Income Inequality and Redistribution In Sub-Saharan Africa

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Bringing Rigour and Evidence to Economic Policy Making in Africa

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Abstract

The theoretical expectation postulated by standard economic theory is that high inequality would lead to higher redistribution via the collective action of the median voter. In this paper, we adopt an instrumental variable approach to test the median voter hypothesis with specific reference to sub-Saharan Africa (SSA). Overall, we find a positive relationship between inequality and redistribution, especially among middle-income countries, which is driven by the abundance of natural resource rents. Thus, our results do not provide strong evidence to support the median voter theorem, but instead, call for alternative interpretations, more closely to the existence of multiple steady states.

JEL Classification: D63, D72, E62, H20, H39

Key words: Inequality, redistribution, taxation, sub-Saharan Africa.

1. Introduction

High levels of income inequality in many parts of the developing world have drawn the attention of scholars to investigate their drivers and consequences, and the extent to which the median voter and poorer members of society are able to influence governments' redistributive decisions (McCarty and Pontusson, 2011). One of the main concerns about high and increasing levels of income inequality is the possible negative effects that it may have on economic growth and, ultimately, aggregate welfare.

Indeed, a long-standing debate exists in the economics literature about the impact of income inequality on economic and social development (Adelman and Robinson, 1989). The pioneering works by Kuznets (1955) and Lewis (1954) provide a theoretical analysis of the underlying mechanisms in the relationship between inequality and economic development, focussing on the sectoral composition of the economy. Specifically, inequality is expected to increase with the shift from a low-income agrarian economy to a high-income, modern, industrialized economy.

As for the possible influence of inequality on growth a positive association, that is inequality as growth-enhancing, has been envisaged based on three main arguments (Aghion et al., 1999). First, the rich have a higher marginal propensity to save, which translates into higher aggregate savings and growth. Second, the existence of investment indivisibilities in the presence of imperfect capital markets requires some concentration of wealth to finance certain productive activities. Third, the existence of incentives would foster the production of output when the latter depends on effort.

By assuming a different perspective, some studies point out the detrimental effects of inequality on growth. Among others, Galor and Zeira (1993) and Banerjee and Newman (1993) looked at the role of credit market imperfections. Specifically, they highlight how credit constraints reduce the ability of the poor to invest in education which, in turn, has an impact on occupational choices and labour productivity, and create poverty traps and income gaps that, ultimately, hamper aggregate output.

A much smaller strand of the literature that emphasizes the effects of income inequality takes a political economy perspective. The seminal works by Alesina and Rodrik (1994) and Persson and Tabellini (1994) highlight a negative effect of inequality on growth, which materializes through redistributive policies. In contrast, by moving from different assumptions, Li and Zou (1998) come to the conclusion that inequality has a positive effect on growth.[1] Taxing the wealthy would have two effects on growth: one would reduce the net return on production factors, such as capital and skilled labour, thus affecting growth negatively. Another would increase transfers to the poor and finance public services such as infrastructure and education that would stimulate growth. As redistribution decisions are endogenous to inequality, past inequality would influence redistribution and, consequently, future economic growth.

While the theoretical predictions from this strand of the literature are certainly relevant for developing countries, the empirical evidence testing these dynamics remains largely ambiguous. In this paper, we contribute to filling this gap by examining the relationship between income inequality and redistributive decisions, particularly in the context of sub-Saharan Africa (SSA), a region characterized by high levels of income inequality and limited redistribution. We adopt an instrumental variable approach to unpack the determinants and likely mechanisms underpinning the association between income inequality and redistribution. Given the role of elites highlighted by the literature as influencing redistributive decisions, we follow Jordá and Niño-Zarazúa (2019) to account for the effect of omitted top incomes in the estimation of income inequality due to existing data constraints in household surveys.

Overall, we find strong evidence of a negative effect of inequality on total government revenues, our proxy for redistribution. The results are consistent for most country income groups, and across model specifications, econometric methods and inequality measures, with the only exception of SSA, which differs from the rest of the global sample by showing a positive effect of inequality on redistribution. Interestingly, accounting for the omission of the richest (those at the top 99th percentile of the income distribution) in income inequality estimates has a qualitatively negligible effect on redistribution. This seems to reflect not only a limited revenue mobilization capacity via direct taxes in SSA countries, but also the likely strength of elite cohesion and their connectedness with political regimes that, in the presence of natural resources rents, undermine the feasibility of progressive tax policies. Thus, our results do not seem to provide strong evidence to support the propositions of the median voter theorem, but instead hint at alternative propositions that underpin the causal relationship between income inequality and redistribution in low- and lower-middle-income countries.

The remainder of the paper is organized as follows: Section 2 reviews the literature with specific reference to the redistribution hypothesis, particularly in the context of SSA. Section 3 introduces the empirical strategy and the model specification (3.1), by highlighting the relationship between inequality and redistribution. Section 3.2 describes the data sources and key variables used in the empirical analysis. Section 4 discusses the results while Section 5 presents a series of robustness checks. Finally, Section 6 concludes.

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1 See Ostry et al. (2014) for a formal discussion on the relationship between inequality, redistribution and growth.

2. Inequality and Redistribution

Within the political economy literature, there is an emphasis on the role of the median voter in influencing redistribution decisions, particularly in the context of high levels of inequality (Meltzer and Richard, 1981; Alesina and Rodrik, 1994; Persson and Tabellini, 1994). The theoretical expectation is that in contexts of competitive electoral systems, high inequality would lead to higher redistribution via the collective action of the median voter.

Most of the empirical literature testing the role of inequality in influencing redistribution has been conducted in the context of advanced economies, most with longstanding liberal democracies, providing mixed results. Studies that support a positive association between inequality and redistribution (Shelton, 2007; Boustan et al., 2013) differ in terms of sample, timeframe, proxies for both inequality and redistribution, and estimation strategies, making the comparison of findings difficult.[2] To illustrate, redistribution has been measured by the difference in the share of the bottom quantiles of the income distribution when disposable income is considered in relation to factor income (Milanovic, 2000), or by the change in the Gini coefficient from gross market income to disposable income (Lupu and Pontusson, 2011; Scervini, 2012; Luebker, 2014). Further analyses have been conducted using social spending or tax revenues as proxy measures for redistribution (Schwabish et al., 2006).

Several studies that examine the association between inequality and redistribution do not find any significant result (see De Mello and Tiongson, 2003 for a review), while others report a non-positive relationship (Lindert, 1996; or non-linear, De Mello and Tiongson, 2003). It should be noted that some of the conditions necessary for the median voter theorem to apply barely hold for developing countries whose political institutions and electoral systems differ in significant ways from those outlined by the median voter model. Even among liberal and consolidated democracies, it is not always the case that countries with high levels of income inequality redistribute more.

In light of the inconclusive evidence from the literature, it is pertinent to consider alternative interpretations of the relationship between inequality and redistribution. The work by Bénabou (2000), which takes a 'social contract paradigm' perspective, predicts a non-linear relationship between inequality and redistribution that can become negative over the long run, with possible multiple steady states: high

2 Scervini (2012) reviews some of the most influential studies of the early reference literature.

inequality and low redistribution; low inequality and high redistribution. The rationale of the model is that, corresponding with low levels of inequality, popular support for redistributive policies is high. Then, as inequality increases, the share of the rich population is sufficiently high to oppose the implementation of further redistribution. Finally, in the presence of a high level of inequality, the share of the poor population is large enough to impose high levels of redistribution, even if it is inefficient.

Similarly, the work by Moene and Wallerstein (2001) predicts a negative relationship between inequality and redistribution. However, in this case where there is such a negative association, there is an underlying assumption that social spending is not only a way to redistribute income but also to provide some form of insurance.

More recently, other interpretations of the mechanisms underlying the median voter hypothesis have been proposed. In particular, the rational utility maximization paradigm driving the median voter's choice in the traditional approach has been revised on the basis of arguments from behavioural economics, emphasizing the role of individual motivations and normative value judgements in shaping preferences about redistribution (Luebker, 2014; Bussolo et al., 2019; Ahrens, 2019). In addition, taking advantage of the substantial improvement in the quality of data recently achieved, empirical analyses on the political economy of redistribution have been increasing. The social contract paradigm has more recently been tested also with reference to developing countries. Prominent analyses are those by Breceda et al. (2009) for Latin America, Birdsall and Haggard (2002) for East Asia, and Zoellick (2011) for the Middle East and North Africa.[3]

3 It should be acknowledged that the debate about social contract is still open, and the related literature is still evolving, for both less developed and advanced countries. Among the most recent contributions can be found in Bussolo et al. (2018).

3. Empirical Strategy

Empirical analyses of the relationship between inequality and redistribution remain ambiguous partly due to two important constraints: first, data have been a major limitation, especially for cross-country analysis. Second, some of the underlying assumptions of the median voter theorem are difficult to test in developing country contexts, partly because social and political institutions differ substantially from the assumptions imposed by the theorem. In order to test this hypothesis empirically, we present in the next section the baseline model.

3.1 Model Specification

In order to assess the effect that inequality may have on redistribution, we estimate the following model:

$$R_{it} = \beta_0 + \beta_1 I_{it} + \beta_2 X_{it} + \upsilon_t + \epsilon_{it} \quad (1)$$

where the subscripts *i* and *t* denote country and period, respectively, R_{it} is a proxy for redistribution, β_0 is the constant, I_{it} is an index of income inequality, X is the matrix of the control variables, υ_t is a vector of period dummies capturing common time trends and ϵ_{it} is the error term.

Inequality (I_{it}) is our key variable of interest. Specifically, we want to assess whether, and to what extent, income inequality affects redistributive decisions. It should be noted here that inequality is likely to be endogenous in Equation 1 due to several reasons. First, the presence of omitted variables influencing both inequality and redistribution. Second, the possibility of measurement error due to the absence of top income earners in household surveys. Finally, simultaneity bias may emerge as the level of inequality is likely to influence redistribution as much as redistribution is likely to influence the level of inequality. In such cases, the assumption of exogeneity would not hold and we would need to find a valid instrument for inequality to make our estimates consistent. Consequently, we extend Equation 1 into a system of equations by modelling inequality as follows:

$$I_{it} = \delta_0 + \delta_1 Z_{it} + \delta_2 X_{it} + \upsilon_t + u_{it} \quad (2)$$

where *Zit* is exogenous with respect to Equation 1, but partially correlated with inequality in Equation 2, i.e., $Cov(Z_{it}, \epsilon_{it})$= 0 and $\delta_1 \neq 0$.4 The variables considered as instruments for inequality in this analysis are described in Section 3.2.3. In addition to inequality, we control for other factors that influence redistributive decisions, following the reference literature (see, e.g., Dioda, 2012; Drummond et al., 2012; Sen Gupta, 2007).

