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The Rising Tide of Absolute Global Income Inequality During 1850–2010: Is It Driven by Inequality Within or Between Countries?

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Abstract This paper is the first to decompose absolute global income inequality into its within-country and between-country component. The results show a continuous increase of absolute global inequality during 1850–2010, which can be separated into three distinct phases: (1) between 1850 and 1929, within-country inequality explained up to 76 % of absolute global inequality, yet the growth rates of within- and between-country inequality were very similar; (2) a sharp increase in the importance of between-country inequality occurred during the 1929–1950 period, which was followed by a period during which the within- and between-country components were approximately equally relevant; and (3) after 1985, the growth in absolute global inequality was driven primarily by the accelerated growth of within-country income differences. Currently, within-country inequality explains 70 % of absolute global market inequality, a figure close to that of the year 1850. Additional findings include that absolute income convergence between countries took place after 2005, that it is possible to reduce absolute inequality and to grow simultaneously, and that recently within-country net inequality has grown faster than market inequality. The main findings are preserved when different absolute decomposable inequality measures, sample sizes, and purchasing power parity exchange rates are used.

Keywords Absolute inequality · Personal income distribution · Global inequality · Within-country inequality · Between-country inequality

JEL Classification D31 · D63 · O15

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1 Introduction

Existing research suggests that income inequality can have adverse effects on social justice and economic growth (Persson and Tabellini 1994; Sen 2000; Pickett and Wilkinson 2010; Herzer and Vollmer 2012, 2013; Halter et al. 2014; Onaran and Galanis 2014; Kumhof et al. 2015), and recently the popular perception that globalization is not leading to "a rising tide that lifts all boats" is growing. Accordingly, politicians, academics and the media frequently state that inequality is among the biggest challenges of our time and that the topic demands much more attention (Obama 2011; Krueger 2012; Minton Beddoes 2012; Shiller 2014; Stiglitz 2012; Lagarde 2013; Piketty 2015).

Empirical studies of the global evolution of income inequality concentrate almost exclusively on relative inequality (e.g., Bourguignon and Morrisson 2002; Milanovic 2005, 2012b; Sala-i-Martin 2006; Piketty 2014; van Zanden et al. 2014). However, inequality can also be measured in absolute terms. Contrary to relative inequality, absolute inequality depends on changes in the absolute income differences between citizens or countries and can widen even if proportionate income differences remain constant. If, for example, the income of the whole population increases by the same percentage, the relative income differences remain constant, but the gap in absolute monetary terms increases.[1]

Several authors argue that the focus on relative inequality is unduly restrictive (Kolm 1976; Ravallion 2004; Svedberg 2004; Atkinson and Brandolini 2010; Bosmans et al. 2014; Anand and Segal 2014). Surveys indicate that people often refer to absolute income differences when they talk about inequality (Ballano and Ruiz-Castillo 1993; Harrison and Seidl 1994; Amiel and Cowell 1999), and there is "little obvious reason for assuming that it is the relative inequalities in incomes (rather than absolute inequalities) that matter instrumentally to valued social outcomes" (Ravallion 2004, p. 19). Indeed, differences in perceptions partly explain conflicting views about the distributional outcomes of globalization. Depending on whether people refer to absolute or relative inequality, they claim that globalization leads to less or more inequality (Ravallion 2004; Atkinson and Brandolini 2010). Moreover, previous studies suggest that absolute inequality (1) increases likelihood that crimes are committed, given that the expected value of delinquency increases (Fleisher 1966; Ehrlich 1973), (2) augments the potential lobbying power of elites and thus likely influences democratic decision-making processes (see Esteban and Ray 2006; Acemoglu and Robinson 2008; Gilens and Page 2014), and (3) affects the demand for assets and thus influences their prices (Froud et al. 2001; Goda and Lysandrou 2014).[2]

When inequality is measured across countries, three concepts are typically used: within-country, between-country and global inequality. The first concept refers to inequality within the border of a country, the second concept refers to differences in GDP per capita between countries, and the third concept refers to worldwide inequality between individuals irrespective of their country of residence. The few papers that present data about absolute income changes unanimously report a sharp increase in between-country and global inequality. Pritchett (1997, p. 11) reports that the average difference between the GDP per capita of the seven richest countries and that of the least developed countries

[1] Suppose that a country has two citizens who have incomes of $1000 (A) and $100,000 (B). If the income of both grows by 10 %, the new income of citizen A is $1100, and that of citizen B is $110,000. The proportional income difference between the two remains constant (B has still 100 times more income than A), but the absolute gap between the two incomes increased by $9900.

[2] Note that also from a technical perspective, absolute indices are as good inequality measures as relative indices (see Kolm 1976).

increased from approximately 1000 to approximately 11,500 constant international dollars between 1870 and 1990, and Bosmans et al. (2014) estimate that this trend continued between 1990 and 2005. With regard to global inequality, Dikhanov and Ward (2002, Table 2) show that absolute income difference between an average person in the bottom and top deciles grew from approximately 19,000 to approximately 29,000 between 1970 and 1999. These findings are consistent with both Atkinson and Brandolini (2010) and Anand and Segal's (2014) estimations, which indicate that absolute global inequality increased continuously between 1820 and 2005. Finally, Svedberg (2004, p. 19) argues that "that absolute income gaps will continue to grow for at least one or two generations".

However, in contrast to studies that measure relative income differences, to date, no absolute inequality study has measured within-country inequality trends on a global scale. It is therefore unclear whether the reported increase in absolute global inequality has been driven primarily by growing inequalities within or between countries. To fill this gap in the literature, the major aim of this paper is to decompose absolute global inequality into its within-country and between-country components for the period from 1850 to 2010. In addition, this paper is the first absolute inequality study that compares changes in net and market inequality[3] and considers different purchasing power parity (PPP) exchange rates. As noted by Anand and Segal (2014, p. 1), the decomposition of global inequality is important because it "is at least a necessary precursor to any causal explanation because one would expect different mechanisms to explain the two components". Moreover, such a decomposition has important policy implications; if one intends to reduce global inequality, migration would be a very efficient policy if inequality between countries primarily explains global income differences (Milanovic 2012a, 2013, 2015), whereas redistribution between rich and poor citizens would be the best policy option if inequality is driven primarily by income differences within countries.

To decompose absolute global inequality, we use the variance. Our estimates confirm the results of previous studies that report a continuous rise in absolute global income inequality since 1820, with an accelerated growth rate after 1950 (Atkinson and Brandolini 2010; Anand and Segal 2014). More importantly, we discover that the historical evolution of absolute global inequality can be divided into three distinct phases: (i) between 1850 and 1929, the growth rates of within- and between-country inequality were very similar, but within-country inequality explained, on average, approximately 70 % of absolute global inequality; (ii) a sharp rise in the importance of inequality between countries occurred after the Great Depression and was followed by a period (1950–1985) during which within- and between-country inequality were roughly equally important; and (iii) after 1985, the accelerated growth of within-country income differences was the main driver of the rise in absolute global inequality.

Additionally, we find that, for the first time since 1850, absolute income convergence between countries took place after 2005. The combination of declining growth rates of between-country inequality and sharply rising within-country inequality means that, as in the 19th century, current income differences within countries are far more important for explaining absolute global inequality than are variations in the GDP per capita of countries. In 2010, the within-country component explained 70 % of absolute global market income inequality and approximately 60 % of absolute global net income inequality. Finally, the estimates suggest that it is possible to reduce absolute inequality and grow simultaneously when countries have high initial levels of relative inequality, and that within-country net

[3] Market income is pre-tax and pre-transfer income, whereas net income considers tax payments and transfer receipts.

inequality grew faster than market inequality between 1995 and 2010. We also demonstrate that the main findings are robust for the complete class of absolute decomposable inequality measures when the weight that is given to transfers at the upper or lower tail of the distribution lies in the range $-0.09 \leq \theta \leq 0.04$.

