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A more equal world? An analysis of the global inequality trends in the period 2000-2020

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A more equal world?

An analysis of the global inequality trends in the period 2000-2020

Arthur Zito Guerriero[*]

Abstract: This paper analyzes the evolution of global interpersonal income inequality in the last decades. While some authors characterize the period 2000-2020 as an "age of convergence" (Milanovic, 2022), others argue that global inequality has remained constant (Chancel & Piketty, 2021) or even increased (Hickel, 2017). Nevertheless, all datasets used in the literature point to a decline in standard measures of relative inequality, meaning that the difference in narratives stems from the way these data are interpreted. This paper contributes to the interpretation of this period by showing that while global inequality did fall between 2000 and 2020, this trend was not the result of a truly global convergence process involving all countries, as it was mainly driven by high growth rates in Asia. Combining data from the World Income Inequality Database (WIID) with population forecasts from the United Nations, an upward trend in global income inequality is projected, even if the economic shocks of COVID-19 and the invasion of Ukraine are not taken into account. The present study shows that a significant share of the Chinese population has reached such high-income levels that further increases in these incomes will contribute to a rise in inequality. Moreover, a further reduction in global inequality will require faster income growth in sub-Saharan Africa and South Asia, whereas sustained high growth rates in East Asia will contribute to higher inequality.

Keywords: global inequality; income distribution; China; convergence; projection

JEL codes: D30, D31

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1. Introduction

The importance of the global income distribution goes beyond mere academic curiosity and populates public and political discourse. The United Nations (2023) has set the reduction of inequality between and within countries as one of the Sustainable Development Goals, and progress on this issue is monitored by the World Bank (2022). In contrast to the alarming rise in inequality within most countries (Chancel & Piketty, 2021), global income inequality is estimated to have declined over the period 2000-2020, at least before the COVID-19 pandemic. Milanovic (2022) even labels this period the “age of convergence” and compares it to the “great divergence” (Pomeranz, 2000) that followed the Industrial Revolution and was characterized by a sharp rise in inequality both between and within countries.

However, this narrative is contested by different authors who argue that global inequality has remained constant (Chancel & Piketty, 2021) or even increased (Hickel, 2017). This divergence in narratives can only partially be explained by the fact that different authors use different data sets. In fact, the primary data sources are largely the same, and all datasets used in the literature point to a decline in relative inequality between 2000 and 2020. The reason for the disagreement must therefore lie in the interpretation of the data.

This paper contributes to the interpretation of the development of global income inequality in the period 2000-2020 by showing that the decline in synthetic measures of relative inequality (such as the Gini) was not the result of a true convergence process leading to an egalitarian world. Focusing on the role of China, it is argued that the decline in relative inequality in the period was too short in duration and destined to end at a still very high level of inequality. Using data from the World Income Inequality Database (WIID) (UNU-WIDER, 2022) in conjunction with population forecasts from

the United Nations (2022), projections for the period 2021-2040 years are presented. These projections suggest that the so-called “age of convergence” is accompanied by endogenous dynamics that will soon reverse the short-lived trend of relatively declining global income inequality. This projected trend cannot be explained by the external shocks of the COVID-19 pandemic or the invasion of Ukraine, as the data used here do not represent these events. In fact, the projections remain similar even if only data up to 2019 are used.

The reason why inequality is projected to rise is the structure of growth rates in recent decades. It has not been the case that the countries with the lowest incomes have had the highest growth rates, as would be necessary for incomes to converge. Instead, the reduction in inequality has been driven by middle-income countries, especially in Asia, while other groups have been left behind.

The importance of China in the recent evolution of global inequality has already been highlighted in the literature (Alderson & Pandian, 2018; Anand & Segal, 2008; Hickel, 2017; Sala-i-Martin, 2006), and it is widely recognized that high growth rates in the country have played an essential role in reducing global inequality. Nevertheless, some authors, such as Gradín (2021a), recognize that further rapid growth in China would soon have the opposite effect once incomes in the country exceed a certain level. While in the past almost all incomes in China were so low that their increase reduced global inequality, there is already a large share of the Chinese population with incomes so high that their further increase would lead to more global inequality. This paper takes a closer look at the Chinese distribution to determine which income groups in the country can still contribute to reducing global inequality.

This paper shows that the elasticity of global inequality with respect to China´s growth was in 2020 already close to zero for the most common inequality measures

(such as Theil-L and Gini) and is projected to be positive in the coming years. This detailed analysis explains why rapid growth in China will increase global inequality in the future. The same is true for East Asia as a whole, as growth in the region is already contributing to higher global inequality (as measured by Theil-L). A further reduction in global inequality will therefore only occur if the growth trends of 2000-2020 change. This would require high growth rates in countries that still have very low-income levels, especially in sub-Saharan Africa and South Asia.

The next section of the paper compares different data sources used to calculate global inequality. **Section 3** presents a literature review of the competing narratives on global inequality. **Section 4** presents and interprets projections for the next 20 years. **Section 5** analyzes how growth rates have been distributed globally, and **section 6** provides a more detailed analysis of China´s role in recent developments. **Section 7** shows which regions could contribute to a further reduction in global inequality, while **section 8** concludes.

2. Data sources

The results presented in this paper are based on the companion dataset (wiidglobal) of the World Income Inequality Database (WIID), released in June 2022 (UNU-WIDER, 2022). The WIID is constructed by combining the most reliable household surveys from each country with national accounts using a meticulous harmonization process transparently described by Gradín (2021b, 2021c). It is understood as a continuation of the database created by Deininger and Squire (1996) and has been widely used in the recent literature (Alderson & Pandian, 2018; Gradín, 2021a; Ravallion, 2018). This dataset contains information on the mean income of each percentile for almost all countries from 1950 to 2020, allowing a detailed analysis of the dynamics of inequality within and between countries.

The data presented in the WIID refer to disposable income and are expressed in 2017 international dollars. This means that incomes in different countries are converted using purchasing power parity (PPP) exchange rates, which take into account differences in price levels across countries.

Recent studies have also used other data sources apart from the WIID. However, all of the datasets used are secondary, combining household surveys and national accounts that are essentially the same in all studies. It is therefore not surprising that different authors find similar results. For example, the estimates presented by Milanovic (2022) are hardly different from those obtained using the WIID, as presented by Gradín (2021a). While Milanovic does not make the data he uses publicly available, Gradín (2021b) is very transparent about the construction of the WIID. The small differences between their estimates are due to the way these surveys are combined.

Another important source of data for estimating global inequality is the World Inequality Database (WID), which is used, for example, by Piketty and Chancel (2021). This database differs significantly from the WIID, mainly because it was constructed using not only household surveys and national accounts but also tax and administrative data. The data for each country in the WID were compiled by different researchers following the Distributional National Accounts (DINA) guidelines (Alvaredo et al., 2021) to ensure international comparability. The use of these alternative data sources aims at correcting the underestimation of top incomes in household surveys at the national level. The differences in results between the use of WID and WIID are discussed in the next section.

Similar to WIID, Milanovic (2022) and WID use PPP exchange rates to compare incomes across countries. In fact, the recent literature has hardly used market exchange rates (MER) to calculate global inequality. PPP exchange rates are intended

to account for differences in price levels across countries since it is arguable that MER overstates differences in living standards, as prices in low-income countries tend to be lower than in rich countries. On the other hand, PPP exchange rates can be said to underestimate inequality arising from access to internationally traded goods and services. Dowrick and Akmal (2005) show that the choice between PPP and MER can change not only the level of inequality but also its trend. However, it is beyond the scope of this paper to analyze this issue in more detail. The paper follows the current literature by using WIID data constructed using PPP exchange rates.

Demographics are also essential for calculating global inequality, as countries with larger populations carry more weight in inequality measures. As the demographic composition of the world changes over time, this affects inequality measures. For this purpose, this study uses forecasts published by the United Nations (2022), which are considered highly reliable.

3. Literature review

Following the seminal work of Bourguignon and Morrisson (2002), several studies of global inequality begin their time series as early as 1820 (Chancel & Piketty, 2021; Milanovic, 2022), allowing for a long-term trajectory analysis. Although data quality was worse in the past than it is today, the magnitude of the increase in inequality, both within and between countries, leaves no doubt about the direction of the trend from 1820 to 1910. This period corresponds to the dominance of the West and the widening of class disparities within industrialized countries, often referred to as the “great divergence” (Pomeranz, 2000).

Between 1910 and 1980, within-country inequality fell while between-country inequality continued to rise (Milanovic, 2022). Between 1980 and 2000, the opposite

occurred, with rising within-country inequality and falling between-country inequality. There is no consensus on the direction of the trend resulting from the combined effect of these two opposing forces, although the magnitude of the changes appears to be small. Chancel and Piketty (2021) find slightly different directions in the trends over the period depending on the measure of inequality used. In addition, Anand and Segal (2008) found that it was not possible to determine the trajectory of global inequality in the period 1980-2000 with certainty, as existing estimates in the literature were not robust to different methods and data sets.

At first glance, the developments in the period 2000-2020 seem to be less controversial. Most authors agree that standard measures of relative inequality have declined at least since 2000, and this result appears to be robust to various methodological issues raised in the literature (Alderson & Pandian, 2018). This has given rise to a convergence narrative, according to which the world is on a path toward greater equality. A prominent proponent of this narrative is Milanovic, who explicitly compares this reduction in inequality to the period of divergence following the Industrial Revolution:

> “In the nineteenth century, the rise of the West meant growing between-country inequalities whereas in the more recent period, the rise of Asia means a catch-up of incomes and hence a declining global inequality. The first period was one of divergence, the current one is one of convergence” (Milanovic, 2022, p. 8)

Even if the decline in standard measures of relative inequality between 2000 and 2020 is uncontested, disputes remain over the interpretation of the trajectory during this period. Hickel (2017) criticizes Milanovic's convergence narrative, emphasizing that the decline in relative inequality was largely driven by China and that not all regions

of the world were closing their gaps with rich countries. Moreover, he claims that “global inequality has tripled since 1960” (Hickel, 2017). While the author acknowledges that relative inequality has declined, he is referring to absolute inequality, which has steadily increased, including in the period from 2000 to 2020. This fact has also been observed by several other authors, such as Atkinson and Brandolini (2010), Niño-Zarazúa et al. (2017), Ravallion (2018) and Gradín (2021a). However, a convincing interpretation of absolute inequality measures that could justify their use instead of the more commonly used relative measures is still lacking.