First, we consider some structural economic factors. As proxies for the level of economic development, we use both per capita income (*yPPP*) and the share of value-added originating from agriculture (*agric*), the latter variable also providing information about the sectoral composition of output. Per capita income is expected to be positively correlated with government tax revenues – our proxy for redistribution – as the demand for goods and services provided by governments is expected to increase with income. In addition, economic development usually goes along with a greater capacity of governments to levy and collect taxes (Dioda, 2012). In contrast, a high share of agriculture over national output denotes a less diversified and developed economy which, in turn, negatively impacts government revenues. Moreover, when characterized by subsistence farming and mainly driven by dispersed small-scale producers, the primary sector may also be difficult to tax (Sen Gupta, 2007).

Our model also includes an indicator that measures the trade openness of countries (*trade*) as the share of import and export over GDP is expected to influence the revenue performance of an economy and the size of the government, although the direction of its association with tax revenues remains ambiguous in the literature. On the one hand, taxes on imports and exports are relatively easy to collect because monitoring the entry and exit of goods into and from a country is generally straightforward, thus leading to a positive association with tax revenues. On the other hand, trade liberalization and trade agreements usually involve cuts in international tax rates which, in the absence of appropriate domestic tax reforms, can result in a consequential fall in government revenues (Khattry and Rao, 2002; Gnangnon and Brun, 2019).

Furthermore, in order to control for the influence of the overall economic cycle, we include the unemployment rate (*unempl*). In principle, tax revenues are expected to rise during booms and fall during recessions. As a consequence, the correlation between tax revenues and unemployment would be expected to be negative, although the country-specific revenue composition and the procyclicality of fiscal policies characteristic of many developing countries may influence and even reverse the expected pattern of this relationship (Alesina et al., 2008; Talvi and Vegh, 2005).

4 Following Andrews et al. (2019), we refer to Equation 1 as the structural form equation and to Equation 2 as the first-stage equation.

Second, we consider some socio-demographic factors influencing tax revenues. In particular, we control for the dependency ratio of countries (*depratio*), defined as the share of the population younger than 15 or older than 64 to the working-age population (aged 15–64), as well as for female participation in the labour force (*femlabpart*). Both variables are expected to be positively associated with revenue collection, although not unambiguously (Dioda, 2012). Countries characterized by a high or rapidly growing proportion of elderly in the population face the pressure to create or expand their pension systems, a goal which can be favourably approached through increasing revenues. In contrast, countries with a large proportion of children face limited productive capacity that generates tax revenues. Female labour force participation is expected to be positively correlated with tax revenue as a higher share of women employed in the labour market enlarges the tax base (Dioda, 2012).

We also control for population density (*popdens*), as it is expected to lower the administrative costs of tax collection and evasion controls. Finally, we consider ethnic tension (*ethnt*) in order to assess whether ethnicity may affect the mobilization of collective resources and the provision of public goods (Alesina et al., 1999). The literature has extensively highlighted the influence of ethnic composition on countries' economic performance (Alesina and La Ferrara, 2005; Habyarimana et al., 2007). Moreover, specific attention has also been devoted to examining the influence of ethnicity on the government's effectiveness, with some studies arguing that individuals in diverse communities are less willing to contribute to the public good (Lindqvist and Östling, 2013; Kimenyi, 2006), while other studies find an ethnic diversity divided with respect to public goods provision (Gisselquist et al., 2016). Nonetheless, ethnic fractionalization could lead to lower tax revenues, especially in countries characterized by an important colonial history that may have resulted in fragmented policies and weaker national identities (Besley and Persson, 2014).

Third, we consider a set of institutional factors in the realm of the political system that may exert some influence on revenue collection (Bird et al., 2014). Specifically, we include proxy indicators for: i) government stability (*govstab*), i.e., the ability of governments to carry out their declared programmes and policies, ii) internal conflict (*intconfl*), i.e., the political violence in the country and its actual or potential impact on governance, and iii) corruption (*corrup*) within the political system. Overall, we expect higher institutional quality and political stability to positively influence revenue collection, while more corruption is expected to be negatively associated with tax revenues (Botlhole et al., 2012). In the next section, we describe the main indicators used in the empirical analysis, and the data sources.

3.2 Data and Variables

3.2.1 *Revenues*

We estimate Model 1 by using total government revenue as share of GDP as our dependent variable. Total government revenue captures the level of fiscal resources available to governments and is a valid approximation of a country's redistributive capacity. In fact, the ability to collect taxes is central to a country's capacity to finance social services such as health and education, critical infrastructure and other public goods (Akitoby et al., 2019). Moreover, the correlation between redistribution and revenues has been widely documented (see, for example, Ostry et al., 2014).

Given the international comparative perspective of the present analysis, we resort to UNU-WIDER's Government Revenue Dataset (GRD), which provides sufficient cross-national information on governments' revenue collection capacity. Specifically, we use the series of revenues exclusive of social contributions.[5] This choice is motivated by the problems of completeness and comparability for social contribution figures, particularly for developing countries.

3.2.2 *Inequality*

We estimate reference Model 1 by using the Gini coefficient as our preferred measure of income inequality. The Gini index for each country and reference year were estimated using data on income shares from UNU-WIDER's World Income Inequality Database (WIID), which contains repeated cross-country information on Gini indices and income (or consumption) shares for 189 countries.[6] The WIID is the most reliable and comprehensive database of worldwide distributional data currently available.[7]

Whenever there was missing information for every reference country-year data point, we opted to include observations within a maximum of the previous or next five years of each data point, while giving preference to the closest observations. In addition, we adopted the conceptual base of the Canberra Group to minimize the problems that may arise from informational differences in the WIID in terms of unit of analysis, equivalence scale, the quality of the data and the welfare concept.[8]

In order to keep the global coverage as high as possible, we included consumption-based quintile data, in addition to income-based data, which is our preferred welfare

5 Revenue data used for the analysis are also exclusive of grants. The GRD database is available at: UNU-WIDER : Government Revenue Dataset (GRD).

6 The WIID database is available at: https://www.wider.unu.edu/database/wiid.

7 For a review of the data coverage and the main statistical features of the WIID, see Jenkins (2015).

8 More specifically, we focus on individuals rather than households, as the preferred unit of analysis. We also opt for income per capita rather than adult equivalent adjustments. In addition, we give preference to observations from nationally representative surveys, which are deemed to be of the highest quality. Finally, our preference is to use income over consumption as the welfare concept in the analysis.

concept. We note that mixing consumption and income data could lead to misleading results as both variables present different distributional patterns, being consumption typically characterized by lower inequality. Therefore, we adopt a harmonization procedure that consists of comparing the average income shares with those of consumption, for the available country year observations that had both income and consumption data available for the same year. We then grouped countries together in world regions and computed an average index of income relative to consumption, following Jordá and Niño-Zarazúa (2019). This procedure is similar, although not strictly identical, to those adopted by Niño-Zarazúa et al. (2017) and Deininger and Squire (1996), with the key distinctive feature being that in the present study, we account for the difference in the income-consumption relationship at the regional, not global, levels.

An important potential source of bias in the empirical literature comes from the omission of top income earners in household surveys, from which inequality measures such as the Gini index are generated. The size of the national income pie in the hands of the richest can change not only the shape of the income distribution and the level of income inequality, but also governments' incentives and preferences for redistribution. A few previous studies have used administrative records on personal income tax returns to adjust the upper tail of the income distribution from household surveys (Atkinson et al., 2011; Piketty and Saez, 2013; Leigh, 2007; Alvaredo et al., 2013). However, tax records are only available for a very small number of countries, and mostly for a relative short time window.

In order to overcome the limitations in the existing literature, we follow Jordá and Niño-Zarazúa (2019) by applying a parametric model, based on the so-called generalized beta distribution of the second kind (GB2) to help us estimate the size of the bias – or truncation points in the Lorenz curves – arising from the omission of top incomes in the estimation of income inequality measures. We mitigate this bias by adjusting the income distribution after setting the truncation points at the $t = 0.99$, 0.9925, 0.995 and 0.9975 percentile levels. We then estimate the reference Model 1 based on both the unadjusted Gini index and the adjusted Gini by top incomes, following the truncation points described above.

3.2.3 Instrumental Variables

In order to control for the simultaneity bias problem in the relationship between inequality and redistribution, we experiment with three instrumental variables that have been used in previous studies. The first instrument captures countries' agricultural endowments. Following Easterly (2007), we consider the share of land used to produce wheat, relative to the share of land used for sugarcane production (wheatsugar). The rationale behind this instrument is motivated by Sokoloff and Engerman's (2000) hypothesis that the abundance of land for specific modes of agricultural production in former colonies set a pattern of structural inequality that continues to influence inequality levels in many developing countries, but it not expected to exert a direct influence on redistribution. We compute this instrumental variable as follows:

$$wheatsugar = ln\left(\frac{1+Wheat\_agril}{1+Sugarcane\_agril}\right) \quad 3$$

where *wheat_agril* is the share of land used to grow wheat over total arable land, while *sugarcane_agril* is the share of land used to grow sugarcane over total arable land. We use lagged values of this indicator as instrument to current inequality.

We expect a higher incidence of land for growing wheat to be associated with lower inequality. In fact, as pointed out by Easterly (2007), sugarcane is a labour-intensive crop compared to wheat, and its production proved to be profitable only in the presence of economies of scale obtained in large plantations. These features led nations with relative abundance in land suitable for sugarcane production to rely more on forced labour than family farms, thus impeding the development of a middle class and fostering inequality.

We use the share of domestic credit to the private sector over GDP (*dcredit*) as our second instrument variable for inequality. The rationale behind this instrument reflects the theoretical argument put forward by Bénabou (2000) that in the context of capital market imperfections, access to credit and investment opportunities vary substantially among individuals with differential capital endowments which, consequently, leads to a persistence in income inequality.[9]

Finally, we follow the argument put forward by Aiyar and Ebeke (2019), and consider the adolescent fertility rate (*adolfert*) as our third instrumental variable. High fertility rates among adolescents are likely to adversely affect human capital endowments and future earnings which, in turn, would worsen income inequality. As higher adolescent fertility rates are likely to be more prevalent among low-income households, we use the lagged values of this indicator as an instrument to inequality.

