Income Inequality and Redistribution in sub-Saharan Africa

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Abstract

A strand of the political economy literature emphases the negative effect of income inequality on growth and poverty, which materialises through redistribution. The theoretical expectation is that high inequality would lead to higher redistribution via the collective action of the median voter. Most of the empirical literature testing the *redistribution hypothesis* has been conducted in the context of industrialised economies. This paper examines this hypothesis with specific reference to sub-Saharan Africa, a region characterised by high levels of income inequality and limited redistribution. We adopt an instrumental variable approach to unpack the determinants and plausible mechanisms underpinning this relationship. In the analysis, we account for the effect of omitted top income earners in income inequality estimates, given their weight in the shape of the income distribution and their influence in redistributive policies. Overall, we find a positive relationship between inequality and redistribution, especially among middle-income countries. Further examination reveals that the abundance of natural resource rents seem to be the driving force affecting tax policy choices, which in turn exacerbates income inequity and undermines progressive redistribution. Thus, our results do not provide strong evidence to support the propositions of the median voter theorem but instead, seem to aligned more closely to the predictions of the multiple steady states hypothesis.

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1 Introduction

High levels of income inequality in many parts of the developing world has 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 generate 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 work by Kuznets (1955) provided a theoretical analysis of the underlying mechanisms in the relationship between inequality and economic development, focusing on the effects of savings and economic convergence. The intersectoral analysis of changes in income inequality proposed by Kuznets was later formalised by Robinson (1976); Knight (1976) and Fields (1979).

Similarly to Kuznets (1955), the surplus labor model by Lewis (1954) also predicts that inequality would increase with the shift from the low-income traditional economy to the high-income modern industrial development. More recently, the sectoral composition of the economy has been the main issue examined by Bourguignon and Morrisson (1998). In their model, differences in income distribution across developing countries is explained by the extent of economic dualism between agriculture and the modern economy.

Some studies, (e.g. Aghion et al. 1999) underscore a trade off between productive efficiency and equality, which implies a positive association between inequality and growth. According to this view, inequality might be growth-enhancing on the basis of three main arguments. First, the rich have 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 contributions 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 impact occupational choices, labour productivity and create poverty traps and income gaps that ultimately hampers aggregate output.

A much smaller strand of the literature that emphasises the negative effects of income inequality takes a political economy perspective. Some studies such as Alesina and Rodrik (1994) and Persson and Tabellini (1994) highlight a negative effect of inequality on growth, which materialises through redistributive policies. In these models, growth is a function of the capital stock, which is in turn influenced by individual saving decisions, while the aggregate output is a function of capital as well as of government services, which are financed via taxes on income and capital.[1] Taxing the wealthy would have two effects on

[1]See Ostry et al. (2014) for formal discussion on the relationship between inequality,

growth: one would reduce the net return on production factors, such as capital and skilled labour, thus affecting negatively growth. Another would increase transfers to the poor and finance public services such as infrastructure and education that would stimulate growth. Since redistribution decisions are endogenous to inequality, past inequality would influence redistribution and consequently, future economic growth.

While the theoretical predictions from this strand of 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, a region characterised 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 Jorda 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 revenue, 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 sub-Saharan Africa, which differs from the rest of the global sample by showing a positive effect of inequality on redistribution. Specifically, we find that one percent increase in the Gini coefficient leads to approximately 2.5 percent increase in total government revenue in the baseline results. Interestingly, accounting for the omission of the richest (those at the top 99 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 mobilisation capacity via direct taxes of sub-Saharan African countries, but also the likely strength of elite cohesion and their connectedness with political regimes, which 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, seem to be aligned more closely to the predictions of multiple steady states that are envisaged by Bénabou (2000)'s theoretical framework.

The remainder of the paper is organised as follows: section 2 review the literature with specific reference to the redistribution hypothesis, particularly in the context of sub-Saharan Africa. 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.

2 Inequality and redistribution

Within the political economy literature, there is an emphasis on 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 a competitive electoral systems, high inequality would lead to higher redistribution (*redistribution hypothesis*) via the collective action of the median voter (*median voter hypothesis*).

The work by Alesina and Rodrik (1994) highlights the negative effect that inequality has on growth due to redistribution. The model distinguishes between relative factor endowments between capital and labour, and the redistributive preferences of the median voter, who in contexts of high income inequality, would favour higher taxes. Since growth is driven by capital accumulation, the model predicts a positive relationship between inequality and

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redistribution and growth.

redistribution, and an inverse relationship between redistribution and growth rates. Persson and Tabellini (1994) arrived to a similar conclusion, based on a general equilibrium model that shows that higher income inequality leads to lower growth.

In contrast, the model by Li and Zou (1998) comes to a different conclusion, according to which inequality provides a positive contribution to growth. Under a majority voting system and according to the median voter theorem, when the distribution is more equal (i.e. when the median voter's capital share is higher) taxation will be higher, implying now lower growth. This occurs because individuals now aim to maximize their utility through both, private and public consumption.[2]

2.1 Testing the *redistribution hypothesis*

Most of the empirical literature testing both the redistribution hypothesis and the median voter hypothesis has been conducted in the context of advanced economies, most of them with long standing 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.[3] 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 compared to factor income (Milanovic, 2000) or, by the change in the Gini coefficients which is registered moving 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 (Lindert, 1996) or non linear (De Mello and Tiongson, 2003) relationship. It should be noted that some of the conditions necessary for the median voter theorem to apply hardly 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 the light of the heterogeneous 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 perspective from the 'social contract paradigm', predicts a non-linear relationship between inequality and redistribution, which can become negative over the long run, with possible multiple steady states: high inequality and low redistribution; low inequality and high redistribution. The rational of the model is that, in correspondence of low levels of inequality, the popular support for redistributive policies is quite high. Then, as inequality increases, the share of rich population is sufficiently high to oppose the implementation of further redistribution. Finally, in presence of high level of inequality, the share of 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. In this case, however, behind such a negative association, there is the assumption that social spending is not only a way to redistribute income but also to provide some forms of insurance.

[2] In the model, government spending on public services enters the individual utility function, and not the production function, as in the model by Alesina and Rodrik (1994).

[3] Scervini (2012) reviews some of the most influential studies of the early reference literature.

More recently, other interpretations of the mechanisms underlying the redistribution hypothesis have been proposed. In particular, the rational utility maximisation paradigm driving the median voter's choice in the traditional approach has been revised on the basis of arguments from behavioural economics emphasising 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 have been more recently tested also with reference to developing countries. Prominent analyses are those by Breceda et al. (2008) for Latina America, Birdsall and Haggard (2002) for East Asia, and Zoellick (2011) for Middle East and North Africa.[4]

3 Empirical strategy

3.1 Model specification

Empirical analyses of the relationship between inequality and redistribution remains ambiguous partly due to two important constraints: first, data has been a major limitation, especially for cross-country analysis. Second, some of the underlying assumptions of such a theorem may not hold for developing country contexts, whose social and political institutions may differ substantially from the assumptions imposed by the theorem.

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

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

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 the extent to which the concentration of income 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, measurement error in the empirical analysis of the relationship of interest cannot be ruled out. Finally, simultaneity bias may emerge since 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:

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

where Z_{it} is exogenous with respect to equation (1), but partially correlated with inequality

[4]It should be acknowledged that the debate about social contract is still open and the related literature still flourishing, for both less developed and advanced countries. Among the most recent contributions see Bussolo et al. (2018).

in equation (2), i.e. $Cov(Z_{it}, \epsilon_{it}) = 0$ and $\delta_1 \neq 0$.[5] 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 ($yPPP$) as well as the share of value added originating from agriculture ($agric$), the latter variable providing also information about the sectoral composition of output. Per capita income is expected to be positively correlated with government tax revenues–our proxy for redistribution–since the demand for goods and services provided by governments is expected to increase with income. In addition, economic development usually goes along with greater governments' capacity 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 impact 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).

We also include in the model an indicator that measures the trade openness of countries ($trade$), since 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 the monitoring of the entry and exit of goods into and from the country is generally straightforwardly, 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 while falling 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).

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 population younger than 15 or older than 64 to the working-age population (aged 15-64), as well as for female participation to the labor 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 its elderly population face the pressure to create or expand their pension systems, a goal which can be favorably approached through increasing revenues. In contrast, countries with a large proportion of children face limited productive capacity that generate tax revenues. Female labor force participation is expected to be positively correlated with tax revenue as a higher share of women employed in the labor market enlarges the tax base.