Ravallion (2018) shows that conflicting conceptualizations of inequality and ethical perspectives can lead to different results. He shows that an upward trend in global inequality can be observed if more weight is given to the very poor (who have not seen much progress in recent decades) or the very rich (who have experienced disproportionate income growth). Moreover, he argues that inequality can also be said to have increased if one adopts a nationalist perspective and gives more weight to the rise in inequality within countries than to the decline in inequality between countries.

Even using only standard measures of relative inequality, Piketty and Chancel (2021) also disagree with the convergence narrative, claiming that global inequality remained stable at very high levels from 1910 to 2020. One might expect that the difference in the narrative arises because the authors use different data. As explained in **section 2**, Piketty and Chancel (2021) use data from the WID, which differs significantly from the WIID and the data used by Milanovic (2022). The estimated reduction in inequality over the period is indeed different: while Milanovic (2022) finds a decrease in the Gini coefficient of 10 points (from 0.7 in 2000 to 0.6 in 2020), Piketty and Chancel (2021) find a decrease of only 5 Gini points (from 0.72 in 2000 to 0.67 in 2020). It is not appropriate to directly compare these levels of inequality, since the

studies use not only different data sets, but also different income concepts[1] and reference units.[2] However, it is important to note that the authors agree on the direction of the inequality trend over the period, pointing to a decline in global inequality between 2000 and 2020.

There is also no doubt that the measured level of inequality is very high. Even Milanovic (2022) calculates a global Gini of 0.6 in 2020, which is comparable to the level found in the most unequal countries in the world and higher than the global Gini of 0.5 at the beginning of his time series in 1820. It is worth noting that these levels of inequality are reached using PPP exchange rates, which significantly reduce the measured inequality and, in some ways, underestimate the economic disparities between people in different countries. Given current levels of inequality, it is difficult to conceive of a credible narrative of convergence without implicitly linking it to an optimistic expectation of a continued downward trend in the future.

Convergence narratives convey the idea that the forces driving the downward trend would continue in the future if no external shocks were to occur. This belief is evident in the positions taken by organizations such as the United Nations (2023) in The “Sustainable Development Goals Report 2023” and the World Bank (2022) in “Poverty and Shared Prosperity 2022”, which acknowledge that global inequality is estimated to have increased in 2020, but attribute this reversal of trend to external shocks, particularly the economic impact of the COVID-19 pandemic, rather than to structural features of the past trajectory.

However, the projections presented in this paper indicate an endogenous reversal of the declining trend in the coming years, even without considering the effects of the pandemic and the war. In fact, the projections remain similar if data only up to 2019 are considered (see **figure 10** in **appendix B**). This means that the reversal of the

declining trend in global inequality cannot be explained by these external shocks alone, but also depends on the nature of the growth trends over the period.

Similar projections have been made by other authors using different methodologies and assumptions. For example, by incorporating growth and demographic projections, Rougoor and Marrewijk (2015) predicted that global inequality would reach its lowest point in 2027 and then begin to rise again. In addition, the projections of Kanbur et al. (2022) also point to a rising trend in global inequality starting soon. In light of these projections, it becomes difficult to justify the characterization of the period from 2000 to 2020 as an “age of convergence,” as it seems destined to end soon after a relatively short period of inequality reduction, leaving inequality levels still very high.

4. Projecting future trends

Benign views of the world's trajectory between 2000 and 2020 are closely linked to optimistic expectations about the future, which intuitively follow from the fact that the downward trend in inequality has persisted over two decades. This persistence seems to indicate that there is a strong force driving this trend, which can reasonably be expected to continue in the future. According to this line of reasoning, inequality would continue to fall if the driving forces remain as they were during the “convergence period”. This section presents projections for the period 2021-2040 years that contradict this expectation, showing that if the world continues on the same path, inequality will begin to rise again in the coming years.

There are different interpretations of what it means to assume that income trends will continue in the future. The most intuitive approach is to assume that past growth rates will remain unaltered. However, it is necessary to define which income unit is assumed to experience these persistent growth rates. One possible approach is to

look at the growth rate of average income in each country (or, similarly, GDP growth) and assume that this rate applies to all income groups, which amounts to assuming constant inequality within the country. Another possibility would be to assume that growth rates remain the same for each individual. However, this would require panel data that track income changes for specific individuals, which is not available at the global level. Even if such data were available, the assumption of constant individual growth rates may not be appropriate, as individual income is typically considered to be strongly dependent on age and often subject to significant variation.

To address these challenges, this study assumes constant growth rates in the average income of each percentile in each country. This approach allows for accounting for both changes in inequality between countries (since constant growth rates of the percentiles imply constant growth rates of average income) and within countries (since trends in inequality within each country depend on differences in the growth rates of each part of its income distribution). While the individuals who fall into these specific percentiles may change over time, they can be assumed to represent income groups that remain relatively constant over time.

Figure 1 shows the results of projections based on WIID (UNU-WIDER, 2022) and population forecasts from the United Nations (2022), assuming that each percentile of each country experiences the same growth rate as in the period 2000 to 2020. The blue line represents historical trends and projections using data for all countries. In addition, two counterfactual scenarios are included: one where China is excluded from the calculations (red) and another where India is excluded (green). Comparing these three lines allows for a better understanding of the specific contributions of these countries to the inequality trajectory. This method of excluding countries has been used in previous literature, such as by Sala-i-Martin (2006), Anand and Segal (2008),

Alderson and Pandian (2018) and Hickel (2017). All of these authors find that China has made a significant contribution to the downward trend in global inequality since 1980.

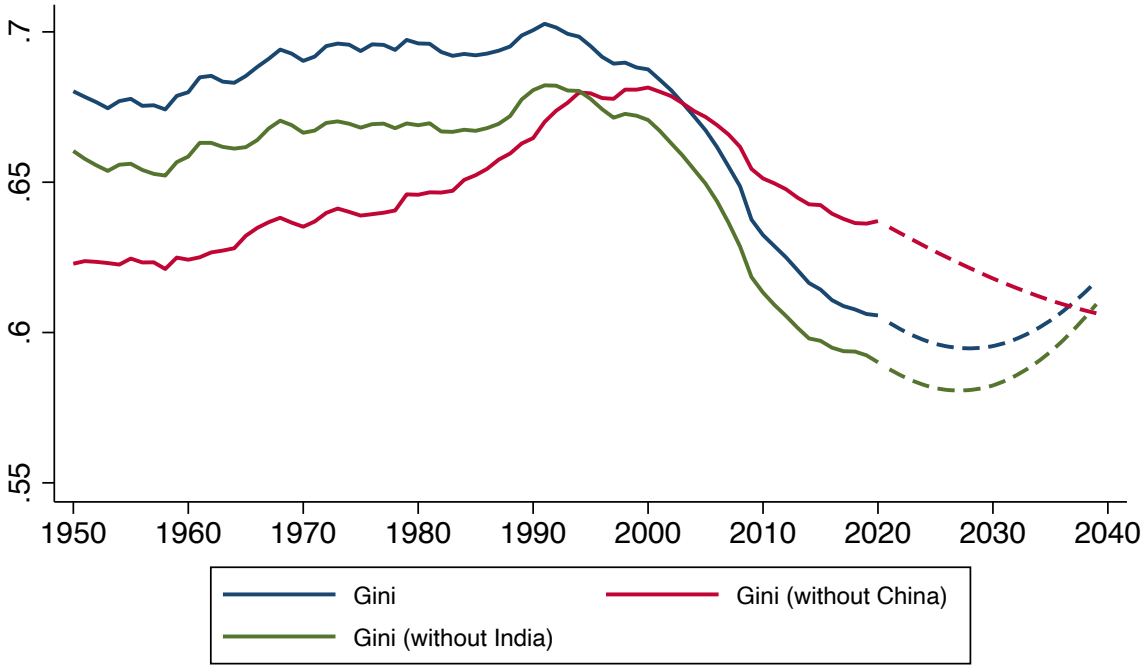

Figure 1: Projections of Global Income Inequality. Author´s calculations based on WIID data. Values after 2021 are projections based on the assumption that each country´s percentile grows at the same rate as in 2000-2020.

In all three scenarios presented in **figure 1**, global inequality decreases, with the decline starting in the 1990s if China is included and only in the 2000s if China is excluded. This decline is also less pronounced when China is not included, highlighting the importance of China for this trend in recent decades. However, it also suggests that other countries have contributed to this decline. The increase in global inequality until the 1990s would also have been much more pronounced when China is excluded, suggesting that this country played a role in offsetting the upward trend in the Gini coefficient in the period 1980-1990.

The scenario that excludes India is presented for comparison because this country is, like China, home to a significant portion of the world's population. Excluding India

affects the level of inequality, contributing negatively to the global aggregate due to its low income, but has little impact on the overall trend. This suggests that changes in Indian incomes have followed a similar path to that of the world, while China has diverged more from the latter due to its high growth rates.

The projections in **figure 1** show a reversal of the downward trend in inequality starting around 2027 in the two scenarios where China is included in the calculation. However, this reversal is not observed when China is excluded. This shows that the accelerated growth of Chinese incomes, which has contributed to a reduction in global inequality, would have the opposite effect if it were to continue in the future. The specific role of China is discussed in more detail in **section 6**.

It is important to recognize that the exact trajectory of future global inequality depends on many unpredictable factors. It can be argued that it is unrealistic to assume that growth rates in China will remain at such high levels for an extended period, and that they have already been much lower in recent years than in the past. However, this does not challenge the purpose of this paper, which is to analyze past trends from the period 2000-2020. The projections presented here are not intended to be predictions of the future and serve only to understand the forces that were present in the period. The main goal of these projections is to show that the process of reducing global inequality had endogenous limits. A further decline in global inequality is not impossible, but it would require growth trends to be significantly different from those of the recent past.

5. The distribution of growth rates

The projection of a rising trend in inequality in the coming years, as presented in the last section, suggests that the reduction in global inequality observed between 2000

and 2020 was not the result of a process in which all countries were converging to the same income level, but that this process was limited to some countries. To better understand this process, it is helpful to look at how growth rates were distributed globally.

Figure 2 shows the Kernel estimation of the probability density function of the annualized growth rates in the period 2000-2020 of all national percentiles, weighted by their population and separated by the corresponding country's income group (as defined by the World Bank). It reveals the main factors behind the downward trend in inequality measures between in the period. The first factor is the relatively low growth rates in high-income countries, with a peak just below 1% per year, which corresponds mainly to the United States but also to some European countries (see **figure 11** in **appendix c** for the regional distribution of growth rates). Another factor is the high growth rates of upper-middle-income countries, with a peak around 8% per year (corresponding to China). High growth rates are also observed in lower-middle-income countries, peaking at around 4% (mainly corresponding to India). Low-income countries show a wide range of growth rates, with peaks ranging from -4% to 6%.

