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The global inequality boomerang

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Abstract: In this paper we argue that the decline in global inequality over the last decades has spurred a 'sunshine' narrative of falling global inequality that has been rather oversold, in the sense, we argue, it is likely to be *temporary*. We argue the decline in global inequality will reverse due to changes in the between-country component. We find there is a potentially startling global inequality 'boomerang', possibly in the mid-to-late 2020s, which would have happened even if there were no pandemic, and that the pandemic is likely to bring forward the global inequality boomerang.

Key words: global inequality, inequality boomerang, COVID-19 pandemic

JEL classification: D31, D63, O15

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1 Introduction

This paper focuses on the past and potential future evolution of income (or consumption) inequality in the world over the period 1981–2040. Inequality in the world has fallen by most common definitions since the late 1980s, and this is largely due to a decline in the between-country component of inequality (Anand and Segal 2015; Gradín 2021; Lakner and Milanovic 2016; Niño-Zarazúa et al. 2017). Specifically, the concept of *global inequality* for household income or consumption per capita, defined as if all individuals in the world belonged to one single country—i.e., Milanovic's (2005) *concept 3*—has declined between 1988 and 2013 at an average annual rate of between 0.41 per cent and 1.1 per cent, when measured by the Gini coefficient and the mean log deviation (MLD), respectively, with the most notable decline occurring after 2003. The decomposition of the MLD shows that the decline in global inequality has been largely driven by an important drop in the between-country component, whose relative contribution to the overall MLD measure has reduced from 80 per cent in 1988 to just above 65 per cent.

Looking ahead, we argue that the impact of China's economic development—and of other fast-growing, populous countries such as India—on the between-country component will, at some point, diminish and start to add to global inequality if economic growth continues apace. Perhaps paradoxical, but the same force which was contributing to lowering global inequality will start to raise it. When will this happen? Our calculations suggest that this could happen within a decade.

To answer this question, our paper reconstructs the full household per capita income (or consumption) distributions from household surveys of more than 160 countries over the period 1981–2019 and considers what can be said about the plausible evolution of income inequality between countries in the aftermath of the COVID-19 pandemic, up to 2040.[1] Based on this data, we argue that the decline in global income inequality over the last decades has spurred a 'sunshine' narrative of falling inequality that has been rather oversold, in the sense that it is likely to be *temporary*, i.e. the decline in global inequality will reverse due to changes in the between-country component. We find there is a potentially startling global inequality 'boomerang', possibly in the mid-to-late 2020s, which would have happened even if there had not been a pandemic, and that the pandemic is likely to bring forward such a global inequality boomerang.

The remainder of the paper is structured as follows. Section 2 discusses global income inequality in relation to some aspects of a Kuznets lens and presents a formalization of the evolution of global income inequality with a focus on the between-country component. Section 3 describes the dataset we use. Section 4 presents the results. Finally, Section 5 concludes.

2 A new Kuznetsian twist

In his seminal work, Kuznets (1955) considered the evolution of inequality in a country during the course of a structural transformation in which the population moved from a low mean/low inequality income distribution (rural/agricultural sector) to a high mean/high inequality income distribution (urban/industrial sector). He argued that such a transformation would lead to inequality increasing in the early stages, peaking, and then declining in the later stages—the famous

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[1] From here onwards, we refer to income inequality only as is customary in this literature, although we are aware of the important distinctions between income and consumption.

inverted-U shape. This formulation has spurred a vast literature, encompassing both mathematical formalization and empirical estimation (see, e.g., Anand and Kanbur 1993a, 1993b).

Kuznets's formulation of viewing overall distribution as composed of a population-weighted sum of component distributions, can equally well be applied to the world distribution of income, except that instead of sectors within a country, we have countries within the world as the key components. But the change of lens also changes the focus of attention. The global setting makes it more appropriate to focus on changes in the constituent distributions since, despite global migration and differential population growth rates, global population shares accounted for by different countries would not change dramatically over the period of a decade or so. Further, in a global setting, as we shall see, it is the fast-growing middle-income countries which play a central role in the evolution of world inequality—so, instead of the simple Kuznets model of two component distributions (the sectors), we need minimally three component distributions (high-, middle-, and low-income countries). Assuming there is unlikely to be very large-scale population shifts between countries, global income inequality may rise or fall primarily because of changes either in within-country inequality or in the mean income of countries (between-country inequality).

The previous argument can be formalized in a three-country model with per capita incomes y_i (i = 1, 2, 3), with $y_1 \leq y_2 \leq y_3$ and population shares $x_1 + x_2 + x_3 = 1$. In this hypothetical setting, the low-income group or country 1 can be thought of as 'Africa', the middle-income country 2 as 'China', and the high-income country 3 as 'the United States (US)'. For the sake of the argument, let us focus on the mean log deviation (L) as the measure of inequality, with L_1, L_2, L_3 being the mean log deviation for each of the three countries. Given the properties of this measure, the global L thus can be broken down into the within-group (L_W) and the between-group (L_B) components as follows:

$$L = L_W + L_B \tag{1}$$

where

$$L_W = x_1 L_1 + x_2 L_2 + x_3 L_3 \tag{2}$$

$$L_B = ln(x_1 y_1 + x_2 y_2 + x_3 y_3) - [x_1 ln(y_1) + x_2 ln(y_2) + x_3 ln(y_3)] \tag{3}$$

Now consider what happens to the global L as y_2 (China) goes from a value of y_1 (Africa) to a value of y_3 (US), holding everything else constant. Note that since the mean log deviation is scale independent, this exercise is about the relative values of the three per capita incomes—they could all be growing, but it is the relative growth rates which are important. From (1), (2), and (3), the only impact on overall inequality L of a change in y_2 comes through the impact on L_B. The derivative of L_B with respect to y_2 is given by:

$$\frac{dL_B}{dy_2} = \frac{x_2}{x_1 y_1 + x_2 y_2 + x_3 y_3} - \frac{x_2}{y_2} \tag{4}$$

It thus follows that:

$$\frac{dL_B}{dy_2} < 0 \; when \; y_2 = y_1$$

$$\frac{dL_B}{dy_2} > 0 \; when \; y_2 = \; y_3$$

$$\frac{dL_B}{dy_2} = 0 \; when \; y_2 = \frac{x_1 y_1 + \; x_3 y_3}{x_1 + x_3}$$

Thus, we have a new Kuznetsian twist. It can be demonstrated that, holding all else constant, L_B, and hence L, first decreases and then increases with y_2, with the minimum value occurring when y_2 (i.e. the per capita income of 'China') crosses the population weighted average of y_1 and y_3 (i.e. the per capita incomes of 'the US' and 'Africa'). Obviously, the story is more complicated empirically since there are also changes in within-country inequalities and in population shares. These forces will indeed be taken into account in what follows, but the basic force making for the 'inequality boomerang' has been identified as the changing contribution of the middle-income country mean to overall between-country inequality—first negative, and then positive.