We also control for population density ($popdens$), since it is expected to lower the administrative costs of tax collection and evasion controls. Finally, we control for ethnic tensions ($ethnt$), 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 widely 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 in examining the influence of ethnicity on the government effectiveness, with some studies arguing that individuals in diverse communities are less willing to contribute to the

[5] We refer to equation (1) as the *structural form* equation and to equation (2) as the *first stage* equation (Andrews et al., 2019).

public good (Lindqvist and Östling, 2013; Kimenyi, 2006), while others find an ethnic diversity divided (Gisselquist et al., 2016). Nonetheless, ethnic fractionalization could lead to lower tax revenues, especially in countries characterized by an important colonial history which might 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 proxÿ 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 revenues collection, while more corruption to be negatively associated with tax revenues (Botlhole et al., 2012). In the next Section 3.2, 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 it is a valid approximation for 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 e.g. 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.[6] This choice is motivated based on the problems of completeness and comparability for social contribution figures, particularly for developing countries. As for the economic and socio-demographic controls, we employed data from the World Bank's World Development Indicators (WDI) as our primary data source. Data on institutional dimensions are drawn from the International Country Risk Guide (ICRG) dataset, which is published annualy by the PRS Group.[7]

3.2.2 Inequality

We estimate the 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.[8] The WIID is the most reliable and comprehensive database

[6] Revenues data used for the analysis are also exclusive of grants.

[7] 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.

[8] The WIID database is available on the following link: https://www.wider.unu.edu/database/wiid.

of worldwide distributional data currently available.[9]

Whenever we had 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 Camberra 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.[10]

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 concept. We note that mixing consumption and income data could lead to misleading results because 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. Then, we grouped countries into world regions and computed an average index of income relative to consumption, following (Jorda and Niño-Zarazúa, 2019). This procedure is similar, although not strictly identical to the ones 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 coming from household surveys (Atkinson et al., 2011; Piketty and Saez, 2013; Leigh, 2007; Alvaredo et al., 2013). Tax records, however, 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 Jorda and Niño-Zarazúa (2019), and apply a parametric model, based on the so-called generalized beta distribution of the second kind (GB2) that 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 Gini adjusted 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

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

[10] 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 the welfare concept in the analysis.

share of land used for sugarcane production ($wheatsugar$). The rationale behind this instrument is motivated by Sokoloff and Engerman (2000)'s 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:

$$wheatsugar = ln\Big(\frac{1 + wheat\_agril}{1 + sugarcane\_agril}\Big) \tag{3}$$

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 was a labor-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 slave labor than family farms, thus impeding the development of a middle class and fostering inequality.

We also 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, and that consequently lead to a persistence in income inequality.[11]

Finally, we follow the argument put forward by Aiyar et al. (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. Since 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 Study coverage

The present study covers 116 countries, 27 of which are in the sub-Saharan Africa (SSA) region, over the period 1990-2015.[12] All the variables used in the analysis are averaged over five-year periods.[13] This choice is motivated by the fact that comparable annual data for inequality measures are available only for a limited number of countries. Furthermore, inequality is a highly persistent variable, although 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 the variables used in the analysis.

On average, over the period of analysis, 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 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 58 points. Figure 1 provides an general picture of the pattern characterizing the two main variables of interest

[11]This instrumental variable has been by previous studies (e.g. De Mello and Tiongson (2006) that empirically examine the causal relationship between inequality and redistribution

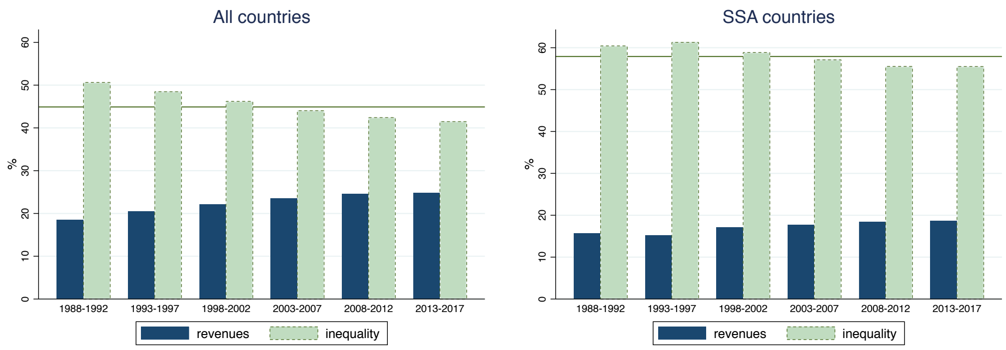
[12]The list of countries included in the sample is referred to in Table A2.

[13]Variables' definitions and data sources are reported in Table A1.

over the reference period.[14] On a global level, the share of total government revenues over GDP shows a increasing pattern while income inequality exhibits a sizable reduction over the same period. In the case of sub-Saharan Africa, 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, we show in Figure B1 the average values of revenues and inequality by country whereas Figures B1.1-B2.13 in Appendix B show the tax and non-tax components of total government revenues and within the former, the contribution from direct and indirect taxes. The next section presents the results of the analysis.

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 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.

Regarding other control variables, among the structural economic factors, 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 mobilisation. For example, the share of agriculture over GDP has a negative and significant association with total government revenues while trade openness show a positive and statistically significant, although very small, association.

The parameter 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, show that the results are driven by the presence of several middle-income countries in our sample, which are characterized by high level 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).

[14] 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.

Most socio-demographic factors included in Model (1) appear insignificant in their association with total revenues, with the only exception of population density that shows a small, negative and significant association with total revenues. While the results may appear counter intuitive, they appear to influenced by the presence in our global sample of a large number of middle-income countries in Asia, with 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 the 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 the ability of governments to implement policies show a significant correlation with revenue collection.

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 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 Gini index that measures the level of income inequality is in fact endogenous to redistribution in the specified model.[15] Therefore, we focus on the 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 IV procedure. First, we perform an under-identification test to assess the relevance of the instruments.[16] 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.[17] Third, we compute the Hansen test of over-identifying restrictions.[18] In this case, a rejection of the null casts doubt on the validity of the instruments. Overall, the performed tests show that the IV approach is the appropriate one to estimate the causal effect of inequality on redistribution.

Looking at the first-stage regressions, we find that the selected instruments are statistically significant. Specifically, the sign of the $wheatsugar$ 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 occurs at the cost of higher income inequality. Finally, higher fertility rates among young women is found to be correlated with higher inequality, as postulated by the literature.

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

[16]Since the reference model has been estimated by assuming cluster-robust errors by country, Table 1 reports the LM versions of the Kleibergen-Paap (2006) rk statistic.

[17]Given the clustered standard errors, Table 1 reports the Kleibergen-Paap Wald rk F statistic to test for weak identification.

[18]The Hansen test is the appropriate test for over-identifying restrictions in the context of clustered standard errors. By definition, the test is not computable when the model is exactly identified.

Table 1: Inequality and total government revenues. Global sample. OLS and 2SLS estimators.

	OLS	**2SLS**		**2SLS**	
	(1)	(2)	(3)	(4)	(5)
Depvar	*revenues*	*revenues*	*ineq*	*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)
popdens	-0.000***	-0.001***	-0.000	-0.001***	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
govstab	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)
Observations	530	530	530	530	530
R-squared	0.679	0.629		0.642	
Endog test p-val			0.014		0.049
K-P rk LM st. p-val			0.000		0.000
K-P rk Wald F st.			72.52		28.24
Hansen J p-val					0.265

Depvar cols (1), (2) and (4): total revenues (% GDP, *ln*). Depvar cols (3) and (5): inequality (gini, *ln*). Panel-clustered (country level) standard errors in brackets. Period dummies included. *** p<0.01, ** p<0.05, * p<0.1.

Turning to the main structural equation, we find that inequality has a negative effect on revenues. Since 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.

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 levels. In addition, we estimate the model for sub-Saharan Africa 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 allow us to reduce the threat of unobserved heterogeneity in the relationship between inequality and redistribution in the sub-Saharan African region. Results from the 2SLS estimators are reported in Table 3.