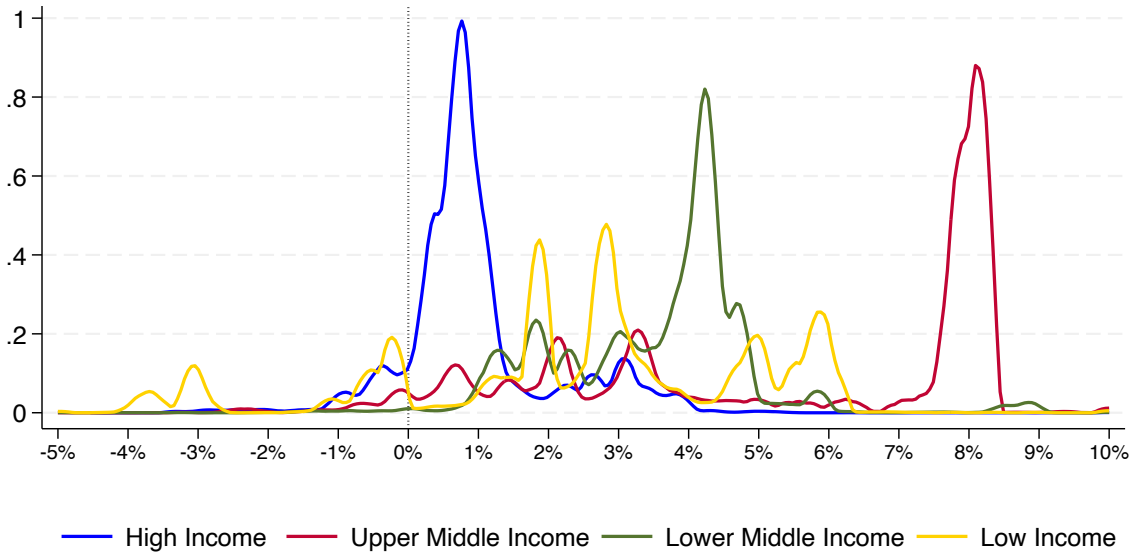

Figure 2: Empirical Probability Density Function of Growth Rates (2000-2020) over Income Groups. Author´s calculations based on WIID data. The annualized growth rates of all

national percentiles are considered and weighted by their population. Estimates are made using the kernel smoothing method.

As a result of this process, upper-middle-income countries and, to a lesser extent, lower-middle-income countries have narrowed their gaps with high-income countries, while low-income countries have not shown any significant improvement, as can be seen in **figures 15** and **16** in **appendix C**.

This pattern differs from what one would typically expect from a true convergence process, which would eventually lead to an egalitarian situation. For all countries to converge, the highest growth rates would have to be found in the lowest income groups. Therefore, low-income countries should have the highest growth rates, followed by lower-middle and upper-middle-income countries, a pattern that is not observed in the period 2000-2020.

The fact that the reduction in inequality has been driven mainly by high growth rates in upper-middle-income countries (especially in China) means that the gap between these countries and high-income countries is narrowing. But it also means that the gap between these fast-growing income countries and low-income countries is widening. While incomes in China were relatively low, their rapid growth led to less global inequality. However, the combined effect of these contradictory phenomena is destined to lead to more global inequality once incomes in China exceed the critical point of the chosen inequality measure, as will be shown in the next section.

6. The role of China

The importance of India and China for understanding trends in interpersonal global inequality is often emphasized in the literature (Alderson & Pandian, 2018; Anand & Segal, 2008; Hickel, 2017; Sala-i-Martin, 2006). The reason is simple: each of these countries is home to a significant share of the world's population. Since the weight of

each individual is the same when calculating interpersonal global inequality, these countries carry more weight than others. Moreover, they are both countries with low incomes that have experienced higher growth rates than the global average in recent decades, contributing to the downward trend in global inequality.

However, developments in China are much more important for understanding recent trends than those in India. As shown in **figure 1**, excluding incomes in China from the calculation of global inequality significantly alters the observed inequality trend, while excluding India only leads to a difference in level, but not in trend. Moreover, the projected return of an upward trend in inequality does not appear without China.

India's annualized growth rates were close to 4% for almost its entire distribution, a rate well above the world average of 1.9%. Thus, India has indeed contributed to the downward trend in inequality. One might think, therefore, that excluding India from the calculations should make the decline in inequality appear less sharp than it was. The reason why this is not the case is that income growth in India followed a similar pattern to the world, meaning that the Indian population experienced growth rates similar to the global percentiles to which they belonged, as shown in **figure 3.**

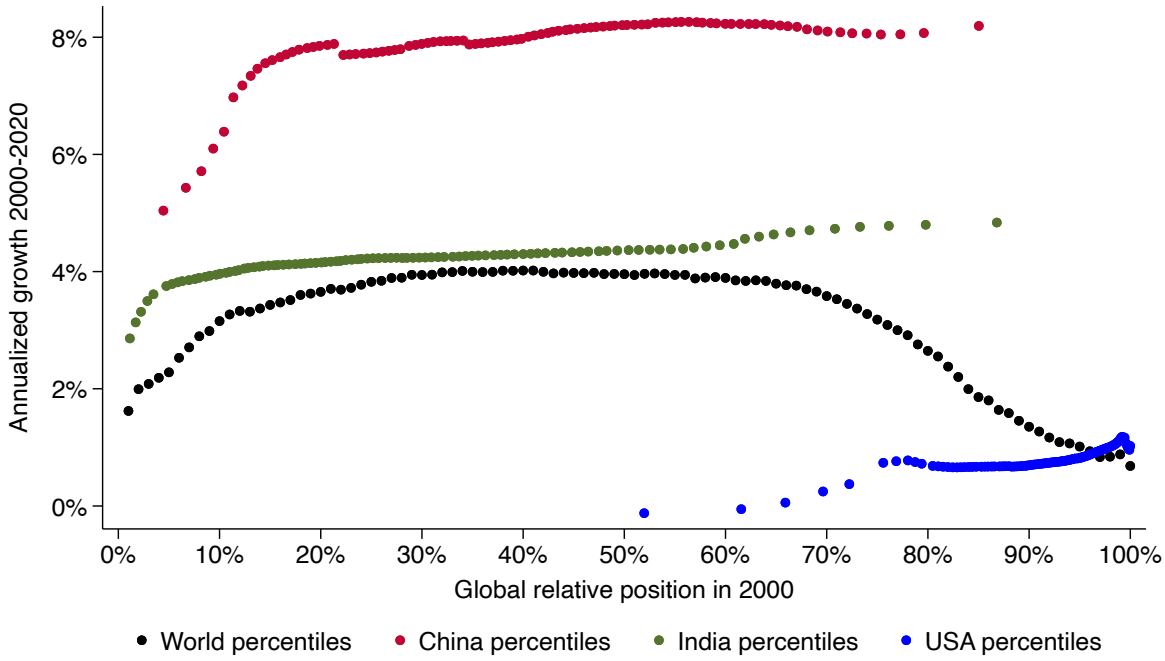

Figure 3: Growth incidence curve (2000-2020) for the world, China, India and United States. Author´s calculations based on WIID data. Each point represents a percentile of the corresponding country or the world.

Figure 3 shows the growth rates of each percentile in China, India, and the United States over the period 2000-2020 and compares them to the growth rates of the global percentiles. All Chinese percentiles experienced much higher growth rates (around 8% per year) than the world percentiles to which they belonged. This led to a significant increase in the position of its incomes in the global hierarchy, while incomes in India did not change their relative position as dramatically, as shown in **figure 12** in **appendix C**.

One reason for the decline in inequality over this period is that the global percentiles in the top 20% had significantly lower growth rates than the middle of the distribution. This is because the top of the global distribution is over-represented by high-income countries such as the United States, which experienced low growth rates during this period. **Figure 3** shows that the high growth rates of China and India could only raise

the growth rate of the global bottom 80%, as these countries were barely represented in the top 20% of the world in 2000.

The fact that high growth rates in China would eventually start to contribute to higher global inequality has long been recognized, even before it became a reality (Anand & Segal, 2008). Recent literature acknowledges that China is close to reaching the point where it will no longer contribute to the reduction of inequality between countries (Gradín, 2021a; Milanovic, 2022). Indeed, the WIID data show that China's average annual income in 2020 (16,315 US$ PPP) is already higher than the global average (16,147 US$ PPP).

To understand the point at which China's growth ceases to contribute to reducing overall global inequality, one should consider all incomes in China, not just its average. **Figures 4** and **5** show the position of each percentile of China, India and the United States in the global distribution in 2000 and 2020. In 2000, only the top 3% of the Chinese distribution had incomes above the global average (corresponding to the 76th global percentile), while the situation was very different in 2020, when 40% of the country's population was above this threshold (which then corresponded to the 71st global percentile). As shown in **appendix A**, the mean income is the critical point of Theil-L (also known as Mean Log Deviation), and therefore the increase in income in the top 40% of the Chinese distribution already contributes to greater global inequality as measured by this index.

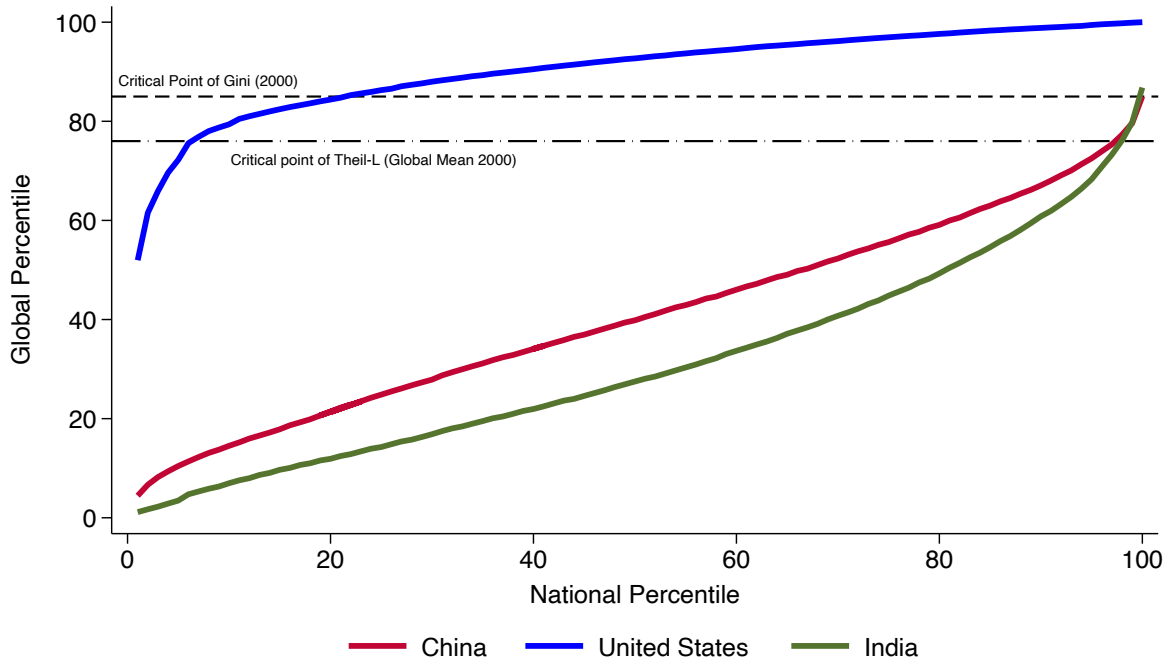

Figure 4: Relative Position of National Percentiles in the Global Distribution in 2000. Author´s calculation based on WIID data.