Indeed, what was described earlier can be summarized as a new Kuznetsian twist in the terms that follow. Global income inequality, defined as if all individuals in the world belonged to one single country, has fallen despite the increase in within-country inequality in large countries (data from the World Bank (2016), based on Lakner and Milanovic (2016) and Milanovic (2016), shows that the within-country component has moved upwards from accounting for 20 per cent of total global inequality in 1988 to almost 35 per cent in 2013). This is because previously poor populous countries like China and India have grown relative to rich countries such as the US, and hence, the between-country component has fallen and done so sufficiently (from 80 to 65.2 per cent of total global inequality, World Bank (2016)) to overcome the rise in the within-country component. Nonetheless, as China's rapid growth continues (as well as other large emerging economies such as India), it will pull away from other poor countries, and this will contribute to rising between-country inequality. Will there then be a turning point in global inequality, and when will that happen?

3   The ten cents database

In order to analyse changes in global income inequality (e.g., Milanovic's 2005 *concept 3*) we need household survey data that allows for a global interpersonal comparison of incomes. To this end, this paper exploits what we have termed as the 'ten cents database', which has been built from the World Bank's tool of harmonized household income and consumption surveys (Arayavechkit et al. 2021).[2] This tool contains household income and consumption data for between 156 and 162 countries each year over the period 1981–2019, which together concentrate about 96 per cent of the world's population. These numbers imply the existence of about 6,230 country-year distributions, although only about 1,858, or 30 per cent, are actual surveys (with 2015 and 2017 as the mean and median years, respectively), whereas the remaining 70 per cent corresponds to

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[2] PovcalNet March 2021 global poverty update.

distributions that were interpolated or extrapolated to fill the country-year gaps over the period—since not all surveys were collected in a year that is common to all countries.

The interpolation and extrapolation exercises were performed under distribution-neutral assumptions using two potential indicators from national accounts: the annual growth rate of household final consumption expenditure (HFCE) per capita—arguably, the indicator that is conceptually closest to households' economic activity captured by surveys—and the annual growth rate of GDP per capita—which is adopted in countries where HFCE is scarce or not available, mainly in sub-Saharan Africa—(see, e.g., Prydz et al. 2019).[3] With 30 per cent of the country-year data points being actual surveys, the vast majority of countries in the dataset have at least two actual surveys, which allows capturing some intertemporal changes in each country's distribution. Yet, the fact that 70 per cent of the data points were filled under distribution-neutral assumptions imply that any changes in the evolution of global inequality over 1981–2019, according to this dataset, were mostly driven by the between-country component—which is the focus of this paper after 2019 (see Section 4).[4]

The user of the World Bank's tool cannot observe household per capita income or consumption at the individual level, but rather can retrieve the distributions of those indicators for each country and year using an algorithm, in the spirit of Dykstra et al. (2014), applied to the dataset's application programming interface (Castañeda Aguilar et al. 2019; Zhao 2019). Specifically, to retrieve each country-year distribution, the algorithm computed the cumulative share of the population with per capita income or consumption below an array of monetary thresholds that change in value every $0.10 a day per person (2011 PPP), starting from $0.10 up to a maximum value that covers 99.99 per cent of the population. From these cumulative shares, individuals within each $0.10-bin were isolated and then assigned the middle value of their bin as their daily amount of per capita income or consumption (hence, the label 'ten cents database').

Each of the country-year distributions were pooled together over the period 1981–2019, from which inequality measures such as the Gini coefficient and the MLD are estimated globally using the size of the population within each bin as weights.[5] Figure 1 plots the global distributions of household per capita income (or consumption) reconstructed from the World Bank's tool only for 1981 and 2019. The Panel A shows the transition from the well-known bimodal distribution that still prevailed by the early 1980s to the current unimodal density with the three poverty lines used by the World Bank ($1.90, $3.20, and $5.50 a day). Poverty at those lines are better seen in the cumulative distribution functions of Panel B, suggesting a decrease of those living under $1.90-a-day from about 45 per cent of the world's population in 1981 to less than 10 per cent in 2019—

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[3] See also World Bank (2018), Appendix A, and World Bank (2020), Chapter 1. The latter presents details on the extrapolation of per capita consumption in India, as captured by the latest available survey from 2011.

[4] An important issue to highlight is that the latest actual data in India correspond to 2011–12, which has been extrapolated by the World Bank to 2017. While the extrapolation usually applies a pass-through rate (from HFCE in national accounts to household expenditure) of 1 in the rest of the countries (see footnote 13 in World Bank 2020, p. 73), in India the employed rate is 0.67. Why this exception and why not to perform the extrapolation up to 2019 is not clear, however. In this paper, the distribution in India has been extrapolated to 2019 following the previous approach.

[5] This ten cents database comprised by all the country-year distributions matches the temporal and geographic coverage of the World Bank's PovcalNet component of the dataset used in World Bank (2016), which is based on Lakner and Milanovic (2016) and Milanovic (2016). These authors made a significant step forward in measuring global inequality by combining standardized household survey data from the World Bank's PovcalNet and other sources such as the Luxembourg Income Study Database (LIS), the Survey of Living Conditions (SILC), Branko Milanovic's World Income Distribution Dataset (WYD), among others.

consistent with the figures reported elsewhere by the World Bank (see, e.g., discussion of poverty trends at different levels in Sumner et al. 2022).