3.2.4 Other Controls

For economic and socio-demographic controls, we employ data from the World Bank's World Development Indicators (WDI) as our primary data source (World Bank 2019). Data on institutional dimensions are drawn from the International Country Risk Guide dataset (ICRG 2020), which is published annually by the PRS Group .[10]

9 This instrumental variable has been used by previous studies (e.g., De Mello and Tiongson, 2006, who empirically examined the causal relationship between inequality and redistribution.

10 We are aware of the heterogeneity in the quality of data for the different groups of countries included in the analysis. We have relied on the most accurate, harmonized and comprehensive data sources available for cross-country analysis. Nevertheless, we acknowledge the possibility of having problems of measurement error due to data constraints.

3.2.5 Study Coverage

The present study covers 116 countries, 27 of which are in the SSA region, over the period 1990–2015.[11] All variables used in the analysis are averaged over five-year periods.[12] This choice is motivated by the fact that comparable annual data for inequality are available only for a limited number of countries and by the evidence that inequality is a highly persistent variable. Furthermore, averaging data over time intervals makes the results less sensitive to the possibility of short-term fluctuations. Table A3 presents the summary statistics for all variables used in the analysis.

On average, over the examined period, total government revenues represent nearly 23% of GDP at the global level. This share is lower for SSA (see Table A4), for which total revenues amount to approximately 17% of GDP. As for income inequality, the average value for the Gini index is about 45 points on a 0–100 scale. Compared to the global average, SSA countries are characterized by a much higher level of inequality, with a mean value of almost 58 points. Figure 1 provides a general picture of the pattern characterizing the two main variables of interest over the reference period.[13] On a global level, the share of total government revenues over GDP shows an increasing pattern, while income inequality exhibits a sizable reduction over the same period. In the case of SSA we observe a similar pattern, although the trends in both total revenues and inequality are not strictly monotonic, especially with reference to the first decade.

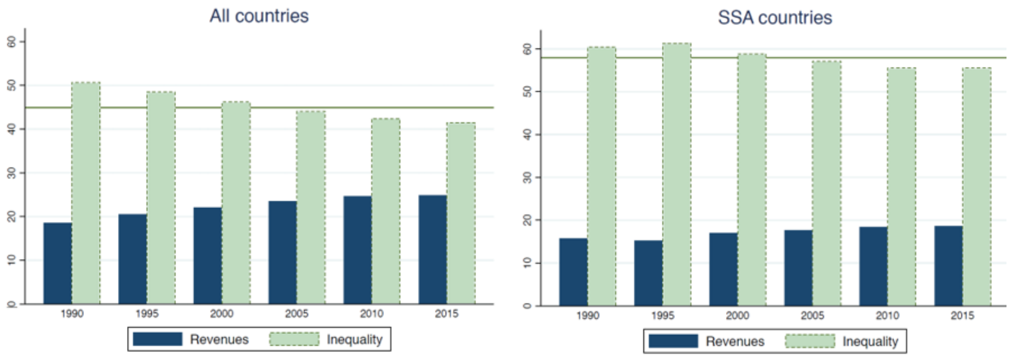
In order to have a more detailed representation of the structure of total government revenues in the SSA region, in Figure B1 we show the average values of revenues and inequality by country. The next section presents the results of the econometric analysis.

11 The list of countries included in the sample is given in Table A2.

12 Variables' definitions and data sources are reported in Table A1.

13 A slightly different view on the association between total revenues and inequality is provided by Figure A1, where country-period observations are plotted instead of the average values.

Figure 1: Total revenues (GDP share, %) and inequality (Gini)



4. Results

We begin the discussion by presenting the results of Model (1) based on a 'naïve' pooled ordinary least squares (OLS) estimator, which relies on the exogeneity assumption of inequality. The results in Table 1 (column 1) show a negative coefficient for the Gini index, indicating that higher levels of income inequality are associated with lower revenue capacity, thus acting as a detrimental factor in countries' resource mobilization efforts.

As discussed earlier, we suspect the OLS estimators to be biased, as the level of income inequality is unlikely to be independent from redistribution decisions, measured by total government revenues. In such a case, the unobservable error term would be correlated with the Gini index and the OLS estimator would produce inconsistent parameter estimates. Therefore, we adopt an instrumental variable approach.

As shown in Table 1, we first compute Model 1 as an exactly identified model (columns 2 and 3), with the share of land used to produce wheat, relative to the share of land used for sugarcane production (*wheatsugar*) as the instrumental variable. We then compute the same Model 1, but with a richer set of instruments (columns 4 and 5), adding to (*wheatsugar*) two additional instruments: the share of domestic credit to the private sector over GDP (*dcredit*) and the adolescent fertility rate (*adolfert*). After conducting an endogeneity test, we find that the Gini index that measures the level of income inequality is in fact endogenous to redistribution in the specified model.[14] Therefore, we focus on the two-stage least squares (2SLS) estimators (columns 2–5), which provide consistent parameter estimates of the causal effect of inequality on redistribution.

Before turning our attention to the results, we test the validity of the instrumental variables (IV) procedure. First, we perform an under-identification test to assess the relevance of the instruments. A rejection of the null indicates that the model is identified. Second, we perform a weak-identification test to assess whether the instruments are strongly correlated with the endogenous regressor. A value of the F statistics above the critical values denotes that the correlation is not weak. Third, we compute the Hansen test of over-identifying restrictions. In this case, a rejection of the null casts doubt on the validity of the instruments. Overall, the performed tests verify the validity of the selected instruments and show that the IV approach is the appropriate one to estimate the causal effect of inequality on redistribution.

14 The null hypothesis assumes the regressor to be exogenous. Test results reject the null at a 5% level.

Table 1: Inequality and total government revenues

	OLS	2SLS		2SLS	
	(1)	(2)	(3)	(4)	(5)
Depvar	revenues	revenues	in q	revenues	ineq
gini	-0.358***	-0.960***	-	-0.874***	-
	(0.122)	(0.293)		(0.259)	
yPPP	0.059	-0.032	-0.118***	-0.019	-0.126***
	(0.062)	(0.079)	(0.028)	(0.075)	(0.031)
agric	-0.013***	-0.019***	-0.007***	-0.018***	-0.007***
	(0.004)	(0.005)	(0.002)	(0.004)	(0.002)
unempl	0.020***	0.024***	0.011***	0.024***	0.011***
	(0.004)	(0.006)	(0.003)	(0.005)	(0.003)
trade	0.001**	0.001**	-0.000	0.001**	-0.000
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
depratio	0.000	0.003	0.004***	0.003	0.002
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
femlabpart	-0.000	-0.000	-0.002	-0.000	-0.003
	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
papdens	-0.000***	-0.001***	-0.000	-0.001***	-0.000**
	(0.000)	(0.000)	(0. 000)	(0.000)	(0.000)
gQlJstab	0.031*	0.040**	0.001	0.039**	0.004
	(0.016)	(0.016)	(0.010)	(0.016)	(0.010)
intconfl	0.008	0.001	-0.004	0.002	-0.004
	(0.014)	(0.016)	(0.007)	(0.016)	(0.007)
corrup	0.059**	0.039	-0.021*	0.042	-0.025**
	(0.028)	(0.026)	(0.012)	(0.026)	(0.012)
ethnt	-0.018	-0.015	-0.008	-0.015	-0.008
	(0.022)	(0.023)	(0.010)	(0.022)	(0.010)
wheatsugar			-1.599***		-1.439***
			(0.188)		(0.182)
dcredit			-		0.001*
					(0.000)
adolfert			-		0.001*
					(0.001)
Constant	3.413***	6.444***	4.863***	6.017***	4.937***
	(0.953)	(1.722)	(0.314)	(1.550)	(0.314)
Observat ions	530	530	530	530	530
R-squared	0.679	0.629		0.642	
Endog test p-val			0.014		0.049
K-P rk L1vl st. p-val			0.000		0.000
K-P rk Wald F st.			72.52		28.24
Hansen J p-val					0.265

Depvar columns 1, 2 and 4: total re,·euues (% GDP , ln). Depvar colwnns 3 and 5: in equality (gini, ln). Panel-clustered (country) standard errors in parentheses. Period dummies included. *** p< 0.01, ** p< 0.05, * p<0.l.

Looking at the first-stage regressions in Table A5, we find that the selected instruments are statistically significant. Specifically, the sign of the *wheat sugar* variable is the expected one, capturing the negative association between the relative abundance of land for growing wheat and inequality. A higher share of domestic credit to the private sector, instead, seems to have a detrimental distributive effect, exacerbating inequality. This indicates that capital market development seems to occur at the cost of higher income inequality. Finally, a higher fertility rate among young women is found to be correlated with higher inequality, as postulated by the literature.

Turning to the main structural equation, we find that inequality has a negative effect on revenues. As we enter Equation 1 with a log-log specification, the coefficient of the Gini index can be interpreted as elasticities, i.e., the percentage change in total government revenues as the outcome of one percentage change in the levels of income inequality, ceteris paribus. More specifically, we find that an increase in the Gini index by 1% leads to a decrease in total government revenues by approximately 0.87% to 0.96%, depending on the choice of the instruments set.

Regarding other control variables, the size of the economy, measured by GDP per capita, is positive but statistically insignificant, indicating a weak relationship between economic development and revenue collection. Other structural indicators show that the sectoral composition of output is relevant for revenue mobilization. For example, the share of agriculture over GDP has a negative and significant association with total government revenues, while trade openness shows a positive and statistically significant, although very small, association.

The coefficient for the unemployment rate shows a positive and significant sign, which at first sight may not be in line with conventional theoretical expectations. Further analysis, below, shows that the results are driven by the presence of several middle-income countries in our sample, which are characterized by high levels of unemployment and high values of total revenues over GDP, which is indicative of the procyclicality of business cycles among many developing countries as reported by Alesina et al. (2008) and Talvi and Vegh (2005).