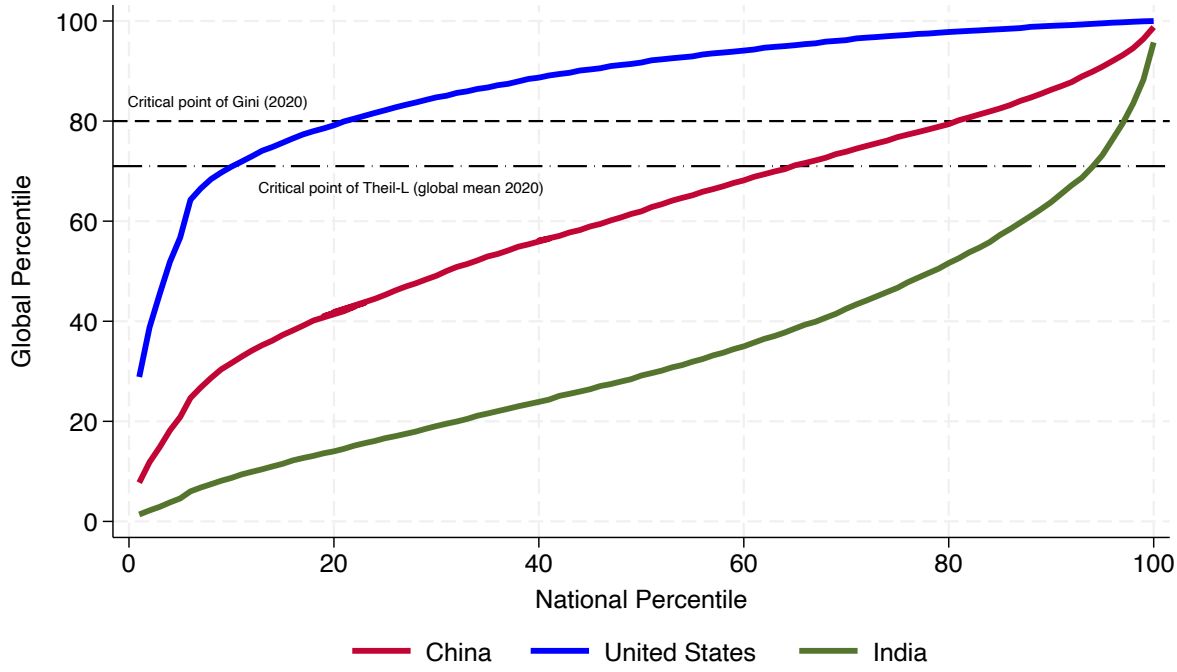

Figure 5: Relative Position of National Percentiles in the Global Distribution in 2020. Author´s calculation based on WIID data.

In 2000, the global Gini was about 0.7, so the critical point of the Gini was 85%, meaning that an increase in the incomes of the world's top 15% had the effect of increasing this measure of inequality (see **appendix A** for the determination of critical points). In 2000, even the richest percentile of China was not in the global top 15%. Therefore, any income growth in China unambiguously reduced global inequality. By 2020, the situation had changed. First, the critical point had been reduced to 80% because the global Gini had been reduced to 0.6 (with a lower Gini, it became “easier” to increase inequality), and second, because the relative position of all Chinese incomes had increased, resulting in the richest 19% in China being above the global critical point of Gini. Income growth among the relatively rich in China began to contribute to more global inequality, while growth in the rest of China's distribution continued to reduce global inequality.

To estimate the compounding effect of China's average growth, it is necessary to make assumptions about the evolution of inequality within the country or, equivalently, how this growth is distributed between Chinese income groups. Assuming that all percentiles would have the same relative growth rate (so that relative inequality within the country remains constant), it is possible to calculate the elasticity of global inequality with respect to China's growth. This elasticity represents the percentage change in a given inequality measure caused by 1% growth in all Chinese percentiles, holding incomes in other countries constant. This value can be taken as an approximation of the direction of the effect on global inequality when growth in the country is higher than the world average.

Figure 6 shows that this elasticity, measured by Theil-L,[3] was negative until 2020, indicating that rapid growth in the country contributed to reducing global inequality. However, this elasticity has already reached 0 in 2020 and is projected to become

positive in the coming years. This means that rapid growth in the country will contribute to higher levels of the Theil-L index. The exact value of this elasticity depends on the inequality measure used, and the contribution of China's growth is still negative for other inequality measures. However, it is projected to become positive in the coming years regardless of the measure used (see **figure 13** in **appendix C**).

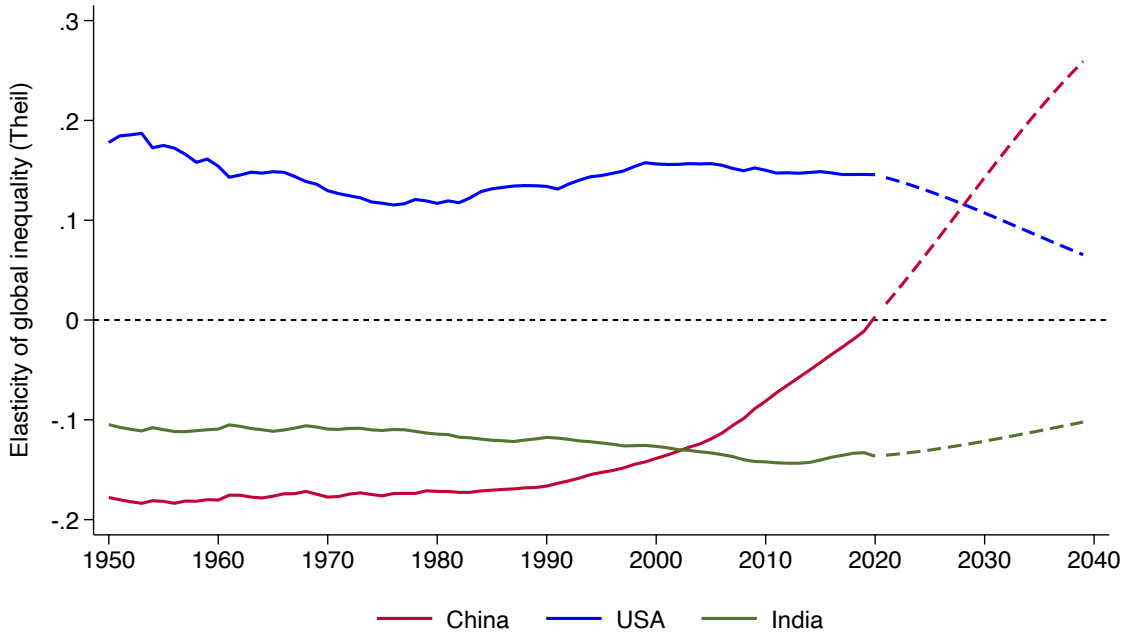

Figure 6: Elasticity of Global Inequality with Respect to Growth. Author´s calculations based on WIID data. The values correspond to the percentage change in Theil-L if all incomes in the respective countries were to increase by 1% in the corresponding years.

Growth in the United States unambiguously leads to higher levels of global inequality, as almost its entire distribution has incomes above the critical points. The opposite is true for India, where almost all income groups are still below the critical points, even after having grown faster than the world average in recent decades.

7. Where growth is most needed

The reduction in global income inequality between 2000 and 2020 was mainly driven by high growth rates in East Asia, especially in China. However, growth in China will

have the opposite effect in the future, as shown in the last sections. It is therefore important to ask in which regions growth could still contribute to reducing inequality.

Figure 7 shows the elasticity of global inequality (measured by Theil-L) with respect to growth in different regions of the world, as defined by the World Bank. It shows the percentage effect of a 1% increase in all incomes in a given region, assuming that incomes in other regions remain constant. Rich regions such as North America or Europe and Central Asia have high elasticities, between 0.15% and 0.2%, meaning that rapid growth in these regions would lead to greater inequality at the global level. Due to its low income and large population, South Asia has a negative elasticity, ranging from -0.1% to -0.2%, meaning that growth in the region could reduce global inequality. It is noteworthy that the elasticity for East Asia and the Pacific has risen continuously since 1950, from very low levels (-0.2%) to values above zero in recent years. This is the result of the process by which incomes in the region have become higher and closer to the world average. Since the elasticity for East Asia and the Pacific is already positive, growth rates in the region that are higher than the world average contribute to higher levels of global inequality.