The layout of this paper is as follows. Section 2 details the methodology and the data used. Section 3 presents and discusses the estimation results. Section 4 concludes.

2 Methodology and Data

An inequality index $I_A : R \rightarrow R^1$ is an absolute index if it remains constant when all incomes change by the same absolute amount (Chakravarty 2001; Chakravarty and Tyagarupananda 2009). That is, for all $n \in N$ and for all $x \in R^n$:

$$I_A^n = I_A^n(x + c1^n), \tag{1}$$

where $c > 0$ is any scalar, and 1 is a vector of ones of dimension n.

To isolate the contributions of within-country and between-country inequality, our absolute inequality index must be subgroup decomposable (SUD), in addition to the standard properties of inequality indices (namely, symmetry (SYM), the population principle (POP) and normalization (NOM)).[4] According to Chakravarty (2001) and Chakravarty and Tyagarupananda (2009), an absolute inequality index (I_A) that fulfills the SUD property can be expressed as follows:

$$I_A^n(x) = I^n(\lambda_1 1^{n_1}, \ldots, \lambda_k 1^{n_k}) + \sum_{i=1}^{k} \omega(\underline{n}, \underline{\lambda}) I^{n_i}\left(x^i\right), \tag{2}$$

where $k \geq 2$ denotes the number of subgroups used, n_i is the population size associated with the distribution x_i, $n = \sum_{i=1}^{k} n_i$, $\lambda_i =$ mean of distribution x_i, $\underline{\lambda} = \left(\lambda^1, \lambda^2 \ldots \lambda^k\right), \underline{n} = \left(n^1, n^2 \ldots n^k\right)$, and $\omega_i(\underline{n}, \underline{\lambda})$ is the positive weight attached to inequality in x_i, which is assumed to depend on $\underline{n}$ and $\underline{\lambda}$. The first part of (2) represents between-group inequality, and the second part represents within-group inequality.

At the same time, Chakravarty and Tyagarupananda (2009) and Bosmans and Cowell (2010) demonstrate that an absolute inequality index satisfies SYM, POP, SUD, NOM and CON[5] if and only if it is a positive multiple of one of the following two indices:

$$\begin{aligned} I_\theta^n(x) &= \frac{1}{n}\sum_{i=1}^{n}\left[e^{\theta(x_i-\lambda)} - 1\right], \theta \neq 0 \\ I_V^n(x) &= \frac{1}{n}\sum_{i=1}^{n} x_i^2 - \lambda^2, \theta = 0 \end{aligned}, \tag{3}$$

where the weight attached to the inequality of subgroup i in the decomposition of I_θ is:

[4] SYM means that the index is invariant with respect to the reordering of incomes. POP means that the value of the index does not depend on the population size. NOM means that the index is non-negative and that it has the value of zero only under the condition that all incomes are equal.

[5] CON refers to continuity: for all $n \in N, I^n$ is a continuous function. Bosmans and Cowell (2010) show that I_θ^n and I_V^n are the *only* class of absolute decomposable inequality measures, even when the CON property is absent.

$$\omega_i(\underline{n}, \underline{\lambda}) = \frac{n_i}{n}\frac{e^{\theta\lambda_i}}{e^{\theta\lambda}}. \tag{4}$$

For any $\theta<0$, I_θ favors transfers at the lower tail of the distribution, while for any $\theta > 0$, transfers to the richest part of the population are favored. On the contrary, when $\theta = 0$, the transfer neutral property is fulfilled (POT). In this case, the index takes the form of the variance (I_V^n) in (3), and the weight term in (4) is $\omega_i(\underline{n}, \underline{\lambda}) = {}^{n_i}/_{n}$. Chakravarty (2001) calls this specific weight form the Population Share Weighted Decomposability (PSD) property.

Studies that estimate historic changes in global income inequality typically concentrate their analysis on inequality measures that are transfer neutral because these measures are easy to interpret (e.g., Bourguignon and Morrisson 2002; Milanovic 2005; Sala-i-Martin 2006; van Zanden et al. 2014). As previously demonstrated, the variance (or any positive multiple of it) is the only absolute inequality measure that satisfies PSD and POT.[6] Together, these two properties ensure that the importance of each component does not depend on the rest of the decomposition and that any transfer from a richer to a poorer person (and vice versa) in any country is equally valuable, regardless of a person's income position. Therefore, we will use the variance for our analysis. To ensure that the main results of this paper are robust for the entire class of inequality measures presented in (3), we perform robustness checks by changing the θ parameters (see Sect. 3.3).

The specific form of our index to decompose worldwide inequalities between individuals into that due to absolute income disparities within countries and that due to absolute income disparities between countries is as follows:

$$I_V^n(x) = \frac{1}{n}\left(\sum_{i=1}^{k} n_i(GDPpc_i - GDPpcw)^2\right) + \sum_{i=1}^{k}\frac{n_i}{n}\left(\frac{1}{20}\sum_{p=1}^{20}\left(\left(x_{ip} * GDP_i\right) - GDPpc_i\right)^2\right), \tag{5}$$

where k is the number of countries included in the measure, n_i denotes the population size of the *i-th* country, $n = \sum_{i=1}^{k} n_i$ is the global population, GDP_{pci} is the mean per capita income of the *i-th* country, GDP_{pcw} is the population-weighted mean income of the world, x_{ip} is the income share of the *p-th* population ventile[7] of the *i-th* country, and GDP_i is the total income of the *i-th* country. The first part of this index shows inequality between countries, and the second part shows inequality within countries.

To estimate the first part of (5), we compile a dataset that contains constant GDP per capita in PPP[8] and population size for each country. Due to data availability, this dataset is based on two series: a historical series for the period from 1850 to 1980 and a recent series from 1980 to 2010. The data are retrieved from the Maddison Project (2013) and the World Development Indicators (WDI). To ensure relatively consistent estimates between the

[6] The variance has the additional advantages that it fulfills the Shorrocks and Theil criterion, that it is easy to compute, and that it can be interpreted as a measure of deprivation (Chakravarty 2001).

[7] Ventile shares are frequently used in the literature; they allow for relatively exact inequality estimates when income differences within income share groups are not taken into account (see e.g., Davies and Shorrocks 1989; Milanovic 2012b). Each population ventile represent 5 % of the population. The ordering and grouping of the population takes place according to their income. (The lowest ventile represents the poorest 5 % of the population, etc.). Please note that our results are robust when decile or quintile shares are used instead of ventile shares.

[8] It is a common procedure in global inequality studies to use GDP per capita in PPP and not in market exchange rates [see Anand and Segal (2008) for a discussion of the reasons].

historical and recent data series, most of our analysis in the next section is based on the Maddison Project's GDP per capita estimates in 1990 PPP. Additional reasons to concentrate primarily on these data are that the 2005 PPP estimates have been heavily criticized (see e.g., Deaton and Heston 2010; Breton and García 2015) and that the new 2011 PPP estimates are similar to the pre-2005 estimates (see Deaton and Aten 2014). To examine the robustness of our results when different PPP exchange rates are used, we also present estimates using 2005 and 2011 PPP exchange rates (see Sect. 3.3).