Figure 1: Global distributions of per capita income or consumption, 1981 and 2019
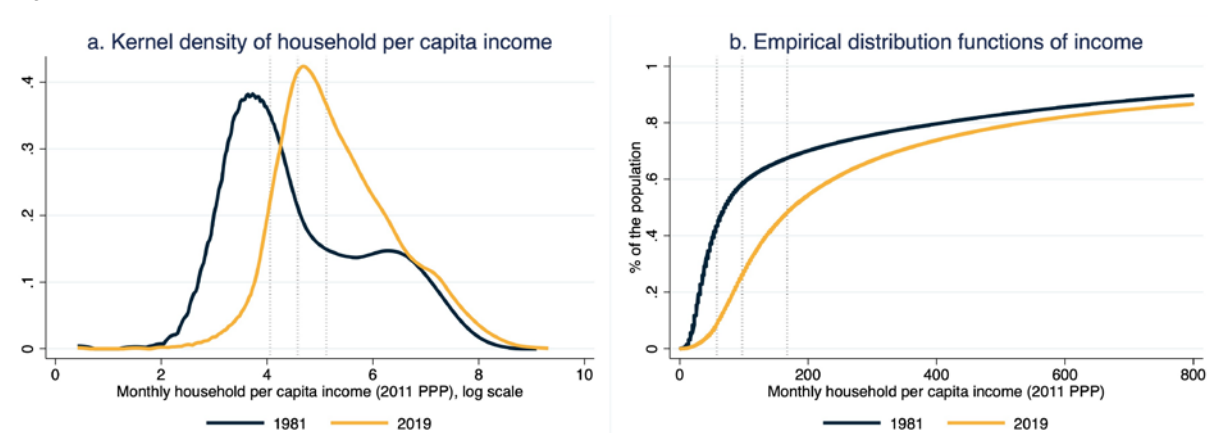
Note: in both panels, the dotted vertical lines represent, starting from the left, the monthly equivalent of the $1.90, $3.20, and $5.50 poverty lines, respectively.

Source: author's calculations based on country-year per capita income or consumption distributions reconstructed from the World Bank's PovcalNet online tool (March 2021 update).

## 4   The global income inequality boomerang

4.1   The past

Our first task is to show that our 'ten cents database' produces results consistent with available evidence on the past (e.g., Lakner and Milanovic 2016; Milanovic 2016; World Bank 2016). The computations from the reconstructed income distributions reveal that global income inequality, as measured by either the Gini coefficient or the MLD, has been falling markedly and steadily since the end of the 1990s and up to 2015, with a relative stagnation onwards to 2019 (Figure 2).[6] Focusing on the period of sustained decline, viz. 1999–2015, the decomposition of the MLD into its within- and between-country components reveals that the absolute change in the latter has accounted for the lion's share of the absolute change in the MLD throughout the subperiod (Figure 3).

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[6] Appendix A reproduces this trend under different scenarios that exclude either China, India, or both from the global income inequality computation to see whether they exert an equalizing or unequalizing force. In general, the growth in incomes in China has exerted an increasingly equalizing force (i.e. the exclusion of this country moves the level of global inequality upwards) since the early 2000s, whereas India has exerted an unequalizing effect during the whole period (i.e. the exclusion of this country moves the level of inequality downwards).

Figure 2: Evolution of global income inequality, 1981–2019
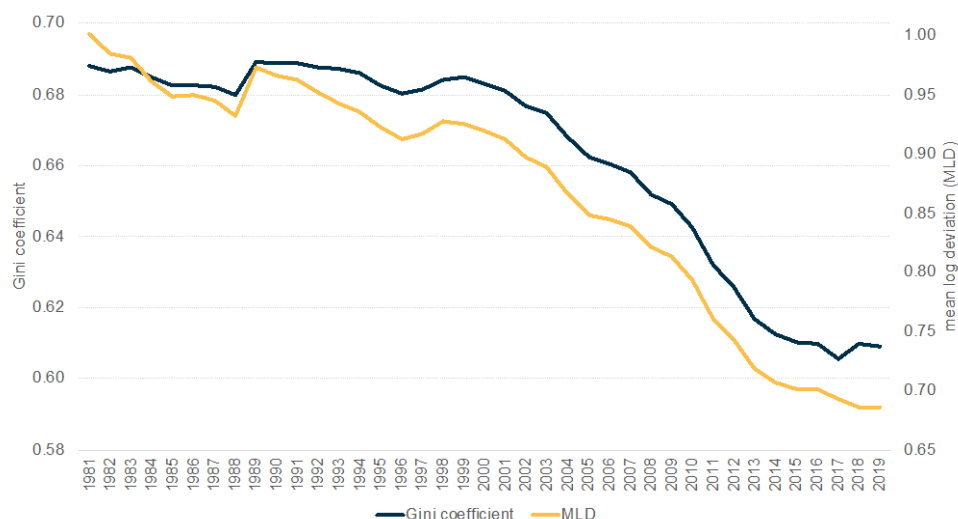
Figure 3: Relative contribution of the absolute annual change in the within- and between-country components to the absolute annual decline in the MLD during 1999–2015
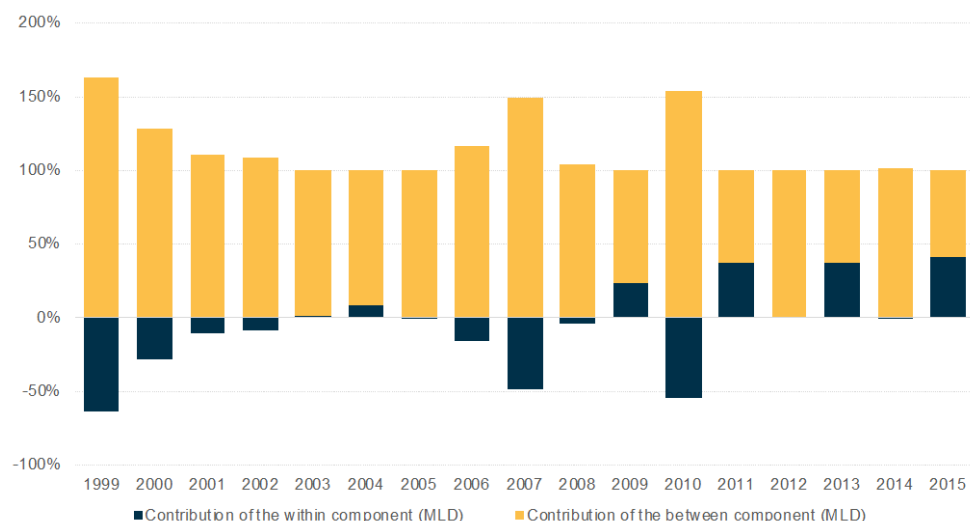
Note: a negative value of the relative contribution indicates that the corresponding component of inequality increased in absolute terms.

