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#### **DEVELOPMENT ECONOMICS | RESEARCH ARTICLE**

### Do trade liberalization and external debt offset income inequality? New evidence from selected African countries

Sulemana Mumuni<sup>1\*</sup> and Adamu Braimah Abille<sup>2</sup>

#### Abstract: Data from the World Bank shows that in the 21st century, over

100 million Africans have become poor and about 43% of the African population is extremely poor. Notwithstanding. African governments have over the years liberalized their economies through a low tariff regime, in addition to external debt financing of major projects and social intervention programs. However, no study has explored the nexus between trade liberalization, external debt, and income inequality in Africa. Therefore, this study examines the impact of trade liberalization and external debt on income inequality using the Driscoll and Kraay augmented fixed and random effects models on data from 2000 to 2018 for 30 African countries. The findings reveal that, while external debt worsens income inequality, winwin trade liberalization policies could act as instruments for poverty alleviation and income inequality reduction in Africa. The results further show that growth in per capita income exerts a widening effect on income inequality in Africa, implying that income is concentrated in the hands of only a few as the economies grow. The study, therefore, calls for strengthening member countries' commitments to the African Continental Free Trade Area (AfCFTA), cutting down on external debt financing of major developments projects, rolling out more poverty alleviation programs, and enforcing proper regulatory standards to curb illicit financial flows and repatriation of profits by foreign firms.

Subjects: Macroeconomics; Labour Economics; Econometrics; International Economics; Development Economics

Keywords: income Inequality; poverty; trade liberalization; external debt, and AfCfta

#### 1. Introduction

In this era of globalization, technology, and innovation, no country is an island on its own. Rather, countries have integrated into diverse forms- be it cultural, environmental, social, political, and or economic. Of all the forms of integration, economic globalization provides a stepping stone for empirically analyzing the effects of globalization on the economies of individual countries since it can be quantified. When talking about globalization, two concepts come to mind, trade liberalization and external debt. Are they cankers or precursors of growth, poverty, and income inequality? Liberalization and external debt have been among the major sources through which governments in developing countries obtain a substantial amount of capital for development





© 2023 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The terms on which this article has been published allow the posting of the Accepted Manuscript in a repository by the author(s) or with their consent. (World Bank, 2005). While there is a dispute in the literature regarding the effects of these concepts on growth, poverty, and income inequality, this study seeks to re-examine their effects on income inequality in the context of Africa.

Most recently, the African Union (AU) together with the Regional Economic Communities (RECs) came up with what seems to be called, the overly ambitious African Continental Free Trade Area Agreement (AfCFTA) to strengthen Africa's Regional Integration, boost intra-African trade and improve the competitiveness and efficiency of African economies. According to Tralac (2018), the AfCFTA is a flagship project for the AU's agenda 2063, a framework considered to be the blueprint for achieving inclusive and sustainable development. However, it is important to note that, the potential benefits of trade liberalization policies are not self-evident as they could lead to trade creation or trade diversion. Even though it is often presumed that the latter forces tend to offset the former forces leading to potential welfare gains for participating countries.

Moreover, economic theory suggests that trade liberalization could lead to the reallocation of resources from the comparative advantage areas into the comparative disadvantage areas, thereby facilitating the movement of income toward its steady-state level. Thus, even if trade liberalization could adversely affect economic growth in the short term, its impact could become positive in the medium to the long term. In the words of Lee (1995), the gains from trade liberalization could be reinforced by rent-seeking, corruption, and smuggling reductions. Despite these presumptions, many still view trade liberalization through the lens of "dependency," in which the economic superpowers seek a new way to retain their colonial legacy with developing countries and to continue their exploitation (Goldsmith, 1997; SANTOS, 1970).

Nevertheless, the broader consensus in the literature is that trade liberalization has a positive and significant impact on economic growth and development, particularly in developing countries (Dollar & Kraay, 2001; Masson, 2001; Pigato, 1997; World Bank, 2005). However, what is still not clear is the distributional effect of the gains from trade. From the standpoint of the neoclassical school of thought, increasing exports enable laborers (s) and firms or entrepreneurs to generate more income while the government gains a substantial amount of foreign exchange and revenue from a broader tax base to finance social intervention programs.