To calculate the within-country component, income shares for each country and year under study are required [see part two of (5)]. While Gini coefficients are readily available for many countries, the Lorenz curves associated with these data are unfortunately not. To solve this issue, we follow van Zanden et al. (2014) and suppose a lognormal distribution.[9] Under this assumption, the relationship between the Gini coefficient and the Lorenz curve can be expressed as follows (Aitchison and Brown 1966):

$$L(p) = \Phi\left(\Phi^{-1}(p) - \sigma_i\right), \tag{6}$$

where Φ is the lognormal cumulative distribution function of income, p is the percentile of the distribution, and σ_i is the standard deviation, which is associated with the Gini coefficient of each country and year under study as is shown by the following expression:

$$\sigma_i = \sqrt{2}\Phi^{-1}\left(\frac{1+G_i}{2}\right), \tag{7}$$

where G_i is the Gini coefficient of the *i-th* country. Hence, changes in the Gini coefficient affect the estimation of the standard deviation and, consequently, of the Lorenz curve and the income share of the p-th percent of the population. It is important to note that a higher Gini coefficient leads to a higher standard deviation, which implies that the population at the bottom (top) has a lower (higher) income share.[10]

The Gini coefficients for the historical series that allow us to implement this method were kindly provided by Bas van Leeuwen and are based on the paper by van Zanden et al. (2014). At the time of writing, this dataset provided not only the broadest available but also the most consistent estimates of historical Gini coefficients. Van Zanden et al. (2014) report the market income Gini coefficients in 20-year intervals for the period between 1850 and 1950 and in 5-year intervals afterwards. Given that data are not available for all countries in 5-year intervals, we use 10-year intervals between 1950 and 1980 to maximize the number of countries with data for all years under consideration.

The Gini coefficients for the recent series were retrieved from Solt's (2013) Standardized World Income Inequality Database (SWIID). This database is widely used and has the advantage that it "provides comparable Gini indices of gross and net income inequality for 153 countries for as many years as possible [and therefore] is better suited to broad cross-national research on income inequality than previously available sources" (Solt 2009, p. 231). Given that the SWIID does not provide data for every country year, we

[9] "The literature suggests that when the whole distribution is covered, the log-normal is to be preferred [and] on average the difference between an assumed log-normal and a Pareto distribution [is] limited" [van Zanden et al. 2014, pp. 4–5 of their data appendix; see also Soltow (1998) and Lopez and Servén (2006)].

[10] To verify that this method produces estimates that fit the existing income share data well, we compared our estimates with readily available income share data from the WDI database (see the "Appendix").

Table 1 Data sources and number of countries with available data

Year	Population		GDP per capita (1990 PPP)		Gini		All three variables
	No. of countries	Source	No. of countries	Source	No. of countries	Source	No. of countries
1850	67	Maddison	44	Maddison	47	van Zanden et al.	32
1870	90	Maddison	72	Maddison	67	van Zanden	46
1890	52	Maddison	50	Maddison	76	van Zanden	36
1910	90	Maddison	72	Maddison	89	van Zanden	45
1929	67	Maddison	59	Maddison	91	van Zanden	41
1950	165	Maddison	152	Maddison	91	van Zanden	81
1960	165	Maddison	152	Maddison	97	van Zanden	86
1970	165	Maddison	166	Maddison	103	van Zanden	97
1980	165/210	Maddison/WDI	152	Maddison	87/89	van Zanden et al./ SWIID	79/75
1985	210	WDI	152	Maddison	99	SWIID	76
1990	212	WDI	169	Maddison	124	SWIID	113
1995	212	WDI	168	Maddison	142	SWIID	128
2000	214	WDI	168	Maddison	150	SWIID	132
2005	214	WDI	168	Maddison	154	SWIID	140
2010	214	WDI	125	Maddison	105	SWIID	85

This table shows the number of countries for which population, GDP per capita data in 1990 PPP, and Gini coefficients are available. The last column shows the number of countries for which all three variables are available

use a 5-year benchmark methodology that is similar to Milanovic's (2005; 2012b) approach.[11]

Table 1 summarizes the data availability and the data sources. The available data are very unbalanced: the minimum number of countries whose population, GDP per capita and Gini data are available is 32 (year 1850), and the maximum number is 140 (year 2005). If one used the whole sample for the estimates, the results could be influenced by the inclusion/exclusion of different countries in different years. We therefore base our estimates on a core group of 29 countries[12] for which data are available for all variables and years.[13] This core group of countries is very representative—on average, it represents 76 % of global population and 88 % of global GDP—but is hampered by the non-inclusion of African countries. Nevertheless, our overall results are robust to the use of all available data (see Sect. 3.3).

All three inequality concepts that are discussed in Sects. 3.1 and 3.2—global, within-country and between-country income inequality—are normalized by the value of the global

[11] When Solt's database reports a Gini coefficient for a country in a benchmark year, this coefficient is taken for that year. Otherwise, we use either the Gini coefficient that was reported one year before or after the respective benchmark year, or when data for both years are available, the mean of the these two Gini coefficients is used.

[12] Australia, Belgium, Brazil, Canada, Chile, China, Colombia, Czechoslovakia, Denmark, France, Germany, India, Indonesia, Ireland, Italy, Japan, Mexico, the Netherlands, Norway, Peru, the Philippines, Poland, Portugal, Russia, Spain, Sweden, Switzerland, Thailand, the United Kingdom, and the United States.

[13] To ensure a maximum amount of core countries, we imputed some data (see Table 6 in the "Appendix").

variance of 1990 in 1990 PPP (i.e., approximately 112 million) so that the sum of the within- and between-country indices equals the global inequality index number. It is important to note that the 1980 values of the indices that are calculated with historical or recent data series are nearly identical (see Fig. 1 in Sect. 3.1). The within-country and global inequality values are slightly higher when the recent data series is used (by 3.2 and 1.4 %, respectively), but the two data series practically lead to the same between-country inequality value.[14] This similarity not only allows us to analyze the whole period without the need to consider a break but also suggests that our results are robust to using market Gini coefficients from different sources.

3 The Historical Development of Absolute Global Inequality

3.1 Absolute Market Income Inequality

The solid lines in Fig. 1 show that absolute global market income inequality has grown continuously since the industrial revolution, with a particularly stark increase after 1950. In the first one hundred years of our sample, the average annual growth rate of absolute global inequality was 3.0 %, whereas it was 4.3 % between 1950 and 2010. This result is not surprising because it confirms Atkinson and Brandolini's (2010, p. 7) finding that "the absolute Gini coefficient … increased throughout [1820–1992], accelerating upward after

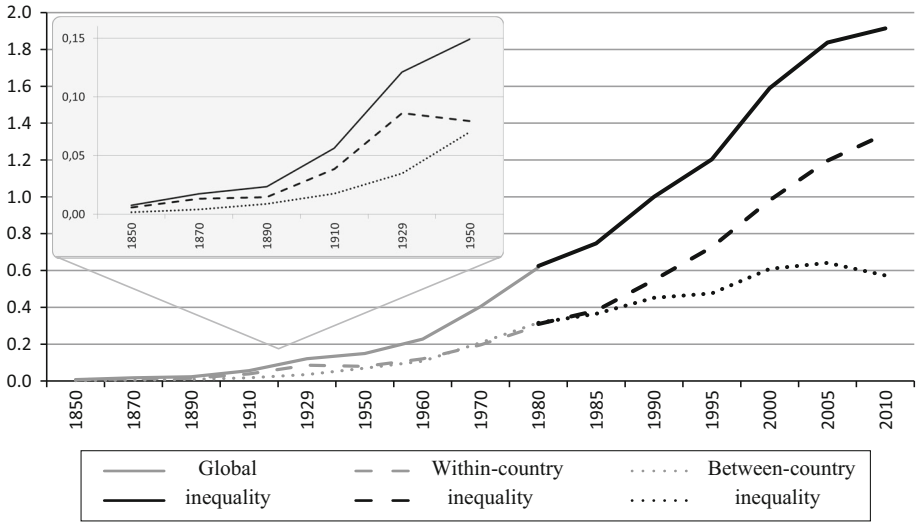

Fig. 1 The evolution of absolute global market income inequality, 1850–2010 (Index; 1 = global variance of 1990). *Notes* This figure shows the historic evolution of absolute market inequality for a group of 29 core countries, using GDP per capita at 1990 PPP rates. The *gray lines* show the estimates based on the historical data series, and the *black lines* are calculated with the recent data series—see Table 1 for the data sources. The small graph within the figure is a magnification of the 1850–1950 period to highlight the changes in that period

[14] The 1980 estimates from the recent and historical series are nearly identical because (1) the same GDP per capita data are used for both series, (2) the population data from Maddison and WDI are very similar, and (3) the market Gini data from van Zanden et al. (2014) and SWIID are similar for many countries.

