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From the bottom 40 to inequality lines

Sharing prosperity globally and domestically

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Abstract: A major of focus of global development policy is the aim to achieve and sustain income growth of the bottom 40% (B40) of the population at a rate higher than the national average. We propose an alternative approach to assessing shared prosperity using 'inequality lines'. Analogous to poverty lines but focused on inequality, inequality lines are benchmark incomes. Income increases below the inequality line decrease inequality; income increases above the line increase inequality. In contrast to the B40 approach and all conventional poverty lines, inequality lines arise naturally: their location in the income distribution is directly implied by standard inequality indexes and the social preferences they embody. Using inequality lines, we investigate the extent to which there may be trade-offs between sharing prosperity domestically and sharing prosperity globally. With data from the World Income Inequality Database, we present the most comprehensive empirical study to date of where inequality lines lie and how they evolved during 1950–2020. With estimates for 208 countries in 2020, we provide the first estimates of global inequality lines, how the global inequality line percentile changed over time, and how it compares with domestic inequality lines. Our results reveal when income growth, subsidies, or developmental interventions are likely to reduce inequality both domestically and globally, and where there are trade-offs between the two. We also shed light on important domestic trade-offs between inequality reduction and poverty alleviation.

Key words: benchmark incomes, global inequality, global poverty, inequality, inequality lines, poverty, shared prosperity

JEL classification: D31, D63, O15

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1 Introduction

A major of focus of recent global development policy, enshrined in the Sustainable Development Goals (SDGs), is the aim to 'progressively achieve and sustain income growth of the bottom 40% (B40) of the population at a rate higher than the national average' (SDG target 10.1). While the choice by the World Bank and international community of the 40th percentile as the cut-off point is arbitrary (Öhler et al. 2019), the goal is to ensure that the spoils of development are inclusive and that no one is left behind. The SDG target pertains to national income distributions, but an important consideration for development policy, such as how best to target official development assistance, is whether to prioritize poorer countries or poorer people (Kanbur and Sumner 2012).

The concerns of this paper relate to this development goal in two ways. First, we suggest a modification to the current shared prosperity approach by proposing an alternative benchmark to the B40, one that arises naturally based on the normative principles that underpin standard inequality measures. Second, using these benchmark incomes—or 'inequality lines'—we investigate the extent to which there may be trade-offs between sharing prosperity domestically and sharing prosperity globally. In so doing, we propose a method that policy makers can use to easily pinpoint whether and where such trade-offs exist in the context of any given domestic economy and the global economy.

In recent years there has been considerable interest in the global distribution of income among all the citizens of the world, ignoring national borders. Such studies typically involve constructing a distribution of income of all the citizens of the world using national accounts and/or survey data. Inequality and other distributional concepts such as polarization are subsequently measured based on this global interpersonal distribution of income. There is some consensus that since at least the mid-1980s, global inequality has been decreasing in relative terms (Bourguignon 2017; Jorda and Niño-Zarazúa 2019; Lakner and Milanovic 2016; Milanovic 2012; Niño-Zarazúa et al. 2017) but increasing in absolute terms (Bosmans et al. 2014; Niño-Zarazúa et al. 2017).

The fall in relative global inequality occurred despite the fact that relative inequality grew in many countries over this period. In large part, the fall in global inequality has been attributed to long-sustained high levels of economic growth in heavily populated, previously poor countries, notably China and India (Niño-Zarazúa et al. 2017). There is no doubt that the changes that took place in these countries' income distributions contributed to a very substantial fall in global inequality as their economies grew and converged with middle-income countries. With these changes India and China became much richer countries, and hundreds of millions of people were lifted out of absolute poverty. At the same time, it is equally clear that those same changes in India's and China's income distributions resulted in very substantial increases in domestic inequality, in both relative and absolute terms (Niño-Zarazúa et al. 2017). Thus, with respect to relative measures of inequality such as the Gini coefficient, China's growth in recent decades has been equalizing globally but disequalizing domestically. Such a phenomenon is suggestive of potentially important trade-offs for international policy makers. For example, should official development assistance be used to grow or subsidize those on incomes that are relatively low by global standards even if it is likely to increase domestic inequality, with all the potential adverse impacts domestic inequality may bring? Or should instead international resources be used to reduce domestic inequality wherever it is severe, even if this means exacerbating global inequality and the corresponding gaps between countries? We think these questions, which speak to how best to share prosperity both domestically and globally, deserve greater consideration. We do not, however, attempt to answer them here. Instead, this paper aims to inform such debates by conducting an extensive empirical

investigation into when income growth or subsidies are likely to be equalizing with respect to both domestic and global income distributions, and where there are trade-offs between the two. We also aim to illuminate where there are important, purely domestic trade-offs between reducing domestic inequality and reducing poverty.

Our approach is rooted in and brings together three strands of literature: the literatures on global income inequality and shared prosperity noted above, and the literature on inequality benchmark incomes.[1] Nearly all widely used inequality measures are associated with a benchmark income or position, above which adding increments of income increases inequality, and below which it decreases inequality.[2] These benchmark incomes can be interpreted as inequality lines—social reference levels for inequality, analogous to poverty lines, above which increases to incomes increase inequality, and below which they decrease inequality (Roope 2021). They can be interpreted as signifying the richest person in society for whom it is just and fair to subsidize their income (Corvalan 2014; Lambert 2014).

In one of the first empirical studies to estimate where benchmark incomes lie in practice, Roope (2021) found in a study of ten countries that inequality lines for all countries lay far above official poverty lines, with on average half of the income distribution lying above the official poverty line but below the inequality line implied by the Gini coefficient. In this paper, we employ a similar approach, but using more recent data we extend the analysis in three ways by estimating inequality lines (i) for a far wider range of countries (208 versus ten), (ii) for the global income distribution as a whole, and (iii) over a 70-year period rather than at a single point in time. For all countries we locate the percentile of the income distribution above which income growth or subsidized income transfers would increase inequality and below which they would decrease inequality—i.e. we locate each country's inequality line. We do the same for the global income distribution. We argue that the location of the inequality line has a firmer basis for analyses of shared prosperity than any approaches that rely on arbitrary reference incomes. This includes not only the current World Bank approach of focusing on the 40th percentile but also leading alternatives, such as the indexes proposed by Kraay et al. (2023: 2), which conceptualize welfare as 'the average factor by which individual incomes must be multiplied to attain a given reference level of income'.[3]

Using the inequality line approach, for each country we consider where the domestic inequality line lies compared with the global inequality line. This enables us to identify the range of incomes in which income growth or subsidized income transfers would (i) reduce both domestic and global inequality, (ii) reduce domestic inequality but increase global inequality, (iii) reduce global inequality but increase domestic inequality, or (iv) increase both domestic and global inequality. At the same time we also compare where each country's domestic inequality line lies in comparison with the national poverty line, illuminating the range of incomes in which income growth/subsidies would

[1] The small but growing literature on inequality benchmark incomes began with Hoffman (2001) and Lambert and Lanza (2006), with more recent contributions by Corvalan (2014) and Roope (2019, 2021).

[2] As shown by Roope (2019), any inequality measure which embodies social preferences that satisfy a strong version of the Pigou-Dalton transfer property must have a benchmark income. In essence, this means that a benchmark income exists for any inequality measure that always registers a fall in inequality when income is transferred from a richer individual to a less well-off individual.