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, an increase in the Gini index by 1% leads to a decrease in total government revenues by approximately 0.87%. The magnitude of the inequality elasticity of redistribution increases to 1.44% when the sample is restricted o high-income countries while slightly decreases to 0.8% when the analysis is restricted to middle-income countries. The direction of the relationship is also negative but statistically insignificant for the case of low-income countries, partly due to the smaller sample of countries falling in that income classification.

Surprisingly, we find that the sign of the parameter estimate for the Gini index is positive and statistically significant for sub-Saharan Africa as a whole, and also for middle-income countries, in the order of 2.5 and 1.7, respectively, although it turns negative, -1.96, when we restrict the sample to low-income countries (see Table 3, columns 5, 6 and 7).[19]

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):360 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'.

We believe, however, that this channel is implausible, at least in the context of sub-Saharan Africa, due to two important reasons: First, despite recent progress toward democracy, the region continues to be dominated by autocracies and electoral autocracies, where the median voter is less influential in redistribution decisions than elites, which are via lobbying groups and practices of corruption, closely linked to government power (Carter, 2016; Kroeger, 2020; Bénabou, 2000; Stiglitz, 2012). Second, taxes on income, profits and capital gains have remained largely stagnated, 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 stagnated but in fact declined between the 1990s and 2000s (see Table 2).

We believe the most plausible mechanism for the positive causal relationship between in-

[19] We note that due to a finite sample problem, the estimated coefficients for middle-income and low-income countries in sub-Saharan Africa 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 out of the three instruments (see Harding et al. (2016); Andrews et al. (2019) for a discussion on the finite sample bias and weak instrument issues). Moreover, as discussed below 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.

equality and total government revenues in sub-Saharan Africa, 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 2.

Table 2: Natural resource rents and taxes on income profits and capital gains as percentage 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 levying higher taxes on the richest is not a key element in redistribution and resource mobilisation 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 impact positively on government revenues.

4.1 Top-incomes adjusted inequality estimates

So far, we have discussed the results based on a Gini index that is truncated due to the omission of top incomes in household surveys. Since 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 estimates of income inequality on government revenues change 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 a summary statistics of the top-incomes adjusted

Table 3: Inequality effects on total government revenues. 2SLS 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)	-0.874***	-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)
femlabpart	-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)
govstab	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)
intconfl	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)
corrup	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*). IV estimates. 2SLS pooled estimator. Panel-clustered (country level) standard errors in brackets. Period dummies included. *** p<0.01, ** p<0.05, * p<0.1. IVs col. (1)-(4): *wheatsugar*, *adolfert*, *dcreditp*. IVs col. (5)-(7): *wheatsugar*, *dcreditp*.

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 sub-Saharan Africa, 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.

Table 4: Top-incomes adjusted Gini indices. Global

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 increases.

Table 5: Top-incomes adjusted Gini indices. 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

We present in Table 6 the results of the re-estimated equation (1), using the top-incomes adjusted Gini indices. We find that size effect of income inequality on total government revenues is somehow contained, although marginally, when we account for the effect of top incomes.[20] 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. 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 just marginally.

In the case of sub-Saharan Africa, the size of the elasticities goes down from 2.52 to 2.37, and from 1.719 and -1.958 to 1.592 and -0.683, for the cases of middle-income and low-income

[20] See comparatively baseline estimates in Table 3 and top-incomes adjusted estimates in Table 6.

countries, respectively.[21] Thus, despite the very large effect of top incomes on income inequality in the sub-Saharan Africa 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 a 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.[22] Indeed, the share of income taxes to GDP had remained under a 5% level in sub-Saharan Africa since the 1990s until recently, when it increased marginally. Among middle-income countries, that share is slightly higher, about 7%, although it has not changed since the 1990s, and in fact declined by about one percentage between the 1990s and the 2000s.

The second consideration is in the domain of political economy. In the African context, characterised 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 to 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 and even higher due to top incomes, would lead to a constrained redistribution, which is reinforced by the presence of natural resource rents as discussed earlier in Section 4.

5 Robustness checks

In order to assess the fitness of our results, we perform a number of robustness checks. First, we estimate in Section 5.1, 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 generalised method of moments (GMM) and the limited-information maximum likelihood (LIML). Third, we apply in Section 5.3, a random-effect panel estimator, which allows us to take into account the potential presence of unobserved individual effects.[23]

5.1 Model with interaction terms

The reference model relies on regional sub-samples, that limits the number of observations available for analysis, especially in the case of sub-Saharan Africa. 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 (CCd_i) considered in Table 3 and their interaction

[21] We note that the statistical significance of the parameter estimates for the full sample of sub-Saharan African countries and the sub-sample of low-income countries, disappears when accounting for the effects of top incomes.

[22] Informal employment in the 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. (World Bank 2019b).

[23] 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 further.

Table 6: Inequality effects on total government revenues (top-incomes adjusted Gini indices). 2SLS 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*), $t = 0.9975$	-0.851***	-1.399***	-0.795***	-0.573	2.351*	1.425*	-0.946
	(0.250)	(0.319)	(0.233)	(0.907)	(1.318)	(0.728)	(0.917)
Observations	530	174	285	71	141	73	68
R-squared	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	2.369*	1.408*	-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
Hansen J p-val	0.297	0.411	0.130	0.231	0.101	0.617	0.309
K-P rk LM st. p-val	0.000	0.003	0.006	0.153	0.188	0.226	0.087
K-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-squared	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
K-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 brackets. Period dummies included. *** p<0.01, ** p<0.05, * p<0.1. IVs col. (1)-(4): *wheatsugar*, *adolfert*, *dcreditp*. IVs col. (5)-(7): *wheatsugar*, *dcreditp*.

with income inequality ($I_{it} \times CCd_i$), and which takes the following form:[24]

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

where β_1 denotes the marginal effect of income inequality for those countries which 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 $\beta_1+\beta_4$ measures the marginal effect of income inequality on total government revenues for the referenced group of countries. To illustrate, when looking at sub-Saharan Africa, the coefficient β_1 will capture the effect of income inequality on government revenues for countries which do not belong to sub-Saharan Africa, β_4 will measure the difference between sub-Saharan African countries and the rest of the world, whereas the linear combination $\beta_1+\beta_4$ will measure effect of income inequality on total government revenues in sub-Saharan Africa. 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 be worsen in the presence of over-identifying restrictions. We considered alternative estimators that are asymptotically equivalent to 2SLS but have better finite-sample properties.

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 i.i.d. assumption. Results are presented in Table 8. In addition, we adopt a limited-information maximum likelihood estimator, which performs better than 2SLS in presence of weak instruments. Results are presented in Table 9. All in all, the findings from these alternative estimators confirm the results from the 2SLS model.

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:

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

where η_i denotes the individual unobserved effects and u_{it} is the idiosyncratic error. In a RE-IV model, it is assumed a strict exogeneity of the individual term η_i 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.[25] Therefore, we proceed to implement the RE-IV estimator. Results are presented in Table 10. In addition, we estimate the RE-IV model

[24] These country subgroups are: high-income, middle-income, low-income, countries in the sub-Saharan African region, and middle-income and low-income countries in that region.

[25] $H_0 : var(\eta_i) = 0$. Chibar2(01) = 540.43 (p-value=0.000.

Table 7: Inequality effects on total government revenues (model with interactions). 2SLS 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)	-0.874***	-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)
unempl	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)
$femlabpart$	-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)
govstab	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)
$intconfl$	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)
ethnt	-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)
$CCd \times gini$	-	-0.108	0.261	-2.621*	3.118***	1.884**	-3.433
		(0.401)	(0.385)	(1.561)	(1.171)	(0.848)	(2.341)
Observations	530	530	530	530	530	530	530
R-squared	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.: $gini + (CCd \times gini)$		-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: total revenues (% GDP, *ln*). IV estimates. 2SLS pooled estimator. Panel-clustered (country level) standard errors in brackets. Period dummies included. *** p<0.01, ** p<0.05, * p<0.1. IVs col. (1)-(4): *wheatsugar*, $adolfert$, *dcreditp*. IVs col. (5)-(7): *wheatsugar*, *dcreditp*.