1950", and because Anand and Segal's (2014) results show that this growth continued between 1992 and 2005.[15] However, our estimates are the first to demonstrate that this growth was driven by both within-country (dashed lines) and between-country inequality (dotted lines).

The importance of these two components for explaining absolute global income inequality was not constant over time. Figure 1 demonstrates that, for the first time since the beginning of the industrial revolution, absolute income convergence between developing and developed countries took place between 2005 and 2010. Two developments explain this absolute convergence process. On the one hand, many rich countries experienced a decline in their per capita income due to the financial crisis of 2008 (e.g., the US, the UK, Italy, Spain, Denmark, and Ireland); on the other hand, many relatively poor and populous countries had relatively high GDP growth rates during this period (e.g., China, Russia, Thailand, Brazil, India and Indonesia).

Figure 1 (magnification) also shows that between 1929 and 1950, absolute within-country inequality decreased (by approximately 8 %). At first sight, this result is surprising, as GDP per capita growth was relatively strong during this period.[16] Previous studies claim that absolute inequality typically only declines when GDP growth figures are very low or negative (Ravallion 2004; Anand and Segal 2014). Closer inspection of the data reveals, however, that during the 1929–1950 period in most countries in the sample, the income shares of the richest population ventiles declined substantially,[17] with the result that this is the only period under study during which most countries experienced inclusive growth in absolute terms (i.e., substantial GDP growth rates coupled with declines in absolute income differences).

It is often argued that important reasons for this sharp decline in the top income shares are the bankruptcies and destruction caused by the Great Depression and WWII (which led to sharp decreases in capital income) and increasing government interference in the market (see e.g., Crotty 2012; Piketty 2014; Atkinson 2015). The rise in government intervention is explained by the fact that the economic and financial elite was blamed for the Great Depression and that social movements and social attitudes gained strength during this time. In response, many countries increased their top income tax rates (partly to finance the war), regulated their financial sectors, nationalized major industries, strengthened trade unions and labor rights, and created social security programs.

With regard to the composition of absolute global inequality, three different phases can be distinguished. During the first phase (1850–1929), within-country inequality was much more important than between-country inequality. On average, 71 % of global inequality could be attributed to absolute income differences within countries during this period (Fig. 2a). Having said this, the average annual growth rates of within-country (3.5 %) and between-country inequality (3.8 %) were similar during this phase.

[15] Anand and Segal (2014) also use 'absolute versions' of the Theil L and Theil T indexes to measure changes in absolute global inequality, that is, the mean income of a given year multiplied by the respective relative Theil L and Theil T index. Both Theil measures report the same trend changes as the absolute Gini index. Please note that these indices are not in line with the formal definition presented on p. 5.

[16] GDP per capita in the core group of countries grew, on average, approximately 22 % between 1929 and 1950.

[17] In approximately 60 % of the core group of countries, the Gini coefficient declined by more than 5 Gini points, and in approximately 30 % of the core group countries, the decrease was more than 10 Gini points.

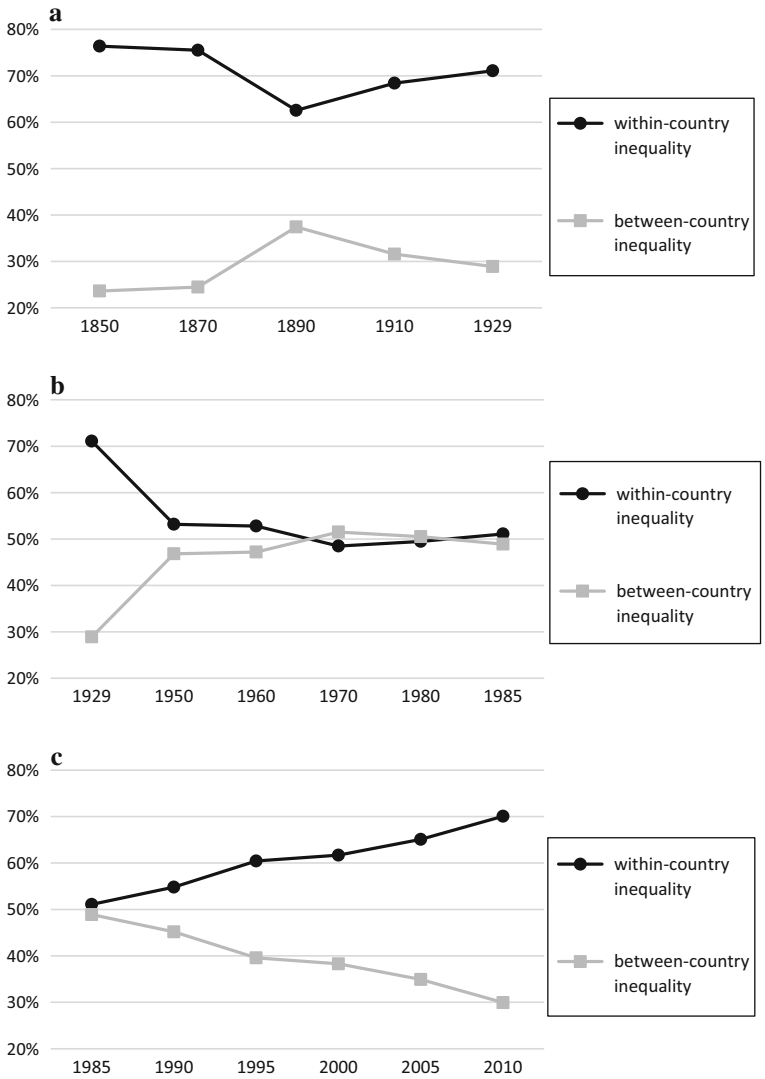

Fig. 2 The composition of absolute global market income inequality: three phases. **a** 1850–1929: the dominance of within-country inequality, **b** 1950–1985: equal importance of within-country and between-country inequality, **c** Post-1985: the return of the dominance of within-country inequality. *Notes* These three figures show the changes in the respective percentage shares to which absolute global market income inequality can be attributed to within-country and between-country income differences. The 1850–1970 estimates are based on the historical data series, and the 1980–2010 estimates on the recent data series

During the second phase (1950–1985), the average annual growth rates of within- and between-country inequality increased but remained similar—the annual growth rates were 4.6 and 4.8 %, respectively. This phase was primarily distinct insofar as within- and between-country inequality were roughly equally important contributors to absolute global inequality (Fig. 2b). The end of the dominance of the within-country component resulted

from the previously mentioned decrease in within-country inequality during the 1929–1950 period coupled with a 3.3 % annual growth rate of between-country inequality.

In contrast to the two previous phases, the most recent period was dominated by the rapid growth of within-country inequality (Fig. 2c). The post-1985 phase had higher annual growth rates of within-country inequality (5.2 %) and was the only time in the study period during which the growth rate of within-country inequality was much higher than that of between-country inequality (1.8 %). Consequently, the within-country component again became dominant. To be more precise, in 2010, within-country inequality explained approximately 70 % of absolute global inequality.

These findings stand in stark contrast to the conclusions of studies that use relative inequality indices to measure global market income inequality trends (e.g., Bourguignon and Morrisson 2002; Milanovic 2005; 2013; Sala-i-Martin 2006; Pinkovskiy and Sala-i-Martin 2009; Piketty 2014; van Zanden et al. 2014). These studies typically make the following claims: (1) Global inequality grew sharply between 1820 and 1950 and remained relatively flat or even declined afterwards[18]; (2) population-weighted between-country inequality increased strongly between the mid-nineteenth century and the mid-twentieth century but then began to decline; (3) within-country inequality registered a downward trend between 1929 and the 1970s and an upward trend afterwards; and (4) currently, income differences between countries are much more important to explaining global inequality than are within-country differences.[19]

The discrepancy between our findings and those of relative inequality studies suggests that statements about inequality should clarify whether they refer to absolute or relative inequality.