Empirical studies conducted over the past reveal mixed and inconclusive results regarding the impact of trade liberalization on poverty and income inequality. This could result from scanty data on measures of inequality, different methods of estimation, and or the heterogeneous nature of countries as most of these studies are conducted at country-specific levels. For this reason, this study uses the panel estimation technique to allow for the examination of the real impact of trade liberalization on poverty and income inequality in the context of a rapidly integrating Africa. Studies such as (Acharya et al., 2012; Artuc et al., 2019; Cheong & Jung, 2021; Khan et al., 2021) have found that trade liberalization contributes significantly to increasing the income of both the rich and the poor, thereby reducing absolute poverty. In contrast (Anwar & Sun, 2012; Wagle, 2007; Weller & Hersch, 2002), found that trade liberalization efforts worsen income inequalities even if it increases the gains from trade, it tends to benefit the rich more than the poor.

Similarly, while a lot of studies abound in the literature relative to the debate on the effects of external debt on economic growth, not much is done regarding the effects of external debt on income inequality, particularly in developing countries. The few known studies focus on the impact of income inequality on external debt or public debt but not vice versa. For instance studies (Bartak et al., 2022; Batuo et al., 2022; Bodea et al., 2021; Borissov & Kalk, 2020; Luo, 2020; Wagle, 2007) found that, increased income inequality causes an increase in external debt and or public debt stock, particularly in the long run. The current study did not come to provide such analysis, but to examine the effect of external debt stock on income inequality in Africa.

Finally, this study however seeks to test the opposite hypothesis by examining the effects of trade liberalization and external debt on income inequality in Africa in a panel framework. Consequently, the study seeks to answer the following questions; Is there a relationship between trade liberalization and income inequality in Africa? What is the relationship between external debt and income inequality in Africa? The rest of the paper is organized as follows: The second section is the literature review where associated theoretical and empirical reviews are analyzed. The third section presents the methods and sources of data while the estimation strategies are presented in the fourth section. The fifth section outlines the empirical results and discussions, while the sixth and final section presents the conclusions and policy directions.

#### 2. Literature review

#### 2.1. Theoretical literature review

Different trade models can be used to analyze the nexus between trade and income inequality. All those models differ widely in their predictions about how precisely the gains from trade will be distributed. However, they all predict that the gains from trade will not be distributed equally within an economy. For this paper, we are going to consider only the classical theory of Stolper and Samuelson (1941) and the trade models of Yeaple (2005) in modeling the link between trade liberalization and poverty or income inequality.

Traditionally, the model used in establishing the link between trade and income inequality has been the Stolper-Samuelson Theorem (Heckscher-Ohlin) which is based on the assumption of full employment (Robbins, 2003). According to this model, trade flows are determined by comparative advantage and the latter, in turn, depends on each country's resources or relative factor endowment to be precise. In this light, as developing countries are typically well endowed with lowskilled labor relative to developed countries, the former was expected to start exporting low-skill labor-intensive goods to the latter. This was based on the notion that relative demand for low-skill workers increases in developing countries and decreases in industrialized or developed countries. Against this backdrop, inequality is expected to decline in developing countries in the face of globalization.

Also, the theorem further predicted that inequality between high-skill and low-skill workers would probably increase in industrialized countries as a result of trade with developing countries. The theorem thus applies to trade among different countries rather than countries that are similar in terms of development and production structures. For example, developed countries trade with developing countries and not developed versus developed countries. Hence, relative rewards from trade were predicted to move in opposite directions.

However, it is important to state clearly that, the traditional theory is less useful for predicting the distributional effects of trade among similar countries as noted above (Kurose & Yoshihara, 2018). This is particularly important since developed countries trade more with other developed countries than with developing countries. Furthermore, the predictions of traditional theory also appear to conflict with the evidence from firm-level data which revealed that companies differ significantly within sectors, that only a subset of companies within a given sector export, and that those companies tend to pay higher wages than non-exporting companies (Bernard & Jensen, 1999; Jones & Marjit, 1985). Despite the weaknesses of the Stolper-Samuelson Theorem (Heckscher-Ohlin) as noted above, its relevance in the empirical literature on trade and income inequality nexus cannot be overlooked (Abrego & Edwards, 2002).

The second and quite modern form of the model we will consider in this paper is the one developed by Yeaple (2005) in which fixed costs also play a role and allow for differences between firms and a so-called continuous distribution of skills among workers. In this model, there is no clear line of separation between "high skill" or "low skill" workers, but rather a large variety of workers with different skill levels. The model specified that, the highest-skilled workers will end up

working in exporting companies after trade liberalization and that those companies use more productive technologies. Therefore, only skilled workers can take advantage of the increased opportunities provided by trade liberalization, and the difference between their wages and those working in other, non-export companies increases as a consequence of trade liberalization. It is worth noting that, this mechanism would not only work for trade between very different countries but also trade among similar countries. For example, industrialized countries trading among themselves or developing versus developing countries. This model further predicts increased inequality in all countries participating in trade.