[3] As with the choice of the 40th percentile, and with typical approaches to setting poverty lines, computing Kraay et al.'s (2023) measures requires choosing an arbitrary reference income. The major advantage of our inequality lines approach is that the reference income to be targeted is not arbitrary but is implied directly by the analyst's or policy maker's inequality measure of choice. In turn this also means that the inequality line is implied by the well-known properties of those inequality measures, such as the Pigou-Dalton transfer principle.

(v) reduce both poverty and (domestic) inequality, (vi) reduce (domestic) inequality but not poverty, or (vii) fail to reduce poverty and increase inequality.

The rest of this paper is structured as follows. In Section 2 we outline the inequality measures used in the paper and their associated inequality lines. We also outline the relationship between the inequality line-based approach we advocate and the more standard B40 approach to analysing shared prosperity. In Section 3 we describe the data used in the paper and the methods used to construct both domestic and global income distributions, upon which the various inequality line estimates are based. Our results are presented in Section 4, and sensitivity analyses are presented in Section 5. We offer a concluding discussion in Section 6.

2 Inequality measures, inequality lines, and shared prosperity

We employ the same measures and notation used in Roope (2021); thus, this section closely follows that study. For a society of $n \geq 2$ individuals, let $\mathbf{x} = (x_1, \cdots, x_n) \in \mathbb{R}_+^n$ denote the distribution of incomes. An inequality measure is a function that assigns to each income profile a non-negative number, so that $I: \bigcup_{n\in\mathbb{N}} \mathbb{R}_+^n \longrightarrow \mathbb{R}_+$. The mean of income profile $\mathbf{x} \in \mathbb{R}_+^n$ is given by $\mu = \frac{1}{n} \cdot \sum_{i=1}^n x_i$, and the median income by m. Let $\varepsilon > 0$ denote an incremental increase in individual i's income. As in Roope (2021), we use five inequality measures with contrasting normative properties. These measures, the inequality lines corresponding to them, and some limiting values are displayed in Table 1.

The measures include two 'relative' measures, $I_G(\cdot)$ and $I_{MLD}(\cdot)$; two 'absolute' measures, $I_{AG}(\cdot)$ and $I_V(\cdot)$; and a 'centrist' measure, $I_K(\cdot)$.[4] In the context of a growing economy, relative measures have widely been regarded as 'rightist' and absolute measures as 'leftist' (Kolm 1976). However, this taxonomy can be misleading, especially with respect to inequality lines. In fact, while the relative versus absolute measures typically rank countries very differently with respect to inequality, Roope (2021) found that ordering countries according to the measures' inequality line percentiles provided very similar rankings. Moreover, the inequality line percentiles implied by absolute measures are not necessarily lower than those implied by relative measures. Indeed, it is clear from Table 1 that the (relative) mean log deviation (MLD) and (absolute) variance imply identical inequality lines. An attractive property of the Gini coefficient, one not shared by any of the other measures in Table 1, is that it is perfectly correlated with its inequality line percentile (Roope 2021). Thus, the Gini coefficient's inequality line percentiles are consistent with the measure itself, in the sense that higher inequality necessarily means a higher inequality line, and in large samples this relationship is linear. For these reasons and for tractability, we focus our inequality line analysis mainly on the Gini coefficient, but we provide analogous results for the other measures in the supplementary materials.

[4] Relative inequality measures are those that are invariant under equiproportional increases in all incomes. By contrast, absolute inequality measures are those that register no change when the same absolute amount of income is added to all incomes. Centrist inequality measures (sometimes also referred to as 'intermediate' or 'compromise' measures) register an increase in inequality if all incomes increase equiproportionally, and a decrease if the same absolute amount of income is added to all incomes.

Table 1: Inequality measures and corresponding inequality lines

	Formula	Inequality line ($L_{\mathbf{x}}$)
Gini coefficient	$I_G(\mathbf{x}) = 1 - \frac{1}{n}\left[\frac{\sum_{i=1}^{n} 2\left(n - i + \frac{1}{2}\right)x_i}{\sum_{i=1}^{n} x_i}\right]$	$L_{\mathbf{x}} = \frac{\sum_{i=1}^{n} i x_i}{\sum_{i=1}^{n} x_i}$ $\lim n \to \infty \frac{L_{\mathbf{x}}}{n} = \frac{1}{2}(I_G(\mathbf{x}) + 1)$
Mean log deviation	$I_{MLD}(\mathbf{x}) = \frac{1}{n}\sum_{i=1}^{n} \ln\left(\frac{\mu}{x_i}\right)$	$L_{\mathbf{x},\varepsilon} = \frac{\varepsilon}{\left(1 + \frac{\varepsilon}{n\mu}\right)^n - 1}$ $\lim \varepsilon \to 0\ L_{\mathbf{x},\varepsilon} = \mu$
Absolute Gini	$I_{AG}(\mathbf{x}) = \mu \cdot I_G(\mathbf{x})$	$L_{\mathbf{x}} = m$
Variance	$I_V(\mathbf{x}) = \frac{1}{n}\sum_{i=1}^{n}(x_i - \mu)^2$	$L_{\mathbf{x},\varepsilon} = \mu + \frac{1}{2}\left(\frac{n-1}{n}\right)\varepsilon$ $\lim \varepsilon \to 0\ L_{\mathbf{x},\varepsilon} = \mu$
Krtscha	$I_K(\mathbf{x}) = \frac{1}{n\mu}\sum_{i=1}^{n}(x_i - \mu)^2.$	$L_{\mathbf{x},\varepsilon} = \mu + \frac{\sigma_{\mathbf{x}}^2}{2\mu} - \frac{\varepsilon(n-1)}{2n}$ $\lim \varepsilon \to 0\ L_{\mathbf{x},\varepsilon} = \mu + \frac{\sigma_{\mathbf{x}}^2}{2\mu}$

Note: for proofs of these results, see Hoffmann (2001), Lambert and Lanza (2006), Corvalan (2014), and Roope (2019).

Source: authors' compilation.

2.1 Inequality lines and the B40

At this point it is instructive to consider the link between inequality lines and the B40 approach. Compared with poverty lines and other reference income levels that can be criticized as being arbitrary, a major advantage of the inequality line approach is that inequality lines arise naturally, fully determined by the inequality measure of choice (Table 1). Once a particular inequality measure is decided upon, unlike with poverty lines, there can be no disagreement over the level of the inequality line, reducing the scope for both disagreement and political manipulation. Moreover, the axiomatic properties of commonly used inequality measures, such as the ubiquitous Gini coefficient, have been widely analysed and are well understood.

This contrasts with the B40 approach. The choice of the 40th percentile specifically as the cut-off point for prioritization of income growth and subsidies is ad hoc. Yet, in fact it is easy to see that there *is* both an inequality measure and an inequality line associated with the B40 approach. It is just that it is not an inequality measure with a particularly appealing normative foundation. Consider the inequality measure:

$$I_{B40}(\mathbf{x}) = 1 - \frac{\sum_{i=1}^{s} x_i}{\sum_{i=1}^{n} x_i} \tag{1}$$

where s denotes the individual at the 40th percentile of the distribution. This measure depends entirely on the share of the income distribution accruing to the B40. In the extreme case that all income belongs to the top 60%, it takes its maximum value of one. In the other extreme, where all incomes are equal, it takes its minimum value of 0.6. This relative inequality measure assesses inequality solely with respect to the income of those in the B40 compared with the distribution as a whole. A key feature of most widely used inequality measures is that they satisfy a strong version of the Pigou-Dalton transfer principle, where progressive transfers of income from a richer to a poorer individual always reduce inequality. In contrast, the $I_{B40}(\mathbf{x})$ measure only satisfies a restricted and rather ad hoc version of this principle, where progressive transfers reduce inequality

only if the richer individual is above the 40th percentile and the recipient is below the 40th percentile. Transfers that take place between individuals who are both above, or both below, the 40th percentile have no effect on inequality. It is easily seen that this measure implies that x_s is an inequality line: all else equal, increasing any income below x_s reduces $I_{B40}(\mathbf{x})$, while increasing any income above x_s increases $I_{B40}(\mathbf{x})$.