Though this result may be somewhat expected due to the distribution-neutral extrapolations (e.g. only about half of the country-year distributions in the subperiod come from actual surveys), it is strongly consistent with the same exercise applied to World Bank (2016, Figure 4.5), which uses actual surveys within two years of a reference year, and where the absolute changes in the between-country component dominate the decline in the MLD over 1988–2013 (see Appendix B). Thus, this result supports the focus of this paper on the potential evolution of global income inequality in the medium term, namely, 2020–40.

4.2 The future of global income inequality to 2040

Assumptions

The projections over 2020–40 exploit the World Bank's World Development Indicators on past growth in both HFCE per capita and GDP per capita. First, for 2020, the computation of income inequality considers the shock induced by the pandemic. To do so, the analysis follows the World Bank's (2020) approach used to estimate the impact of the pandemic on global poverty. That is, we project forward the global distribution of income (or consumption) in 2019 by applying a pass-through rate of 85 per cent of the country's GDP per capita growth rate between that year and 2020 to each country's income bin (see Lakner et al. 2020 for details).[7]

Then, for the period 2021–40, the computation of inequality indices results after each country's income bin is extrapolated following the approach of Prydz et al. (2019). That is, each value of the distribution is multiplied by a factor $\left(\frac{n_{t+1}}{n_t}\right)$ that represents the corresponding country's annual growth rate between the year t, starting in 2020, and $t+1$, either of HFCE per capita or of GDP per capita in those cases where the former indicator is not available. In all these distribution-neutral projections, the analysis accounts for demographic changes by assuming that the population share in each country's income bin grows yearly at the country's population rates projected by the UN World Population Prospects for the period 2020–40.

We project forward with two ad-hoc growth scenarios. First, an optimistic, *return to pre-pandemic long-run growth* scenario (1)—in the spirit of Pritchett and Summers' (2014) argument on 'regression to the mean'—in which each country's income bin will grow at the per capita annual average rate observed over 1990–2019. Second, a *vaccination-driven post-pandemic growth* scenario (2) in which each country's income bin will grow at a rate that depends on each country's share of population fully vaccinated (see discussion in Deb et al. 2021; UNDP 2022a, 2022b; and on the COVID vaccination data, see Mathieu et al. 2021). Specifically, if such share is above 50 per cent, we assume a full return to the average growth over 1990–2019; if the share ranges 25–50 per cent, we assume a growth rate of half of that average growth; and if the share is less than 25 per cent, we assume a growth rate of only a quarter of that average growth.[8]

Main results

What do we find? First, between 2019 and 2020, global inequality exhibits a rise (Figure 4). This inequality uptick is consistent with the result reported by Yonzan et al. (2021). It is also consistent with the finding by Deaton (2021) for the concept of world inequality, i.e. that in which each individual in the world is assigned their corresponding country's GDP per capita. As Deaton (2021: 7) argues, such increase 'can be largely attributed to India's poor performance; if [world] inequality is recalculated without India, the uptick is eliminated. By contrast, eliminating China, […] does

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[7] This assumes no changes in the distribution. Yet, in the recent experience of an almost generalized GDP contraction, such rate seems optimistic as it implies the full contraction did not 'pass-through' to households (in particular those that were severely affected by lockdowns), which goes against the expectation that economy-wide shutdowns may affect household's income more (see discussion in Sumner et al. 2022). Depending on pre-existing conditions, economy-wide shutdowns can be expected to be both drastic (e.g. because informality is widespread and safety nets are absent) and prolonged as the sudden drop of incomes often persists with a low recovery (see, e.g., Davis and von Wachter 2017).

[8] This analysis employs the updated vaccination rates by the end of 2021 and published in OurWorldInData. These are of course arbitrary scenarios that play a role to demonstrate if a vaccination-to-growth association is upheld then what would that imply.

nothing to eliminate the uptick in 2020.' In Appendix C, we show that these conclusions hold after removing China or India, each at a time, from the computations, but interestingly, after removing both China and India simultaneously, the inequality uptick remains, suggesting that the pandemic-induced contraction has driven the rest of the countries apart.

Second, the estimates after 2020 under the two distribution-neutral growth assumptions described above, suggest an unambiguous feature: there will be a reversal, or 'boomerang', in the recent declining (between-country) inequality trend by the early-2030s. Specifically, if each country's income bins grow at the average annual rate observed over 1990–2019 (scenario 1), the declining trend recorded since 2000 would reach a minimum by the end-2020s, followed by the emergence of a global income inequality boomerang (Figure 4). If, on the other hand, growth is linked to countries' share of fully vaccinated population (scenario 2), a startling result emerges: the inequality boomerang would occur around 2024 based on the Gini coefficient, while it may be happening immediately after the first year of the pandemic based on the MLD.