#### 2.2. Empirical literature review

In this section, we discuss the related empirical works conducted over the past in the realms of trade liberalization, external debt, and poverty or income inequalities.

#### 2.2.1. Trade liberalization and income inequalities

Previous empirical studies have had varied and inconclusive results regarding the distributional impact of the gains from trade liberalization. These disparities could be related to several factors which include but are not limited to the limitedness of data on what constitutes inequality, for country-specific studies; method of estimation; as well as the heterogeneous nature of countries around the world. The current study addressed some of these factors by providing a comprehensive snapshot through marshaling secondary time series data over the period 2000–2018 across 30 countries in Africa. These countries, notwithstanding their diverse cultural backgrounds, seem to have broader similarities in terms of the composition of trade and the level of economic growth and development. The study also adopts the Pooled Mean Group (PMG) dynamic panel model for the estimation to ascertain both the short and long-run impact of trade liberalization on income inequalities in Africa.

The assertion that trade liberalization policies—notably in poor countries—tend to increase growth and thereby alleviate poverty and income inequality has not been empirically verified for Less Developed Countries (LDCs). However, this does not necessarily call for alarm—Given that trade in general leads to welfare gains and everybody can be made better off if appropriate domestic policies are put in place. Nonetheless, the fact that trade may in some cases lead to increased inequality has created a serious debate in the empirical trade literature. Khan et al. (2021) analyzed the predictions made by the trade models concerning the influence of trade liberalization on income inequality using real data and real trade agreements from Pakistan. The findings revealed that, in the short run, trade liberalization does not always result in a reduction in income inequality. Trade agreements that do enhance income equality benefit agriculture and often rely on a drop in urban and non-farm household income. Changes in income equality are more positive in the long run, suggesting that efforts should be focused on enhancing labor and capital mobility.

Moreover, Anderson (2020) carried out a systematic review of the evidence from CGE models to analyze the linkages between trade liberalization, poverty, and income inequality. The results strongly show that trade liberalization reduces poverty, but it is more likely to worsen inequality than alleviate it; however, the projected effects are minor. Variation in the amount and direction of impact can be explained by the choice of outcome measure, the fiscal reaction to liberalization, the type of CGE model, and specific country characteristics—but not the approach used to link the CGE model to the income distribution. Similarly, Mehta and Hasan (2012) in a study to examine the effects of trade and services liberalization on wage inequality in India found that labor reallocations and wage shifts due to liberalization account for only around 29% of the increase in inequality between 1993 and 2004, and that the effects of service reforms are many times greater than those of trade liberalization.

Furthermore, Foellmi and Oechslin (2010) in a study to examine the distributional effects of the gains from trade observed that trade liberalization policies in LDCs considerably worsen disparities

in wealth among business owners. The findings also suggested that, while the fortunes of wealthy entrepreneurs improve, the fortunes of relatively poor business people deteriorate. Intuitively, profit margins drop in integrated marketplaces, making it more difficult to obtain loans for relatively poorer businessmen. On the other hand, richer entrepreneurs, benefit since they are capitalized on new export opportunities. In all, liberalization tends to widen the gap between the rich and the poor in LDCs. Also, Bergh and Nilsson (2010) used the Standardized World Income Inequality (SWII) Database to examine whether the KOF Index of Globalization and the Economic Freedom Index of the Fraser Institute is related to within-country income inequality across a sample panel of 80 countries over the period 1970–2005. The findings suggested that, liberalization worsens income inequality particularly in richer countries than in poor countries and that social globalization is more important in LDCs.

In addition to the above, Forster et al. (2019) conducted a study to investigate how Structural Adjustment Programs (SAPs) affect income inequality using a sample of 135 countries over the period 1980-to 2014. The results indicated that reforms in the external sector, such as trade and capital account liberalization as well as the overall reforms are linked to income inequality. Besides, Weller and Hersch (2002) examine the nexus between global liberalization, poverty, and inequality and found that global trade and financial market deregulation harms the poor. The findings also revealed that the poor's income share is smaller in deregulated and less stable macroeconomic situations, which are more likely to emerge following capital account liberalization. However, the study concluded that, in the long run, trade flows in more regulated environments may be beneficial to the growth and, by extension, to the poor.