The shared prosperity premium approach of targeting a greater growth in the income of the B40 than in mean income demands economic growth to be accompanied by a decrease in $I_{B40}(\mathbf{x})$. It is not clear quite how one can justify a requirement that economic growth should be accompanied by a decrease in this particular inequality measure rather than other more popular inequality measures, such as $I_G(\mathbf{x})$ or $I_{MLD}(\mathbf{x})$. Thus, it is also not clear what normative principles might justify the inequality line associated with this measure—namely the 40th percentile.

In this paper, therefore, we depart from the B40 approach and investigate sharing prosperity domestically and globally through the lens of the inequality lines implied by more conventional inequality measures with firmer theoretical foundations.

3 Constructing global and domestic synthetic income distributions

For the analysis of inequality lines, we rely on UNU-WIDER's (2022) World Income Inequality Database (WIID) Companion Dataset, which contains harmonized annual income shares covering 209 countries over the period 1950–2020.[5] We use this dataset to construct annual synthetic income distributions for each available country-year data point. The WIID Companion Dataset represents an important effort to harmonize grouped data that may vary due to differences in welfare concept, data source, equivalence scale, and survey design, allowing a robust comparative analysis of income distribution across countries over time.[6]

In order to construct synthetic income distributions, we adopt a fully parametric approach to approximate the Lorenz curve of the entire income distribution at the global, regional, and country levels. More specifically, we follow Jorda and Niño-Zarazúa (2019) and Jordá et al. (2022) to adopt a general functional form, the generalized beta of the second kind (GB2), which is a general class of distributions that provide an accurate fit to income data (McDonald and Mantrala 1995; McDonald and Xu 1995). The GB2 income distribution has the following probability density function:

$$f(x;a,b,p,q) = \frac{ax^{ap-1}}{b^{ap}B(p,q)[1+(x/b)^a]^{p+q}}, \qquad x > 0 \tag{2}$$

where $a, b, p, q > 0$ and $B(p,q) = \int_0^1 t^{p-1}(1-t)^{q-1}dt$ is the beta function. Parameter b is a scale parameter, and a, p, and q are shape parameters.

Jordá et al.'s (2022) procedure is based on minimum distance estimators that yield the four parameters of the GB2 distribution in the context of limited information. It starts by recovering

[5] We exclude North Korea from the analysis, leaving us with 208 countries, because the country reports perfect equality in the income distribution.

[6] For a detailed discussion of the methods and procedures used to harmonize the WIID Companion Dataset, see Gradín (2021a, 2021b, 2021c).

the shape parameters from the Lorenz curve using the GB2 distribution. The shape parameter estimates are used to obtain a first-stage estimate of the scale parameter. The complete vector of estimated parameters is then used to estimate the variance and covariance matrix of the moment conditions used in the estimation of the shape parameters, which are efficiently estimated in a second stage.

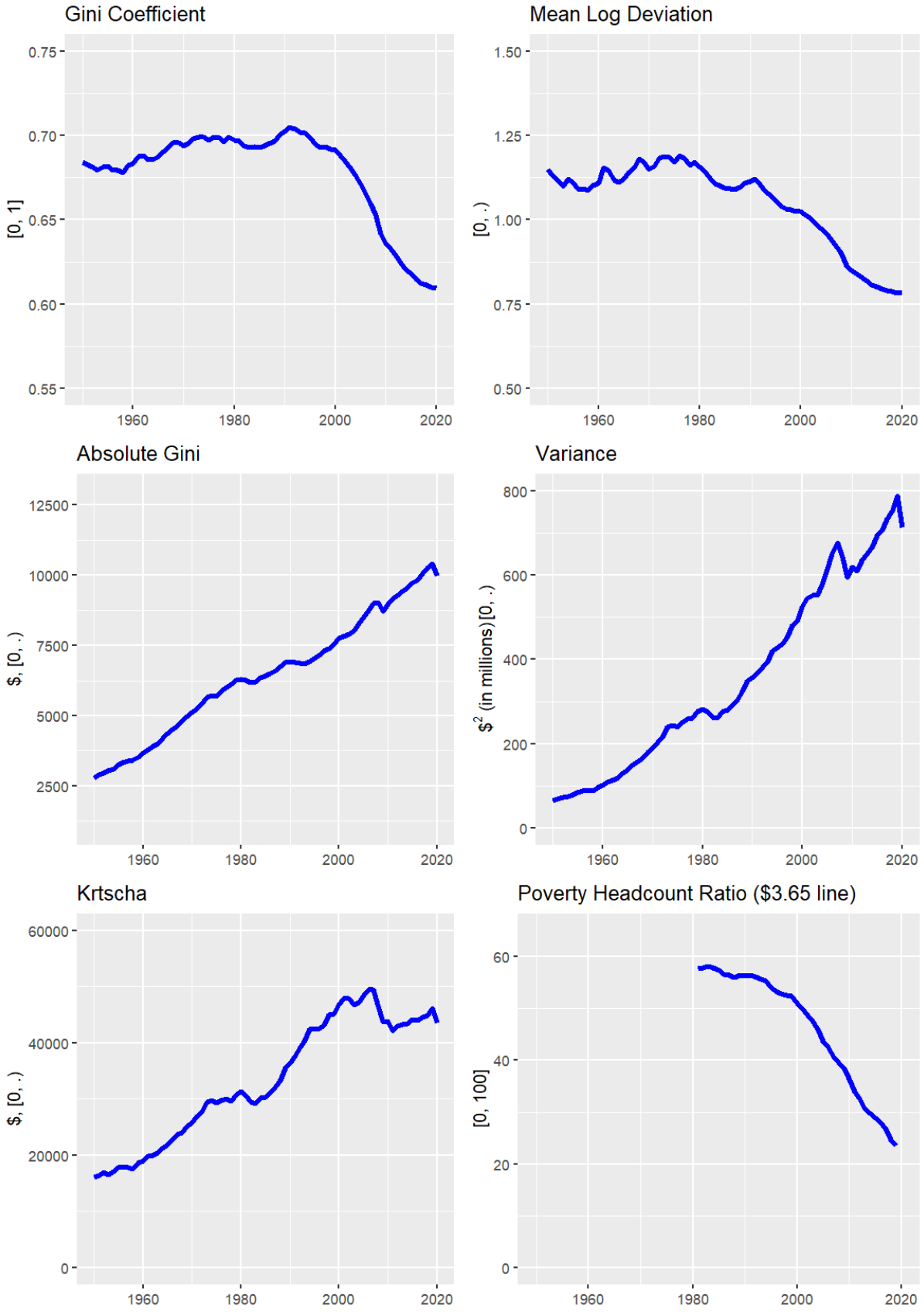
For each country-year, using the respective cumulative distribution function (CDF), we obtain synthetic samples (N=10,000). Then the CDFs for each country are aggregated, using weights based on population size, to obtain global, regional, and World Bank income group-level CDFs. Finally, synthetic income distributions at global, regional, and World Bank income group levels are obtained by sampling from the respective CDF (all N=10,000). The subsequent inequality analysis is based on these synthetic income distributions. All computations are performed with R version 4.2.1 (R Core Team 2022), using the packages GB2group (Jordá et al. 2022) to estimate the parameters of the GB2 income distributions and GB2 (Graf and Nedyalkova 2022) to obtain the synthetic samples.

