Extended Abstract
Global Estimates of Post-Tax Income Inequality

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Abstract

Existing global estimates of income inequality have thus far failed to account for the role of government redistribution in most of the developing world. This paper develops a novel method to estimate the impact of fiscal interventions on income inequality for countries where micro-data is scarce or unavailable. Our method builds on the distributional national accounts (DINA) framework developed by Piketty, Saez, and Zucman (2018), which has served as a benchmark for subsequent efforts that have produced worldwide income inequality estimates since 1980, gathered in the World Inequality Database. Whereas those efforts have either been limited to pre-tax income distributions, or to developed countries for post-tax distributions, here we model a 'simplified' methodology using a range of complementary datasets, and extend post-tax DINA to a much broader range of countries and years than have been previously studied. This extension allows us to estimate a

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measure of the full distributional consequences of fiscal progressivity in both taxes and transfers, and to achieve coverage for over 150 countries since 1980. We document a strong correlation between high pre-tax inequality and low redistributive capacity of the fiscal system. This represents a *double curse* for developing economies: facing generally higher levels of pre-tax income inequality they are less capable of mitigating economic disparities through state intervention.

1 Introduction

While income inequality has garnered intense public and scholarly attention in recent years, global estimates remain incomplete. In particular, existing systematic estimates of income inequality fail to account for the role of government redistribution in most of the developing world. Building on the work of *inter alia* Alvaredo et al. (2021), Bachas et al. (2021), and Piketty, Saez, and Zucman (2018), we bring together several unique data sources on taxes, transfers, and their incidence on incomes, in order to move from estimates of pre-tax income distributions to arrive at their post-tax equivalents, and achieve a coverage of over 150 countries worldwide since 1980. To our knowledge, these are the first set of long-run, harmonized, consistent series on post-tax distributions for many developing countries.

Recent efforts coordinated under the World Inequality Database project have produced worldwide estimates of distributional national accounts for what we call 'pre-tax' income: that is, the income that accrues to all earners directly on the marketplace, before taxes and transfers but after social insurance 'replacement income' (netting out social security and unemployment insurance contributions and benefits), with the distribution of income adding to the sum of annual national income.[1] These are the only existing long-run, worldwide, harmonized estimates of total income distribution dating back to 1980.

However, most these benchmark income distributions available [2] are measured only before the effect of taxes and transfers, leaving an open question on the absolute and relative importance of government fiscal policy to decrease inequality in 'post-tax' income distributions.

Globally there are several important exceptions: In countries such as the United States, France, and others in Europe (see *inter alia* Piketty, Saez, and

[1] For more on this point, refer to Alvaredo et al. (2021).
[2] See wid.world

Zucman, 2018; Bozio et al., 2020; Blanchet, Chancel, and Gethin, 2021), detailed post-tax distributional estimates have already been established, using tax microdata and occasionally linked microdatasets on wealth distributions—to estimate post-tax distributions at the same time (and with the same data) as the pre-tax distributions. These post-tax series, however, have largely been limited to the developed countries,[3] while the distance between pre- and post-tax inequality in developing countries had not yet been studied with the same income concepts, comprehensiveness and rigor.

The importance of these series, then, is to retrieve the first global, long-run set of harmonized, consistent series on post-tax national income distributions, for over 150 countries worldwide since 1980.

From there, we are be able to better understand the extent and effects of cross-country differences in redistributive effort and capacity, and to explore and compare the magnitude of redistribution at the level of world regions. This, of course, opens several interesting avenues for further research, on pre-tax inequality itself, and on economic development more broadly.

In what follows, we will first present our data and methods for retrieving an income distribution net of tax (subtracting all tax revenues from their corresponding portion of the income distribution); then repeat to explain our data and methods to estimate the incidence of government spending along the income distribution net of tax, now inclusive of transfers. We will detail some of the challenges and data decisions that were necessary along the way, and return to offer preliminary results in a brief conclusion.

[3]Notable exceptions are Latin America and South Africa: see respectively De Rosa, Flores, and Morgan (2022) and Chatterjee, Gethin, and Czajka (2021).

2 Data and Methodology

Our estimates start with the pre-tax income distributions estimated and described in the foundational inequality studies of the World Inequality Lab (WIL, 2020). For those countries and years which do not yet include post-tax distributions (consisting of, we subtract all taxes and add back all public spending, according to a simplified but rigorous set of incidence assumptions, after harmonizing and integrating a range of complementary datasets.