Most socio-demographic factors do not appear to be significant in their association with total revenues, with the only exception being population density that shows a small, negative and significant association with total revenues. While the results may appear counter-intuitive, they are influenced by the presence of a large number of middle-income Asian countries in our global sample, that have high population density and low shares of government revenues over GDP, as well as a group of countries with very low population density and high shares of government revenues.

Finally, regarding controls for institutional factors such as government stability, the level of corruption within the political system, the level of political violence and the presence of ethnic tensions show the expected sign in their coefficients, however, only the parameter coefficient that measures the ability of governments to implement policies shows a significant correlation with revenue collection.

Given the significant heterogeneity in the global sample, we estimate the reference model with more homogeneous groups of countries, following the World Bank's country classification by income level. In addition, we estimate the model for SSA as a whole (the region of interest in this study), and then divide the sub-sample into two groups of middle-income or low-income countries. This allows us to reduce the threat of unobserved heterogeneity in the relationship between inequality and redistribution in the SSA region. Results from the 2SLS estimators are reported in Table 2.

As already pointed out, looking at the estimated coefficients from the global sample, we find a significant negative effect of inequality on total revenues. Taking the global sample of countries as a benchmark, the magnitude of the inequality elasticity of redistribution increases to 1.45% when the sample is restricted to high-income countries, while it slightly decreases to 0.81% when the analysis is restricted to middle-income countries. The direction of the relationship is also negative, but statistically insignificant, for low-income countries, partly due to the smaller sample of countries falling into that income classification.

Surprisingly, we find that the sign of the parameter estimate for the Gini index is positive and statistically significant for SSA as a whole, and also for middle-income countries, in the order of 2.52 and 1.72, respectively, although it turns negative, -1.96, when we restrict the sample to low-income countries (see Table 2, columns 5, 6 and 7).[15]

One possible interpretation is that higher levels of inequality create the incentives for governments to redistribute. Under competitive electoral systems, political power is better distributed than income, so the median voter would have the power to persuade elites to redistribute (Meltzer and Richard, 1981). As Alesina and Perotti (1996) argue: …"in the fiscal channel explanation, the level of government expenditure and taxation is the result of a voting process in which income is a main determinant of a voter's preferences; in particular, poor voters will favor high taxation".

However, we believe that this channel is implausible, at least in the context of SSA, due to two important reasons: first, despite recent progress toward democracy, the region continues to be dominated by autocracies and electoral autocracies, where the

15 We note that due to a finite sample problem, the estimated coefficients for middle-income and low-income countries in SSA are likely to be affected by a weak identification bias. In order to limit this problem, we reduce the number of overidentifying restrictions by using two of the three instruments (see Harding et al., 2016; Andrews et al., 2019, for a discussion on finite sample bias and weak instrument issues). Moreover, as discussed in Section 5.2, we estimate Model 1 using a limited information maximum likelihood (LIML) estimator, which has better small sample performance than 2SLS with weak instruments.

median voter is less influential in redistribution decisions than elites, who are closely linked to government power via lobbying groups and practices of corruption (Carter, 2016; Kroeger, 2020; Bénabou, 2000; Stiglitz, 2012). Second, taxes on income, profits and capital gains have remained largely stagnant, and under a 5% level in terms of GDP since the 1990s. Among African middle-income countries, this share is slightly higher, about 7% of GDP, but this has not only remained stagnant but in fact declined between the 1990s and 2000s (see Table 3).

Table 2: Inequality effects on total government revenues and total government revenues, 2SLS estimators

	Global sample				Sub Saharan Africa		
	All countries	*by*	*income level*		All countries	*by income level*	
		Hi g h	Middle	Low		Middle	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
gini (ln)	-0.874***	-1.446***	-0.808***	-1.316	2.522**	1.719*	-1.958*
	(0.259)	(0.348)	(0.239)	(1.563)	(1.233)	(0.887)	(1.126)
yPPP	-0.019	-0.027	-0.127	-0.138	0.387**	0.260**	-0.186**
	(0.075)	(0.203)	(0.081)	(0.164)	(0.151)	(0.112)	(0.093)
agric	-0.018***	0.016	-0.025***	-0.010**	0.001	-0.014	-0.016**
	(0.004)	(0.037)	(0.006)	(0.005)	(0.008)	(0.012)	(0.006)
unempl	0.024**	0.006	0.025***	0.006	-0.002	-0.001	0.015
	(0.005)	(0.008)	(0.005)	(0.009)	(0.012}	(0.007)	(0.011)
trade	0.001**	-0.000	0.002***	0.002**	0.003***	0.004***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
depratio	0.003	0.017*	0.001	0.008*	0.015**	0.004	-0.003
	(0.002)	(0.010)	(0.003)	(0.004)	(0.008)	(0.006)	(0.006)
f em labpart	-0.000	-0.021	0.004	-0.024*	-0.022*	-0.006	-0.045***
	(0.003)	(0.014)	(0.003)	(0.013)	(0.011)	(0.012)	(0.009)
popdens	-0.001***	-0.000	-0.001***	-0.000	-0.001	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001}	(0.001)
gavstab	0.039**	-0.014	0.042*-	-0.061	0.037	0.031	-0.062*
	(0.016)	(0.027)	(0.016)	(0.037)	(0.035)	(0.026)	(0.032)
intcanfl	0.002	-0.023	0.005	0.023	0.018	0.028	0.021
	(0.016)	(0.038)	(0.019)	(0.026)	(0.026)	(0.028)	(0.031)
carrup	0.042	0.101***	0.017	0.107**	0.013	-0.109***	0.057
	(0.026)	(0.032)	(0.038)	(0.052)	(0.065)	(0.034)	(0.059)
ethnt	-0.015	-0.031	-0.056*	0.151*	-0.033	-0.057*	0.148**
	(0.022)	(0.032)	(0.030)	(0.078)	(0.050)	(0.033)	(0.062)
Observations	530	174	285	71	141	73	68
R-squared	0.642	0.306	0.541	0.495	0.665	0.780	0.418
Hansen J p-val	0.265	0.427	0.108	0.265	0.122	0.531	0.668
K-P rk LM st. p-val	0.000	0.003	0.005	0.448	0.094	0.198	0.315
K-P rk Wald F st.	28.24	17.06	17.16	0.905	1.907	1.687	2.351

Depvar: total revenues (% GDP, ln). IVestimates. 2SLS pooled estimator. Panel-clustered (country level) stan dard error s in parentheses. Period dummies included. *** p< 0.01, ** p< 0.05, * p<0.l. IVscol. 1-4: wheatsugar, adolfert , dcreditp. Ns col 5-7: wheatsugar, dcreditp.

We posit that the most plausible mechanism for the positive causal relationship between inequality and total government revenues in SSA, especially among middle-income countries, relates to the composition of government revenue sources and, in particular, to the large and growing contribution of natural resource rents to government's budgets. Indeed, natural resource rents represent the largest source of revenue for governments in middle-income Africa, accounting for roughly one-tenth of national income, after having experienced rapid growth between 1990s and 2000s (Table 3).

Table 3: Natural resource rents and taxes on income profits and capital gains, % of GDP

	Natural resources rents			Taxes on income, profits and capital gains		
Regions	1990-1995	2000-2015	Var %	1990-1995	2000-2015	Var %
Global	4.84	6.41	32.48	6.13	7.36	20.11
High-income countries	6. 28	6.83	8.79	11.92	10.82	-9.26
Middle-income countries	5.10	7.24	41.99	5.19	5.67	9.06
Low-income countries	1.69	1.70	0.06	2.09	2.80	33.95
Sub-Saharan Africa	4.87	6.09	25.05	4.49	4.89	8.77
Sub-Saharan Africa (MICs)	8.23	10.55	28.13	6.89	6.84	-0.76
Sub-Saharan Africa (LICs)	1.69	1.73	2.15	2.09	2.88	37.77

Source: Authors' calculations, based on the Government Revenue Dataset (GRD).

The abundance of natural resource rents can affect redistributive preferences and tax policy choices among opportunistic incumbents, as tax redistribution and non-tax redistribution face different political and economic costs (Baldwin, 1990). Tax revenues are subject to stronger opposition from voters than non-tax revenues, especially when non-tax revenues are dominated by a windfall of natural resource rents. In this sense, the presence of natural resources allow incumbents to bypass the interdependent preferences problem, insofar as levying higher taxes on the richest is not a key element in redistribution and resource mobilization strategies (Currie and Gahvari, 2008). Furthermore, natural resource rents can boost autocratic and rent-seeking behaviour, which militates against the bargaining power of the median voter (Torvik, 2002; Collier, 2010; Bjorvatn and Naghavi, 2011), and since the extractive industries are capital intensive, they exacerbate income inequality via capital accumulation and wages to skilled workers that are higher than those of the median voter (Addison and Roe, 2018). This, in turn, impacts positively on government revenues.

4.1 Top-incomes Adjusted Inequality Estimates

So far, we have discussed the results based on a Gini index, which may be biased due to the omission of top incomes in household surveys. As the income share going to the richest individuals can have a strong influence on the shape of the Lorenz curve and the Gini index, as well as on governments' redistributive decisions, we are interested in assessing the extent to which the impact of income inequality on government revenues changes by alternative assumptions on the shape of the income distribution. Therefore, we re-estimate the reference Equation 1 with an alternative series of the Gini index, which is adjusted by the effect of top incomes on the income distribution, based on specific assumptions about the truncation points that occur at the top percentiles as described in Section 3.2.2.

Before discussing the results, we present summary statistics of the top-incomes adjusted Gini indices in Tables 4 and 5. As expected, we observe that the Gini index displays its lowest value when it is assumed that the distribution of income is not truncated, i.e., at $t = 1$. In contrast, when we assume that household survey data upon which the Gini indices are estimated are representative of the bottom 99% of the income distribution, i.e., with a truncation that excludes the richest 1%, a much higher level of income inequality is observed. Truncation points lying within such a range are associated with intermediate monotonic values of the Gini index.

The increase in the level of income inequality after adjusting for the effects of top incomes is particularly striking for the case of SSA, for which the mean value of the Gini index goes from 57.91 with no top-incomes adjustment, up to 73.12 when the income distribution is adjusted based on a truncation at the 0.99 percentile.

In Table 6 we present the results of the re-estimated Equation 1, using the top-incomes adjusted Gini indices. We find that the size effect of income inequality on total government revenues is somehow contained, although marginally, when we account for the effect of top incomes.[16] The findings suggest that despite the very considerable impact that the richest individuals have on the shape of the income distribution, their inclusion in the estimates have a very small mitigating income inequality effect on total government revenues.