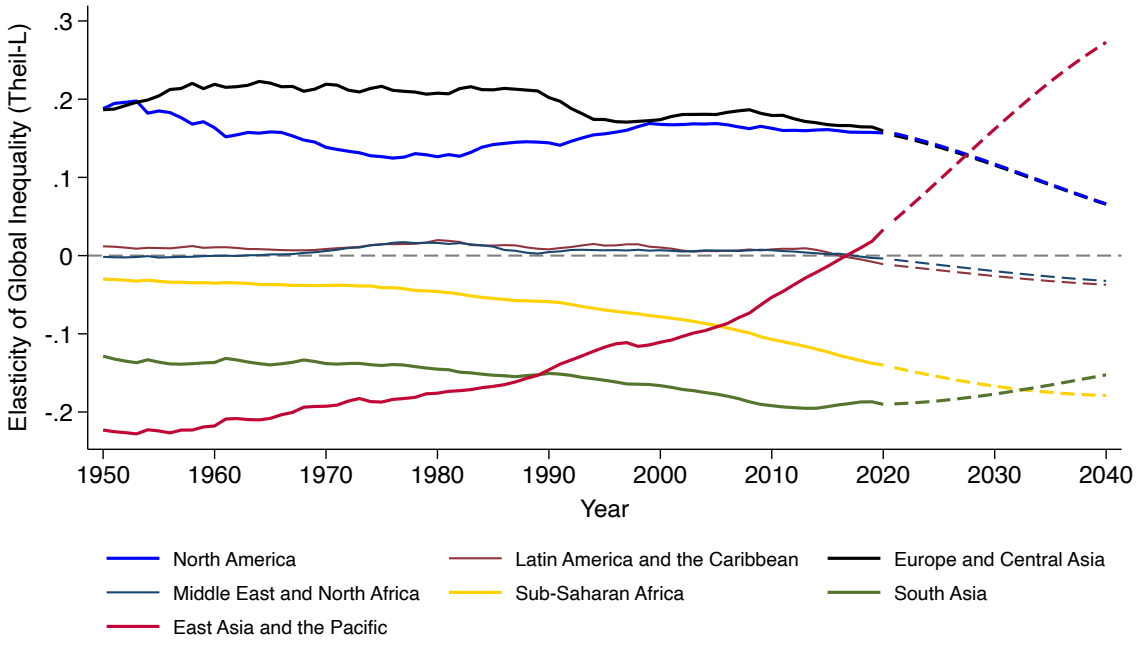

Figure 7: Elasticity of Global Inequality (Theil-L) with Respect of Growth in World Regions. Own calculations using WIID data. The values correspond to the percentage change in Theil-L if all incomes in the respective regions would increase by 1% in the corresponding years.

Figure 7 also shows that South Asia and Sub-Saharan Africa are the regions with the lowest elasticities. This means that high growth rates in these regions would be of great importance for global inequality to continue to decline in the future. In fact, the importance of these two regions has increased steadily since 1950. The picture is very similar when inequality is measured by the Gini index (see **figure 14** in **appendix C**).

Incomes in Latin America and the Caribbean or the Middle East and North Africa are, on average, not very different from the world mean and their populations are not very large, so growth in these regions does not have a strong impact on global inequality. Although these regions have incomes that are much lower than those of high-income countries, their elasticities have even been positive in some years. Inequality in Latin America is very high, which means that the region has incomes in the lowest parts of the global distribution in parallel with those in the top percentiles. Growth without redistribution within the region leads to a contradictory effect, in which

the increase in incomes at the bottom of the distribution has an equalizing effect, while the increase in the incomes of its elite contributes to higher levels of inequality. To help reduce global inequality, growth in these regions must be concentrated at the bottom of their distributions.

These considerations show that growth rates in Sub-Saharan Africa and South Asia above the world average would be needed for the world to experience a further reduction in inequality comparable to the one experienced between 2000 and 2020. However, there is no indication that these regions will replicate the high growth rates experienced in China, so a further reduction in global inequality seems unlikely.

8. Conclusion

This paper analyzes the dynamics of global income inequality over the period 2000-2020. Although it is widely accepted that relative inequality has declined over this period, this has not been the result of a true convergence process. Global dynamics have not put the world on an egalitarian trajectory; rather, the downward trend is projected to be reversed in the coming years if the growth pattern of recent decades does not change.

The reduction in synthetic inequality measures (such as the Gini) was mainly explained by high growth rates in upper-middle-income countries rather than in low-income countries. This means that incomes in the middle of the global distribution narrowed their gap with the top income groups, while widening their gap with those at the bottom. Projecting this process into the future leads to higher levels of inequality from the moment these income groups exceed the critical point of the chosen measure of inequality.

This is the case of incomes in East Asia (and especially China) which have become so high on average that their further increase would lead to higher levels of global inequality. To better understand this effect, this paper takes a closer look at China's contribution to global inequality by identifying which incomes in the country are already so high that their increase would lead to higher inequality at the global level. While until 2000 almost the entire Chinese distribution was below the critical point of Gini and Theil-L, there is now a substantial share of the Chinese population whose incomes are above these levels and whose increase would contribute to higher inequality. The combined effect of an equal increase in all incomes in the country was estimated to be negative until 2020, but is projected to be positive for many inequality measures (including Gini and Theil-L) in the coming years. Moreover, the elasticity of global inequality with respect to growth in East Asia and the Pacific was already positive in 2020, meaning that growth rates in the region that are higher than the global average are already contributing to more inequality.

Therefore, further reductions in inequality would require countries that are still poor relative to the world to grow faster, especially in Sub-Saharan Africa and South Asia, the regions with the lowest elasticities. However, there is no evidence that these regions will reproduce the high growth rates of China, so a continuation of the downward trend in global inequality is unlikely.

In light of these findings, it seems excessive to characterize the trajectory of global inequality since 2000 as an “age of convergence,” as Milanovic (2022) has done. Although the downward trend from 2000 to 2020 is well documented and significant, it covers a period of only two decades, was driven by forces that will cease to exist in the coming years and still left us with considerable levels of global inequality. The global Gini coefficient in 2020 is still estimated to be at least 0.6 (Milanovic, 2022), a level

similar to that of the most unequal countries in the world and also higher than the level of global inequality in 1820, which is estimated to be 0.5. Therefore, a comparison with the so-called “great divergence” is hardly appropriate, as this term refers to a process that lasted over a century and reshaped the entire global economic structure.

There are still many unanswered questions about the future of global inequality. Some will be answered only with the passage of time, as new data covering the next decade become available. It will then be possible to place the so-called “age of convergence” in a longer historical perspective, as well as to understand the impacts of current tensions at the global level in the aftermath of the COVID-19 pandemic and the war in Ukraine.

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NOTES:

[1] While Milanovic (2022) and WIID measure inequality in disposable income (measured after taxes), Chancel and Piketty (2021) measure inequality in pre-tax income (measured before taxes). Since the payment of taxes, especially income taxes, reduces inequality, it is not surprising that Chancel and Piketty (2021) estimate a higher level of inequality than Milanovic (2022).

[2] While Chancel and Piketty (2021) measure inequality between adults (with equal splitting within households), WIID and Milanovic (2022) use household per capita income as a reference. Equal splitting within adults means that the number of children in a household does not affect the reported income, as the total household income is simply divided by the number of adults. In contrast, WIID and Milanovic consider household income per capita, which is the total income of a household divided by the number of persons in it, including children. The household per capita concept may overestimate inequality in living standards because families with lower incomes tend to have more children, so their low income is considered even lower because it is divided by a large number. However, it is not clear how these differences affect the presented trends.

[3] The elasticity depends on the inequality measure used, as each measure has different critical points and is more sensitive to changes that occur in certain parts of the distribution. Theil-L is chosen because its elasticity is much easier to interpret than other measures. Since its critical point is the mean income (as shown in **appendix A**), incomes above it have positive elasticities and incomes below it have negative elasticities. Moreover, the absolute value of the elasticity depends on the distance of the income from the mean. This is not the case, for example, for the Gini coefficient.

While absolute increases in income have a greater effect on the Gini the further away that income is from the critical point, this is not true for a relative increase. For example, if a very low income increases by 1%, the absolute change in its income will be small. In this case, the overall effect on the Gini coefficient cannot be generally stated, as it varies across the distribution. A percentage increase in a very low income tends to have a small effect on the Gini, while incomes between the bottom and the critical point have larger effects. Incomes close to the critical point again have small effects. In contrast, a 1% increase in a lower income will always have a stronger effect than in a higher income under the mean when Theil-L is used.

10. Appendix A: Who is considered rich?

Following our intuitive understanding of what inequality is, it should be clear that the following principle should hold for every inequality measure: If the income of a “rich” person grows, then inequality rises, while if the income of a “poor” person grows, then inequality falls. Indeed, no inequality measure used in the literature contradicts this principle. However, the exact definition of “rich” and “poor” depends on the specific measure used. By analyzing the behavior of different inequality measures regarding the increase of specific incomes, it is possible to identify how they implicitly define “rich” and “poor.” Someone is considered “rich” for a given inequality measure if, in the case their income is increased and other incomes remain constant, the total value of inequality increases, and “poor” if the opposite is true. The level of income necessary to be considered “rich” in a determined distribution using a specific measure will be called the “critical point.” This means that the increase in incomes above this critical point leads to a rise in inequality, assuming other incomes remain constant.

For some measures, this critical point is self-evident. For instance, the share of the top 1% in the total income explicitly defines the top 1% as “rich” and the rest 99% as “poor.” Some measures do not completely divide the incomes between “rich” (whose increase leads to more inequality) and “poor” (whose increase leads to less inequality) but allow a third category of incomes, whose increase does not lead to either an increase or a decrease in the total level of inequality. An excellent example is the measures constructed as ratios between top and bottom shares, such as the Palma ratio (top 10%/bottom 40%) or the top 10%/bottom 50%. In this case, the division between “rich” and “poor” is clear: increases in the income of the top 10% generate higher levels of inequality, while increases in the bottom 50% generate lower levels.

Changes in the middle 40% do not change the inequality measure, assuming that this does not change incomes in the top 10%.

The critical point is not so evident in synthetic measures like the Gini or the Theil-L (also called mean logarithmic deviation). In what follows, the critical point for these two measures is demonstrated. By definition, the marginal contribution of the increase of a "poor" income to inequality is negative, while it is positive for "rich" incomes. Therefore, the critical point can be found by looking at the point at which this marginal contribution is equal to zero.

Let $x = (x_1, \dots, x_n)$ be an income distribution, then the Theil-L can be expressed as:

$$L(x) = \frac{1}{n}\sum_{i=1}^{n} \ln\left(\frac{\mu}{x_i}\right) = \ln\left(\frac{\sum_{i=1}^{n} x_i}{n}\right) - \frac{1}{n}\sum_{i=1}^{n} \ln(x_i)$$

Using this formula and differentiating for a given income x_h for an arbitrary h, one finds the marginal contribution of an increase in this income to the overall Theil-L. After setting it to be equal to zero, one gets:

$$\frac{\partial L(x)}{\partial x_h} = \frac{\partial \ln\left(\frac{\sum_{i=1}^{n} x_i}{n}\right) - \frac{1}{n}\sum_{i=1}^{n} \ln(x_i)}{\partial x_h} = \frac{n \cdot \frac{1}{n}}{\sum_{i=1}^{n} x_i} - \frac{1}{n x_h} = 0$$

$$\Rightarrow x_h = \frac{\sum_{i=1}^{n} x_i}{n} = \mu$$

This means that Theil-L considers incomes above the mean as "rich," while incomes under the mean are considered "poor."