2.1 Taxes

From Bachas et al. (2021), we obtain long-run series on aggregate tax revenues, disaggregated by type of tax and expressed as a percentage of net domestic product, for more than 150 countries since at least 1980. The types of taxes include personal income taxes, corporate income taxes, other individual income taxes, social security contributions, wealth and property taxes, indirect taxes (taxes on trade and consumption), and other taxes.[4]

Beginning with the complete pre-tax income distribution, we subtract labor income taxes from labor income, and capital income taxes from capital income. For labor income taxes, we consider strictly personal income taxes; social security contributions and benefits have been assessed under the pre-tax income distribution.[5] Capital income taxes include the corporate income tax, as well as wealth and property taxes. For indirect taxes, we rely on incidence estimates provided by the CEQ (Commitment to Equity) project where such estimates are available, and impute the distribution based on comparable countries for a few missing cases.

[4]For the purpose of this study we do not consider non-tax public revenue as a form of tax. (By construction, these are not taxes. From a national accounts perspective, they may frequently already be allocated to individuals as a part of pre-tax income, particularly in the case of state-owned enterprises.)

[5]See Alvaredo et al. (2021) for more on this point.

We subtract all other taxes (mostly negligible in magnitude) proportional to this preliminary net of tax distribution, assuming no distributional effect from these taxes in our benchmark estimates.

We draw the labor and capital income distribution within the overall pre-tax income distribution, according to factor income concentrations (where these have been measured) and according to the factor shares of the economy as a whole. Data from Fisher-Post (2020) and Bachas et al. (2021)—where factor shares are retrieved and estimated for all country-years in which national income is known—allows us to estimate labor (capital) income concentrations in proportion to the total labor (capital) income in the economy. Essentially, while subtle differences emerge across countries and over time, it is almost universally true that capital income is concentrated toward the upper tail of the income distribution.[6] See Figure 1 for an illustration of this tendency. We apply the average factor income concentration (in countries where this is observed) to country-years where this is not observed.[7] In this way, factor income distributions vary across countries and over time only according to their aggregate factor shares in national accounts, but not according to a change in relative factor income concentrations. We assume a fixed parameter for the dependency of labor and capital income concentrations.

These labor and capital income distributions, within the total pre-tax distribution, are the basis for arriving at a net-of-tax distribution: From the pre-tax income distribution, we subtract factor taxes from factor incomes, by type of tax.

Labor income taxes are subtracted from the labor income distribution according to statutory tax rates from the World Tax Indicators (WTI) database (see Peter, But-

[6]This 'stylized fact' is widely known, although one may question the precise concentration of capital income at the top of the income distribution, at a given capital share. We run several robustness checks here, and the effect does not affect our results on any significant orders of magnitude.

[7]Several other approaches to this imputation are possible, e.g., to regress capital concentration on income per capita. Such alternative approaches do not significantly affect our estimates.

trick, and Duncan, 2010). This database, in effect, parameterizes the progressivity of the labor income tax structure, as it measures the statutory labor income tax rate at several levels of the pre-tax income distribution: starting at average income, then two and three and four times that level, and finally the top marginal personal income tax rate. We approximate a (continuous) schedule of statutory labor income tax progressivity from that basis. That is, we fit the statutory progressivity of personal income tax rates to the observed total tax revenue from labor income.[8] As such, it is important to note that the WTI statutory rates do not match–but are proportional to–the effective rates we estimate. This mismatch between statutory and effective rates is to be expected, and can be true for a number of reasons that we do not observe in aggregate data (e.g., mismeasurement of the rate schedule, tax evasion or avoidance, differences within the rate schedule according to different types of [non-]taxable income, etc.). Since we do not observe those nuances by which an effective tax rate will differ from the statutory rate, we assume that the progressivity schedule from the statutory schedule is the correct one (i.e., proportional to the effective rate schedule)—and holds as valid for the distribution of effective labor income tax rates along the labor income distribution.

Of course, statutory progressivity along the income distribution can also differ from actual progressivity if tax evasion or avoidance propensities do not run proportional to statutory tax liabilities. For now, we assume that labor (capital) income tax avoidance is proportional to the labor (capital) income tax burden. For this reason, our tax progressivity estimates likely represent an upper bound on the progressivity of tax systems, since evasion and avoidance of taxes is known to be greatest at the upper tail of the distribution (Alstadsæter, Johannesen, and Zucman, 2019).