Table 8: Inequality effects on total government revenues. GMM2S 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)	-0.709***	-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)
unempl	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)
femlabpart	-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)
popdens	-0.001***	-0.000	-0.001***	0.000	-0.001	0.001	0.002*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(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)
intconfl	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)
corrup	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, *ln*). GMM2S pooled estimator. Panel-clustered (country level) standard errors in brackets. Period dummies included. *** p<0.01, ** p<0.05, * p<0.1. IVs col. (1)-(4): *wheatsugar*, *adolfert*, *dcreditp*. IVs col. (5)-(7): *wheatsugar*, *dcreditp*.

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 (% GDP, *ln*). LIML pooled estimator. Panel-clustered (country level) standard errors in brackets. Period dummies included. *** p<0.01, ** p<0.05, * p<0.1. IVs col. (1)-(4): *wheatsugar*, *adolfert*, *dcreditp*. IVs col. (5)-(7): *wheatsugar*, *dcreditp*.

with interactions, to keep the sample 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 sub-Saharan African countries confirm the previous findings.

6 Concluding remarks

The level of income Inequality plays an important role in influencing countries' economic performance and poverty reduction efforts. The literature has pointed out the possible channels through which such an influence may operate. In the present study, we investigate the *redistribution 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 have 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 which could be driving the result are the economic structure and sector composition of many African economies, especially for 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 suggest that it is not the median voter who through the power of persuasion in competitive electoral systems drive elites to redistribute via government revenues, but instead, it is the resource wealth of many African countries, which by allowing opportunistic incumbents to raise revenues without taxing the richest, exacerbate income inequality, which in turn impact 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**
PANEL 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)
agric	-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)
depratio	0.001	0.003	-0.000	0.008	0.015*	0.004	-0.003
	(0.002)	(0.005)	(0.004)	(0.005)	(0.008)	(0.008)	(0.022)
femlabpart	-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**	-0.061	0.036	0.031	0.121
	(0.011)	(0.017)	(0.013)	(0.045)	(0.038)	(0.031)	(0.082)
intconfl	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	0.107*	0.014	-0.109***	-0.111
	(0.017)	(0.018)	(0.025)	(0.062)	(0.069)	(0.041)	(0.123)
ethnt	-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
Hansen J p-val	0.504	0.347	0.407	.	0.137	.	.
K-P rk LM st. p-val	0.000	0.641	0.010	0.448	0.097	0.198	0.415
K-P rk Wald F st.	10.233	0.529	5.960	0.905	1.900	1.687	0.839
PANEL 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)	(1.642)	(2.690)	(6.770)	(6.409)	(4.470)
$CCd \times gini$	-	-0.091	0.388	-1.706**	4.173**	3.641**	-2.014*
		(0.523)	(0.434)	(0.677)	(1.657)	(1.587)	(1.128)
Observations		530	530	530	530	530	530
Number of countries		116	116	116	116	116	116
Hansen J p-val		0.589	0.575	0.427	0.827	0.487	0.219
K-P rk LM st. p-val		0.000	0.000	0.000	0.209	0.085	0.000
K-P rk Wald F st.		5.419	6.260	5.870	3.034	2.224	13.197
Linear combinat.: $gini + (CCd \times gini)$		-0.824*	-0.614*	-2.466***	3.148**	2.521*	-2.816**
		(0.443)	(0.335)	(0.607)	(1.499)	(1.368)	(1.102)

Depvar: total revenues (% GDP, *ln*). RE-IV panel estimator. Robust standard errors in brackets. Period dummies included. *** p<0.01, ** p<0.05, * p<0.1. IVs col. (1)-(4): *wheatsugar*, *adolfert*, *dcreditp*. IVs col. (5)-(7): *wheatsugar*, *dcreditp*.

References

Acemoglu, D., D. Ticchi, and A. Vindigni (2011, Apr). Emergence and persistence of inefficient states. *Journal of the European Economic Association 9*(2), 177–208.

Addison, T. and A. Roe (2018). *Extractive industries: The management of resources as a driver of sustainable development.* Oxford University Press.

Adelman, I. and S. Robinson (1989). Income distribution and development. In H. Chenery and T. N. Srinivasan (Eds.), *Handbook of Development Economics*, Volume II, Chapter 19. Elsevier.

Aghion, P., E. Caroli, and C. Garcia-Penalosa (1999). Inequality and economic growth: The perspective of the new growth theories. *Journal of Economic literature 37*(4), 1615–1660.

Ahrens, L. (2019). Unfair inequality and the demand for redistribution. LIS Working Papers Series 771, Luxembourg Income Study (LIS).

Aiyar, S., C. H. Ebeke, et al. (2019). Inequality of opportunity, inequality of income and economic growth. Technical report, International Monetary Fund.

Akitoby, B., J. Honda, H. Miyamoto, K. Primus, and M. Sy (2019). Case studies in tax revenue mobilization in low-income countries. IMF Working Paper 19/104, International Monetary Fund (IMF).

Alesina, A., R. Baqir, and W. Easterly (1999). Public goods and ethnic divisions. *The Quarterly journal of economics 114*(4), 1243–1284.

Alesina, A. and E. L. La Ferrara (2005, September). Ethnic diversity and economic performance. *Journal of Economic Literature 43*(3), 762–800.

Alesina, A. and R. Perotti (1996). Income distribution, political instability, and investment. *European economic review 40*(6), 1203–1228.

Alesina, A. and D. Rodrik (1994). Distributive politics and economic growth. *The quarterly journal of economics 109*(2), 465–490.

Alesina, A., G. Tabellini, and F. R. Campante (2008). Why is fiscal policy often procyclical? *Journal of the European Economic Association* (5), 1006–1036.

Alvaredo, F., A. B. Atkinson, T. Piketty, and E. Saez (2013). The top 1 percent in international and historical perspective. *Journal of Economic perspectives 27*(3), 3–20.

Andrews, I., J. Stock, and L. Sun (2019, 2019). Weak instruments in iv regression: Theory and practice. *Annual Review of Economics 11*, 727–753.

Atkinson, A. B., T. Piketty, and E. Saez (2011). Top incomes in the long run of history. *Journal of economic literature 49*(1), 3–71.

Banerjee, A. V. and A. F. Newman (1993). Occupational choice and the process of development. *Journal of political economy 101*(2), 274–298.

Bardhan, P. K. and D. Mookherjee (2000). Capture and governance at local and national levels. *American economic review 90*(2), 135–139.

Bénabou, R. (2000). Unequal societies: Income distribution and the social contract. *American Economic Review*, 96–129.

Besley, T. and T. Persson (2014). Why do developing countries tax so little? *Journal of Economic Perspectives 28*(4), 99–120.

Bird, R. M., J. Martinez-Vazquez, B. Torgler, et al. (2014). Societal institutions and tax effort in developing countries. *Annals of Economics and Finance 15*(1), 185–230.

Birdsall, N. and S. Haggard (2002). After the crisis: the social contract and the middle class in east asia. In *When Markets Fail: Social Policy and Economic Reform*, pp. 58–96. Russell Sage Foundation.

Bjorvatn, K. and A. Naghavi (2011). Rent seeking and regime stability in rentier states. *European Journal of Political Economy 27*(4), 740–748.

Botlhole, T., J. Asafu-Adjaye, and F. Carmignani (2012). Natural resource abundance, institutions and tax revenue mobilisation in sub-sahara africa. *South African Journal of Economics 80*(2), 135–156.

Bourguignon, F. and C. Morrisson (1998). Inequality and development: the role of dualism. *Journal of development economics 57*(2), 233–257.

Boustan, L., F. Ferreira, H. Winkler, and E. M. Zolt (2013). The effect of rising income inequality on taxation and public expenditures: Evidence from us municipalities and school districts, 1970–2000. *Review of Economics and Statistics 95*(4), 1291–1302.

Breceda, K., J. Rigolini, and J. Saavedra (2008). *Latin America and the social contract: Patterns of social spending and taxation*. The World Bank.

Bussolo, M., M. E. Davalos, V. Peragine, and R. Sundaram (2018). *Toward a New Social Contract*. The World Bank.

Bussolo, M., A. F. i Carbonell, A. Giolbas, and I. Torre (2019). I perceive therefore i demand: The formation of inequality perceptions and demand for redistribution. Policy Research Working Papers 8926, The World Bank.

Carter, B. L. (2016). The struggle over term limits in africa: How international pressure can help. *Journal of Democracy 27*(3), 36–50.