The critical point of the Gini coefficient can be found similarly. Let $x = (x_1, \dots, x_n)$ be an income distribution, then the Gini can be expressed as:

$$Gini(x) = \frac{2}{n^2 \mu}\sum_{i=1}^{n} i x_i - \left(1 + \frac{1}{n}\right)$$

Differentiating for x_h for an arbitrary h and setting it equal to zero:

$$\frac{\partial gini(x)}{\partial x_h} = \frac{\partial \frac{2\sum_{i=1}^{n} ix_i}{n\sum_{i=1}^{n} x_i} - (1 - \frac{1}{n})}{\partial x_h} = \frac{2nh\sum_{i=1}^{n} x_i - (2n\sum_{i=1}^{n} ix_i)}{(n\sum_{i=1}^{n} x_i)^2} = 0$$

$$2nh\sum_{i=1}^{n} x_i = 2n\sum_{i=1}^{n} ix_i$$

$$h = \frac{\sum_{i=1}^{n} ix_i}{\sum_{i=1}^{n} x_i} = \frac{\sum_{i=1}^{n} ix_i}{n\mu} = \frac{n}{2}\left(gini(x) + \left(1 + \frac{1}{n}\right)\right)$$

Therefore, the critical point of Gini is entirely defined by the position of the income recipient in the distribution (h), whereby this exact point depends on the original level of inequality ($gini(x)$). Dividing the last formula by the size of the population, n, one finds the relative position that person h needs to occupy to be in the critical point, expressed as a percentage. For a large population, the term $\frac{1}{n}$ is close to zero and can be disregarded:

$$\Rightarrow \frac{h}{n} = \frac{1}{2}\left(gini(x) + \left(1 + \frac{1}{n}\right)\right) \cong \frac{(gini(x) + 1)}{2}$$

Intuitively, increasing an income above the mean should increase the inequality level since all incomes should be equal to the average to reach complete equality. However, a given individual can be considered “poor” with respect to Gini even if her income is higher than the average, as their critical point is only defined by the relative position of the income in the distribution and not by its level. For example, in 2020, the global mean income was 16.147 US$ PPP, so 71% of the world population had incomes under this value. At the same time, with a Gini coefficient of 0.6, the critical point was at 80%. An increase in the 71st-80th global percentiles would produce a fall in Gini, assuming other incomes to be constant, even though their incomes were above the global mean.

This counter-intuitive property of the Gini has already been analyzed by Cowell and Flachaire (2023). In this regard, Theil-L (MLD) is more intuitive than the Gini because its critical point is precisely the mean.

11. Appendix B: Varying Assumptions

It is natural to ask what would happen if China did not maintain the same growth rate as in recent decades. **Figure 8** shows alternative projections for the global Gini with different growth rates in China. Each scenario assumes that all Chinese percentiles grow at the same rate, while the percentiles of other countries maintain their own trend from 2000 to 2020.

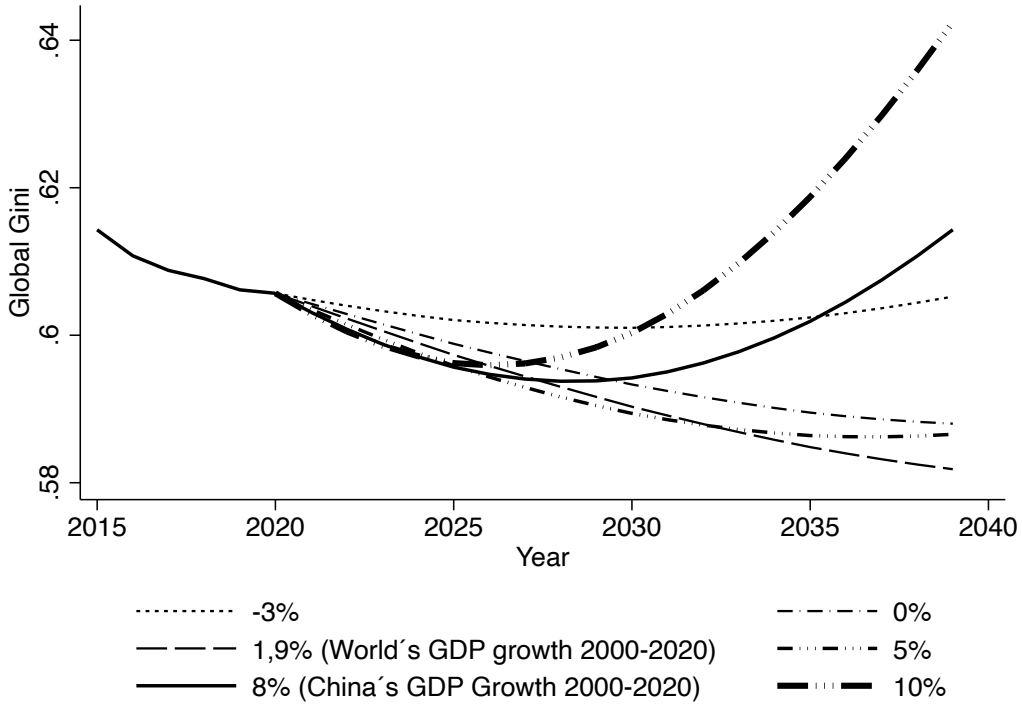

Figure 8: Projections of Global Gini Assuming Different Growth Rates in China. Author´s calculations based on WIID data. Values after 2020 are projections based on the assumption that each country´s percentile will have the same growth rate as it did between 2000 and 2020. In the different scenarios, all China´s percentiles are assumed to grow at the same rate.

The importance of China in the dynamics of global inequality is evident in **figure 8**, as the global Gini responds sensitively to different growth rates in the country. In scenarios where China grows much faster than the world (8% or 10%), the upward trend of the Gini is more pronounced. The Gini would continue its downward trend only in scenarios where Chinese growth is not much different from the world average (0% to 5%), suggesting that the growth path of other countries will continue to have an equalizing effect in the future. However, the magnitude of this force is reduced compared to the potential inequality-increasing force from continued rapid growth in China. In these cases, the downward trend is also limited. In the most “optimistic” scenario, in which China's growth is equal to the world average of 1.9%, the Gini would fall by no more than 2 points in two decades, a much slower pace than the 10 Gini point reduction from 2000 to 2020.

The projections shown in **figure 1** are based on the assumption that the incomes of all percentiles in each country will grow at the same rates as observed over the last 20 years. These specific years were chosen because the paper analyzes developments over this period, during which relative inequality has fallen sharply, but it is also an arbitrary choice. **Figure 9** and **10** show alternative projections for the global Gini, based on the growth trend of different periods. All scenarios show an upward trend in inequality, at least from 2030 onwards, suggesting that the results are not sensitive to the choice of period.

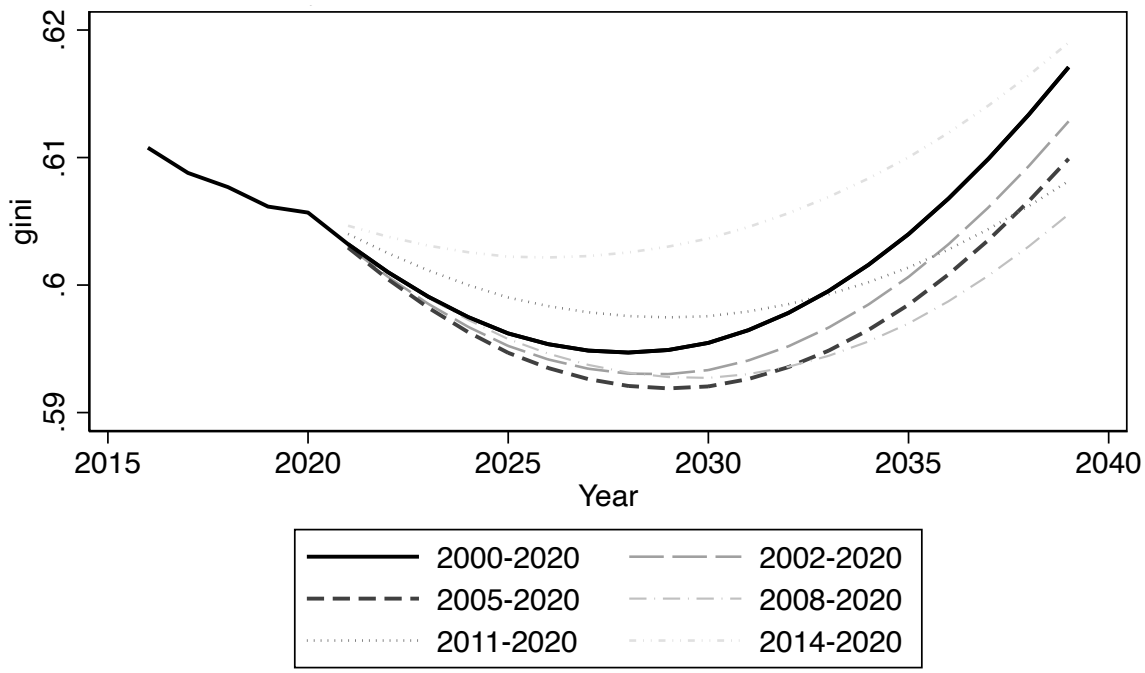

Figure 9: Projections of Global Inequality with Different Reference Periods. Author´s calculations based on WIID data. Values after 2021 are projections based on the assumption that each country´s percentile will have the same growth rate as in the corresponding periods.