In contrast to the above findings, Le et al. (2020) used a global sample of 90 countries, consisting of 27 low and lower-middle-income countries (LMCs), 22 upper-middle-income countries (UMCs), and 41 high-income countries (HICs) over the period 2002–2014. The results show that export diversification, macroeconomic conditions, and income inequality have a long-term relationship. Specifically, across all three sub-samples, trade openness appears to diminish income inequality. However, the results further suggested that the association between export diversification and income inequality appears to be inverted-U shaped.

In the same vein, Glewwe (1988) as part of the World Bank Group, re-examined the effects of economic liberalization on income inequality in Sri Lanka using a survey day of five households over 1969–1970 and 1981–1982. The empirical results suggested that economic liberalization within these periods appears to reduce income inequality in Sri Lanka. However, the study concluded that the fact that liberalization policies do not appear to have exacerbated inequality in Sri Lanka does not mean that the effect will be the same in other countries; what happens in other countries may depend on the specific policy mix adopted and the country's economic and social features.

On the other hand, Santos-Paulino (2012) in the survey to examine the theoretical and empirical relationship between trade, trade liberalization, poverty reduction, and income inequality found divergent and inconclusive results. The results indicated that globalization has had a mixed impact on poverty reduction, although the literature's findings are highly dependent on modeling choices. Also, trade liberalization appears to increase overall well-being, although the advantages are modest and unequally distributed. More similarly, Beaton et al. (2017) in a study conducted to revisit the nexus between trade liberalization, growth, and income inequality particularly for Latin America and the Caribbean found that trade openness has had enormous macroeconomic benefits. However, the study does not find any statistically significant effect between trade openness and income inequality.

Last but not least, Artuc et al. (2019) in a study to investigate whether there exists a trade-off between income gains and inequality cost of trade policy, uses survey data from 54 developing countries and found that whiles trade liberalization increases average incomes, also worsens the

equality gains from trade. Average incomes were found to have increased in 45 countries, whereas 9 countries witness average income losses. However, the findings reveal that the overall average income gain from trade was 1.9 percent of real household expenditure and there was also strong evidence of a trade-off between income gains (losses) and inequality costs (gains), which arise as a result of the fact that trade exacerbates income inequality.

#### 2.2.2. External debt and income inequalities

While the effects of external debt on economic growth have been broadly discussed in the literature, little or nothing has been done regarding its effects on income inequalities, particularly in developing countries. A few studies conducted over the past focused on examining the impact of income inequality on external debt or public debt without regard to the impact of the latter on the former. Bartak et al. (2022) examine the relationship between income inequality and public debt in panel data of OECD countries over the period 1995–2014. The results show that increase in income inequalities is linked to growth in public debt only longitudinally. The study further indicated that this relationship may be explained by changes in unemployment rates. However, the study found no evidence of the effects of inequality on public debt and therefore concluded that the longitudinal effect may be temporary.

Moreover, Bodea et al. (2021) used available data on crises and types of crises, income inequality as well as decade-averaged data, the general method of moments, and error-correction models to investigate whether financial crises increase income inequality. The findings revealed that currency, banking, inflation, and debt crises all enhance income inequality, especially in the long run. Similarly, Borissov and Kalk (2020) conducted a study to examine the extent of public debt, positional concerns, and wealth inequality. The study found that measures intended at decreasing early inequality through the use of public debt may, in the long run, exacerbate wealth inequality.

Furthermore, Luo (2020) analyzes how government debt can be caused by changes in income inequality using a panel data set of OECD countries. The study distinguishes between labor income inequality and capital income inequality. The results suggested that growth in labor income leads to greater debt levels, but increased capital income inequality leads to lower debt levels. Also, Wagle (2007) carried out a study to examine the compatibility between trade liberalization and income inequalities in South Asian countries over the period 1980–20003. The findings indicated that income inequalities are associated with an increase in external debt.

#### 3. Methods and sources of data

This study employs panel data covering the period 2000–2018 for a selected thirty (30) countries in Africa to analyze the impact of trade liberalization and external debt on income inequality in Africa. We select the countries based on the availability of data on the variables of interest for the period under consideration. The dependent variable in this study is income inequality measured as the Gini index of disposable income, whiles the independent variables are trade openness as a proxy of trade liberalization, external debt, inflation, net inflows of foreign direct investment, and annual growth rate of per capita Gross Domestic Product (GDP). Due to limited data availability on income inequality, many cross-national studies have been hampered. However, the Standardize World Inequality Income Database (SWIID) creates room for such analysis as it provides comprehensive data on two measures of inequality—the Gini index of disposable and market income inequality for about 198 countries (Solt, 2020). Similarly, data on external debt, net inflows of foreign direct investment, and annual growth of per capita GDP are obtained from the World Development Indicators (WDI) 2021, World Bank Database, while data on trade openness and inflation are sourced from the WDI and Index Mundi.