Figure 4: Evolution of global income inequality under different assumptions, 1981–2040
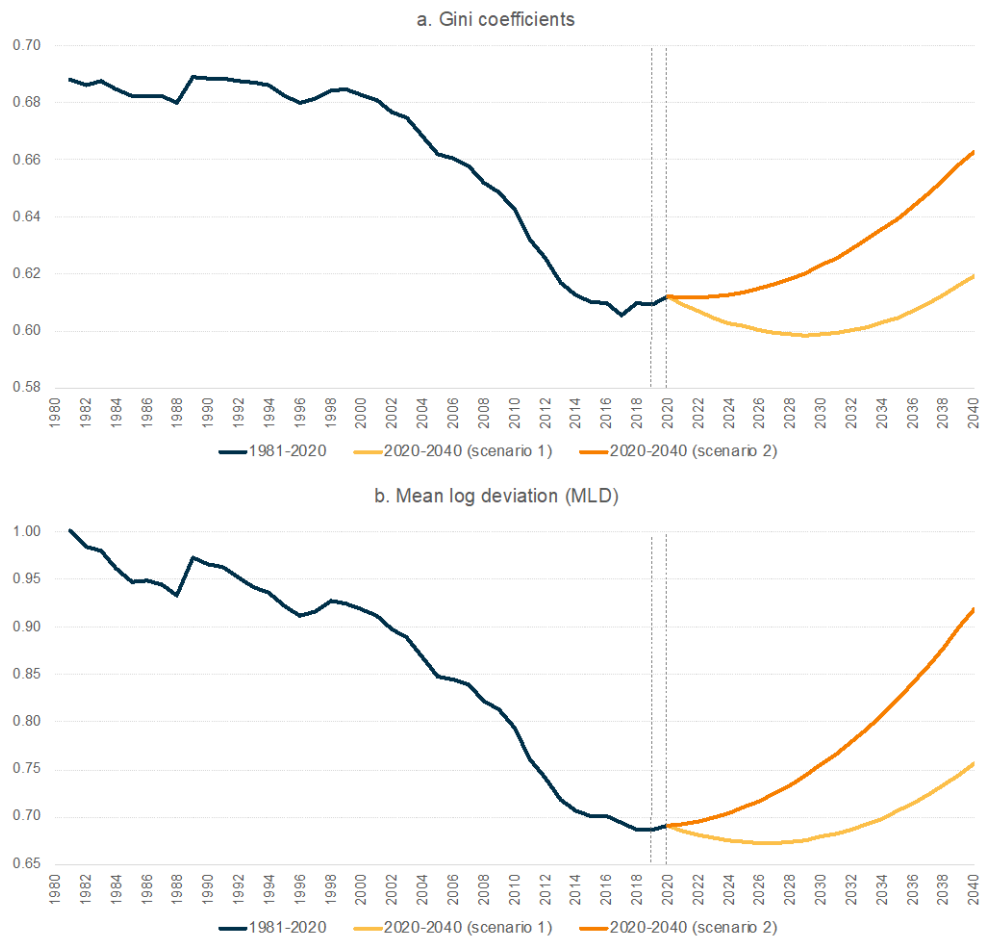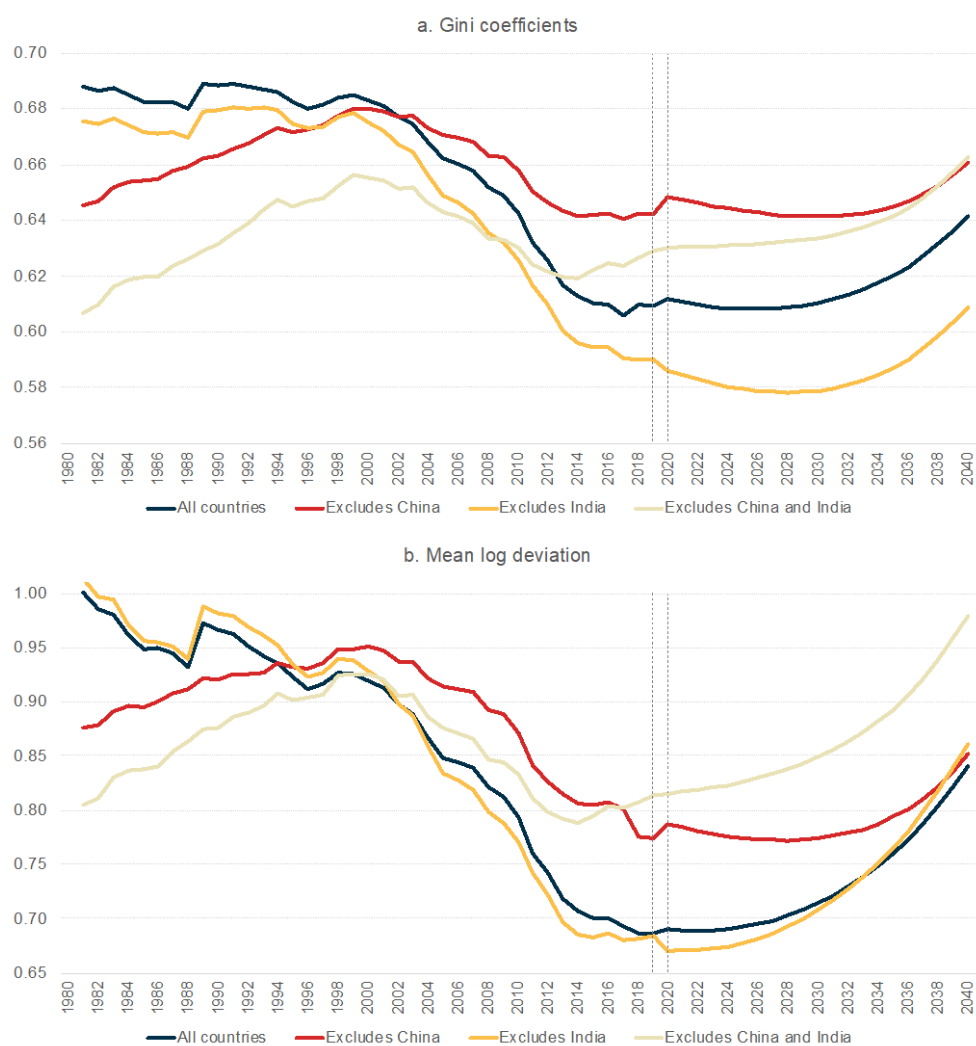

Note: vertical lines delimit the change in income inequality between 2019 and 2020. The scenario 1 refers to the *return to pre-pandemic long-run growth* path in which it is assumed that each country's income bins will grow at the per capita annual average rate observed over 1990–2019. The scenario 2 refers to the *vaccination-driven post-pandemic growth* path in which it is assumed that each country's income bins will grow at a rate conditional on each country's share of fully vaccinated people.