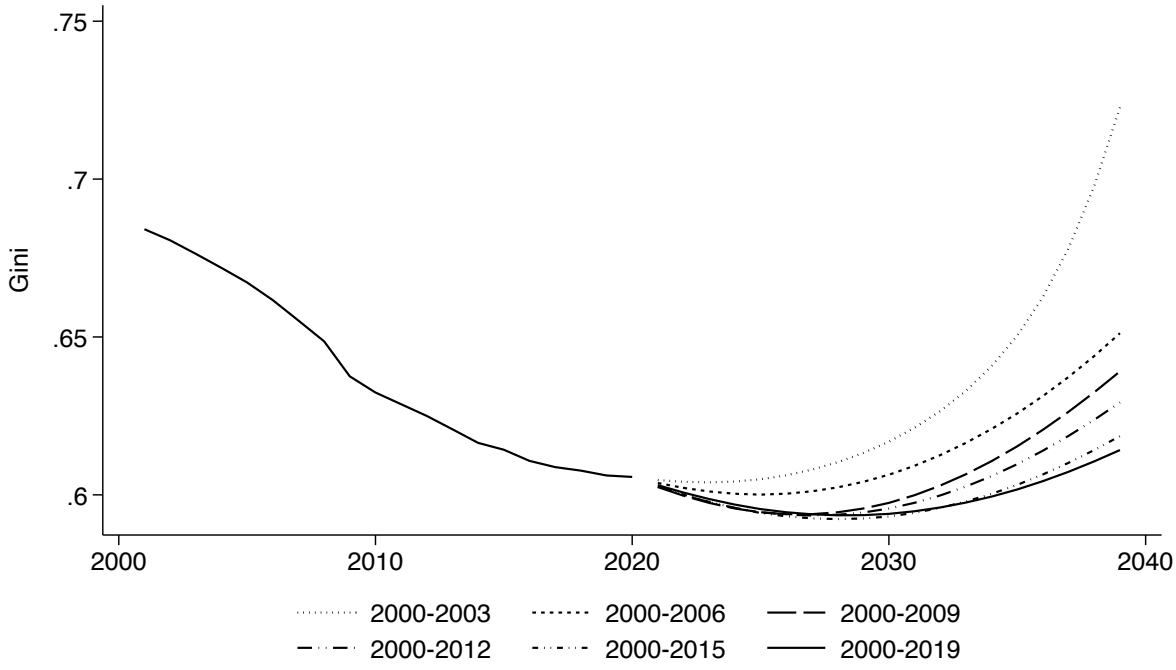

Figure 10: Projections of Global Inequality with Different Reference Periods. Author´s calculations based on WIID data. Values after 2021 are projections based on the assumption that each country´s percentile will have the same growth rate as in the corresponding periods.

12. Appendix C: Additional figures

Figure 11 shows the Kernel density estimates of the growth rates of the national percentiles separated by world region. The pattern observed is very similar to that in **figure 2**, which presents the data separated by income groups. We observe a peak in East Asia and the Pacific at around 8%, corresponding to China, a peak in South Asia at around 4%, corresponding to India, and a peak at just under 1%, corresponding to the United States. Looking at the regional distribution, it can be seen that the low-income countries with the lowest growth rates (of -4% and -3%, respectively) are located in the Middle East and North Africa and in Latin America and the Caribbean.

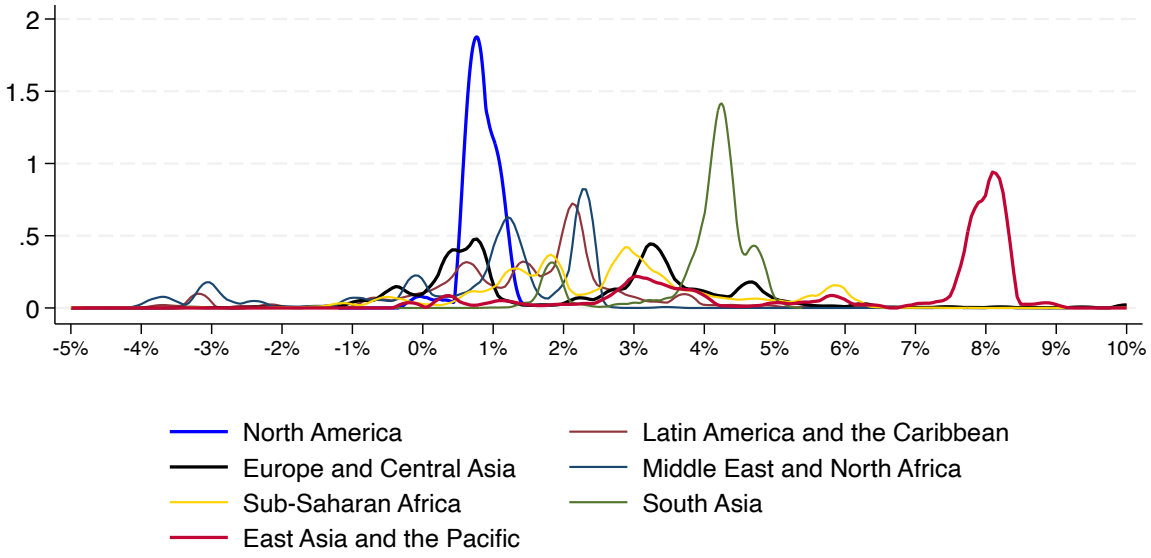

Figure 11: Empirical Probability Density Function of Growth Rates (2000-2020) across World Regions. Author´s calculations based on WIID data. The annualized growth rates of all national percentiles are considered and weighted by their population. Estimates are made using the kernel smoothing method.

Figure 12 shows that the 10th percentile in China increased its position from the 3rd global percentile in 1950 to the 31st global percentile in 2020. Over the same period, income groups in India also increased their position, but at a much slower pace. The

10th Indian percentile was also among the poorest 3% of the world's population in 1950, but has only risen to the 11th global percentile in 2020. The enormous reshuffling of the global income hierarchy has not yet affected the top percentiles in the United States, where incomes are still higher than in China. However, the bottom of the distribution in the country is losing relative position. The 10th percentile of the United States has fallen from the 68th global percentile to the 63rd between 2000 and 2020. The United States represents a process that can also be observed in other high-income countries, as noted by Milanovic (2022).

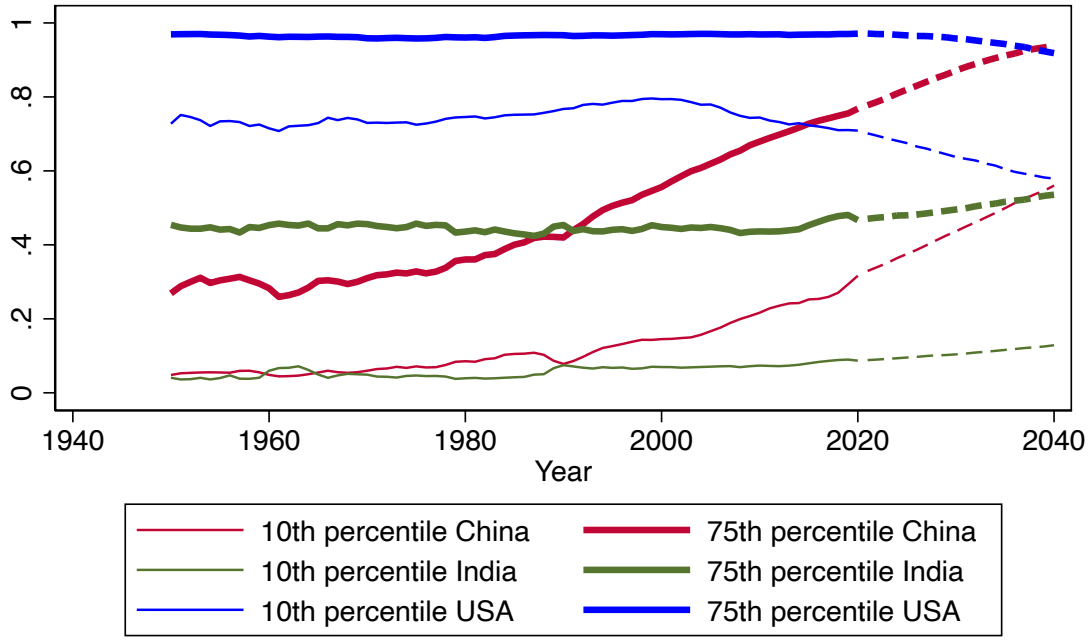

Figure 12: Relative Global Position of Selected Percentiles. Author´s calculations based on WIID data.

Figure 13 shows the elasticity of global inequality with respect to China´s growth using different inequality measures. It compares the Gini coefficient to the generalized entropy index (GE), which is defined as follows. Let $x = (x_1, \dots, x_n)$ be an income distribution, then the generalized entropy index for the parameter α is defined as:

$$GE(\alpha) = \begin{cases} \frac{1}{n\alpha(\alpha-1)} \sum_{i=1}^{n} \left[\left(\frac{x_i}{\mu} \right)^{\alpha} - 1 \right], \alpha \neq 0,1 \\ \frac{1}{n} \sum_{i=1}^{n} \frac{x_i}{\mu} \ln \left(\frac{x_i}{\mu} \right), \alpha = 1 \\ -\frac{1}{n} \sum_{i=1}^{n} \ln \left(\frac{x_i}{\mu} \right), \alpha = 0 \end{cases}$$

$GE(0)$ corresponds to the Theil-L index, also known as the mean logarithmic deviation, and $GE(1)$ corresponds to Theil-T. High values of α give more weight to the top of the distribution, while small values of α give more weight to the bottom. As China has moved away from the bottom of the global distribution, its elasticity, as measured by $GE(-1)$, has already become positive in 2008. However, China is still not much represented in the top of the global distribution, so the elasticity of $GE(2)$ is very low (-0.2). $GE(0)$ and $GE(1)$ occupy positions between these two extremes. It is worth noting that $GE(-1)$ and $GE(2)$ are not widely used in the literature. The elasticity is projected to be positive in the coming years regardless of which inequality measure is chosen.

This is a good example of how measuring elasticity using the Gini coefficient can produce counterintuitive results. China's elasticity, as measured by the Gini, declined from 1990 to 2010, at a time when the country was growing much faster than the world. This contradicts the expectation that a country's contribution to reducing inequality should be greater when it is poorer.