4 Results

Consistent with an increasing body of literature, Figure 1 indicates that in recent decades global inequality has fallen in relative terms. According to both the Gini coefficient and the MLD, inequality has been declining since the early 1990s. In contrast, apart from slight dips following the 2007–8 financial crisis and the onset of the COVID-19 pandemic in 2020, global inequality has been steadily increasing in absolute terms (absolute Gini and variance). According to the intermediate Krtscha measure, inequality increased from 1950 to 2007 but subsequently decreased. Meanwhile, the proportion of those globally living below the US$3.65 poverty line has been steadily decreasing. While relative inequality has been falling at a global level, there has been considerable heterogeneity across countries, with inequality rising in some countries and falling in others (see Figures S1–S7 in the supplementary material for trends in all countries included in this paper, grouped by region).

Next we present this paper's central results on inequality lines, focusing on the most recent data (i.e. 2020). We begin by presenting what are to the best of our knowledge the first estimates of inequality lines and their associated percentiles of the global income distributions, together with the inequality measures that imply them (Table 2). According to the Gini coefficient, the global inequality line was in the 84th percentile in 1950. It climbed slightly to the 85th percentile in 1990 before subsequently falling to the 80th percentile, where it lay in 2020. As the Gini coefficient is perfectly correlated with its implied inequality line percentile, the decline in recent decades is a direct implication of the corresponding decline in the Gini coefficient. The result means that in 2020, for example, increasing the incomes of those below the global 80th percentile would decrease global inequality, while increasing incomes above this would increase global inequality. For the other inequality measures, inequality lines and percentiles are not perfectly correlated with the corresponding measures (Roope 2019, 2021), and this is apparent from Table 2. For example, while inequality has decreased steadily since the early 1990s according to the MLD, and increased steadily according to the variance, these measures imply the same inequality lines (Roope 2019, 2021).

Figure 1: Trends in global inequality and poverty, 1950–2020



Note: poverty headcount ratios sourced from World Bank databank.

Source: authors' illustration.

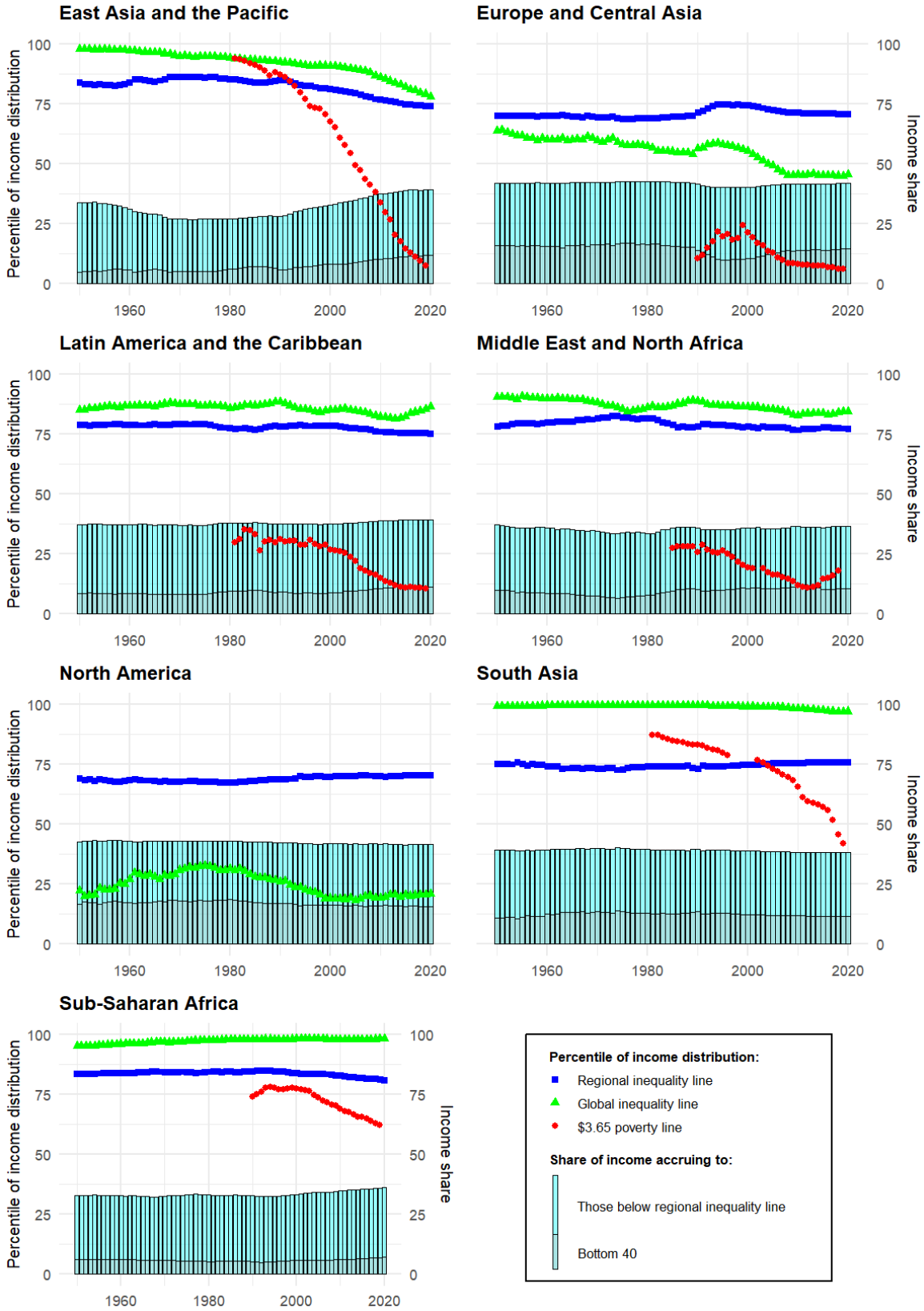
Table 2: Inequality line incomes and percentiles of global income distribution