3.2 Absolute Net Income Inequality

Given that countries (especially developed ones) have redistributive policies, absolute within-country inequality trends might differ when net income shares, which consider tax and transfer payments, are used rather than market income shares. Indeed, Fig. 3a shows that absolute net within-country inequality estimates are approximately 40 % lower than those of market inequality.[20] However, our main interest is the trend of absolute inequality because the exact value of the variance has little meaning. Figure 3b shows that between 1980 and 1995, absolute market inequality increased faster than net inequality within countries, whereas afterwards absolute net inequality increased faster.[21] The latter finding suggests that taxes and/or transfer payments became less progressive after 1995.

The fact that net within-country inequality is lower than market within-country inequality indicates that income differences within-countries are less important when

[18] Several studies report a slight increase in global inequality during recent decades (e.g., Milanovic 2005, 2013; van Zanden et al. 2014), whereas others report a significant decline (e.g., Sala-i-Martin 2006; Pinkovskiy and Sala-i-Martin 2009). See Anand and Segal (2008) and Goda (2013) for in-depth discussions of these inconclusive results.

[19] Van Zanden et al. (2014) estimate that in 2000, approximately 70 % of relative global inequality could be explained by between-country inequality, and Milanovic (2012a, p. 125) finds that currently, "more than 80 % of global income differences is due to large gaps in mean incomes between countries".

[20] Net income inequality can be calculated only with for the recent data series due to data availability.

[21] During the entire period, market income inequality grew approximately 3.3-fold, whereas net inequality grew approximately 3.5-fold.

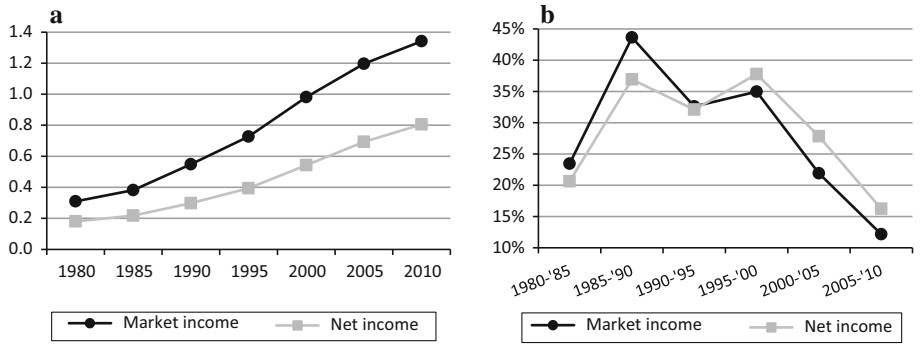

Fig. 3 Absolute market and net income inequality within countries, 1980–2010. **a** Index (1 = global variance of 1990), **b** Growth rates. *Notes* **a** Compares the development of absolute market and net inequality within countries. Both indices are normalized by the value of global market income variance of 1990 (at 1990 PPP rates), **b** shows the 5-year growth rates of absolute within-country market and net income inequality

absolute global inequality is measured by net income shares.[22] Indeed, in 1980 'only' approximately one-third of global net income differences could be attributed to within-country inequality. However, this figure increased to 58 % in 2010 (Fig. 4). The finding that in 2010 differences between income groups within-countries explained most of both absolute global net and market income inequality indicates that the redistribution of income within countries would be the most efficient policy option to reduce the actual levels of absolute global inequality.

3.3 Robustness of the Results

It is important to demonstrate that our main results are robust when alternative inequality measures are used. As shown in (3) and (4) in Sect. 2, the variance is a special case of the class of absolute decomposable inequality measures. It is possible to decompose absolute global inequality using different weights for transfers at the lower or upper tail of the distribution.

Figure 5 and Table 2 show that when the exponential index $I_{\theta}^{n}(x)$ is used our main findings are preserved for the entire range of $-0.09 \leq \theta \leq 0.04$: (1) absolute global inequality increased continuously, (2) absolute within-country inequality increased sharply after 1985 and currently contributes more to absolute global inequality than between-country inequality, and (3) either absolute within-country (1929–1950) or between-country (2005–2010) inequality only decreased during two periods.

The conclusion that absolute global inequality continuously increased throughout the entire period is no longer valid when $\theta \geq 0.05$. In this case absolute global inequality starts decreasing after 2005. In addition, please note that such a subgroup weight makes the importance of the within-country component extremely high (e.g., 96 % in 2010 when $\theta = 0.05$). In contrast, for values of $\theta < -0.09$, the importance of the within-country

[22] Between-country inequality is not affected when net income shares are used instead of market income shares [see part one of (5) in Sect. 2].

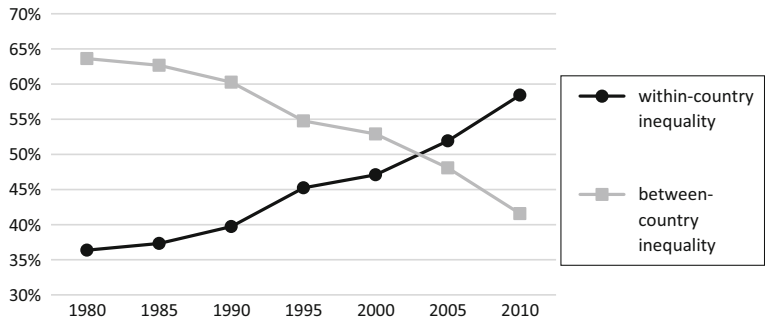

Fig. 4 Absolute global net inequality and the growing importance of income differences within countries. *Notes* This figure shows the degree to which absolute global net income inequality can be attributed to within-country and between-country income differences

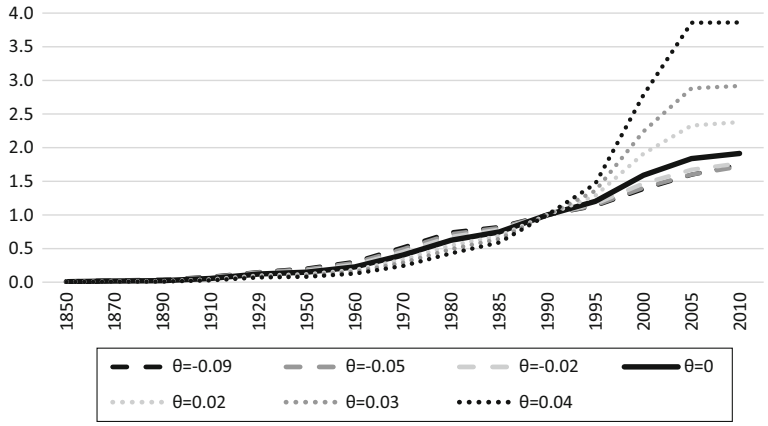

Fig. 5 The impact of transfer weights on the evolution of absolute global market income inequality, 1850–2010 (Index; 1990 = 1). *Notes* This graph shows the evolution of absolute global market income inequality estimates for the core group of 29 countries (at 1990 PPP rates), when different weights are attached to income transfers at the lower or upper end of the distribution. The post-1970 estimates are based on the recent data series. Each index is normalized by its global 1990 value—for details regarding the different measures see (3) and (4) in Sect. 2

component is no longer higher than the between component in 2010 (e.g., 49.5 % when $\theta = -0.10$).[23]

As a second robustness check, we examine whether the main results are also preserved when different PPP exchange rates are used. The effect of PPP exchange rates on absolute inequality is not clear a priori. To the best of our knowledge, absolute inequality studies have not yet tested for the effect of different PPP exchange rates. Existing relative inequality studies have found that estimates that use GDP per capita in 2005 PPP instead of 1990 PPP are higher because the 2005 PPP estimates led to a downward revision of GDP figures in many populous developing countries (Milanovic 2012b; van Zanden et al. 2014).

[23] These findings indicate that the exponential index $I_\theta^n(x)$ is sensitive to relatively small changes of the subgroup weight θ (an observation that was also made by Chakravarty (2001)).