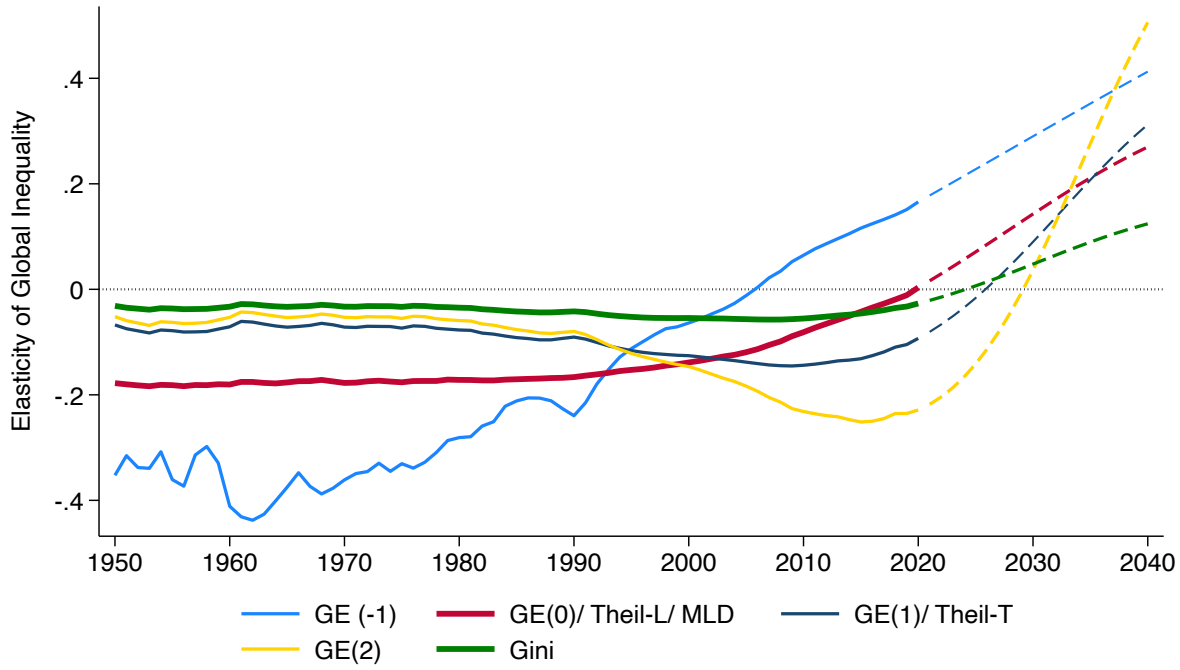

Figure 13: Elasticity of Global Inequality with Respect of China´s Growth. Author´s calculations using WIID data. The values correspond to the percentage change in the respective inequality measures if all incomes in China were to increase by 1% in the corresponding years.

Figure 14 shows the elasticity of different regions as measured by the Gini coefficient, as compared to **figure 7**, which shows the elasticities as measured by Theil-L. The figures convey very similar messages, although the contribution of growth in East Asia and the Pacific is still negative for Gini, while it is already above zero for Theil-L. In addition, growth in Sub-Saharan Africa appears to be somewhat less important in reducing global inequality when using Gini than when using Theil-L.

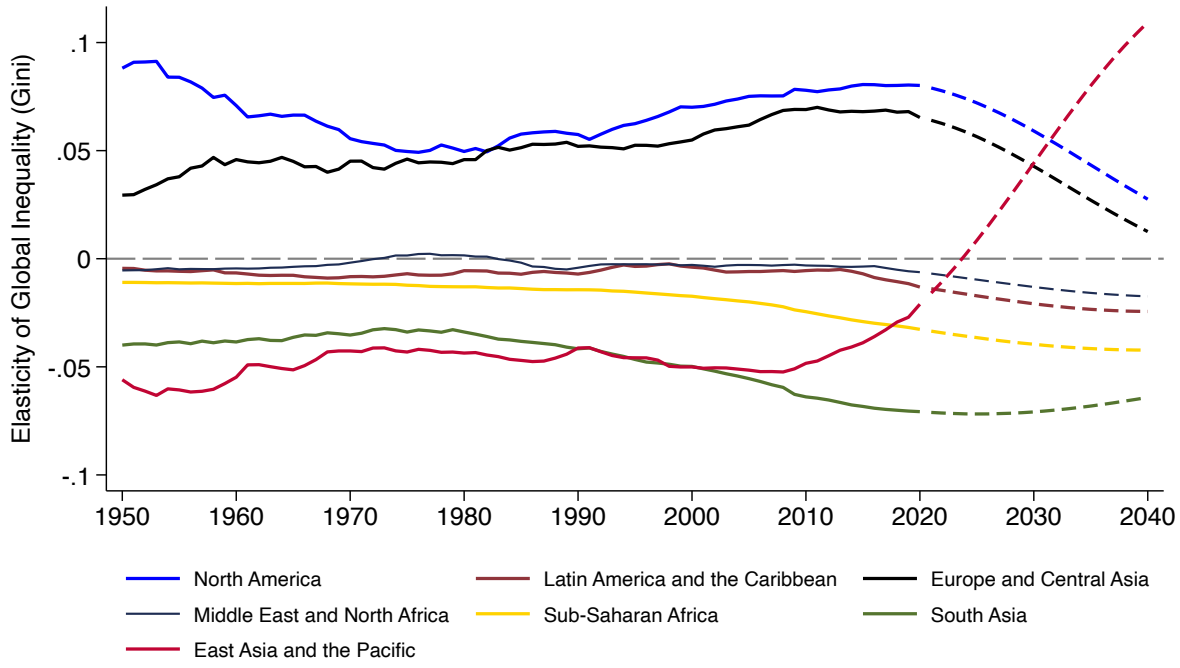

Figure 14: Elasticity of Global Inequality (Gini) with Respect of Growth in World Regions. Author´s calculations based on WIID data. The values correspond to the percentage change in the Gini coefficient if all incomes in the respective regions were to increase by 1% in the corresponding years.

Figures 15 and **16** show that upper-middle-income countries have narrowed their gap with high-income countries, driven mainly by rapid growth in East Asia and the Pacific. GDP per capita in lower-middle-income countries has also converged with high-income countries, albeit at a slower pace, mainly due to growth in South Asia. Low-income countries as well as Sub-Saharan Africa do not appear to be catching up.

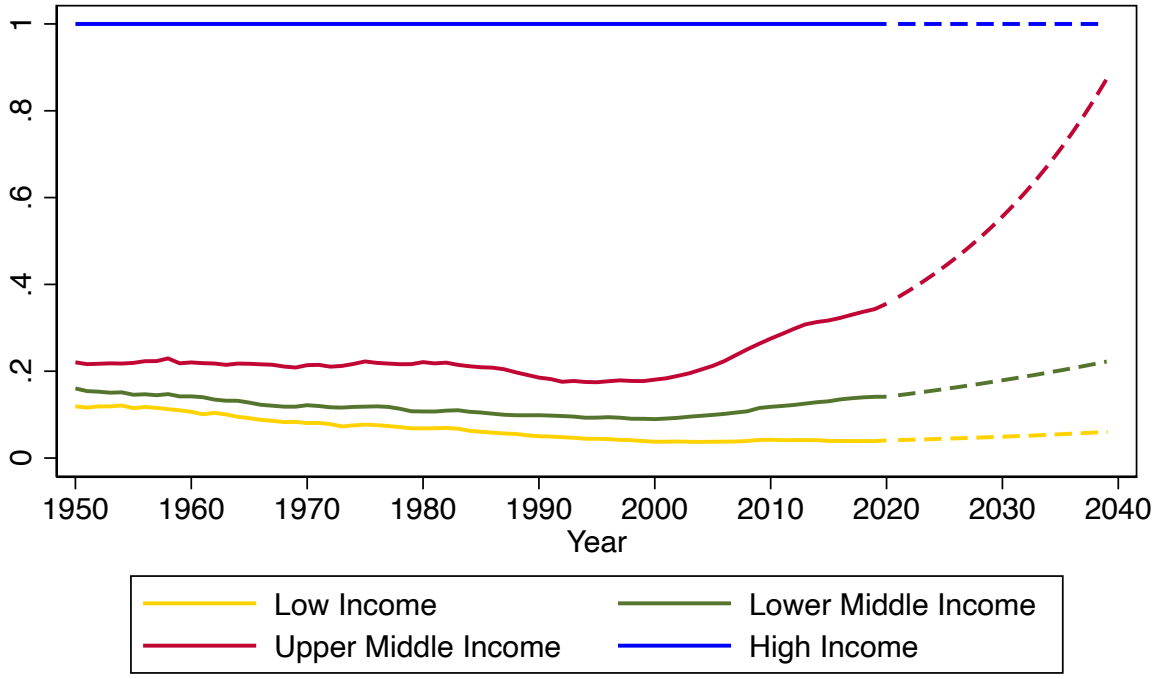

Figure 15: GDP per capita of different income groups as a percentage of GDP per capita of high-income countries. Author´s calculations based on WIID data.

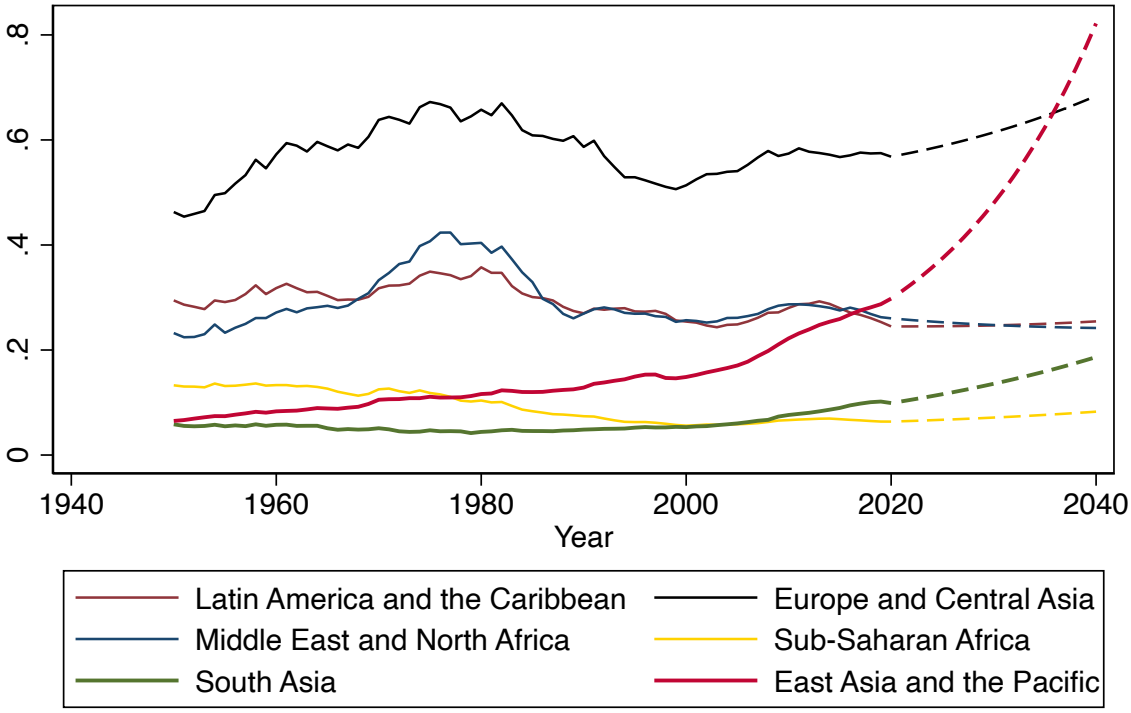

Figure 16: GDP per capita of different world regions as a percentage of North America's GDP per capita. Author´s calculations based on WIID data.

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