	Inequality measures					Inequality line incomes					Inequality line percentiles					Poverty percentiles (US$2.15 and US$3.65)	
Year	I_G	I_{MLD}	I_{AG}	I_V	I_K	B_G	B_{MLD}	B_{AG}	B_V	B_K	p_G	p_{MLD}	p_{AG}	p_V	p_K	$p_{2.15}$	$p_{3.65}$
1950	0.68	1.15	2,788	65	16,062	7,604	4,075	1,308	4,075	12,106	84.2	71.6	50	71.6	91.6	-	
1955	0.68	1.11	3,256	85	17,817	9,000	4,774	1,467	4,774	13,683	84.1	71.3	50	71.3	90.9	-	
1960	0.68	1.11	3,672	102	19,033	10,491	5,375	1,536	5,375	14,892	84.2	70.8	50	70.8	90.1	-	
1965	0.69	1.12	4,352	139	21,926	12,787	6,329	1,630	6,329	17,292	84.4	70.5	50	70.5	89.7	-	
1970	0.69	1.15	5,109	189	25,713	15,564	7,364	1,770	7,364	20,220	84.7	70.9	50	70.9	89.3	-	
1975	0.70	1.17	5,688	239	29,289	17,703	8,156	1,889	8,156	22,801	84.9	71.0	50	71.0	89.5	-	
1980	0.70	1.16	6,280	282	31,308	19,616	9,007	2,052	9,007	24,661	84.9	71.5	50	71.5	89.0	43.6	57.7
1985	0.69	1.09	6,410	281	30,339	19,454	9,247	2,240	9,247	24,417	84.7	72.6	50	72.6	88.4	39.6	57.3
1990	0.70	1.11	6,888	357	36,393	20,356	9,807	2,503	9,807	28,003	85.1	74.6	50	74.6	89.7	37.8	56.3
1995	0.70	1.06	7,031	427	42,465	19,044	10,066	2,903	10,066	31,299	84.9	76.5	50	76.5	91.2	32.8	54.1
2000	0.69	1.02	7,775	526	46,755	20,234	11,247	3,488	11,247	34,625	84.6	76.5	50	76.5	91.2	29.1	51
2005	0.67	0.96	8,497	613	48,444	21,360	12,654	4,422	12,654	36,876	83.6	75.4	50	75.4	91.1	21.7	43.7
2010	0.64	0.85	8,971	619	43,889	21,967	14,101	5,864	14,101	36,046	81.8	73.1	50	73.1	89.9	16.3	36.4
2015	0.62	0.80	9,714	695	44,209	23,321	15,717	7,173	15,717	37,821	80.9	71.7	50	71.7	89.5	10.8	28.9
2020	0.61	0.78	9,975	714	43,637	24,281	16,366	7,701	16,366	38,185	80.5	71.1	50	71.1	89.1	8.4	23.5

Note: inequality line incomes are in 2017 US dollars adjusted for purchasing power parity. Poverty percentiles are based directly on poverty headcount data from the World Bank databank. They are not based on the WIID data or our synthetic distributions and are displayed purely for comparative purposes.

Source: authors' calculations.

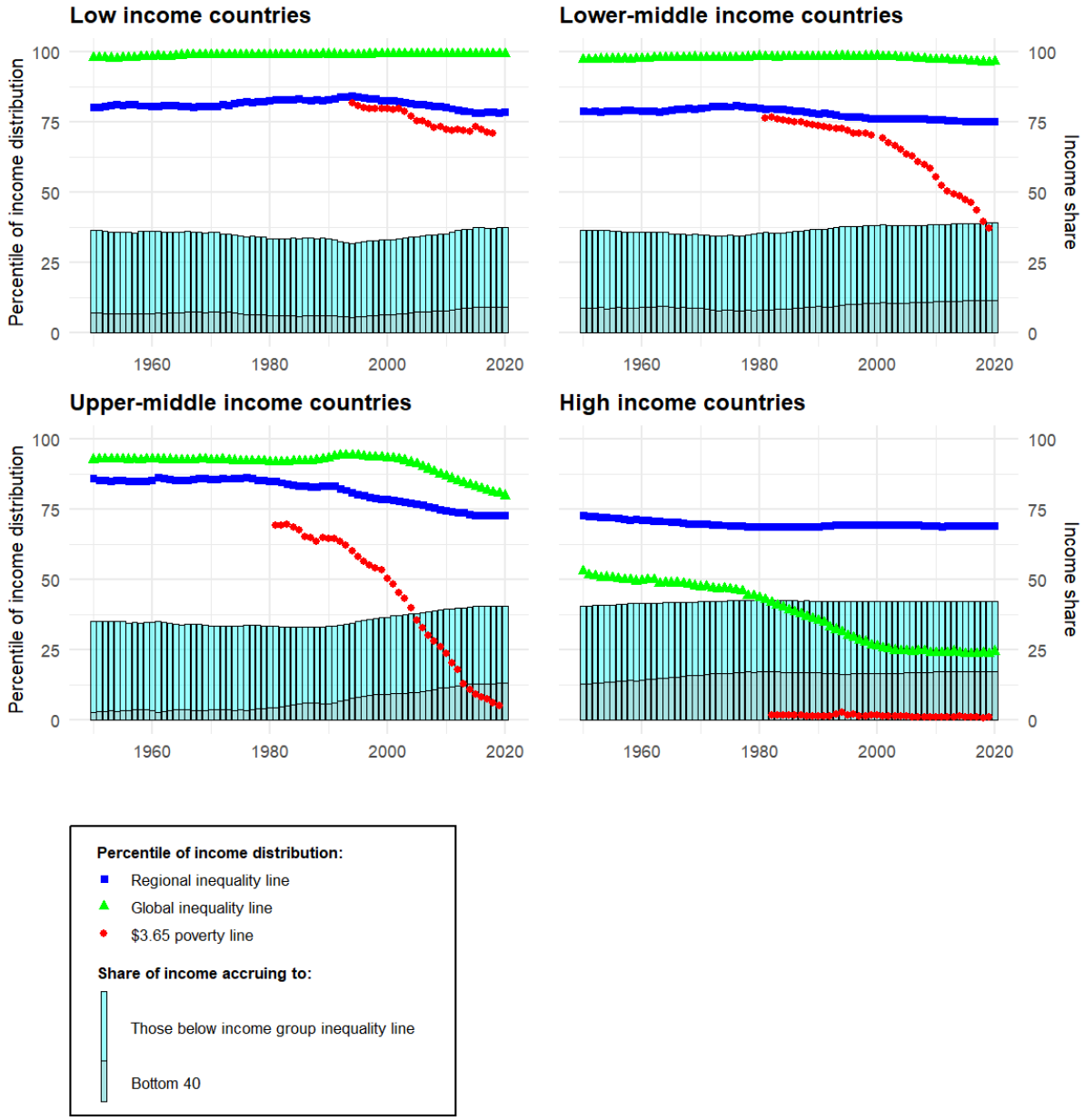
Figure 2: Global versus regional inequality line percentiles by World Bank region, 1950–2020



Note: poverty percentiles are based directly on poverty headcount data from the World Bank databank. They do not use the WIID data or our synthetic distributions and are displayed purely for comparative purposes.

Source: authors' illustration.

Figure 3: Global versus income group inequality line percentiles, 1950–2020



Note: poverty percentiles are based directly on poverty headcount data from the World Bank databank. They do not use the WIID data or our synthetic distributions and are displayed purely for comparative purposes.

Source: authors' illustration.

At a global level, the inequality line corresponding to these measures remained stable at around the 71st percentile from 1950 to 1980. It then climbed to a peak in the 76th percentile around 1995–2000 before gradually declining back to the 71st percentile by 2015. Inequality line percentiles implied by the Krtscha measure are generally very high (Roope 2019, 2021). With small variations, they remained consistently between the 88th and 91st percentile throughout 1950–2020 (Table 2). As guaranteed by definition (Roope 2019), inequality lines for the absolute Gini lie in the 50th percentile.

For all inequality measures, Tables S1–S7 in the supplementary material provide the percentiles of the domestic income distribution in which the domestic and global inequality lines lay in the most recent year (i.e. 2020) and how these compare with domestic poverty lines. Based on these and on the analogous results for all years during 1950–2020, Figures S8–S14 display the percentiles of the income distribution in which the domestic and global inequality lines implied by the Gini coefficient lie for all countries grouped by World Bank region, alongside domestic poverty lines where the data are available. Some striking trends are apparent from Figures S8–S14. In the generally poor regions of South Asia (Figure S13) and sub-Saharan Africa (Figure S14), in almost all countries the global inequality line percentile lies substantially above the domestic inequality line percentile (an average of 21 percentage points in South Asia and 18 percentage points in sub-Saharan Africa in 2020).