Table 2 The impact of transfer weights on the importance of within-country and between-country inequality

	$\theta = -0.09$			Variance ($\theta = 0$)			$\theta = 0.04$		
	Global	Within	Between	Global	Within	Between	Global	Within	Between
1850	0.013	0.010	0.003	0.008	0.006	0.002	0.003	0.003	0.001
1870	0.028	0.020	0.008	0.017	0.013	0.004	0.008	0.006	0.002
1890	0.038	0.022	0.017	0.023	0.015	0.009	0.011	0.007	0.004
1910	0.082	0.049	0.033	0.056	0.038	0.018	0.028	0.021	0.008
1929	0.151	0.087	0.064	0.121	0.086	0.035	0.071	0.055	0.015
1950	0.204	0.081	0.123	0.149	0.079	0.070	0.081	0.050	0.031
1960	0.303	0.114	0.189	0.228	0.120	0.108	0.127	0.079	0.048
1970	0.517	0.158	0.359	0.404	0.196	0.208	0.242	0.148	0.094
1980	0.741	0.213	0.527	0.625	0.309	0.315	0.429	0.283	0.146
1985	0.821	0.230	0.591	0.747	0.382	0.365	0.591	0.418	0.173
1990	1.000	0.290	0.710	1.000	0.548	0.452	1.000	0.781	0.219
1995	1.136	0.406	0.730	1.203	0.727	0.476	1.463	1.229	0.234
2000	1.384	0.488	0.896	1.590	0.981	0.609	2.782	2.472	0.310
2005	1.598	0.656	0.942	1.838	1.196	0.641	3.857	3.528	0.330
2010	1.749	0.875	0.874	1.915	1.342	0.573	3.861	3.573	0.288

This table shows the development of global, within-country and between-country market income inequality estimates for the core group of 29 countries (at 1990 PPP rates), when different weights are attached to income transfers at the lower or upper end of the distribution. The post-1970 estimates are based on the recent data series. Each index is normalized by its global 1990 value—for details regarding the different measures see (3) and (4) in Sect. 2

We are not aware of global inequality studies that use 2011 PPP exchange rates for their calculations, but Deaton and Aten (2014) find that this new round of PPP estimates undoes many of the changes made in 2005; as a result, the "world in 2011 looks sharply more equal than previously calculated" (p. 2). Having said this, the fact that our absolute inequality estimates differ significantly from the existing relative estimates suggests that changes in PPP exchange rates might have different effects in absolute than in relative terms.

Table 3 clearly indicates that, when estimated using the variance, the trends in within-country, between-country and global inequality are highly similar regardless of the PPP exchange rate used. The major differences are that (1) with 2005 PPP, the increase in within-country and global inequality is less steep between 2005 and 2010 (in fact, it is nearly zero when net Gini coefficients are used), and (2) with 2011 PPP exchange rates estimates are, on average, approximately 10 % higher than those calculated with 1990 PPP. The latter finding is surprising given that the 2011 PPP round is expected to lead to lower relative inequality figures (as mentioned above). The reason why the 2011 PPP exchange rates lead to higher absolute inequality estimates is that the latest PPP round resulted in an upward revision of GDP for many rich countries, which, on average, was higher in absolute terms than the upward revisions of GDP for poor countries.

As a final robustness check, we estimate the change in absolute global inequality using the full unbalanced sample. The results suggest that the value and trend changes that are reported in Sects. 3.1 and 3.2 are highly similar irrespective of whether the unbalanced (Fig. 6) or balanced samples (Fig. 7) are used. The main distinction is that the unbalanced

Table 3 The impact of different PPP exchange rates on the evolution of absolute income inequality

	1990 PPP			2005 PPP			2011 PPP		
	Intra-country	Inter-country	Global	Intra-country	Inter-country	Global	Intra-country	Inter-country	Global
Market income inequality index									
1850	0.006	0.002	0.008						
1870	0.013	0.004	0.017						
1890	0.015	0.009	0.023						
1910	0.038	0.018	0.056						
1929	0.086	0.035	0.121						
1950	0.079	0.070	0.149						
1955	0.095	0.092	0.188						
1960	0.120	0.108	0.228						
1965	0.166	0.155	0.321						
1970	0.196	0.208	0.404						
1975	0.247	0.248	0.495						
1980	0.309	0.315	0.625	0.314	0.350	0.663			
1985	0.382	0.365	0.747	0.384	0.407	0.792			
1990	0.548	0.452	1.000	0.553	0.511	1.065	0.59	0.517	1.115
1995	0.727	0.476	1.203	0.709	0.547	1.255	0.786	0.557	1.343
2000	0.981	0.609	1.590	0.964	0.693	1.657	1.056	0.698	1.754
2005	1.196	0.641	1.838	1.133	0.752	1.885	1.236	0.755	1.992
2010	1.342	0.573	1.915	1.234	0.687	1.922	1.370	0.673	2.044
Net income inequality index									
1980	0.180	0.315	0.496	0.182	0.350	0.531			
1985	0.217	0.365	0.583	0.218	0.407	0.625			
1990	0.298	0.452	0.750	0.295	0.511	0.806	0.322	0.517	0.839
1995	0.393	0.476	0.869	0.371	0.547	0.918	0.415	0.557	0.972
2000	0.542	0.609	1.151	0.505	0.693	1.199	0.572	0.698	1.270
2005	0.693	0.641	1.334	0.609	0.752	1.361	0.682	0.755	1.438
2010	0.805	0.573	1.378	0.673	0.687	1.360	0.778	0.673	1.451

This table shows within-country, between-country and global income inequality estimates for the core group of 29 countries, using the variance and different PPP exchange rates. The post-1970 estimates are based on the recent data series. All estimates are normalized by the value of the global market income variance in 1990 (at 1990 PPP rates)—see Table 1 for the data sources

sample does not show absolute income convergence between countries during 2005–2010. This distinction might arise from the inclusion/exclusion of different countries in different years in the unbalanced sample. We therefore estimate between-country inequality for a balanced sample of 160 countries—including many African countries—for the years 1980–2010 [i.e., we estimate only the first part of (5)].[24] The results of this exercise confirm our finding of absolute convergence. Specifically, these estimates demonstrate that

[24] For this calculation, only GDP per capita and population data are needed, which are available for many more countries each year than are the Gini coefficients.

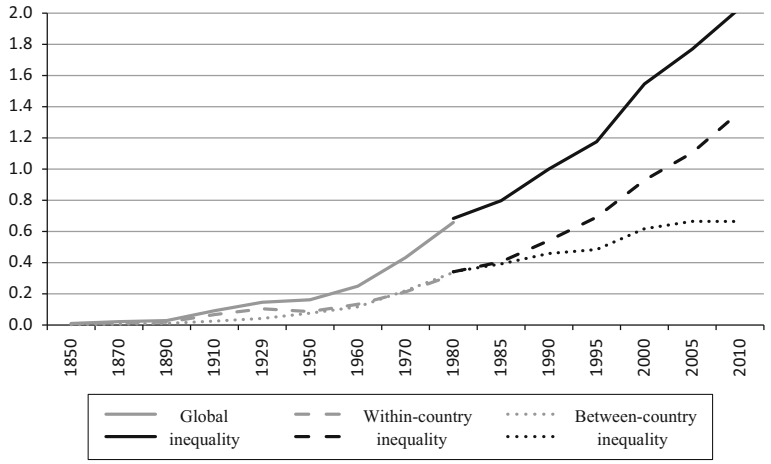

Fig. 6 Evolution of absolute global market income inequality, unbalanced sample (Index; base = global variance of 1990). *Notes* This figure shows the historic evolution of absolute market inequality for the full unbalanced sample. The *gray lines* show the estimates based on the historical data series, and the *black lines* are calculated with the recent data series (see Table 1 for the data sources)