16 See comparative baseline estimates in Table 2 and top-incomes adjusted estimates in Table 6.

Table 4: Top-incomes adjusted Gini indices

Variable	Truncation point	Obs	Mean	Std.Dev.	Min	Max
Gini	t = 1	530	44.901	12.361	14.123	81.071
	t = 0.9975	530	48.218	14.515	14.435	92.703
	t = 0.9950	530	50.421	15.817	14.681	95.585
	t = 0.9925	530	52.424	16.889	14.909	96.152
	t = 0.9900	530	54.323	17.850	15.123	96.555

When t is set equal to one, truncation is not considered in the estimation. As the truncation point falls, the non-response rate in household surveys increases. Estimates based on grouped data from the WIID (2019).

Table 5: Top-incomes adjusted Gini indices for sub-Saharan Africa

Variable	Truncation point	Obs	Mean	Std.Dev.	Min	Max
Gini	t = 1	141	57.914	8.080	45.690	81.071
	t = 0.9975	141	63.369	10.355	48.216	92.703
	t = 0.9950	141	66.964	11.253	49.792	95.585
	t = 0.9925	141	70.157	11.567	51.409	96.152
	t = 0.9900	141	73.115	11.672	53.090	96.555

When t is set equal to one, truncation is not considered in the estimation. As the truncation point falls, the non-response rate in household surveys increases. Estimates based on grouped data from the WIID (2019).

For the global sample, the negative inequality elasticity of government revenues goes down from -0.87 (with no truncation) to -0.81 (with a $t = 0.9900$), which seems to indicate that the contribution of top income earners to government revenues, via taxes on income and capital gains, may contain the negative relationship between the Gini index and government revenues, but only marginally.

In the case of SSA, the size of the elasticities goes down from 2.52 to 2.37, and from 1.72 and -1.96 to 1.59 and -0.68, for the cases of middle-income and low-income countries, respectively.[17] Thus, despite the very large effect of top incomes on income inequality in the SSA region, accounting for the richest does not lead to a sizable increase in government revenues. This may be explained by at least two important considerations. First, there is limited scope for taxes on income, profits and capital gains to contribute to government revenues, partly because of the persistence of informality and subsistence agriculture across the region.[18] Indeed, the share of income taxes to GDP had remained under the 5% level in SSA from the 1990s until recently when it increased marginally. Among middle-income countries, that share is slightly higher at about 7%, although it has not changed since the 1990s, and in fact declined by about one per cent between the 1990s and the 2000s.

The second consideration is in the domain of political economy. In the African context, characterized by imperfect competitive electoral systems dominated by elites, the effect of the median voter on redistribution is likely to be contained by the power of politically cohesive elites that have strong ties with incumbents and systems of patronage and clientelism (Acemoglu et al., 2011). Thus, the preferences of the median voter are likely to be overshadowed by those privileged actors in society that shape policy processes and limit progressive fiscal reforms (Bardhan and Mookherjee, 2000). Consequently, the presence of high income inequality, which is even higher due to top incomes, would lead to a constrained redistribution that is reinforced by the presence of natural resource rents as discussed in Section 4.

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17 We note that the statistical significance of the parameter estimates for the full sample of SSA countries and the sub-sample of low-income countries disappear when accounting for the effects of top incomes.

18 Informal employment represents about 80–90% of total non-agriculture employment in low and lower-middle-income countries, whereas employment in agriculture, measured as percentage of total employment, remains above 60% in low-income countries and about 40% in lower-middle income countries (Niño-Zarazúa 2019)).

5. Robustness Checks

In order to assess the reliability of our results, we perform a number of robustness checks. First, in Section 5.1 we estimate the reference model over comparable samples in terms of number of observations, by including dummies for the different country groups as well as their interactions with the inequality variable. Second, in Section 5.2, we use alternative estimators, specifically the two-step feasible generalized method of moments (GMM) and the limited information maximum likelihood (LIML). Third, in Section 5.3 we apply a random-effect panel estimator, which allows us to take into account the potential presence of unobserved individual effects.[19]

19 We have also considered the possibility of applying a fixed-effect panel estimator, however, given the relevance of time-invariant and persistent variables in our model, and that the use of a fixed-effect estimator would have limited the extension of the model to include country-group dummy variables and their interactions with inequality, we decided not to proceed with that.

Table 6: Inequality effects on total government revenues (top-incomes adjusted Gini indices), 2SLS

	Global sample				Sub-Saharan Africa		
	All countries	*by income level*			All countries	*by income level*	
		High	Middle	Low		Middle	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
gini (l n), t = 0.9975	-0.851 ***	-1.399***	-0.795***	-0.573	2.351*	1. 425*	-0 .946
	(0.250)	(0.319)	(0.233)	(0.907)	(1.3 18)	(0 .728)	(0.917)
Observations	530	174	285	71	141	73	68
R-sq uared	0.634	0.315	0.524	0.540	0.618	0.774	0.515
Hansen J p-val	0.279	0.418	0.119	0.234	0.096	0.591	0.306
K-P rk LM st. p-val	0.000	0.003	0.006	0.175	0.135	0.213	0.103
K-P rk Wald F st.	27.42	17.30	14.96	2.163	1.279	1.575	3.324
gini (ln), t =0.9950	-0. 834***	-1.372***	-0.787***	- 0.526	2.36 9*	1.40 8 *	-0 .802
	(0.244)	(0.305)	(0.230)	(0.784)	(1.403)	(0.741}	(0.782}
Observations	530	174	285	71	141	73	68
R-squared	0.631	0.319	0.518	0.534	0.590	0.764	0.516
Hanse n J p-val	0.297	0.411	0.130	0.231	0.101	0.617	0.309
l<-P rk LM st. p-val	0.000	0.003	0.006	0.153	0.188	0.226	0.087
1(-P rk Wald F st.	27.35	17.32	14.02	2.598	1.083	1.479	4.005
gini (ln), t = 0.9925	-0.819***	-1.348** *	-0.778***	-0.518	2.388	1.489*	-0 .724
	(0.239}	(0.295)	(0.228)	(0.718)	(1.468}	(0.813)	(0.706}
Observations	530	174	285	71	141	73	68
R-squarcd	0.631	0.322	0.517	0 529	0.576	0.755	0.516
Hansen J p-val	0.313	0.403	0.140	0.233	0.099	0.677	0.314
1<- P rk LM st. p-val	0.000	0.003	0.006	0.146	0.212	0.222	0.082
K-P rk Wald F st.	27.49	17.31	13.71	2.922	1.068	1.488	4.426
gini (ln }, t =0.9900	-0.805***	-1.326***	-0.767***	-0.521	2.366	1.592*	-0.683
	(0.235}	(0.286)	(0.225)	(0.681)	(1.492}	(0.900}	(0.661}
Observations	530	174	285	71	141	73	68
R-squared	0.633	0.324	0.520	0.526	0.579	0.747	0.516
Hansen J p-val	0.322	0.396	0.145	0.235	0.092	0.709	0.320
K-P rk LM st. p-val	0.000	0.003	0.005	0.149	0.208	0.215	0.083
K-P rk Wald F st.	27.75	17.35	13.75	3.089	1.150	1.499	4.662

Depvar: total revenues (% GDP, ln). IV estimates . 2SLS pooled estimator. Panel-clustered (country level) standard errors in parentheses. Period dummies included. *** p<0.01, ** p<0.05, * p< 0.l. IVs col. 1---4: wheatsugar, adol fert , dcreditp. IVs col. 5- 7: wheatsugar, dcreditp.

5.1 Model with Interaction Terms

The reference model relies on regional sub-samples, which limits the number of observations available for analysis, especially in the case of SSA. Therefore, in order to keep the sample of countries as large as possible, we extend Model 1 by including a dummy variable that identifies country subgroups (*CCdi*), considered in Table 2, and their interaction with income inequality (*Iit* × *CCdi*), which takes the following form:[20]

$$R_{it} = \beta_0 + \beta_1 I_{it} + \beta_2 X_{it} + \beta_3 CCd_i + \beta_4 (I_{it} \times CCd_i) + \upsilon_t + \epsilon_{it} \qquad 4$$

where β_1 denotes the marginal effect of income inequality for those countries that do not belong to the referred group, β_4 captures the difference in the relationship of interest (i.e., the effect of inequality on total government revenues) between the referenced group of countries and the rest of the world, while β_1+β_4 measures the marginal effect of income inequality on total government revenues for the referenced group of countries. To illustrate, when looking at SSA, the coefficient β_1 will capture the effect of income inequality on government revenues for countries which do not belong to SSA, β_4 will measure the difference between SSA countries and the rest of the world, whereas the linear combination β_1+β_4 will measure the effect of income inequality on total government revenues in SSA. The results of the model including the interactions are presented in Table 7. Overall, the findings from the model with interactions confirm previous results from the baseline model.

5.2 Alternative Estimators

In order to mitigate the weak instrument problem in some specifications, we estimate the reference model by using alternative estimators. This step is motivated by the fact that the 2SLS estimator can be biased in small samples and the bias can worsen in the presence of over-identifying restrictions. We considered alternative estimators that are asymptotically equivalent to 2SLS, but have better finite-sample properties.

20 The country subgroups are: high-income, middle-income and low-income countries in the SSA region; and middle-income and low-income countries in that region.