Collier, P. (2010). The political economy of natural resources. *Social research 77*(4), 1105–1132.

Currie, J. and F. Gahvari (2008). Transfers in cash and in-kind: Theory meets the data. *Journal of Economic Literature 46*(2), 333–83.

De Mello, L. and E. R. Tiongson (2003). Income inequality and redistributive government spending. Technical report, IMF Working Paper 314.

De Mello, L. and E. R. Tiongson (2006). Income inequality and redistributive government spending. *Public finance review 34*(3), 282–305.

Deininger, K. and L. Squire (1996). A new data set measuring income inequality. *The World Bank Economic Review 10*(1), 565–591.

Dioda, L. (2012). Structural determinants of tax revenue in latin america and the caribbean, 1990-2009. Technical report, Naciones Unidas Comisión Económica para América Latina y el Caribe (CEPAL).

Drummond, P., W. Daal, N. Srivastava, L. E. Oliveira, et al. (2012). Mobilizing revenue in sub-saharan africa; empirical norms and key determinants. Technical report, International Monetary Fund.

Easterly, W. (2007). Inequality does cause underdevelopment: Insights from a new instrument. *Journal of development economics 84*(2), 755–776.

Fields, G. S. (1979). A welfare economic approach to growth and distribution in the dual economy. *The Quarterly Journal of Economics 93*(3), 325–353.

Galor, O. and J. Zeira (1993). Income distribution and macroeconomics. *The review of economic studies 60*(1), 35–52.

Gisselquist, R. M., S. Leiderer, and M. Niño-Zarazúa (2016). Ethnic heterogeneity and public goods provision in zambia: Evidence of a subnational "diversity dividend". *World Development 78*, 308–323.

Gnangnon, S. K. and J.-F. Brun (2019). Trade openness, tax reform and tax revenue in developing countries. *The World Economy 42*(12), 3515–3536.

Habyarimana, J., M. Humphreys, D. N. Posner, and J. M. Weinstein (2007). Why does ethnic diversity undermine public goods provision? *American Political Science Review*, 709–725.

Harding, M., J. Hausman, C. Palmer, et al. (2016). Finite sample bias corrected iv estimation for weak and many instruments. *Advances in Econometrics 36*, 245–273.

Jenkins, S. P. (2015). World income inequality databases: an assessment of wiid and swiid. *The Journal of Economic Inequality 13*(4), 629–671.

Jorda, V. and M. Niño-Zarazúa (2019). Global inequality: How large is the effect of top incomes? *World Development 123*, 104593.

Khattry, B. and J. M. Rao (2002). Fiscal faux pas?: an analysis of the revenue implications of trade liberalization. *World Development 30*(8), 1431–1444.

Kimenyi, M. S. (2006, 05). Ethnicity, Governance and the Provision of Public Goods. *Journal of African Economies 15*$(\mathrm{suppl}_1), 62--99$.

Knight, J. B. (1976). Explaining income distribution in less developed countries: A framework and an agenda. *Oxford Bulletin of Economics and Statistics 38*(3), 161–177.

Kroeger, A. M. (2020). Dominant party rule, elections, and cabinet instability in african autocracies. *British Journal of Political Science 50*(1), 79–101.

Kuznets, S. (1955). Economic growth and income inequality. *The American economic review 45*(1), 1–28.

Leigh, A. (2007). How closely do top income shares track other measures of inequality? *The Economic Journal 117*(524), F619–F633.

Lewis, W. A. (1954, May). Economic development with unlimited supplies of labour. *The Manchester School 22*, 139–191.

Li, H. and H.-f. Zou (1998). Income inequality is not harmful for growth: theory and evidence. *Review of development economics 2*(3), 318–334.

Lindert, P. H. (1996). What limits social spending? *Explorations in Economic History 33*(1), 1 – 34.

Lindqvist, E. and R. Östling (2013). Identity and redistribution. *Public Choice 155*(3-4), 469–491.

Luebker, M. (2014). Income inequality, redistribution, and poverty: Contrasting rational choice and behavioral perspectives. *Review of Income and Wealth 60*(1), 133–154.

Lupu, N. and J. Pontusson (2011). The structure of inequality and the politics of redistribution. *American Political Science Review 105*(2), 316?336.

McCarty, N. and J. Pontusson (2011). *The Political Economy of Inequality and Redistribution.* Oxford University Press. publisher: Oxford University Press.

Meltzer, A. H. and S. F. Richard (1981). A rational theory of the size of government. *Journal of political Economy 89*(5), 914–927.

Milanovic, B. (2000). The median-voter hypothesis, income inequality, and income redistribution: an empirical test with the required data. *European Journal of Political Economy 16*(3), 367–410.

Moene, K. O. and M. Wallerstein (2001). Inequality, social insurance, and redistribution. *American Political Science Review*, 859–874.

Niño-Zarazúa, M., L. Roope, and F. Tarp (2017, Dec). Global inequality: Relatively lower, absolutely higher. *Review of Income and Wealth 63*(4), 661–684.

Ostry, M. J. D., M. A. Berg, and M. C. G. Tsangarides (2014). *Redistribution, inequality, and growth.* International Monetary Fund.

Persson, T. and G. Tabellini (1994). Is inequality harmful for growth? *The American economic review*, 600–621.

Piketty, T. and E. Saez (2013). Top incomes and the great recession: Recent evolutions and policy implications. *IMF economic review 61*(3), 456–478.

Robinson, S. (1976). A note on the U hypothesis relating income inequality and economic development. *The American economic review 66*(3), 437–440.

Scervini, F. (2012). Empirics of the median voter: democracy, redistribution and the role of the middle class. *The Journal of Economic Inequality 10*(4), 529–550.

Schwabish, J. A., T. M. Smeeding, and L. Osberg (2006). Income distribution and social expenditures. In *The Distributional Effects of Government Spending and Taxation*, pp. 247–288. Springer.

Sen Gupta, A. (2007). Determinants of tax revenue efforts in developing countries. *IMF Working Papers*, 1–39.

Shelton, C. A. (2007). The size and composition of government expenditure. *Journal of Public Economics 91*(11), 2230 – 2260.

Sokoloff, K. L. and S. L. Engerman (2000, September). Institutions, factor endowments, and paths of development in the new world. *Journal of Economic Perspectives 14*(3), 217–232.

Stiglitz, J. E. (2012). *The price of inequality: How today's divided society endangers our future.* WW Norton & Company.

Talvi, E. and C. A. Vegh (2005). Tax base variability and procyclical fiscal policy in developing countries. *Journal of Development economics 78*(1), 156–190.

Torvik, R. (2002). Natural resources, rent seeking and welfare. *Journal of development economics 67*(2), 455–470.

Zoellick, R. B. (2011). *The Middle East and North Africa.* World Bank.

A Appendix A

Figure A1: Total revenues and inequality (*gini*)

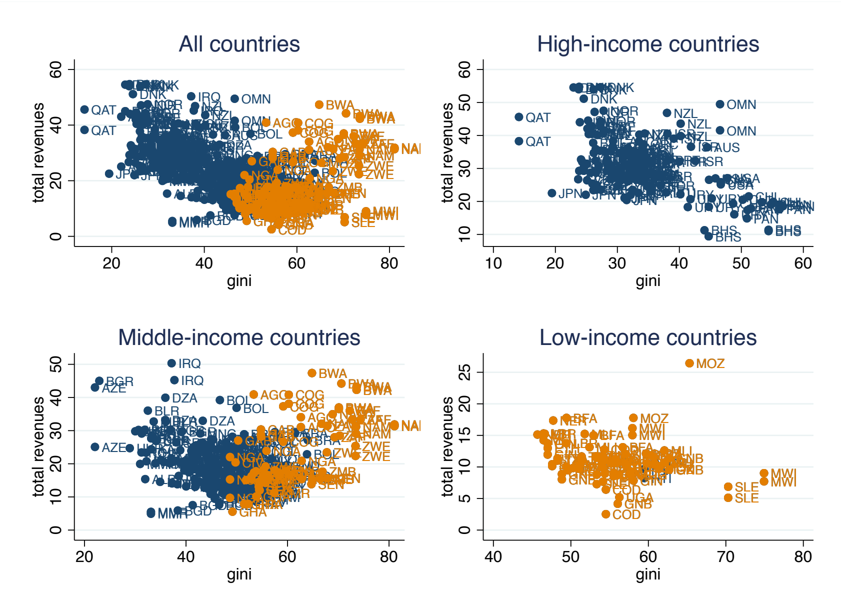


Table A1: Variables and data sources

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	Labor 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 brackets. Period dummies included. *** p<0.01, ** p<0.05, * p<0.1.

