries. *J Econ Inequal* 19:1–26
- Chong A, Gradstein M, Calderon C (2009) Can foreign aid reduce income inequality and poverty? *Public Choice* 140(1–2):59–84

- Collier P, Dollar D (2002) Aid allocation and poverty reduction. *Eur Econ Rev* 46(8):1475–1500
- Easterly W (2003) Can foreign aid buy growth? *J Econ Perspect* 17(3):23–48
- Engstrom R, Hersh J, Newhouse D (2017) Poverty from space using high-resolution satellite imagery for estimating economic well-being. *Policy Res Work* 36:8284
- Gharleghi B, Jahanshahi AA (2020) The way to sustainable development through income equality: the impact of trade liberalisation and financial development. *Sustain Dev* 28(4):990–1001
- Kirikaleli D, Adeshola I, Adebayo TS, Awosusi AA (2021) Do foreign aid triggers economic growth in Chad? A time series analysis. *Future Bus J* 7(1):1–17
- Madalla G (1971) The likelihood approach to pooling cross-sections and time series. *Econometrica* 39(6):939–953
- Madalla G (1975) Some problems arising in pooling cross-section and times series data. Discussion paper, University of Rochester, Nueva York
- Moyer JD, Hedden S (2020) Are we on the right path to achieve the sustainable development goals? *World Dev* 127:104749
- Ncube M, Anyanwu JC, Hausken K (2014) Inequality, economic growth and poverty in the middle East and North Africa (MENA). *Afr Dev Rev* 26(3):435–453
- Nerlove M (1971) Further evidence on the estimation of dynamic economic relations from a time series of cross sections. *Econometrica* 39(2):359–382
- Noonan DS, Sadiq AAA (2018) Flood risk management: exploring the impacts of the community rating system program on poverty and income inequality. *Risk Anal* 38(3):489–503
- Roodman D (2008) A note on the theme of too many instruments. *Oxf Bull Econ Stat* 71(1):135–158
- Ruiz-Porras A (2012) Econometric research with panel data: history models and uses in Mexico. MPRA paper 42909, University Library of Munich, Germany
- United Nations (2000) United nations millenium declaration. Resolution adopted by the general assembly. <https://www.un.org>
- United Nations (2015a) Millenium development goals report. <https://www.sustainabledevelopment.un.org>
- United Nations (2015b) Sustainable development knowledge platform. <https://www.sustainabledevelopment.un.org>
- Vacaflares DE (2018) Are remittances helping lower poverty and inequality levels in Latin America? *Q Rev Econ Finance* 68:254–265
- WDI (2018) World Bank data: world development indicators. <https://databank.worldbank.org/reports.aspx?source=world-development-indicators>

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