In South Asia, the average domestic inequality line in 2020 lay in the 74th percentile, while the global inequality line lay on average in the 95th percentile. This means that in an average South Asian country, increasing incomes below the 74th percentile would reduce domestic inequality, while increasing incomes below the 95th percentile would reduce global inequality. Increasing incomes above the 74th but below the 95th percentile would increase domestic inequality but reduce global inequality. Only increases above the 95th percentile would increase global inequality. The situation in predominantly high-income regions is dramatically different. In North America,[7] domestic inequality line percentiles lie far above the global inequality line percentile. In the United States, in 2020 the domestic inequality line lay in the 71st percentile, while the global inequality line lay in the 21st percentile. Thus, only increasing the incomes of those in the bottom 21% of the United States distribution would help reduce global inequality. Increases above the 21st percentile would increase global inequality; yet, as long as they were below the 71st percentile, they would reduce domestic inequality.

In some of the world's richest countries, such as Ireland and Luxembourg, the global inequality line lies virtually at the bottom of the domestic distribution, in the first and second percentiles respectively. In these countries, except for the very poorest on the margins of society, any increases in income would tend to increase global inequality. Conversely, in the very poorest countries, such as Burundi and the Democratic Republic of the Congo, the global inequality line lies almost at the very top of the distribution. Thus, except for the richest elites, any increases in income would tend to decrease global inequality. Another striking pattern from Figures S8–S14 is that for all countries with a domestic poverty line, the domestic inequality lines lie far higher up the income distribution, the gap in percentiles typically comprising 48 percentiles in 2020, almost half the income distribution. These trends can be more easily visualized by decomposing the world into regional and income-based entities. Figure 2 illustrates the trends in the regional inequality line percentiles implied by the Gini coefficient with respect to the global inequality line percentile, together with the location in the distribution of the US$3.65 poverty line (see Tables S8–S14 in the

[7] Canada, the United States, and Bermuda only for the purposes of this paper. Central American countries are included in the World Bank Latin America and Caribbean group.

supplementary material for further details, including analogous results for other inequality measures).

Similarly, Figure 3 illustrates the trends in each income group inequality line percentile with respect to the global inequality line percentile, together with the location of the US $3.65 poverty line (see Tables S15–S18 in the supplementary material for further details, including analogous results for other inequality measures). Similar broad trends are apparent as in the detailed country analyses. Figures 2 and 3 also indicate trends in the share of income accruing to those in the B40 versus those below the regional/country income group inequality lines. As all inequality lines lie well above the 40th percentile, it is unsurprising that the share of income of those below inequality lines is substantially higher than the share of income of the B40. However, while inequality lines lie in relatively high percentiles of the distribution, the share of income of those below income group-based inequality lines in 2020 ranged from only 37% in low-income countries to 42% in high-income countries. Across regions, the share of income of those below regional inequality lines in 2020 ranged from 36% in sub-Saharan Africa to 42% in Europe and Central Asia. Based on recent years, our approach of focusing on those below inequality lines could be seen as focusing not only on those in the B40 of the distribution but on all those who collectively share about 40% of total income.

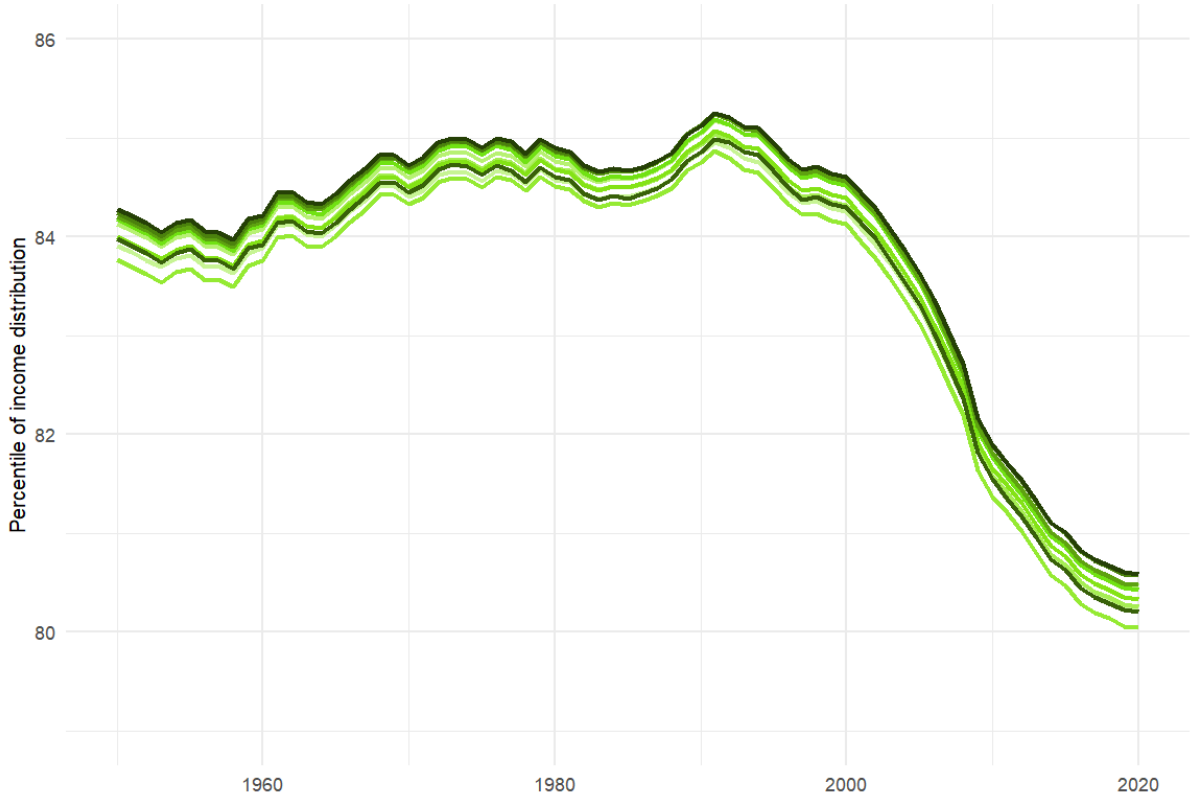
5 Sensitivity analyses

Our point estimates are subject to several sources of error. Unfortunately, we have no access to the underlying micro data that underpin the country-level income shares available in the WIID dataset, and we thus are unable to provide any tentative estimates of survey sampling error. However, the generation of the synthetic samples from the original grouped data entails an additional source of uncertainty due to sampling variability, which we can assess. For each country-year, region-year, and global-year distribution, each element of the 10,000 members of the synthetic sample upon which our estimates are based is a random draw from the respective CDF. To assess the sensitivity of our estimates to this sampling variation, for each country-year, region-year, and global-year distribution we resampled and constructed an additional nine random samples (N=10,000 in each case) to check the robustness of our inequality and inequality line estimates to this source of variability.

There is very little variation in our estimates across the ten random samples. As an indication, Figure 4 depicts the trend in the global inequality line percentile implied by the Gini coefficient during 1950–2020 for each of the ten random samples. The results in Figure 4 indicate that our approach based on N=10,000 random draws from the global CDF appears to be robust to sampling variation, with no substantive differences in levels or trends of inequality lines across the different samples.