Source: author's calculations based on country-year per capita income or consumption distributions reconstructed from the World Bank's PovcalNet online tool (March 2021 update).

Distribution-non-neutral growth and global inequality

For comparison, we generate a distribution-sensitive growth scenario (see Figure 5). We take the two most recent actual household surveys for each country they are available for and compute the income growth rate by deciles between the two surveys. Then, we use such rates and extrapolate the corresponding income bins within each country-decile toward 2040 (i.e. we assume that these growth rates by country's deciles remain the same). In general, the results suggest that the inequality boomerang would emerge well before 2030.

Figure 5: Evolution of global income inequality, 1981–2040

Note: vertical lines delimit the change in income inequality between 2019 and 2020.

Source: author's calculations based on country-year per capita income or consumption distributions reconstructed from the World Bank's PovcalNet online tool (March 2021 update).

5 Conclusion

The analysis in this paper has considered the past and potential future evolution of global inequality. Our results reported point towards the potential of a startling global inequality 'boomerang' toward the end-2020s or the early-2030s, driven by the path of between-country inequality, as middle-income countries approach income level of high-income countries but by the same token pull away from low-income countries. The global inequality boomerang could occur sooner if the access to COVID-19 vaccines across the developing world—which likely prevents a full economic recovery and growth potential—remains unequal.

Our core projections are distribution neutral, so they only pick up the impact of between-country inequality on world inequality. However, projections which extrapolate recent patterns of distributional non-neutral growth show that the upward turn in global inequality could come even sooner. Looked at another way, one set of interventions to counteract the boomerang and upward movement in global inequality is for policy to focus on lowering within-country inequality.

The conclusion is that the 'sunshine narrative' of declining global inequality needs to be tempered. An inequality boomerang is quite likely.

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Appendix

A The (un)equalizing weight of China and India

While the declining trend in global income inequality over the last two decades holds after excluding China from the computation, this country has exerted an increasingly equalizing force since the early 2000s (contrary to its unequalizing role over 1981–2000). The declining trend also holds after excluding India, but such exclusion reveals the unequalizing weight of this country on the global figure. Finally, when excluding both China and India, the levels of the Gini coefficient move downwards for most of the period, with a trend that imitates the one that excludes China only. Interestingly, after excluding the two countries, global income inequality exhibits an increasing trend at the end of the period up to a level that is slightly higher than that recorded back in the early-1990s.

Figure A1: Evolution of global income inequality in selected scenarios, 1981–2019
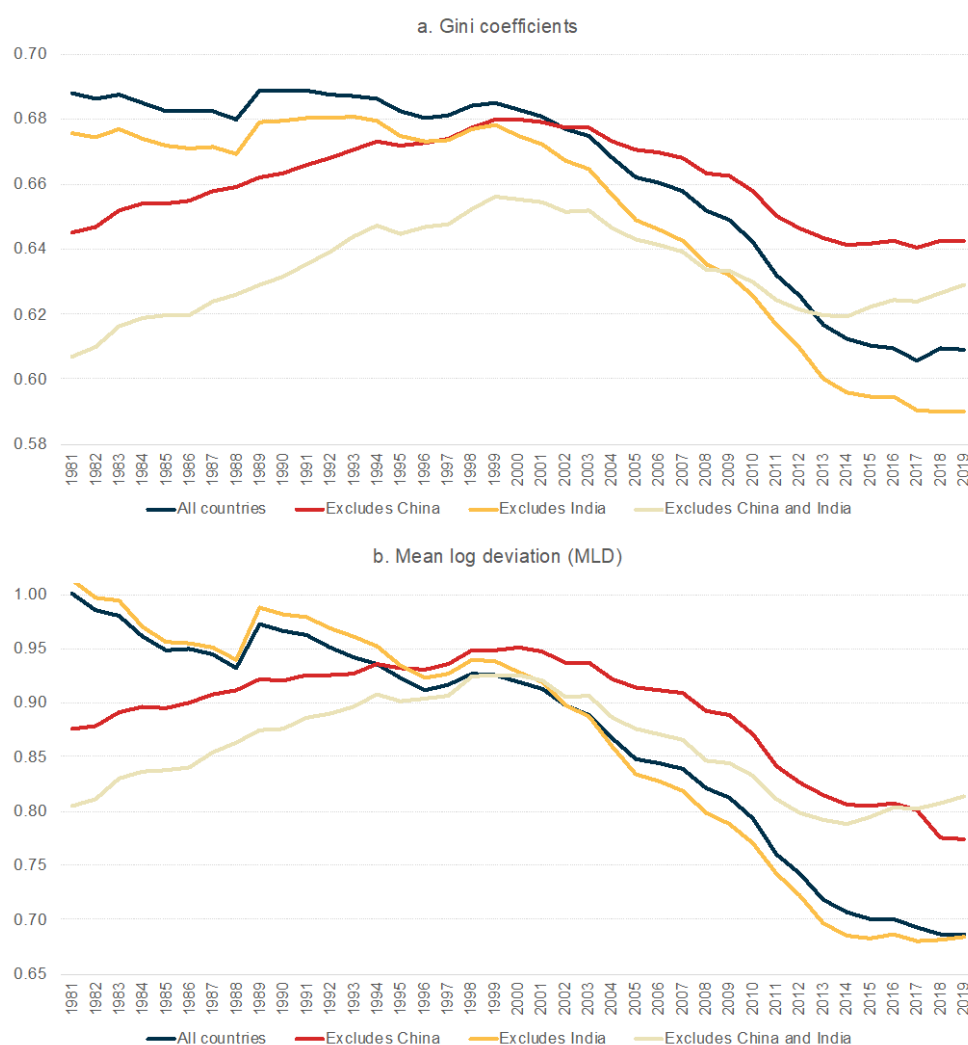
Source: author's calculations based on country-year per capita income or consumption distributions reconstructed from the World Bank's PovcalNet online tool (March 2021 update).