[8]Note that we do not draw a full-fledged income tax calculator: As discussed above, we do not distinguish types of labor income, nor their taxability and the relative rates thereof, but rather we simply fit this statutory rate schedule onto observed revenues received.

With this explanation of labor income taxes in hand, we can turn to capital income taxes. Capital income taxes are assumed to be allocated flatly along the capital income distribution. Therefore, while capital income taxation is progressive along the total pre-tax income distribution, we assume that it is strictly distribution-neutral (perfectly flat, i.e., neither progressive nor regressive) within the capital income distribution: In our estimates all capital income is assigned the same effective tax rate, equal to the sum total of capital income tax revenue received (as a share of national income) divided by the total of capital income (within national income). While it may be unrealistic to assume that all capital income along the capital income distribution faces precisely the same effective tax rate, we do not observe where along this distribution each component of capital income is concentrated, nor the marginal tax rates of, e.g., state and local property taxes. To calculate capital income tax rates by asset or type of investment return, along the capital (or total pre-tax) income distribution, would demand a level of detail that our data sources do not offer.

One additional note is in order here, on mixed income. For tax purposes, we assume that mixed income is taxed more like labor income than capital income (even if, to calculate aggregate factor shares, we might assume that mixed income represents approximately 70% returns to labor and 30% returns to capital inputs). In this sense, we assume that mixed income contributes to the tax base for personal income taxes, but does not contribute to the tax base for corporate income taxes, nor for property or wealth taxes. As discussed above, indirect taxes (on trade, on consumption) are subtracted based on available evidence from the CEQ project, and other taxes are subtracted proportionally from the pre-tax income distribution.[9]

Given the set of simplifying assumptions described here, it is important to verify that we do not sacrifice too much precision. In Figure 2, we compare our 'simplified'

[9]We test additional scenarios for indirect taxes.

results with detailed estimates from Blanchet, Chancel, and Gethin (2021), and in Figure 3 we make a similar comparisons with results from Piketty, Saez, and Zucman (2018). On average, there is notably little difference between the estimates of total tax progressivity (effective tax rates, by g-percentile) in our simplified tax assignments (described above), versus the detailed estimates from tax microdata in that study. For precision, it is obviously preferable to use comprehensive tax microdata that observes taxes paid on an individual basis, as in the Blanchet, Chancel, and Gethin (2021) study and several others in the World Inequality Database (again, see, e.g., Piketty, Saez, and Zucman, 2018; Chatterjee, Gethin, and Czajka, 2021). However, the simplifying assumptions here become useful in countries where such data does not exist or has not yet been made available—to the extent that we do not lose accuracy in the process. It appears that we do not.

Having subtracted all taxes from the pre-tax income distribution, we now turn to add back government spending and arrive at the post-tax distribution.

2.2 Transfers

Our data for government expenditure is sourced primarily from the World Bank, the IMF GFS and from the OECD. These government expentidures are classified and disaggregated according to the UN SNA 2008 Classification of the Functions of Government (COFOG) framework, which enumerates ten categories of government final consumption expenditure. These public expenditure categories are: general public services; defense; public order and safety; economic affairs; environmental protection; housing and community amenities; health; recreation, culture and religion; education; and social protection. We additionally collect disagregated data on social protection expenditure from World Bank Public Expendiure Reviews and official government statistics. This allows us to properly account for expenditures on

conditional cash transfers, a highly relevant category when discussing redistributive efforts to the very poor.

To allocate these disaggregated public expenditures along the net-of-tax distribution, we consider several options, but our benchmark scenario is one in which only several types of expenditure have an impact on the post-tax distribution.

These are health spending, education spending, and social protection spending (including cash transfers). We allocate health and education according to a basic 'lump sum' assumption, such that each of these spending items is distributed equally to all individuals along the income distribution.[10] Conditional cash transfers are allocated based on survey data where such data is available. Where not, their incidence is imputed based on that observed comparable countries (always maintaing consistency with observed aggregates).

All other spending is considered distribution-neutral, so we allocate these expenditure items proportionally along the income distribution.[11]

While other assumptions are possible on the progressivity of spending—two extremes would be either to assume that all government spending is 'lump sum' across the distribution, or that all spending is 'proportional'[12]—our benchmark assumption holds the advantages of simplicity and transparency.

[10]See Gethin (2022) for a full discussion on the plausibility of these different assumptions using micro-data in the context of South Africa.

[11]This is substantially the same as allocating those spending items proportionally to the net-of-tax distribution (while allocating education, health and social protection spending as 'lump sum' to this distribution).