Table 7: Inequality effects on total government revenues (model with interactions), 2SLS

	Global sample				Sub-Saharan Africa		
	All counties	by income level			All countries	by income level	
		High	Middle	Low		Middle	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
gini (ln)	-0.874***	- 0.762 ***	-1.013***	-0.910 ***	-1.098***	-1.116***	-0. 921***
	(0.259)	(0.254)	(0.337)	(0.242)	(0 .300)	(0.295)	(0.267)
yPPP	-0.019	0.049	0.012	-0.063	0.014	-0.027	-0.062
	(0.075)	(0.069)	(0.075)	(0.067)	(0.071)	(0.067)	(0.070)
agric	-0.018***	-0.016***	-0.015***	-0.017***	-0.012**	-0.015***	-0.018***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
unem pl	0.024***	0.022***	0.021***	0.023***	0.011* *	0.012**	0.023 ***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
trade	0.001**	0.001*	0.001*	0.001**	0.001*	0.001*	0.001**
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)
depratio	0.003	0.002	0.003	0.003	0.003	-0.000	0.003
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
femla/,part	-0.000	0.001	0.002	0.003	-0.003	-0.003	0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
popdens	- 0.001***	-0.000***	-0.000***	-0.001***	- 0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
gov stab	0.039**	0.032*	0.032**	0.028	0.042**	0.023	0.026
	(0.016)	(0.017)	(0.016)	(0.018)	(0.017)	(0.016)	(0.019)
int con fl	0.002	0.004	-0.000	-0.006	-0.007	-0.013	-0.005
	(0.016)	(0.015)	(0.015)	(0.016)	(0.019)	(0.017)	(0.017)
corrup	0.042	0.054*	0.059**	0.056**	0.035	0.044*	0.055**
	(0.026)	(0.028)	(0.028)	(0.027)	(0.026)	(0.025)	(0.027)
et hnt	-0.015	-0.013	-0.005	-0.002	-0.010	0.002	-0.004
	(0.022)	(0.023)	(0.023)	(0.024)	(0.024)	(0.024)	(0.025)
CCd	-	0.230	-0.819	10.214	- 12.528***	-7.325**	13.472
		(1.471)	(1.459)	(6.230)	(4.804)	(3.445)	(9.323)
CCd x *gini*	-	-0.108	0.261	-2.621*	3.118***	1.884**	-3.433
		(0.401)	(0.385)	(1.561)	(1.171)	(0.848)	(2.341)
Observa tions	530	530	530	530	530	530	530
R-square d	0.642	0.660	0.665	0.612	0.611	0.671	0.577
Hansen J p-val	0.265	0.208	0.222	0.120	0.436	0.177	0.039
K-P rk LM st. p-val	0.000	0.002	0.000	0.365	0.114	0.027	0.290
K-P rk Wald F st.	28.24	8.832	22.42	1.827	3.339	7.557	1.619
Linear combinat.: *gini* + *(CCd* x *gini)*		-0.870***	-0.751***	-3.530**	2.020**	0.768	-4.354*
		(0.309)	(0.252)	(1.530)	(1.016)	(0.673)	(2.320)

Depvar: tot al revenues (% GDP , ln). IV estimates . 2SLS pooled estimator. Panel-clustered (country level) standard errors in parentheses. Period dummies included. *** p<0.01, ** p<0.05, * p<0 .l. IVs col. 1- 4: wheatsugar, a.dolfert , dcreditp. IVs col. 5---7: w h eatsuga r , dcreditp.

We first adopt a two-step efficient generalized method of moments (GMM) estimator. Its higher efficiency compared to the 2SLS estimator derives from the use of an optimal weighting matrix, the over-identifying restrictions of the model, and the relaxation of the independent and identically distributed random variables, or i.i.d., assumption. The results are presented in Table 8. In addition, we adopt a limited-information maximum likelihood estimator, which performs better than 2SLS in the presence of weak instruments. The results are presented in Table 9. Overall, the findings from these alternative estimators confirm the results from the 2SLS model.

Table 8: Inequality effects on total government revenues, GMM2S estimators

	Global sa mp le				Su b-Saharan Africa		
	All countries,	*by income level*			All countries,	*by income level*	
		High	Middle	Low		M iddle	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
gini (ln)	-0.709***	-1.472***	-0.757***	-2.012	3.054***	1.641*	-2.251**
	(0.237)	(0.328)	(0.232)	(1.490)	(1.184)	(0.878)	(0.896)
yPPP	0.028	-0.013	-0.085	-0.194	0.406**	0.260**	-0.212***
	(0.069)	(0.181)	(0.078)	(0.151)	(0.151)	(0.112)	(0.071)
agric	-0.017***	0.020	-0.025***	-0.012***	0.003	-0.015	-0.018***
	(0.004)	(0.034)	(0.006)	(0.004)	(0.008)	(0.011)	(0.006)
unem pl	0.024***	0.009	0.024***	0.006	-0.005	-0.002	0.016
	(0.005)	(0.007)	(0.005)	(0.009)	(0.012)	(0.007)	(0.011)
trade	0.001**	-0 .000	0.002***	0.002***	0.003***	0.005***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
depratio	0.002	0.015**	0.001	0.008**	0.016**	0.003	-0.004
	(0.002)	(0.008)	(0.003)	(0.004)	(0.008)	(0.006)	(0.005)
feml ahpart	-0 .000	-0 .023*	0.004	-0.019	-0.024**	-0.007	-0.047***
	(0.003)	(0.013)	(0.003)	(0.013)	(0.011)	(0.011)	(0.008)
popden s	-0.001***	-0.000	-0.001***	0.000	-0.001	0.001	0.002*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.00])	(0.001)	(0.001)
govstab	0.039**	-0.010	0.042***	-0.058	0.048	0.025	-0.067**
	(0.016)	(0.027)	(0.015)	(0.036)	(0.035)	(0.024)	(0.028)
intcon fl	0.010	-0.032	0.012	0.041*	0.016	0.031	0.023
	(0.015)	(0.034)	(0.018)	(0.022)	(0.026)	(0.027)	(0.030)
corru p	0.032	0.099***	0.029	0.082*	0.010	-0.108***	0.054
	(0.025)	(0.031)	(0.038)	(0.044)	(0.064)	(0.034)	(0.058)
ethnt	-0.017	-0.043	-0.060**	0.178**	-0.057	-0.055*	0.163***
	(0.022)	(0.031)	(0.030)	(0.074)	(0.047)	(0.033)	(0.052)
Observations	530	174	285	71	141	73	68
R-squared	0.660	0.277	0.539	0.338	0.594	0.784	0.350
Hansen J p-val	0.265	0.427	0.108	0.265	0.122	0.531	0.668
K- P rk LM st. p-val	0.000	0.003	0.005	0.448	0.094	0.198	0.315
K-P rk Wald F st.	28.24	17.06	17.16	0.905	1.907	1.687	2.351

Depvar: total revenues (% GDP, In). GMM2S pooled estimator. Panel-clustered (country level) standard errors in parentheses. Period dummies included. *** p< 0.01, ** p< 0.05, * p< O.l. [V s co l. 1- 4: wheat sugar , adolfe·rt , dcredit p. IVs co l. 5- 7: wheat sugar , dcredit p.

Table 9: Inequality effects on total government revenues, LIML estimators

	Global sample				Sub-Saharan Africa		
	All countries	*by income level*			All countries	*by income level*	
		High	Middle	Low		Middle	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
gini (ln)	-0.901***	-1.526***	-0.868***	-3.869	4.119	1.782*	-2.026*
	(0.269)	(0.373)	(0.263)	(8.899)	(2.943)	(0.949)	(1.179)
yPPP	-0.023	-0.044	-0.128	-0.413	0.494*	0.263**	-0.192**
	(0.076)	(0.213)	(0.082)	(0.921)	(0.257)	(0.115)	(0.096)
agric	-0.018***	0.015	-0.025***	-0.015	0.009	-0.013	-0.016**
	(0.004)	(0.038)	(0.006)	(0.019)	(0.016)	(0.012)	(0.007)
unempl	0.024***	0.006	0.025***	0.013	-0.015	-0.001	0.016
	(0.005)	(0.008)	(0.005)	(0.029)	(0.025)	(0.007)	(0.012)
trade	0.001**	-0.000	0.002***	0.001	0.003*	0.004***	0.002**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)
depratio	0.003	0.018*	0.001	0.004	0.020	0.004	-0.003
	(0.002)	(0.010)	(0.003)	(0.014)	(0.014)	(0.007)	(0.007)
femlabpart	-0.000	-0.021	0.004	-0.001	-0.028*	-0.006	-0.046***
	(0.003)	(0.015)	(0.003)	(0.081)	(0.017)	(0.012)	(0.009)
popdens	-0.001***	-0.000	-0.001***	0.000	-0.001	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.002)	(0.001)	(0.001)	(0.001)
govstab	0.040**	-0.009	0.042***	-0.104	0.052	0.032	-0.062*
	(0.016)	(0.029)	(0.016)	(0.154)	(0.051)	(0.026)	(0.032)
intconfl	0.002	-0.024	0.004	0.025	0.011	0.027	0.021
	(0.016)	(0.039)	(0.019)	(0.051)	(0.038)	(0.029)	(0.031)
corrup	0.041	0.098***	0.021	0.055	0.042	-0.110***	0.054
	(0.026)	(0.032)	(0.039)	(0.209)	(0.099)	(0.035)	(0.060)
ethnt	-0.015	-0.030	-0.057*	0.238	-0.078	-0.057*	0.150**
	(0.023)	(0.033)	(0.030)	(0.322)	(0.094)	(0.033)	(0.063)
Observations	530	174	285	71	141	73	68
R-squared	0.638	0.258	0.530	-0.440	0.413	0.776	0.404
Hansen J p-val	0.269	0.432	0.113	0.534	0.187	0.534	0.668
K-P rk LM st. p-val	0.000	0.003	0.005	0.448	0.094	0.198	0.315
K-P rk Wald F st.	28.24	17.06	17.16	0.905	1.907	1.687	2.351

Depvar: total revenues (% GD P, ln). LIML pooled estimator. Panel-clustered (country level) standard errors in parentheses. Period dummies included. *** p< 0.01, ** p< 0.05, * p< 0.l. IVs col. 1- 4: wheat sugar , adolfert, dcreditp. N s col. 5- 7: wheat sugar , dcredit p.

5.3 Alternative Panel Methods

As a third robustness check, we estimate the reference model based on a random-effect, instrumental variable (RE-IV) panel estimator, which takes into account the presence of unobserved individual effects in the error term. The reference Model 1 can be specified as follows:

$$R_{it} = \beta_0 + \beta_1 I_{it} + \beta_2 X_{it} + \upsilon_t + \eta_i + u_{it} \tag{5}$$

where η_i denotes the individual unobserved effects and u_{it} is the idiosyncratic error. In an RE-IV model, a strict exogeneity of the individual term η_i is assumed in addition to the orthogonality with respect to the independent variables. Before moving onto the estimation of the RE-IV model, we implement a Breusch-Pagan test to formally assess the potential presence of unobserved individual effects. The results reject the null according to which the variance of the unobserved effect is zero.[21] Therefore, we proceeded to implement the RE-IV estimator. The results are presented in Table 10. In addition, we estimate the RE-IV model with interactions, to keep the sample of countries as wide as possible. The results are presented in Panel B of Table 10. Overall, the results for the global sample as well as for the group of SSA countries confirm the previous findings.