14

B   Dominance of the between-country component of global income inequality

Figure B1: Evolution of global income inequality, MLD, 1988–2013
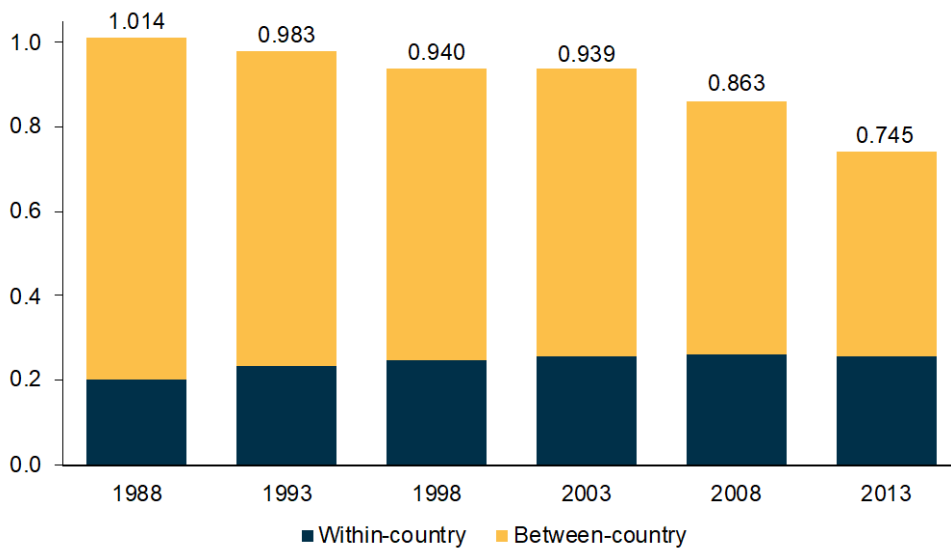
Source: adapted from Figure 4.5 in World Bank (2016: 81), under Creative Commons licence CC BY 3.0 IGO. Based on Lakner and Milanovic (2016) and Milanovic (2016), on the basis of household surveys.

Figure B2: Absolute changes in the MLD and its components, 1988–2013
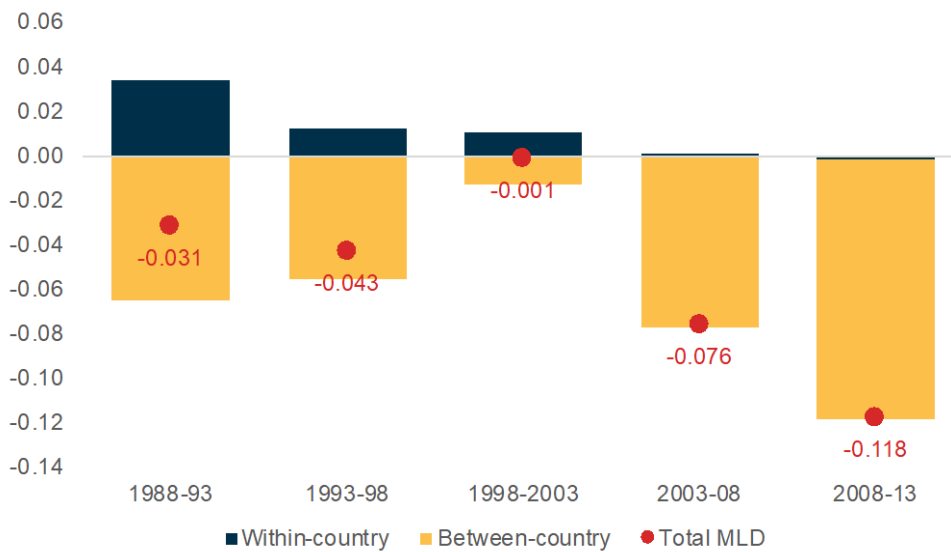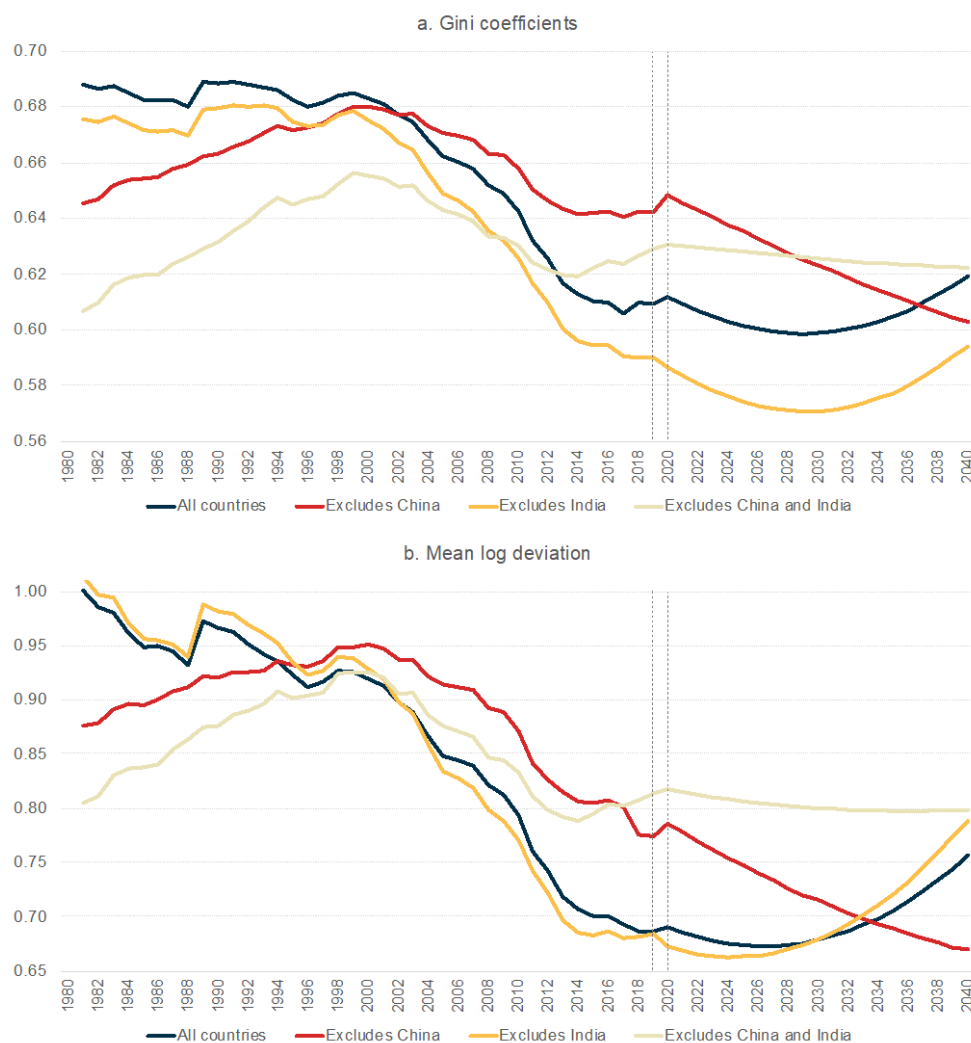