#### 4. Estimation strategy

Considering the short panel nature of the data underlying this study occasioned by the unavailability of data on especially the Gini coefficient for most African countries, the study employs the static panel models for estimation purposes. In this regard and considering also that preliminary tests show the presence of heteroscedasticity in the data, the current study employs the Driscoll and Kraay (1998) robust standard errors augmented fixed and random effects models proposed by Hoechle (2007) for estimating panel data with potential cross-sectional dependence and heteroskedastic and or serially correlated error variances. This mode of estimation follows the standard fixed and random effects technique except that it implements an extra layer to deal with crosssectional dependence and to ensure robust estimates. Thus, the underlying restrictive fixed effect specification is shown in equation 1

$$y_{it} = \alpha_i + X'_{it}\beta + \varepsilon_{it}$$

Where  $y_{it}$  is the dependent variable and in our case, the measure of the Gini coefficient of country i at time t,  $\alpha_i$  is the cross-country effects which could vary across the countries,  $X_{it}$  is the vector of independent variables (trade openness, per capita income, external debt, inflation and foreign direct investment in our case),  $\beta$  are the common slope parameters of the independent variables and  $\varepsilon_{it}$  is the idiosyncratic error term. Unlike in the random effects model, the cross-country effects ( $\alpha_i$ ) in the fixed effects model could be correlated with the regressors ( $X_{it}$ ) in equation 1. Similarly, the underlying restrictive random effects model is shown in equation 2;

#### $y_{it} = X'_{it}\beta + (\alpha_i + \mu_{it})$

Where the variables and parameters in 2 are as defined in 1 except that the idiosyncratic disturbance term in 2 is a composite error term defined as;  $\varepsilon_{it} = \alpha_i + \mu_{it}$  such that  $Var(\varepsilon_{it}) = \sigma_a^2 + \sigma_a^2$ ,  $Cov(\varepsilon_{it}, \varepsilon_{is}) = \sigma_a^2$  and  $\rho_{\varepsilon} = corr(\varepsilon_{it}, \varepsilon_{is}) = \frac{\sigma_a^2}{(\sigma_a^2 + \sigma_a^2)}$ ,  $0 \le \rho_{\varepsilon} \le 1$ 

Here, rho measures the degree to which the country-specific effects inflate the error variance of the idiosyncratic error term. Thus, the cross-country-specific effects dominate the idiosyncratic error term when rho approaches 1.

#### 5. Empirical results and discussions

In this section, we begin with the presentation of the descriptive statistics of the variables, and results of the various diagnostic tests such as autocorrelation, heteroskedasticity, and multicollinearity. We further present in this section the results of the correlation matrix showing the relationship among the variables before reporting the panel regression results establishing the causal relationship between the dependent and the independent variables.

#### 5.1. Descriptive statistics of the variables

Table 1 presents the results of the descriptive statistics of the variables. From the table, it is observed that the average value of the Gini index of disposable income (GINIC) is 45.605 and the standard deviation is 5.976. The lower standard deviation of GINIC below its average value means that African countries are not so much heterogeneous in terms of the levels of income inequality. Similarly, the mean value of trade liberalization (TRADE) is 62.805 and the standard deviation is 17.927, implying that African countries are relatively less spread when it comes to openness to trade. Further, this also implies that African countries are almost at the same level of integration along the way they conduct trade with the rest of the world. Likewise, external debt has an average value of 48.075, with a standard deviation of 33.91. The lower standard deviation from external debt below its mean indicates that the selected countries in Africa are less dispersed in terms of the amount of money being borrowed from external sources to finance development projects in their countries over the years. On the other hand, GDP per capita growth rate (GDPPC); inflation (INFL), and net inflows of foreign direct investment (FDI) have a mean value of 1.944, 8.627, and 3.577 respectively and a standard deviation of 3.9, 19.475, and 4.619 respectively. The higher standard deviations of GDPPC, INFL, and FDI above its means suggest that African countries