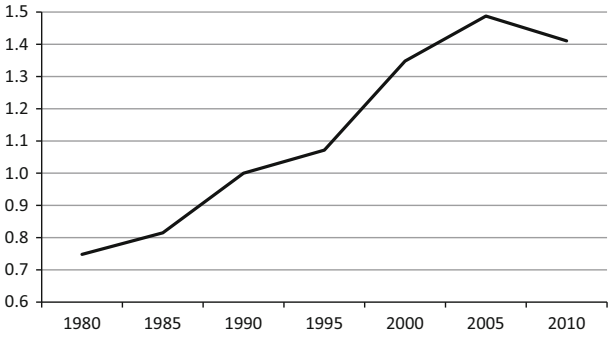

Fig. 7 Absolute between-country inequality estimates for 160 countries (Index; base year 1990). *Notes* This graph shows the evolution of population-weighted between-country inequality for a balanced sample of 160 countries, based on GDP per capita data at 2005 PPP rates from the WDI

absolute income differences between countries decreased by approximately 5 % between 2005 and 2010 (Fig. 7).[25]

4 Conclusions

This paper examines the historical development of absolute income differences more thoroughly than previous research. The results demonstrate that absolute global inequality has grown continuously since 1850, and there was a particularly stark increase beginning in

[25] This finding is consistent with Bosmans et al.'s (2014) results. Bosmans et al. show that absolute between-country inequality increased during the period 1980–2009. However, they find evidence only for an increase between 1980 and 2005, and their estimates suggest that absolute inequality subsequently decreased.

the middle of the twentieth century. Moreover, the results indicate that three different phases can be distinguished with respect to the composition of global inequality.

The first phase lasted from 1850 to 1929 and was characterized by the dominance of within-country inequality (during this period, approximately 70 % of global inequality could be attributed to absolute income differences within countries). The second phase, from 1950 to 1985, was mainly distinct insofar as—after a sharp decrease in the importance of within-country inequality from 1929 to 1950—the within-country and between-country components contributed roughly equally to global income differences. The third phase started in 1985 when the growth of within-country inequality accelerated while the growth rates of between-country inequality declined.

The result of the latest development is that, in 2010, within-country income differences explained 70 % of absolute global market income inequality and nearly 60 % of absolute global net income inequality, which means that income differences within-countries currently explain nearly as much global income inequality as they did in 1850 (in market income terms).

These findings challenge the often-made claims that global inequality has decreased during the last few decades (Sala-i-Martin 2006; Pinkovskiy and Sala-i-Martin 2009) and that between-country income differences explain most global inequality (Milanovic 2012a, 2013, 2015). Although these claims might be correct with regard to relative income inequality, they are not correct with regard to absolute income inequality. One should therefore abstain from general statements on inequality trends without clarifying whether they refer to relative or absolute inequality. The same is true for policy advice concerning the reduction of global inequality. Currently, migration would likely be the best option to reduce relative inequality, whereas redistribution within-countries would be the most efficient policy option to reduce absolute inequality.

Additional novel findings of this paper include that (1) it is possible to reduce absolute inequality and grow simultaneously when countries have high initial levels of relative inequality (as was the case between 1929 and 1950); (2) net inequality within countries grew faster than market inequality after 1995, which suggests that taxes and/or transfers became less progressive; and (3) the financial crisis of 2007–2009 contributed to absolute convergence of income between developing and developed countries (for the first time since the industrial revolution). The main findings of this paper are robust to the use of different PPP exchange rates and for the complete class of absolute decomposable inequality indices when the weights that are attached to transfers at the lower or upper end of the distribution are in the range of $-0.09 \leq \theta \leq 0.04$.

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Appendix

The Goodness of Fit of the Income Share Estimation Methodology

To examine the robustness of our method to derive income shares [(6)–(7) in Sect. 2], we calculate income shares with Gini coefficients drawn from the WDI database and compare

these estimates with readily available income share data from the same database. The WDI provides Gini coefficients and quintile income shares for 155 countries. The available data are very unbalanced (881 of 5115 possible observations between 1980 and 2012); we therefore use a benchmark year methodology (see Footnote 12) to calculate income shares for 1985, 1990, 1995, 2000, 2005 and 2010 (352 of 930 possible observations).

Table 4 shows that the correlation between the income shares readily available from the WDI database and our estimated shares is close to one (with the exception of Quintile 4), and Table 5 demonstrates that the average difference between the values of our estimated

Table 4 Correlation matrix of the calculated and original income shares

	*x*_Q1	*x*_Q2	*x*_Q3	*x*_Q4	*x*_Q5
WDI_Q1	0.96	0.96	0.95	0.85	−0.96
WDI_Q2	0.99	0.99	0.99	0.91	−0.99
WDI_Q3	0.96	0.98	0.98	0.93	−0.98
WDI_Q4	0.75	0.79	0.81	0.83	−0.80
WDI_Q5	−0.98	−0.99	−0.99	−0.93	1.00

The first column refers to the reported quintile shares from the WDI database, and the first row refers to our calculated income shares

Table 5 Average differences between the calculated and original income shares

	1985	1990	1995	2000	2005	2010
Q1						
Calculated	0.059	0.055	0.053	0.056	0.055	0.057
Original	0.062	0.058	0.058	0.059	0.060	0.062
Difference	−0.003	−0.003	−0.005	−0.003	−0.005	−0.005
Q2						
Calculated	0.103	0.098	0.097	0.100	0.099	0.101
Original	0.104	0.100	0.099	0.102	0.101	0.103
Difference	−0.001	−0.002	−0.002	−0.002	−0.002	−0.002
Q3						
Calculated	0.151	0.145	0.145	0.147	0.147	0.149
Original	0.149	0.145	0.143	0.146	0.145	0.147
Difference	0.002	0.000	0.002	0.001	0.002	0.002
Q4						
Calculated	0.223	0.220	0.220	0.220	0.221	0.223
Original	0.215	0.212	0.209	0.212	0.209	0.212
Difference	0.008	0.008	0.011	0.008	0.012	0.011
Q5						
Calculated	0.464	0.483	0.485	0.476	0.479	0.470
Original	0.469	0.486	0.491	0.480	0.485	0.476
Difference	−0.005	−0.003	−0.006	−0.004	−0.006	−0.006
Observations	22	35	72	81	81	61

The first row of each quintile share reports our calculated mean income share, the second row shows the mean income share reported by WDI, and the third row shows the differences between our calculated share and the reported share

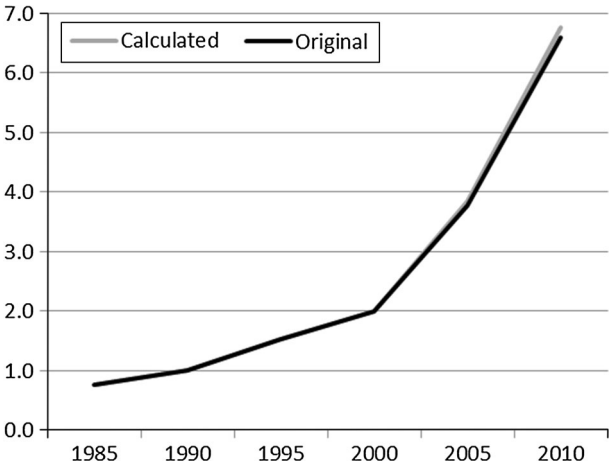

Fig. 8 Absolute within-country inequality estimates based on WDI data (Index, base year 1990). *Notes* This graph shows absolute within-inequality estimates based on the calculated and original WDI income shares for the 11 countries whose data are available for each year

shares and the readily available shares is relatively small. However, our methodology consistently underestimates the two bottom quintile shares, overestimates the shares from Quintile 3 and 4, and underestimates the top quintile share. To examine whether this difference has an effect on the level and/or trend of absolute inequality estimates, we calculate the level of absolute within-country inequality for a core group of 11 countries[26] (66 observations) for which the WDI quintile share and Gini data are available in each benchmark year.