Source: author's calculations based on Figure B1.

C   The boomerang and the weight of China and India

Return to pre-pandemic long-run growth (scenario 1)

The potential emergence of the global income inequality boomerang by the early-2030s seems to be driven almost entirely by China. Note that when excluding India, the plausible future between-country inequality trend (and boomerang emergence) runs almost in parallel to that computed for all countries, whereas the exclusion of both China and India suggests that the level of income inequality would decrease towards 2040 but only slightly.

Figure C1: Evolution of between-country inequality under scenario 1, 1981–2040

Note: vertical lines delimit the change in income inequality between 2019 and 2020.
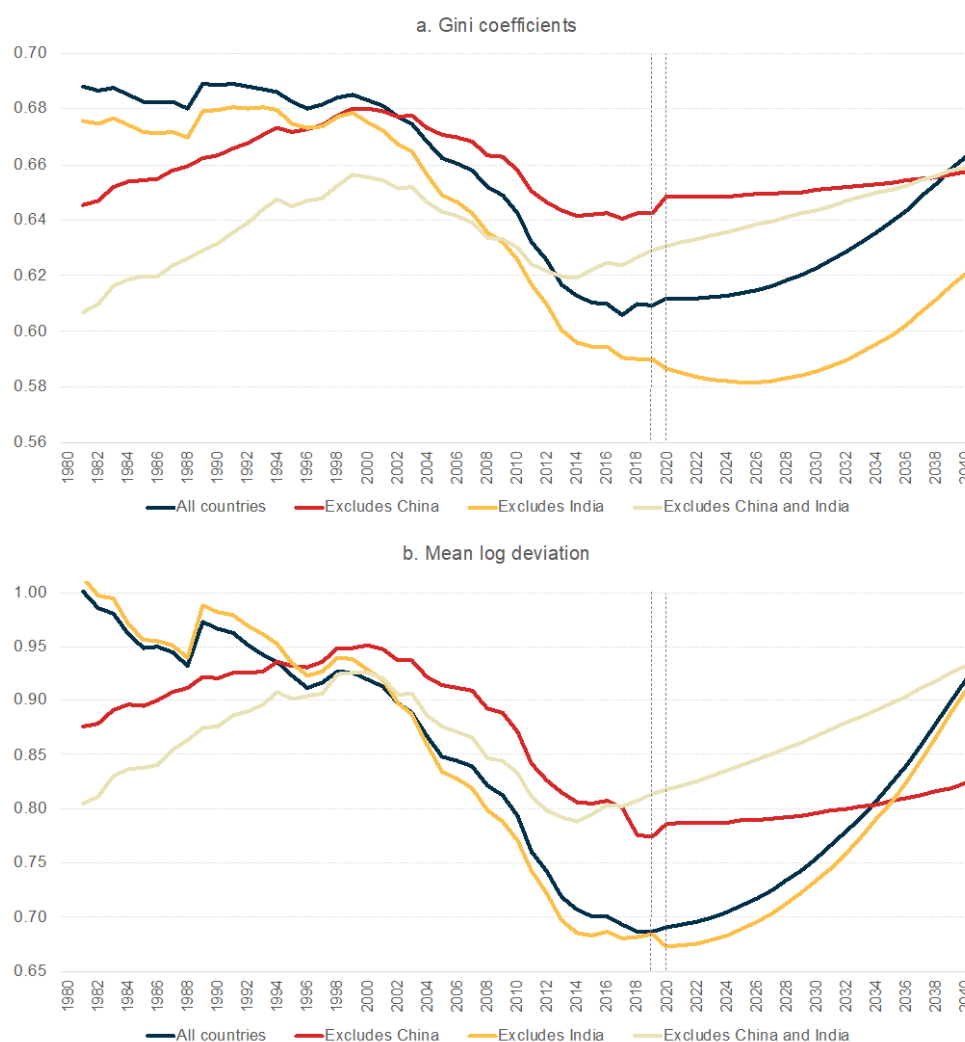
Source: author's calculations based on country-year per capita income or consumption distributions reconstructed from the World Bank's PovcalNet online tool (March 2021 update).

Vaccination-driven post-pandemic growth (scenario 2)

While the emergence of the between-country inequality boomerang is likely driven by the weight of China, it seems to potentially start emerging by the end-2020s, even if this country is excluded from the computations—note that the exclusion of India does not alter the emergence of such boomerang. The simultaneous exclusion of both China and India in this scenario reveals that between-country inequality would experience a rapid and steadily increase.

Figure C2: Evolution of between-country inequality under scenario 2, 1981–2040

Note: vertical lines delimit the change in income inequality between 2019 and 2020.

Source: author's calculations based on country-year per capita income or consumption distributions reconstructed from the World Bank's PovcalNet online tool (March 2021 update).