[12]The former would represent a reasonable upper bound on progressivity (unless one assumes that all spending is more-progressive-than-lump-sum, since some social protection spending programs do have income caps); while the latter would represent a reasonable lower bound on progressivity (unless one argues that much of public spending is actually more-regressive-than-proportional, since some spending programs may disproportionately benefit primarily those with higher incomes).

3 Conclusion

Our paper builds on the distributional national accounts efforts that have been undertaken for worldwide pre-tax inequality estimates since 1980. From those pre-tax inequality series, we build a simple model using novel data, and extend post-tax DINA to a much broader range of countries and years than have been previously studied. This extension allows us to estimate a measure of the full distributional consequences of fiscal progressivity in both taxes and transfers, and to achieve global coverage since 1980.

Preliminary results, summarized in Figure 4, show a strong correlation between high pre-tax inequality and low redistributive capacity of the fiscal system, impliying that developing countries often face a *double course* of inequality. A more extensive analysis of these estimates will be included in the final version of this paper.

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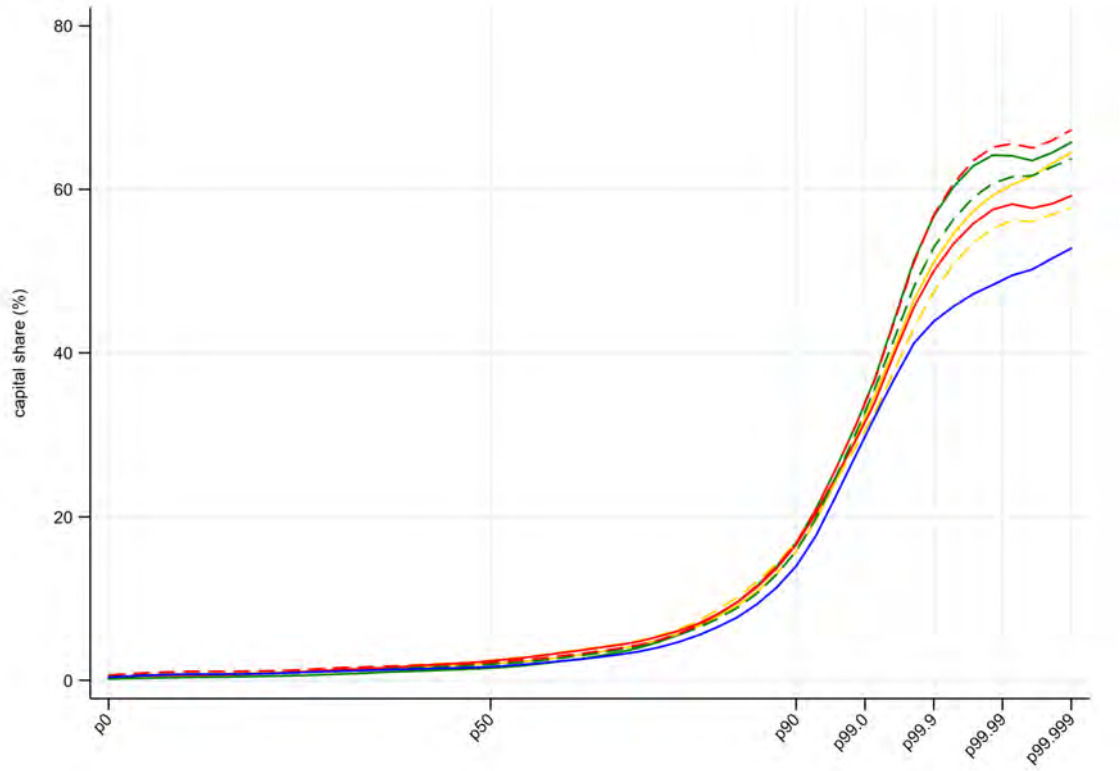
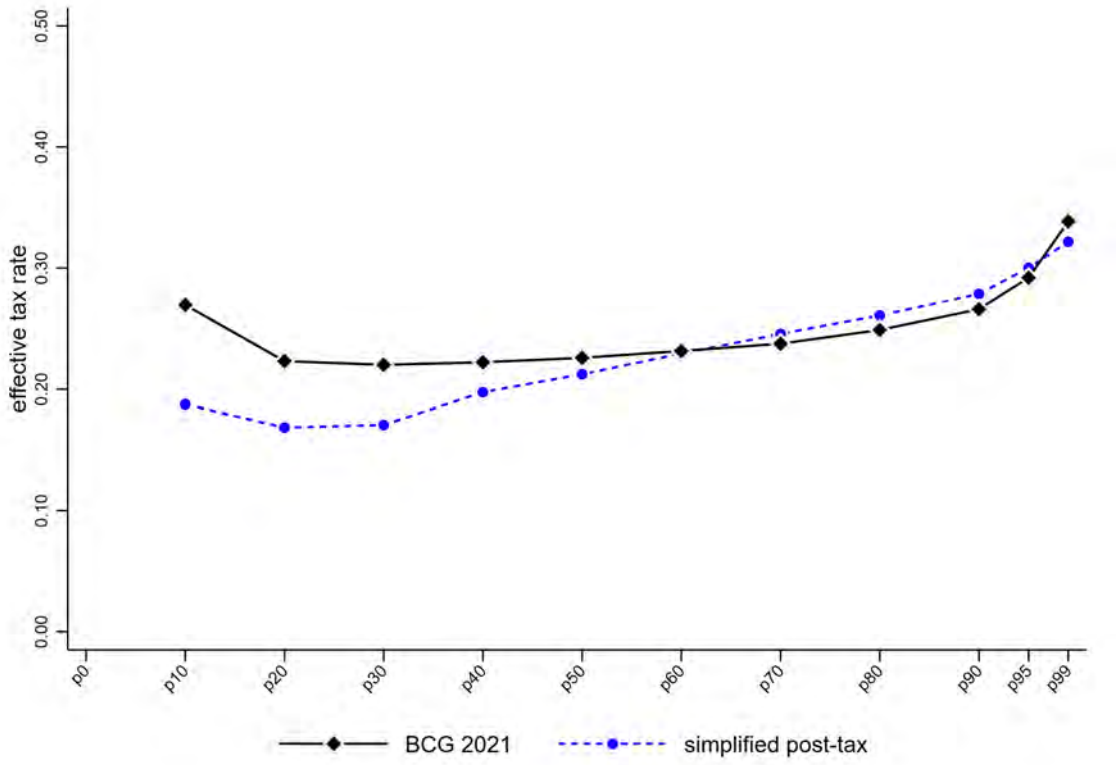
Figure 1: Average capital income concentrations, by g-percentile