21 H0 : var(ηi) = 0. Chibar2(01) = 540.43 (p-value=0.000).

6. Concluding Remarks

The level of income inequality plays an important role in countries' economic performance and poverty reduction efforts. The literature has pointed out possible channels through which such relationships may operate. In the present study, we investigated the *median voter hypothesis*, by providing an empirical analysis of the causal relationship between income inequality and governments' revenue collection efforts.

In order to address the endogeneity of inequality, we implemented a series of instrumental variable estimators and specifications, taking into account the panel structure of the available data, to test the validity of our results.

By looking at a wide sample of countries at the global level, we find a negative relationship between inequality and total government revenues, indicating that higher income inequality leads to a lower collection of government revenues. However, when we focus specifically on sub-Saharan Africa, and subgroups of middle-income and low-income countries in the region, we observe a positive relationship, denoting that higher income inequality leads to higher government revenues. Among the factors that could be driving the result are the economic structure and sector composition of many African economies, especially in those middle-income countries which are rich in natural resources.

Similarly, another relevant issue is related to the composition of government revenues in most sub-Saharan Africa countries, where the contribution of direct taxes is very limited.

Thus, the evidence suggests that it is not the median voter who, through the power of persuasion in competitive electoral systems, drives elites to redistribute via government revenues, but instead it is the natural resource wealth of many African countries that, by allowing opportunistic incumbents to raise revenues without taxing the richest, exacerbate income inequality which, in turn, impacts positively on government revenues.

Table 10: Inequality effects on total government revenues, RE-IV estimators

	Global sample				Sub-Saharan Africa		
	All countries	*By income level*			All countries	*by income level*	
		High	Middle	Low		Middle	Low
P ANE L A	(1)	(2)	(3)	(4)	(5)	(6)	(7)
gini (ln)	-0.834**	0.732	-0.739	-1.316	2.474*	1.719	-4.111
	(0.325)	(1.221)	(0.457)	(1.864)	(1.282)	(1.053)	(2.574)
yPPP	-0.052	0.275	-0.013	-0.138	0.380**	0.260*	-1.055**
	(0.075)	(0.354)	(0.098)	(0.196)	(0.160)	(0.133)	(0.469)
aqric	-0.021***	0.016	-0.023**	-0.010•	0.001	-0.014	-0.059**
	(0.005)	(0.018)	**(0.009)**	(0.005)	(0.008)	(0.014)	(0.025)
unempl	0.013***	0.010	0.014***	**0.006**	-0.001	-0.001	0.003
	(0.003)	(0.007)	**(0.005)**	(0.011)	(0.012)	(0.008)	(0.049)
trade	0.002***	**0.000**	**0.003*****	**0.002***	0.003***	0.004**	0.009**
	(0.001)	**(0.001)**	**(0.001)**	(0.001)	(0.001)	(0.002)	(0.004)
deprotio	0.001	0.003	**-0.000**	0.008	O.o15*	0.004	-0.003
	(0.002)	(0.005)	**(0.004)**	(0.005)	(0.008)	(0.008)	(0.022)
feml at,port	**-0.006***	-0.011 *	**0 .003**	-0. 024	-0.022*	-0.006	-0.075
	(0.003)	(0.007)	**(0.003)**	(0.016)	(0.012)	(0.014)	(0.068)
popdens	-0 .001 ***	**0 .000**	**-0 .001* ****	**-0 .000**	-0.001	0.001	0.002
	(0.000)	**(0.000)**	**(0.000)**	(0.001)	(0.001)	(0.001)	(0.005)
govstab	0.020*	0.002	0.028**	-0.001	0.036	0.031	0.121
	(0.011)	(0.017)	(0.013)	(0.045)	(0.038)	(0.031)	(0.082)
tntwnfl	0.018*	0.015	0.014	0.023	0.019	0.028	0.045
	(0.010)	(0.013)	(0.015)	(0.032)	(0.028)	(0.033)	(0.048)
corrup	0.025	0.035*	0.029	0.101•	0.014	-0.109***	-0.111
	(0.017)	(0.018)	(0.025)	(0.062)	(0.069)	(0.041)	(0.123)
et/mt	-0.018	-0.030	-0.022	0.151	-0.032	-0.057	-0.140
	(0.016)	(0.032)	(0.018)	(0.094)	(0.052)	(0.039)	(0.123)
Observations	530	174	285	71	141	73	68
Number of countries	116	41	61	14	27	14	13
lia nscn .J p-val	0.504	0.347	0.407		0.137	.	.
1(-P rk LM st. p-val	0.000	0.641	0.010	0.448	0.097	0.198	0.415
1(-P rk Wald F st.	10.233	0.529	5.960	0.905	1.900	1.687	0.839

P AN EL B *(model incl. interactions)*

gini (ln)		-0.733**	-1.002***	-0.761**	-1.024***	-1.119***	-0.802**
		0.340)	(0.343)	(0.331)	(0.343)	(0.370)	(0.339)
CCd	-	0.195	-1.339	6.699**	-16.863**	-14.519**	7.945*
		(1.894)	(t. 642)	(2.690)	(6.770)	(6.409)	(4.470)
CCd x *gini*	-	-0.091	0.388	-1.706**	4.173**	3.641••	-2.014*
		(0.523)	(0.434)	(0.677)	(1.657)	(t.587)	(1.128)
Observations		530	530	530	530	530	530
Number of countries		116	116	116	116	116	116
Hanse n J p- val		0.589	0.575	0.427	0.827	0.487	0.219
I<-P rk LM st. p-val		0.000	0.000	0.000	0.209	0.085	0.000
I<-P rk Wald F st.		5.419	6.260	5.870	3.034	2.224	13.197
Linear combinat .: *gini* + *(CCd* x *gini)*		-0.824*	-0.614	-2.466***	3.148**	2.521*	-2.816**
		(0.443)	(0.335)	(0.607)	(t.499)	(1.368)	(1.102)

Depvar: total revenues (% GDP, In). R.&IV panel estimat-0r. Robust standard errors in parentheses. Period dummies included. •• • p< 0.01, ** p< 0.05,• p<0.1. IVs col. 14: wheat9ugar, adolfert, dcreditp. IVs col. 5- 7: wheatsugar , dcreditp.

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APPENDIX A

Figure A1: Total revenues and inequality (Gini)

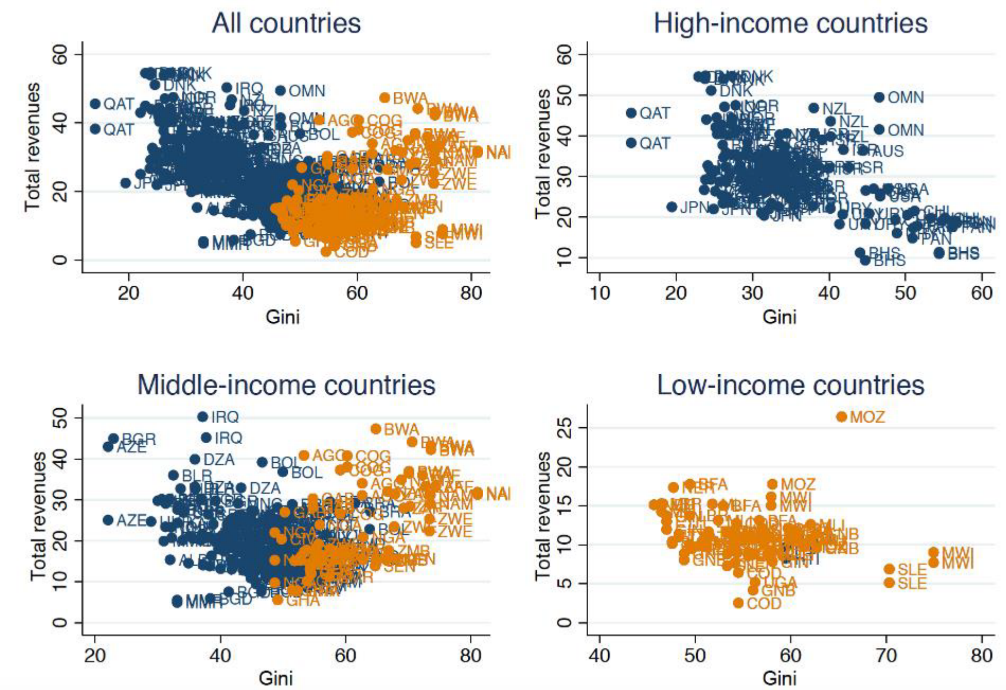


Table A1: Variables and data sources

Variable	Definition	Data source
revenues	Total revenues excluding grants and social contributions (% GDP)	GRD (2019)
gini	Income inequality Gini index	WIID (2019)
yPPP	PPP-adjusted GDP per capita (ln)	WDI (2019)
agric	Agriculture, value added (% GDP)	WDI (2019)
unempl	Unemployment rate	WDI (2019)
trade	Exports and imports of goods and services (% GDP)	WDI (2019)
depratio	Share of population younger than 15 and older than 64 over the working-age population (aged 15–64)	WDI (2019)
femlabpart	Labour force, female (% of total labor force)	WDI (2019)
popdens	Population density (people per squared km of land area)	WDI (2019)
ethnt	Ethnic tensions (degree of tension within a country attributable to racial, nationality or language divisions) (0–6 scale. Lower ratings: high tensions; higher ratings: minimal tensions)	ICRG (2018)
govstab	Government stability (government unity - legislative strength - popular support) (0–12 scale. 0: very high risk; 12: very low risk)	ICRG (2018)
intconfl	Internal conflict (civil war/coup threat - terrorism/political violence - civil disorder) (0–12 scale. 0: very high risk; 12: very low risk)	ICRG (2018)
corrup	Corruption within the political system (0–6 scale. 0: very high risk; 6: very low risk)	ICRG (2018)
dcreditp	Domestic credit to the private sector (% GDP)	WDI (2019)
wheatsugar	Ratio between the share of land used to grow wheat over total arable land and the share of land used to grow sugarcane over total arable land	FAO/WDI (2019)
adolfert	Adolescent fertility rate (births per 1000 women aged 15–19)	WDI (2019)

GRD: Government Revenue Dataset (ICTD-WIDER). WDI: World Development Indicators (World Bank). ICRG: International Country Risk Guide (PRS Group). FAO: FAOSTAT, Crops.