B Appendix B

Figure B1: Total revenues and inequality (*gini*). SSA countries.

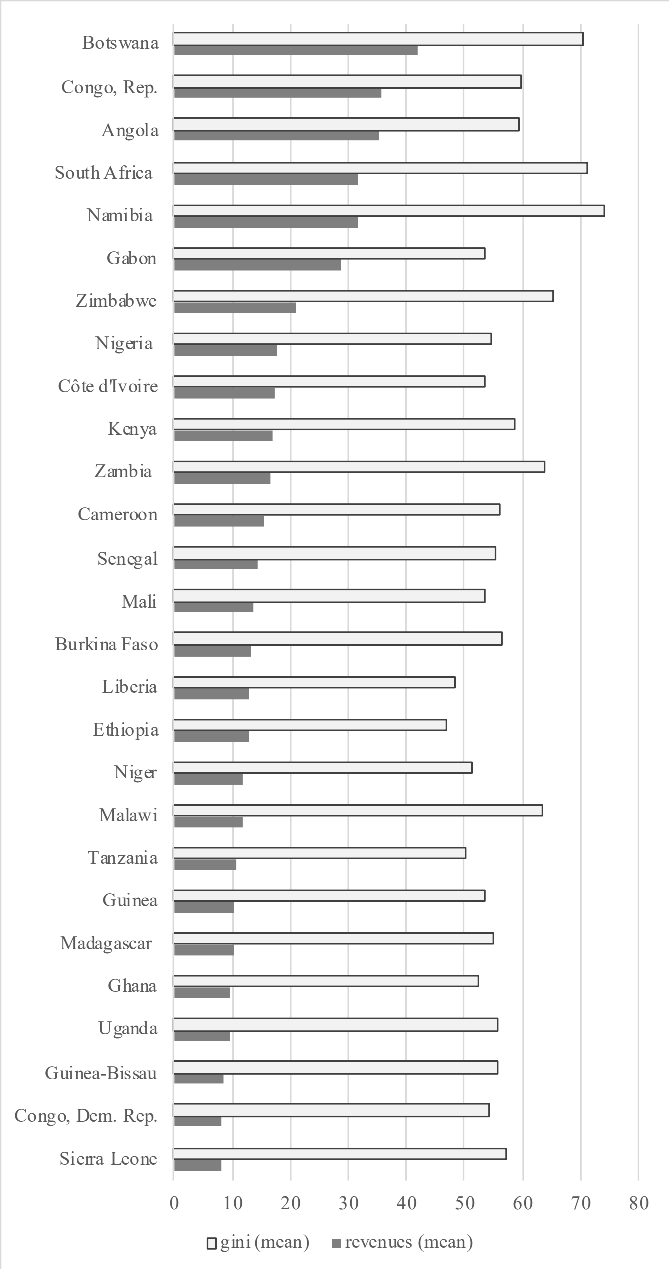


Table B1: Revenue components and definitions

Variable	Definition
revenues	Total revenues excluding grants and social contributions (% GDP).
tax	Total tax revenue, excluding social contributions (%GDP).
non-tax	Total non-tax revenue, comprising data categorized as either "nontax revenue" or "other revenue" depending on the underlying source (%GDP). Revenues from both resource and non-resource sources are included.
direct taxes	Total direct taxes, excluding social contributions but including resource taxes. It includes taxes on income, profits and capitals gains, taxes on payroll and workforce and taxes on property.
indirect taxes	Total Indirect Taxes, including resource revenues. It includes taxes on goods and services, taxes on international trade and other taxes.

Data source: GRD Government Revenue Dataset (ICTD-WIDER) 2019.

B1. Middle-income countries

Figure B1.1: Angola

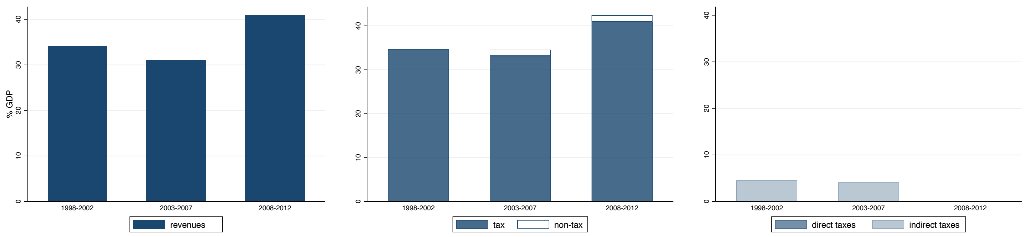


Figure B1.2: Botswana

Figure B1.3: Cameroon

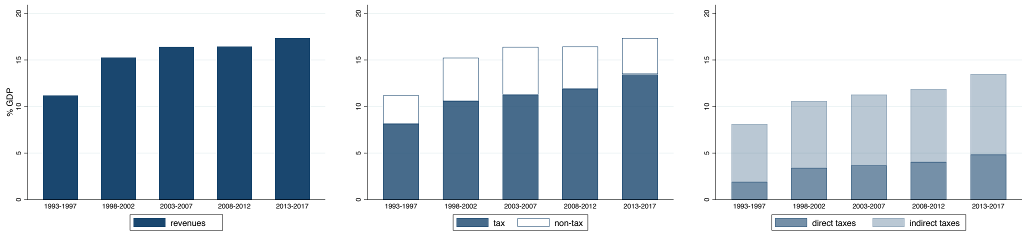


Figure B1.4: Congo, Rep.