As a further indication, Figure 5 depicts the sensitivity to sampling variation of the levels and trends in each World Bank region of the location of the regional inequality line and where this lies in the regional income distribution compared with the global inequality line. In all regions there is very little variation in these estimates across the ten synthetic samples. Finally, Figure 6 depicts the sensitivity to sampling variation of the levels and trends in each World Bank income group of the income group inequality line and where this lies in the country group income distribution compared with the global inequality line. In all country income groups, there is very little variation in estimates across the ten independent synthetic samples.

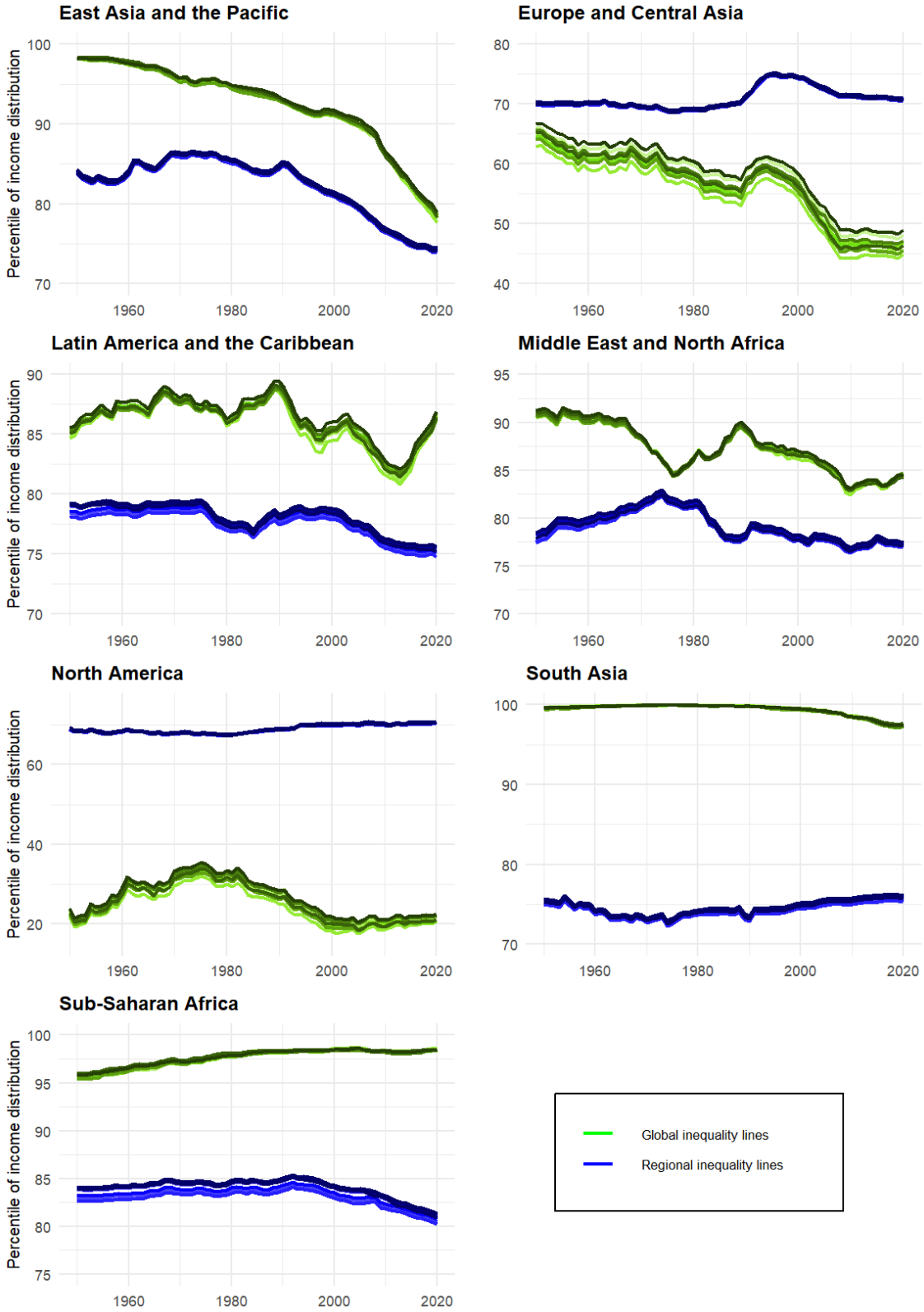
Figure 4: Sensitivity of global inequality line percentiles to sampling variation



Note: figure depicts for each year ten estimates of the global inequality line percentiles implied by the Gini coefficient (including that reported in Table 2, column p_G). Estimates are based on ten independently generated synthetic samples (all N=10,000 and drawn from the same CDF).

Source: authors' illustration.

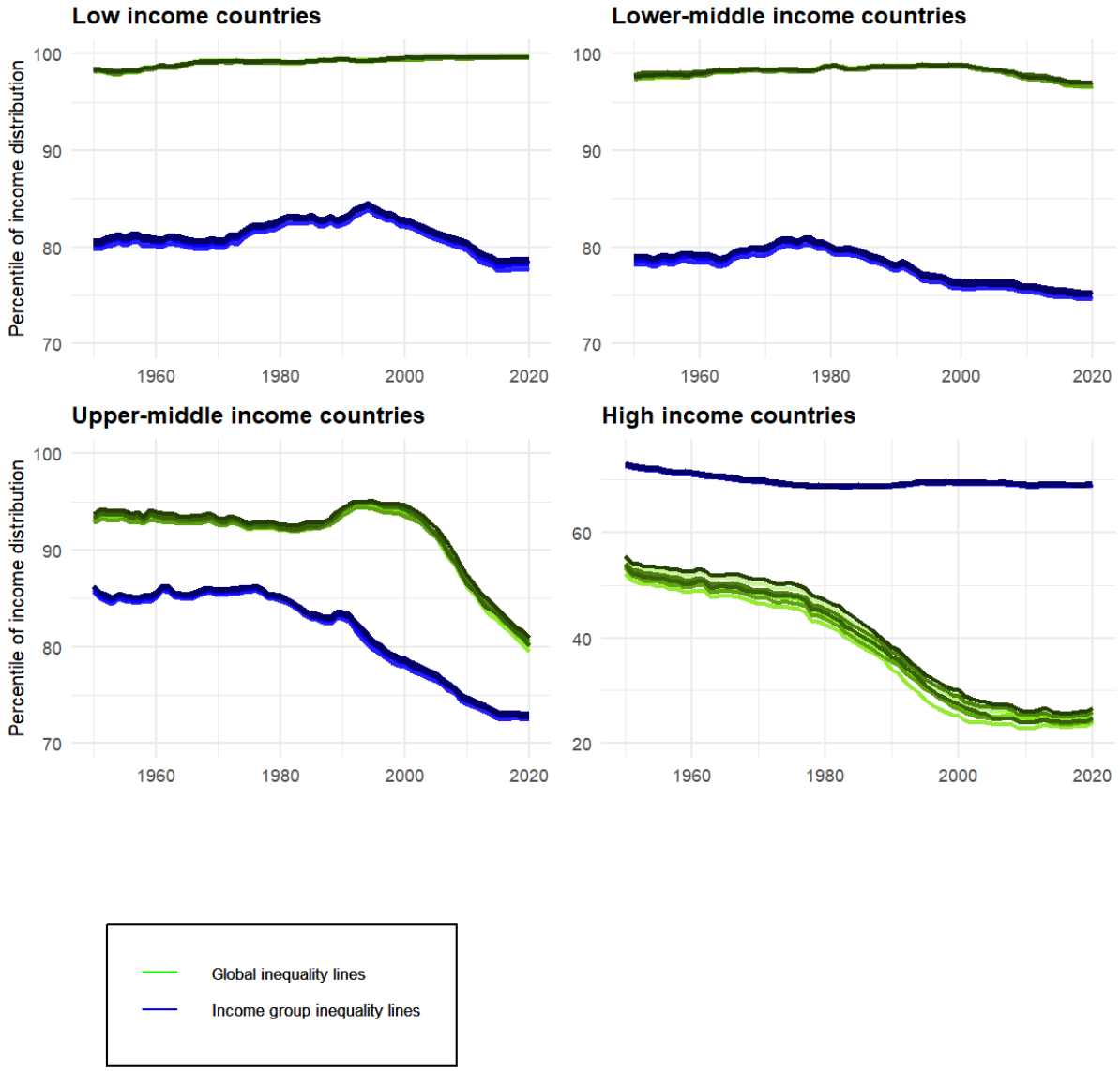
Figure 5: Sensitivity of global versus regional inequality line percentiles to sampling variation, 1950–2020