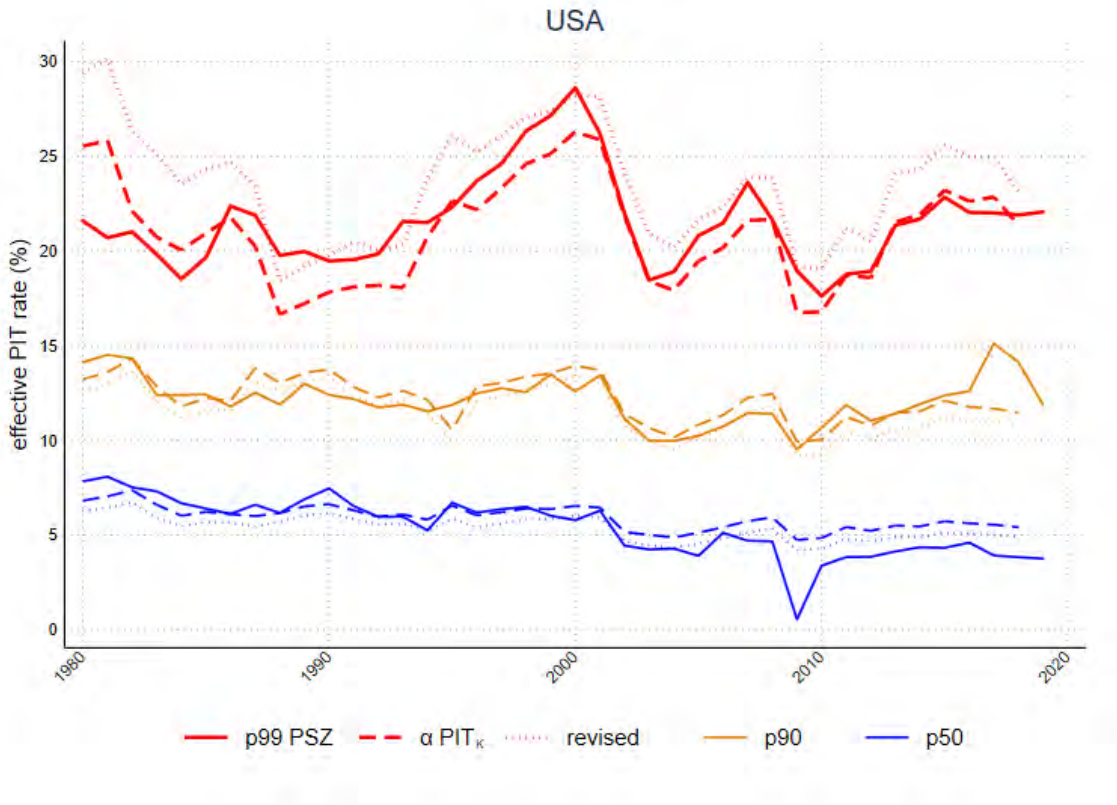
Notes: This graph shows the average capital share, by g-percentile, for countries in the World Inequality Database where this has been measured. There is little variation in capital income concentration across countries or over time: capital income is concentrated at the top of the income distribution.