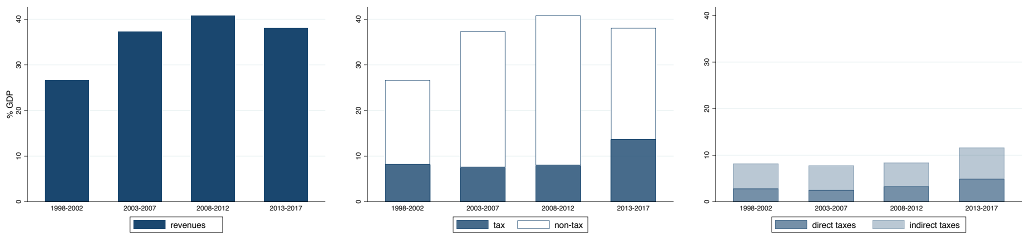


Figure B1.5: Côte d'Ivoire

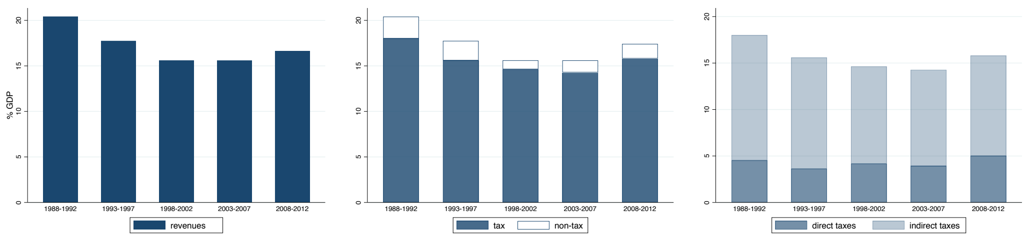


Figure B1.6: Gabon

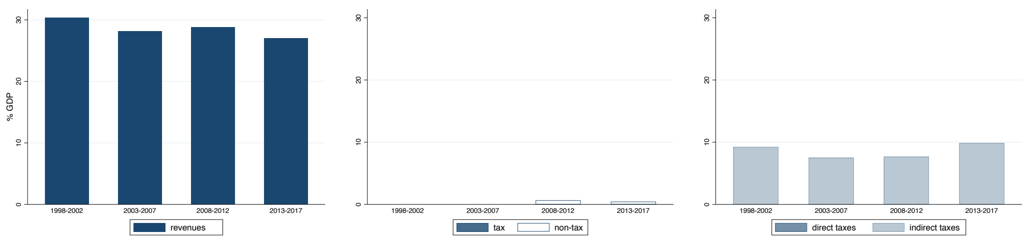


Figure B1.7: Ghana

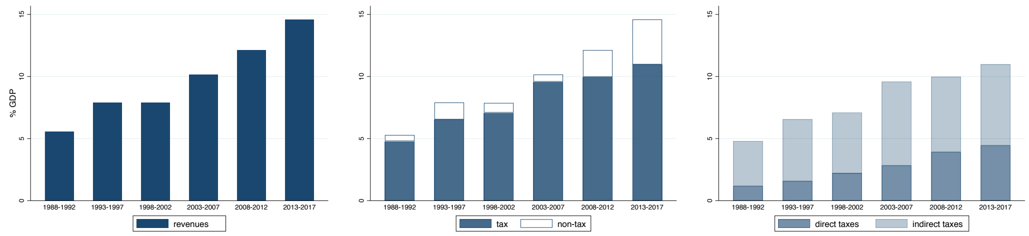


Figure B1.8: Kenya

Figure B1.9: Namibia

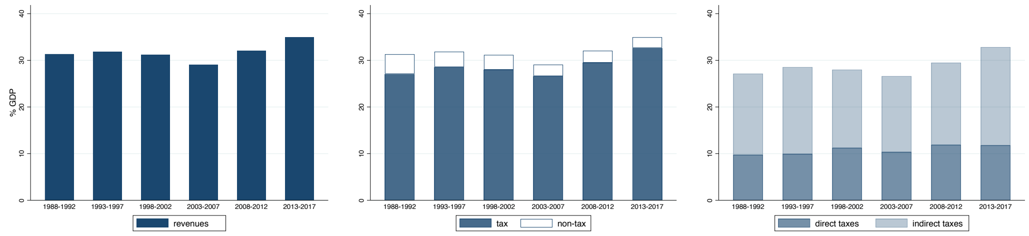


Figure B1.10: Nigeria

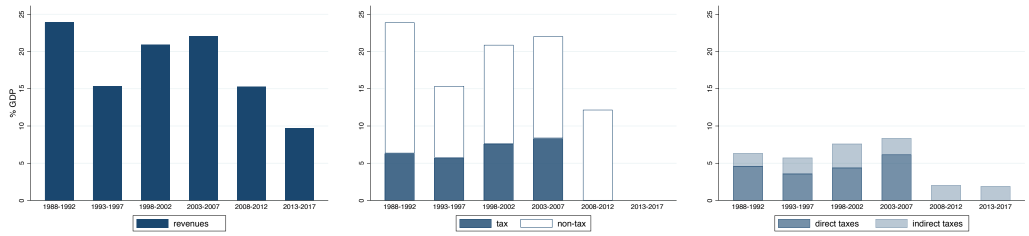


Figure B1.11: Senegal

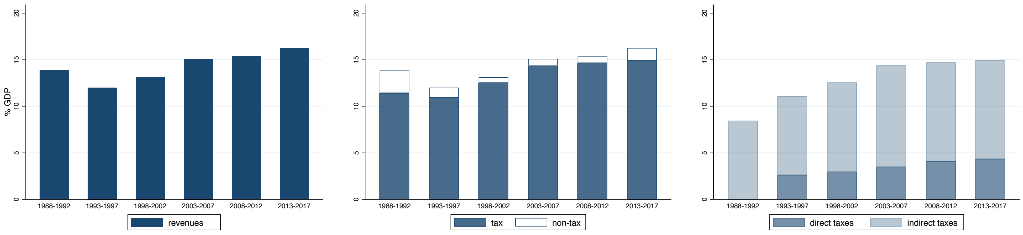


Figure B1.12: South Africa

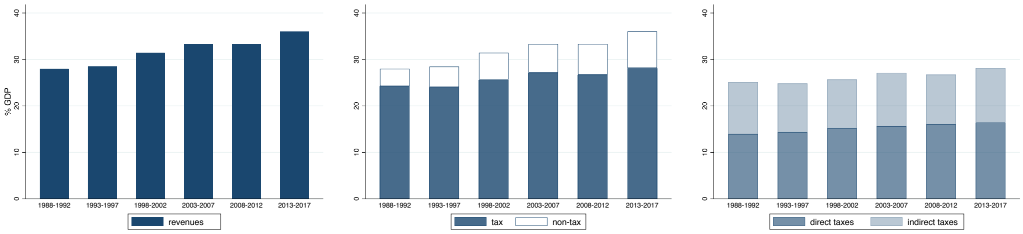


Figure B1.13: Zambia

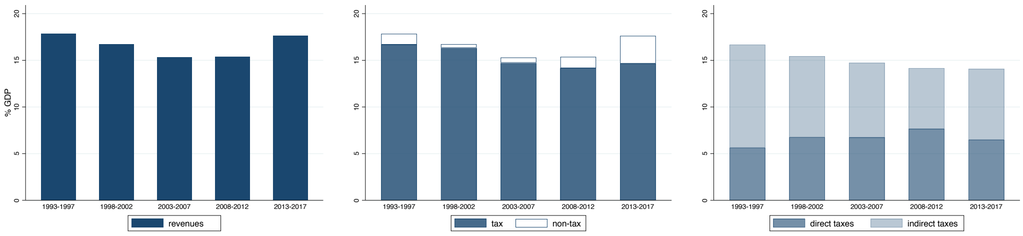
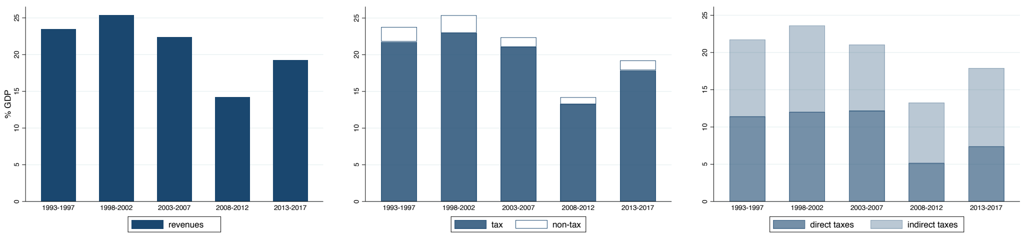


Figure B1.14: Zimbabwe



B2. Low-income countries

Figure B2.1: Burkina Faso

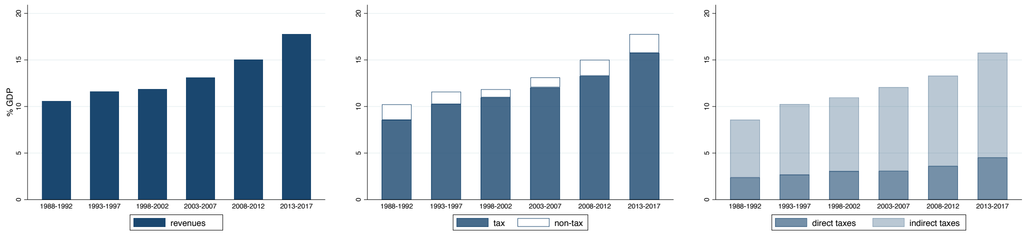


Figure B2.2: Congo, Dem. Rep.