Note: figure depicts for each year ten estimates of the global versus regional inequality line percentiles implied by the Gini coefficient by World Bank region (including those reported in Figure 2). For each region and for the world, estimates are based on ten independently generated synthetic samples (all N=10,000 and drawn from the same respective regional/global CDF).

Source: authors' illustration.

Figure 6: Sensitivity of global versus income group inequality line percentiles to sampling variation, 1950–2020



Note: figure depicts for each year ten estimates of global versus income group inequality line percentiles implied by the Gini coefficient (including those reported in Figure 3). Estimates are based on ten independently generated synthetic samples (all N=10,000 and drawn from the respective income group/global CDF).

Source: authors' illustration.

6 Discussion

In this paper we propose a modification to the current shared prosperity approach. We use inequality lines that arise naturally from standard inequality measures and are underpinned by firmer normative principles than a focus on arbitrary reference incomes such as the B40. Using these inequality lines, we shed light on potential trade-offs between sharing prosperity domestically and sharing prosperity globally. The paper constitutes by far the most comprehensive empirical study to date of where inequality line incomes and percentiles lie in practice and how they have evolved over the last 70 years. As well as estimates for 208 countries in 2020, it provides the first estimates of global inequality line incomes, how the global inequality line percentile has changed

over time, and how it compares with domestic inequality line percentiles. For all countries, the paper provides not only the domestic and global inequality line percentiles but also in many cases where these lie in comparison with domestic poverty lines.

Despite declines, in 2020 the global inequality line lay in the 80th percentile according to the Gini coefficient. This underscores just how unequal the world remains: increasing the incomes of the bottom 80% globally would reduce global income inequality. As with all domestic inequality lines, this global inequality line lies far above the 40th percentile that currently informs so many global development targets, and it is suggestive of a need for more ambitious policies that also target people much further up income distributions. Prioritizing only the B40, whether domestically or globally, risks leaving behind very large sections of the population for whom income growth or subsidies would reduce inequality. Similarly, any contribution that developmental interventions may make to reducing inequality, by improving the prosperity of that large area of the income distribution above the 40th percentile but below the inequality line, will not be captured by the B40 approach. Thus, the B40 approach may be underestimating much of the redistributive value of some developmental interventions. For instance, large infrastructural projects that benefit primarily urban areas might bring limited immediate benefit to the B40, but substantial benefit to many individuals that are above the 40th percentile but well below the inequality line.

Our results illuminate potentially important trade-offs for international policy makers. In low-income countries, domestic inequality lines typically lie far below the global inequality line. In India, for example, for all its growth in recent decades, the global inequality line according to the Gini coefficient in 2020 was still in the 97th percentile, while its domestic inequality line lies in the 76th percentile. In such a country, where domestic inequality is already a major concern, is it desirable that overseas development assistance be used to grow or subsidize those between the 76th and 97th percentile, whose incomes are relatively low by global standards, even though this would have no impact on domestic poverty and would increase domestic inequality?

Similarly, what are the implications of the fact that inequality lines in high-income countries lie so far above the global inequality line? During the last decade, the rise of populist policies and figures that potentially threaten democracy has been attributed to increasing domestic inequality and polarization in many countries in multiple domains (Guriev 2018; Pástor and Veronesi 2021). This has led to increased discussion in both academia and popular discourse about the importance of reducing gaps in living standards between 'elites' and those who feel 'left behind', particularly in high-income countries with comparatively high inequality levels such as the United States and United Kingdom (Jennings et al. 2021).

As Lakner and Milanovic's (2016) much discussed elephant graph illustrated, between 1988 and 2008 the 80th percentile of the global income distribution grew barely at all and less than any other section, constituting the lowest point of a trough between the 80th and 85th percentiles. In large part this area of the global income distribution includes low-income individuals in high-income countries such as the United States, and the lack of opportunities and income growth in populations such as the United States' Rust Belt is widely regarded as a major source of dissatisfaction with globalization and traditional mainstream politics (McQuarrie 2017). Although we use different data, it is interesting to note that this section of the global income distribution corresponds almost exactly with our global inequality line estimates. Income increases in these populations are likely to have very limited impact on global inequality levels, but would certainly reduce domestic inequality in countries such as the United States.

The inequality line approach provides a theoretically justifiable way in which to target areas of the income distribution for subsidies or growth-promoting investment. It can be used to identify the richest sections of the distribution for which it might be deemed fair to subsidize income financed

by taxation (Corvalan 2014) and the poorest sections for which it is just and fair not to subsidize income (Roope 2021). Compared with poverty lines and other reference income levels that can be criticized as being arbitrary, such as the B40 approach, a major advantage of the inequality line approach is that inequality lines arise naturally, fully determined by the inequality measure of choice. Once a particular inequality measure is decided upon, there can be no disagreement over the level of the inequality line. Comfortingly, it is also the case that while different inequality measures—especially relative versus absolute—often disagree substantially about trends in inequality, the inequality lines implied by different types of inequality measures generate broadly similar conclusions about both the location of inequality lines and their trends over time.

Inequality lines arise naturally through social preferences that are concerned with inequality but not necessarily with poverty. Yet, there are good reasons for society to have a concern for both poverty and inequality. Consistent with Roope (2021) but for a much larger range of countries, this paper finds that there is a vast gap in all countries between domestic inequality lines and poverty lines. Focusing on everyone below inequality lines should not come at the cost of failing to give special focus to those near the very bottom of the distribution. Indeed, although increases to any incomes below inequality lines reduce inequality, increases to incomes far below inequality lines reduce inequality the most (Roope 2019). The large gap between poverty lines and inequality lines also underscores the often overlooked fact that economic growth will not necessarily reduce poverty, even if it causes inequality to fall (Roope 2021).

This emphasizes the importance of considering the full impacts that policies are likely to have across the income distribution, e.g., via growth incidence curves, rather than overly relying on any one summary statistic. Awareness of the percentiles in which both poverty lines and inequality lines lie can help to focus consideration of what shape of growth incidence curve is desirable and feasible. With firm theoretical foundations upon which to assess the likely impacts of developmental interventions on inequality, both globally and domestically, our approach offers a richer and more rigorous lens through which to view shared prosperity.

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