Table 1. Descriptive	statistics					
Variable	Measurement	Obs	Mean	Std. Dev.	Min	Max
GINIC	Disposable income	570	45.605	5.976	37.9	63.6
TRADE	Trade (% of GDP)	570	62.805	23.903	17.927	152.547
GDPPC	Growth Per capita (%)	570	1.944	3.9	-22.312	21.028
EXTDEBT	External debt (% of GNI)	570	48.075	33.91	3.895	202.624
INFL	Consumer Price Index (%)	570	8.627	19.475	-72.729	324.997
FDI	Net inflows (% of GDP)	570	3.577	4.619	-6.37	39.456
Source: Author's Calculatic	on through STATA 17.			-		

Table 2. Correlations matrix of the variables						
Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) GINIC	1.000					
(2) TRADE	0.211	1.000				
(3) GDPPC	0.068	0.055	1.000			
(4) EXTDEBT	-0.081	0.159	-0.184	1.000		
(5) INFL	0.038	0.184	-0.081	0.188	1.000	
(6) FDI	-0.077	0.358	0.158	0.115	0.151	1.000

Source: Author's Calculation through STATA 17.

are widely dispersed in terms of their levels of growth, inflation rates, and the amount of foreign direct investment received over the study period.

#### 5.2. Correlation analysis

The results of the correlation matrix presented in Table 2 depict that there is a positive relationship between income inequality and trade liberalization, growth in per capita income, and inflation respectively. This means that rising income inequality in Africa could be associated with trade liberalization, growth in per capita income, and inflation rates. On the contrary, the results in Table 2 reveal that income inequality has a negative relationship with external debt, and net inflows of foreign direct investment respectively. The implication is that lower levels of income inequality in Africa may be associated with external debt and net inflows of foreign direct investment respectively. However, it is important to state that correlation does not always mean causation. Thus, the idea that two things happen simultaneously does not mean one causes the other. Nevertheless, correlation results give us an a priori expectation of the relationships among the variables.

#### 5.3. Multicollinearity test

Multicollinearity may become an issue in a model when two or more of the explanatory variables are highly correlated with each other. When there is high multicollinearity in a model, it inflates the variances or standard errors of the estimated parameters thereby making precision estimates difficult. Consequently, this study employs the Variance Inflation Factor (VIF) together with the correlation matrix in Tables 2 and 3 respectively to check whether multicollinearity exists among the explanatory variables in the model. The results from Table 2 show that the correlation coefficients among the explanatory variables in our model are well below the required value of 80% for multicollinearity to be an issue. Similarly, the VIF results in Table 3 indicate that the VIF of all the variables is below 10, while the mean VIF is also below the standard value of 5. This points to the fact that multicollinearity is not an issue in our model and it is, therefore, suitable for estimation and hypothesis testing.

Table 3. Variance inflation factor			
	VIF	1/VIF	
FDI	1.194	.837	
TRADE	1.184	.844	
EXTDEBT	1.098	.91	
GDPPC	1.078	.927	
INFL	1.078	.928	
Mean VIF	1.127		

Source: Author's Calculation through STATA 17.

Table 4. Jochmans portmanteau test for within-group correlation				
Source	chi2	Prob > chi2		
Jochmans portmanteau test for within-group correlation in panel data	30.000	1.0000		

Note: H<sub>0</sub>: no within-group correlation.

Source: Author's Calculation through STATA 17.

Table 5. White's and Breusch's "Pagan/Cook "Weisberg test for heteroskedasticity			
Source	chi2	Prob > chi2	
White's test for Heteroskedasticity	63.610	.0000	
Breusch"Pagan/Cook "Weisberg test for heteroskedasticity	37.84	.0000	

Note: H<sub>0</sub>: Homoskedasticity.

Source: Author's Calculation through STATA 17.

Table 6. Hausman test results			
	Coef.		
Chi-square test value	.005		
P-value	1.000		

Source: Author's Calculation through STATA 17.

#### 5.4. Test for autocorrelation

The results of the Jochmans portmanteau test for within-group correlation in panel data are reported in Table 4. The null hypothesis is that there is no within-group correlation in the residuals as opposed to the alternative hypothesis that there is a within-group correlation in the residuals. However, based on the results as presented in Table 4, we failed to reject the null even at the 10% significance level. The conclusion is that there is no within-group autocorrelation in the residuals of the model.