Figure 2: Average effective tax rates, by g-percentile, Europe



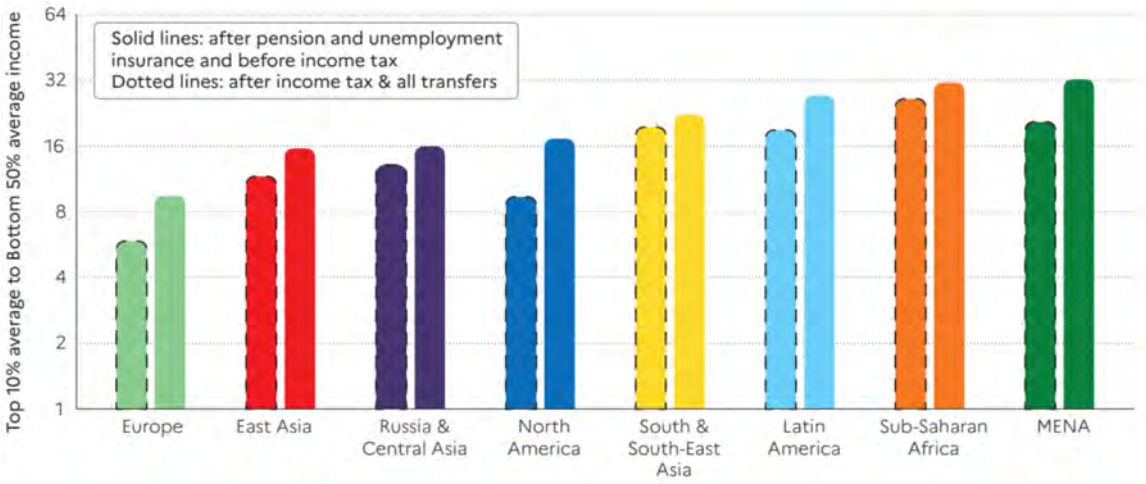
Notes: This graph shows the average effective tax rate, by g-percentile, for European countries estimated in Blanchet, Chancel, and Gethin (2021), compared to estimates for the same countries in our 'simplified' method here. Note that this is an unweighted average, referring to data for the year 2017. As in the methodology adapted here from Alvaredo et al. (2021)—and consistent with Blanchet, Chancel, and Gethin (2021)—taxes to subtract from the pre-tax income distribution include personal income taxes, corporate income taxes, property taxes, wealth taxes, and indirect taxes; they exclude social security contributions.

Figure 3: Time series of effective tax rates, by income group - USA



Notes: This graph shows the time series of average effective tax rates by income group, for the United States estimated in Piketty, Saez, and Zucman (2018), compared to our 'simplified' estimates. As in the methodology adapted here from Alvaredo et al. (2021)—and consistent with Piketty, Saez, and Zucman (2018)—taxes to subtract from the pre-tax income distribution include personal income taxes, corporate income taxes, property taxes, wealth taxes, and indirect taxes; they exclude social security contributions.

Figure 4: Redistribution (pre-tax vs. post-tax income distributions), by region



Notes: This graph, featured in Chancel et al. (2022) and built upon preliminary estimates from our simplified methodology, shows the regional average levels of inequality in both pre-tax and now post-tax distributions for the year 2018. (Inequality is measured as the ratio of the average income of an individual within the top 10% of earners to the average income of an individual within the bottom 50% of earners.) For some interpretation: In North America, the bottom 50% earns 17 times less than the top 10% before income tax, whereas after income tax and all transfers, the bottom 50% earns 9 times less than the top 10%.