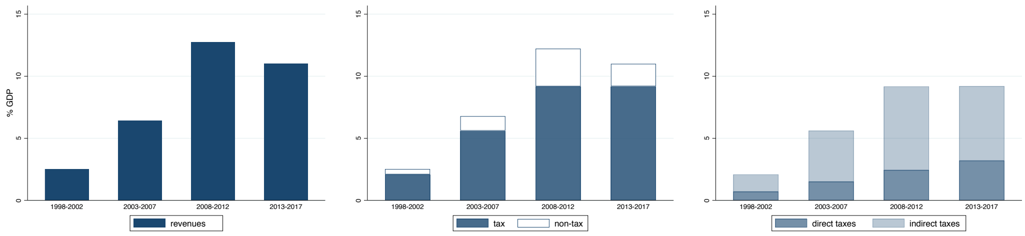


Figure B2.3: Ethiopia

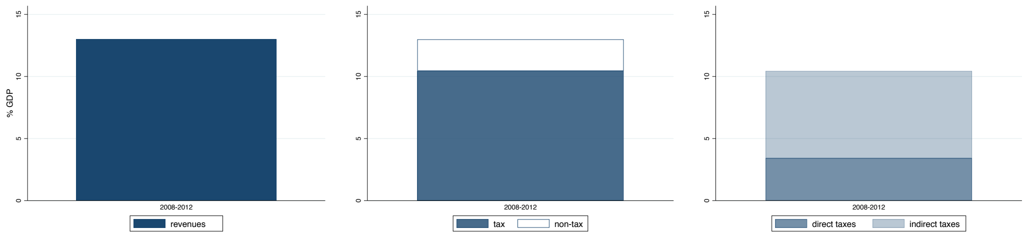


Figure B2.4: Guinea

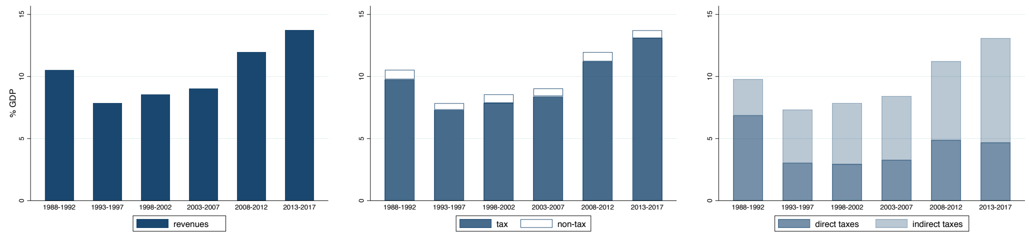


Figure B2.5: Guinea-Bissau

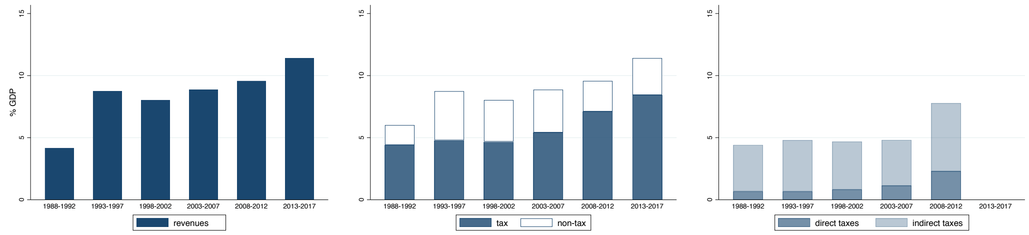


Figure B2.6: Liberia

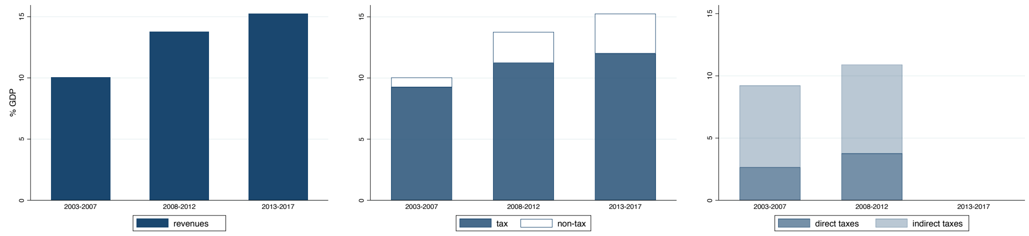


Figure B2.7: Madagascar

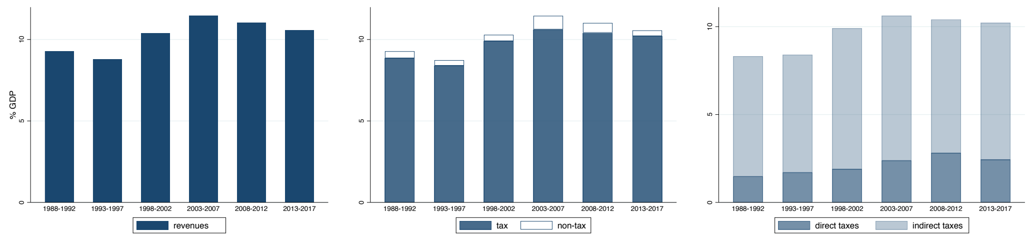


Figure B2.8: Malawi

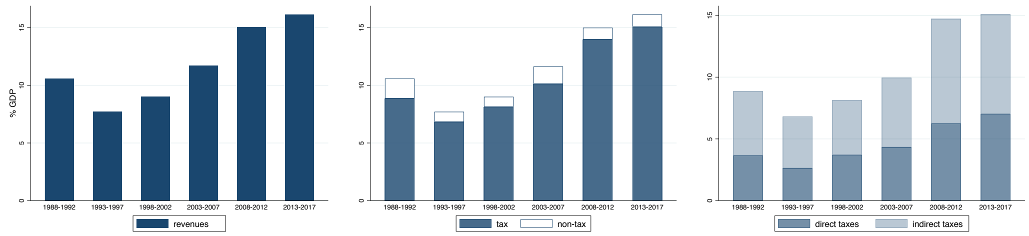


Figure B2.9: Mali

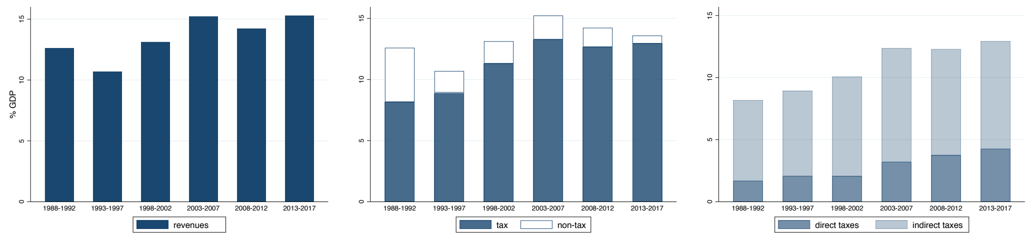


Figure B2.10: Niger

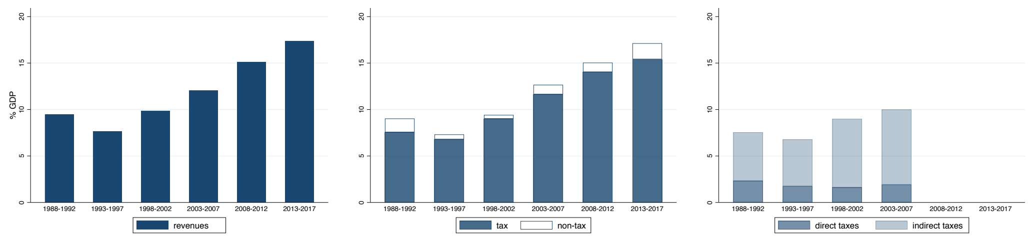


Figure B2.11: Sierra Leone

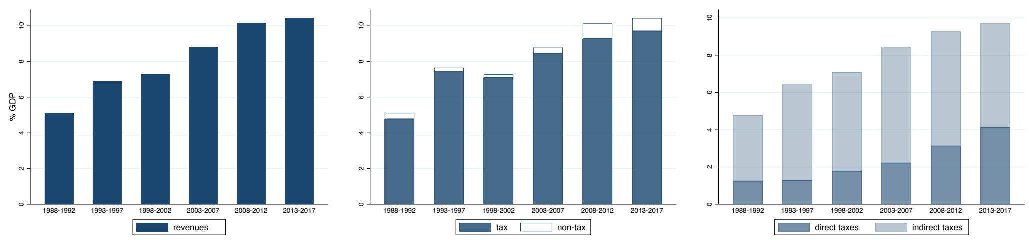


Figure B2.12: Tanzania

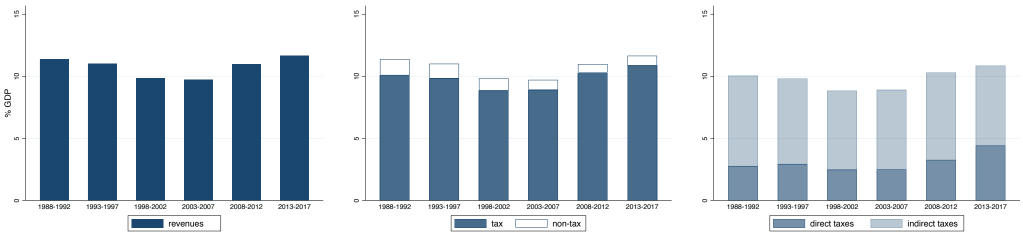


Figure B2.13: Uganda