Table A2: Countries by income level

Income level	Countries
High	Australia, Austria, Bahamas, Belgium, Canada, Chile, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Japan, Korea, Rep., Latvia, Lithuania, Luxembourg, Malta, Netherlands, New Zealand, Norway, Oman, Panama, Poland, Portugal, Qatar, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States, Uruguay.
Middle	Albania, Algeria, Angola (SSA), Argentina, Armenia, Azerbaijan, Bangladesh, Belarus, Bolivia, Botswana (SSA), Brazil, Bulgaria, Cameroon (SSA), China, Colombia, Congo, Rep. (SSA), Costa Rica, Côte d'Ivoire (SSA), Dominican Republic, Egypt, El Salvador, Gabon (SSA), Ghana (SSA), Guatemala, Guyana, Honduras, India, Indonesia, Iran, Islamic Rep., Iraq, Jamaica, Jordan, Kazakhstan, Kenya (SSA), Lebanon, Malaysia, Mexico, Moldova, Mongolia, Morocco, Myanmar, Namibia (SSA), Nigeria (SSA), Pakistan, Papua New Guinea, Paraguay, Peru, Philippines, Romania, Russian Federation, Senegal (SSA), Serbia, South Africa (SSA), Sri Lanka, Thailand, Tunisia, Turkey, Ukraine, Vietnam, Zambia (SSA), Zimbabwe (SSA).
Low	Burkina Faso (SSA), Congo, Dem. Rep. (SSA), Ethiopia (SSA), Guinea (SSA), Guinea-Bissau (SSA), Haiti, Liberia (SSA), Madagascar (SSA), Malawi (SSA), Mali (SSA), Niger (SSA), Sierra Leone (SSA), Tanzania (SSA), Uganda (SSA).

Table A3: Summary statistics, 1990–2015, five-year averages

Variable	Obs	Mean	Std. Dev.	Min	Max
revenues	530	22.778	10.324	2.523	54.740
gini	530	44.901	12.361	14.123	81.071
yPPP	530	15459.99	16612.78	591.547	118533.9
agric	530	13.096	12.515	0.111	66.547
unempl	530	7.729	5.277	0.207	30.910
trade	530	78.683	44.761	0.287	386.145
depratio	530	64.955	19.337	16.540	111.800
femlabpart	530	41.090	8.937	10.655	53.294
popdens	530	117.814	169.933	1.400	1359.977
ethnt	530	3.969	1.268	0.183	6
govstab	530	7.771	1.619	2.75	11.313
intconfl	530	9.007	1.964	0.167	12
corrup	530	2.897	1.212	0.017	6
dcreditp	530	51.749	46.329	0.604	249.788
wheatsugar	530	0.041	0.069	-0.168	0.267
adolfert	530	68.699	54.872	1.859	226.225

Table A4: Summary statistics, 1990–2015, five-year averages, SSA countries

Variable	Obs	Mean	Std. Dev.	Min	Max
revenues	141	17.244	9.852	2.523	47.371
gini	141	57.914	8.080	45.690	81.071
yPPP	141	3498.089	3774.262	591.547	18491.58
agric	141	24.528	14.492	2.120	66.547
unempl	141	8.209	7.047	0.315	30.910
trade	141	66.000	29.498	26.088	244.255
depratio	141	89.588	11.299	52.246	111.800
femlabpart	141	46.195	4.358	30.522	53.294
popdens	141	48.563	42.734	1.737	193.722
ethnt	141	3.286	0.977	0.267	5
govstab	141	7.766	1.791	3.75	10.992
intconfl	141	8.195	1.647	2.833	11.9
corrup	141	2.405	0.888	0.342	5
dcreditp	141	18.475	25.146	0.604	149.240
wheatsugar	141	-0.000	0.005	-0.015	0.038
adolfert	141	138.206	37.647	48.354	226.225

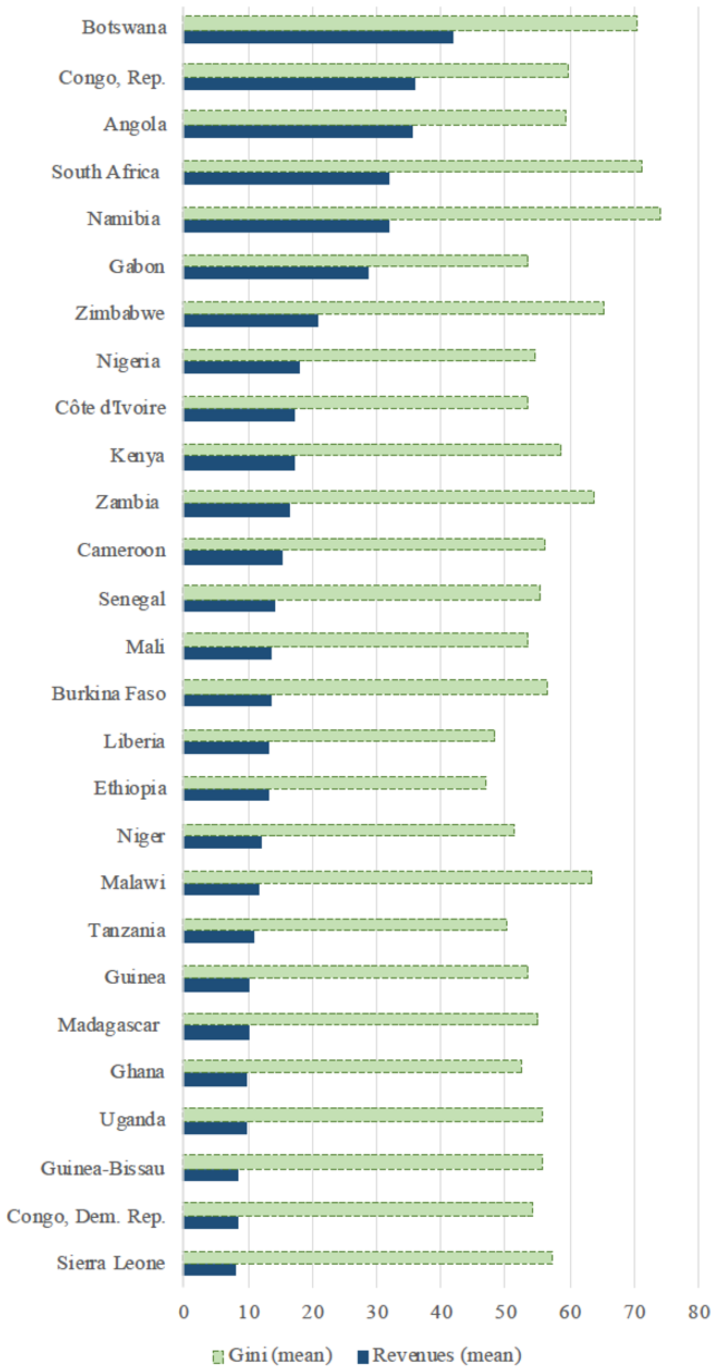
Table A5: Total revenues and inequality, IV first-stage estimates (baseline)

	ALL SAMPLE				SUB-SAHARAN AFRICA		
	All countries	*by income level*			All countries	*by income level*	
		High	Middle	Low		Middle	Low
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
wheatsugar	-1.439***	-0.815**	-1.311***	-2.169	-1.360	1.355	-3.211**
	(0.182)	(0.326)	(0.263)	(1.517)	(0.983)	(3.325)	(1.492)
dcredit	0.001*	0.001*	0.002***	0.004	0.001	0.002*	0.003
	(0.000)	(0.001)	(0.000)	(0.003)	(0.001)	(0.001)	(0.003)
adolfert	0.001*	0.005**	0.000	0.000	-	-	-
	(0.001)	(0.002)	(0.001)	(0.001)			
yPPP	-0.126***	-0.177	-0.030	-0.123**	-0.055**	-0.007	-0.100***
	(0.031)	(0.141)	(0.035)	(0.052)	(0.026)	(0.059)	(0.033)
agric	-0.007***	-0.014	-0.004*	-0.001	-0.005***	-0.007***	-0.004***
	(0.002)	(0.016)	(0.002)	(0.002)	(0.001)	(0.003)	(0.001)
unempl	0.011***	0.005	0.008***	0.001	0.006	-0.004	0.004
	(0.003)	(0.003)	(0.002)	(0.007)	(0.004)	(0.005)	(0.005)
trade	-0.000	-0.000	-0.001**	-0.001	0.000	0.001	-0.000
	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
depratio	0.002	0.008	0.006***	-0.001	-0.002	-0.000	-0.006***
	(0.002)	(0.007)	(0.002)	(0.004)	(0.002)	(0.003)	(0.002)
femlabpart	-0.003	-0.001	0.000	0.015*	0.005**	0.008***	-0.001
	(0.002)	(0.009)	(0.002)	(0.009)	(0.002)	(0.002)	(0.007)
popdens	-0.000**	-0.000	-0.000	0.000	0.000	0.000	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
govstab	0.004	0.035**	-0.007	-0.015	-0.008	-0.014*	-0.011
	(0.010)	(0.016)	(0.010)	(0.015)	(0.008)	(0.008)	(0.012)
intconfl	-0.004	-0.011	0.000	0.002	0.005	0.015	-0.002
	(0.007)	(0.019)	(0.008)	(0.013)	(0.009)	(0.012)	(0.011)
corrup	-0.025**	-0.014	0.028*	-0.029*	-0.020*	0.015	-0.043***
	(0.012)	(0.023)	(0.015)	(0.016)	(0.012)	(0.023)	(0.015)
ethnt	-0.008	-0.014	-0.008	0.032*	0.029***	0.009	0.019
	(0.010)	(0.017)	(0.010)	(0.017)	(0.010)	(0.022)	(0.013)
Observations	530	174	285	71	141	73	68

Depvar: gini (*ln*). IV first-stage estimates. 2SLS pooled estimator. Panel-clustered (country level) standard errors in parentheses. Period dummies included. *** p<0.01, ** p<0.05, * p<0.1.

Appendix B

Figure B1: Total revenues and inequality (Gini), SSA countries



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