#### 5.5. Heteroskedasticity test

This study conducted preliminary heteroskedasticity tests on the initial Random and Fixed Effects models to see whether the models contain heteroskedasticity and or are suitable for the estimations. The study carried out two tests for heteroskedasticity: White's test for Heteroskedasticity and the Breusch"Pagan/Cook "Weisberg test for heteroskedasticity. Here, the null is that there is homoskedasticity in the model as opposed to the alternate hypothesis that there is unrestricted heteroskedasticity. The results from Table 5 show that the null hypothesis of homoskedasticity is rejected at the 1% level of significance. This, therefore, necessitated the use of the Driscol/Kraay standard error estimation techniques using the Random and Fixed Effects models to account for any possible autocorrelation and heteroskedasticity.

#### 5.6. Hausman test for model selection

The results of the Hausman test presented in Table 6 reveal that the probability value of the Chisquare statistics is insignificant even at the 10% level of significance suggesting that the Random Effects model is the most appropriate for the estimation. Hence, we failed to reject the null hypothesis and conclude that the Random Effects model best fits the data.

Table 7. Drisc/Kraay Random and Fixed Effects Estimates				
Dep. Var (Gini)	Random Effects	Fixed Effects		
TRADE	-0.013***	-0.014***		
	(0.000)	(0.000)		
EXTDEBT	0.004***	0.004***		
	(0.001)	(0.000)		
GDPPC	0.009	0.009		
	(0.149)	(0.104)		
INFL	0.001	0.001**		
	(0.146)	(0.028)		
FDI	0.019**	0.019**		
	(0.027)	(0.010)		
Constant	46.19***			
	(0.000)			
Observations	570	570		
Number of groups	30	30		

P values in parentheses \*\*\*p<0.01, \*\*p<0.05, \*p<0.1.

Source: Author's Calculation through STATA 17.

Note. Since the Gini coefficient ranges from 0 denoting perfect equality to 100 denoting perfect inequality, the significant effect of the predictor variables should be reversed for interpretation.

#### 5.7. Discrol/Kraay standard errors estimates and discussions

Table 7 outlines the results of both the Fixed and Random Effects models estimated using the Discrol/Kraay Standard Errors. Contrary to the results of the correlation matrix reported earlier on the relationship between trade liberalization and external debt, the findings from both estimation techniques reveal that trade liberalization reduces income inequality in Africa. On average, judging by the results of the Random Effects model, a percentage increase in openness to trade leads to a reduction in income inequality by about 0.013%, ceteris paribus. This suggests that to tackle the issue of income inequality in Africa, there is a need to pursue a long-term policy of encouraging further integration of the continent through openness to trade. The findings of this study corroborate those of (Le et al., 2020; Weller & Hersch, 2002; Zaghdoudi & Hakimi, 2017) in which openness to trade is found to have a limiting effect on income inequality in developing countries, particularly over the long run and in most especially countries with more economically stable and well-regulated environments.

Moreover, as opposed to the previous relationship between external debt and income inequality established under the correlation matrix, the results based on both the Fixed and the Random Effects acquiescently show that external debt exacerbates income inequality in Africa. Ruling on the results of the Random Effects estimates, on average, a percentage increase in external debt will lead to an increase in income inequality in Africa by approximately 0.004%, holding other factors constant. The implication here is that external borrowing as a means to alleviate poverty and income inequality and or undertake social intervention programs is not necessarily an ideal policy option for African governments. This is evident that a unit increase in external borrowing worsens income inequality rather than alleviates it. The results of this study are also in tandem with the findings of previous empirical studies (Bodea et al., 2021; Borissov & Kalk, 2020; Luo, 2020) in which external debt was found to be a canker to poverty alleviation and income inequality reduction, particularly over the long run.

Furthermore, in contrast to the results of the correlation matrix as demonstrated in Table 2, the estimates from both the Fixed and Random Effects depict that there is a positive relationship between

foreign direct investment, net inflows, and income inequality in Africa. All things being equal, the results indicate that a percentage increase in the net inflows of foreign direct investment will lead to worsening income inequality in Africa by about 0.019%. This could arguably be due to repatriation of profits and illicit financial activities by foreign firms such as tax dodging, and trade mis-invoicing, just to mention but a few. War on Want (2016) and Honest Accounts (2017) reported that Africa lost a net worth of about \$41.3 billion every year to the rest of the world mainly as a result of repatriation of profits by foreign companies, tax havens, illicit financial flows and cost of adapting to climate change. This suggests that African governments need not rely on FDI, net inflows as a means of alleviating poverty and income inequality. Also, the results of this study are in agreement with previous empirical studies (Choi, 2006; Kaulihowa & Adjasi, 2017; Ucal et al., 2014) wherein it is noted that incoming FDI may lead to higher growth but it does not always translate to reducing income inequality.

Besides, the results from Table 7 depict that there is a positive relationship between inflation and income inequality in Africa. The results of both the Fixed and Random Effects models show that inflation adversely affects income inequality in Africa. Ceteris paribus, based on the estimates of the Random Effects model, a percentage increase in inflation will lead to an increase in income inequality by approximately 0.001%, albeit the effect is generally not statistically significant, though it is significant under the Fixed Effects estimates. The findings here also agree with the results of the correlation matrix showing a positive relationship between inflation and income inequality in Africa. The positive relationship between inflation and income inequality means that inflations worsen income inequality in Africa and this could be a result of the fact that higher inflation rates distort the price system and reduce the purchasing power of the average consumer thereby widening the gap between the rich and the poor. The results of this current study concord with the findings of past studies (Bulíř, 2001; Cysne et al., 2005; Nantob, 2015) in which we found that higher inflation rates worsen income inequality especially up to a threshold value of 109% above which it begins to have a marginal limiting effect on income inequality. However (Monnin, 2014; Siami-Namini & Hudson, 2019), found that there is a U-shaped relationship between inflation and income inequality in a panel consisting of some developed and developing countries.

Last but not least, the Fixed and Random Effects estimates suggest that GDP per capita income growth exacerbates income inequality in Africa. These findings vindicate the results acquired earlier on under the matrix of correlation establishing a positive relationship between GDP per capita income growth and income inequality in Africa. On average, the results of the Random effect from Table 7 demonstrate that a percentage increase in the growth of GDP per capita will lead to an increase in income inequality by about 0.019%, holding other factors, although the effect is generally statistically insignificant. The findings, in this case, imply that as the economy grows, incomes are unevenly distributed in Africa. This calls for further policy measures to enhance the even distribution of national income in Africa as the economy grows. The findings of this study reaffirm the results of the studies (Nguyen, 2021; Zaghdoudi & Hakimi, 2017) in which GDP per capita growth was found to exacerbate income inequality.

#### 6. Conclusions and policy recommendations

This study employs the fixed and random effects with Driscoll and Kraay standard errors to reexamine the impact of trade liberalization and external debt on income inequality across a sample of 30 African countries covering the period 2000–2018. The findings reveal that while trade liberalization improves income inequality, external debt worsens income inequality in Africa. This points to the fact that with a better regulatory environment and effective trade policy, countries can still reap the short-term benefits of trade liberalization as a mechanism to alleviate poverty and income inequality in Africa. The logic is that trade openness could open more opportunities for locals and entrepreneurs to have access to a variety of raw materials at cheaper prices, expand their scale of production due to access to a wider market, access to foreign technology and capital, and ultimately create more jobs for the masses thereby reducing income inequality in the long run. Therefore, the creation of the AfCFTA could be a good step toward alleviating poverty, hunger, and income inequality in Africa. However, the overall success of the AfCFTA highly depends on the member country's commitments to the treaties they signed and this should be given serious consideration and attention by African governments.

The findings further imply that improper utilization of external debt could potentially widen the gap between the rich and the poor. This is consistent with the import of the Ricardian equivalence in the sense that external debt accumulation is essentially deferred taxation, which when sub-optimally implemented could worsen income inequality. This is critical because most African governments do not invest their borrowed funds in capital expenditure items such as building factories and industries which could be self-financing over the long run. As a result, it creates a greater burden on the ordinary taxpayer due to higher taxes which leads to job losses and widening income inequality in the long run. Therefore, for external debt to have a long-term effect in reducing income inequality in Africa, the conditionality regarding the use of borrowed funds should be properly negotiated and governments need to ensure judicious and efficient use of these funds to create sustainable jobs for the youth.

Lastly, the results reveal that GDP per capita growth worsens income inequality in Africa. This is indicative of the uneven distribution of income in Africa i.e., typically, income is concentrated in the hands of only a few rich people while the masses are living below the poverty line. Hence, it is recommended that African governments and or policymakers should design more social intervention programs to cushion the burden on the poor. This can be done by establishing more vocational and technical skills training programs for the poor, supporting the poor with funds, health insurance policies, subsidizing education for the poor, and adopting a progressive taxation system.

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#### Disclosure statement

No potential conflict of interest was reported by the author(s).

#### Data availability statement

The data used for this research can be accessed at: https://wid.world/country/switzerland/ & https://data. worldbank.org/indicator

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