Figure 8 shows that the correlation between these two inequality series is close to one. This result suggests that our method produces income share estimates that fit the 'real' data very well and that they do not influence trend changes. It is important to note that the calculated shares lead to a slightly higher level of absolute inequality (by approximately 1 %) than the readily available WDI shares. This means that our income share estimation methodology might slightly overestimate absolute inequality levels.

The Goodness of Fit of the Income Share Estimation Methodology

To prevent imputations from affecting our main findings, we have not imputed more than 2 years of data per variable and country. For the imputation of GDP per capita, we have used regional averages because this approach is widely used in the existing literature (see e.g., Sala-i-Martin 2006). Please see Table 6 for an overview of the imputations.

[26] Argentina, Bangladesh, Brazil, China, Costa Rica, Dominican Republic, Honduras, Indonesia, the Philippines, Poland, Tunisia.

Table 6 Overview of the data imputations for the core group of countries

Country	Missing years	Short description of imputation method		
		GDP per capita	Population	Gini coefficient
Colombia	1850			Country Gini coefficient in 1870 adjusted with the growth rate of the Gini coefficients from Argentina, Chile and Peru during 1850–1870
Ireland	1850, 1890	Country GDP per capita in 1870 adjusted by the regional growth rate for 1850–1870 and 1870–1890		
Peru	1850	Country GDP per capita in 1870 adjusted by the regional growth rate for 1850–1870		
Philippines	1850, 1890	Country GDP per capita in 1870 adjusted by the regional growth rate for 1850–1870 and 1870–1890		
Poland	1850	Country GDP per capita in 1870 adjusted by the regional growth rate for 1850–1870		
Russia	1850, 1870, 1910	Country GDP per capita in 1870 adjusted by the regional growth rate for 1850–1870 and 1870–1890	The population size from 1913 was taken for the year 1910	
Switzerland	1850	Country GDP per capita in 1870 adjusted by the regional growth rate for 1850–1870		
Thailand	1850	Country GDP per capita in 1870 adjusted by the regional growth rate for 1850–1870		

This table shows all imputations that were made to increase the size of the core group to 29 countries

References

Acemoglu, D., & Robinson, J. A. (2008). Persistence of power, elites, and institutions. *American Economic Review, 98*(1), 267–293.

Aitchison, J., & Brown, J. (1966). *The lognormal distribution: With special reference to its uses in economics*. Cambridge: Cambridge University Press.

Amiel, Y., & Cowell, F. A. (1999). *Thinking about inequality: Personal judgment and income distributions*. Cambridge: Cambridge University Press.

Anand, S., & Segal, P. (2008). What do we know about global income inequality? *Journal of Economic Literature, 46*(1), 57–94.
Anand, S. & Segal, P. (2014). The global distribution of income. *Oxford Department of Economics Discussion Paper*, (714).
Atkinson, A. B. (2015). *Inequality: What can be done?*. Cambridge: Harvard University Press.
Atkinson, A. B., & Brandolini, A. (2010). On analyzing the world distribution of income. *World Bank Economic Review, 24*(1), 1–37.
Ballano, C., & Ruiz-Castillo, J. (1993). Searching by questionnaire for the meaning of income inequality. *Revista Español de Economía, 10*(2), 233–259.
Bosmans, K., & Cowell, F. A. (2010). The class of absolute decomposable inequality measures. *Economics Letters, 109*(3), 154–156.
Bosmans, K., Decancq, K., & Decoster, A. (2014). The relativity of decreasing inequality between countries. *Economica, 81*(322), 276–292.
Bourguignon, F., & Morrisson, C. (2002). Inequality among world citizens: 1850–1992. *American Economic Review, 92*(4), 727–744.
Breton, T., & García, J. J. (2015). ICP 2005 construction prices: Are they underestimated in developing countries? *Review of Income and Wealth*. doi:10.1111/roiw.12170.
Chakravarty, S. R. (2001). The variance as a subgroup decomposable measure of inequality. *Social Indicators Research, 53*(1), 79–95.
Chakravarty, S. R., & Tyagarupananda, S. (2009). The subgroup decomposable intermediate indices of inequality. *Spanish Economic Review, 11*(2), 83–97.
Crotty, J. R. (2012). The great austerity war: What caused the US deficit crisis and who should pay to fix it? *Cambridge Journal of Economics, 36*(1), 79–104.
Davies, J.B., & Shorrocks, A.F. (1989). Optimal grouping of income and wealth data. *Journal of Econometrics*, *42*(1), 97–108.
Deaton, A. & Aten, B. (2014). Trying to understand the PPPs in ICP 2011: Why are the results so different? *NBER Working Paper*, (20244).
Deaton, A., & Heston, A. (2010). Understanding PPPs and PPP-based national accounts. *American Economic Journal: Macroeconomics, 2*(4), 1–35.
Dikhanov, Y. & Ward, M. (2002). Evolution of the Global Distribution of Income in 1970–99. In *Fourth meeting of the expert group on poverty statistics, Rio de Janeiro, 15–17 October*.
Ehrlich, I. (1973). Participation in illegitimate activities: A theoretical and empirical investigation. *Journal of Political Economy, 81*(3), 521–565.
Esteban, J., & Ray, D. (2006). Inequality, lobbying, and resource allocation. *American Economic Review, 96*(1), 257–279.
Fleisher, B. M. (1966). The effect of income on delinquency. *American Economic Review, 56*(1/2), 118–137.
Froud, J., Johal, S., Haslam, C., & Williams, K. (2001). Accumulation under conditions of inequality. *Review of International Political Economy, 8*(1), 66–95.
Gilens, M., & Page, B. I. (2014). Testing theories of American politics: Elites, interest groups, and average citizens. *Perspectives on Politics, 12*(3), 564–581.
Goda, T. (2013). Changes in income inequality from a global perspective: An overview. *PKSG Working Paper*, (1303).
Goda, T., & Lysandrou, P. (2014). The contribution of wealth concentration to the subprime crisis: A quantitative estimation. *Cambridge Journal of Economics, 38*(2), 301–327.
Halter, D., Oechslin, M., & Zweimüller, J. (2014). Inequality and growth: The neglected time dimension. *Journal of Economic Growth, 19*(1), 81–104.
Harrison, E., & Seidl, C. (1994). Perceptional inequality and preferential judgments: An empirical examination of distributional axioms. *Public Choice, 79*(1–2), 61–81.
Herzer, D., & Vollmer, S. (2012). Inequality and growth: Evidence from panel cointegration. *Journal of Economic Inequality, 10*(4), 489–503.
Herzer, D., & Vollmer, S. (2013). Rising top incomes do not raise the tide. *Journal of Policy Modeling, 35*(4), 504–519.
Kolm, S.-C. (1976). Unequal inequalities I. *Journal of Economic Theory, 12*(3), 416–442.
Krueger, A. B. (2012). The rise and consequences of inequality in the United States. Center for American Progress, Washington D.C., USA, 12 January.
Kumhof, M., Ranciére, R., & Winant, P. (2015). Inequality, leverage, and crises. *American Economic Review, 105*(3), 1217–1245.
Lagarde, C. (2013). A new global economy for a new generation. In *World economic forum annual meeting 2013, Davos, Switzerland, 23 January*.

López, H. & Servén, L. (2006). A normal relationship? Poverty, growth, and inequality. *World Bank Policy Research Working Paper Series* , (3814).
Maddison Project. (2013). Maddison project database, 2013 version. http://www.ggdc.net/maddison/maddison-project/home.htm
Milanovic, B. (2005). *Worlds apart: Measuring international and global inequality*. Princeton: Princeton University Press.
Milanovic, B. (2012a). Evolution of global inequality: From class to location, from proletarians to migrants. *Global Policy, 3*(2), 198–208.
Milanovic, B. (2012b). Global inequality recalculated and updated: The effect of new PPP estimates on global inequality and 2005 estimates. *Journal of Economic Inequality, 10*(1), 1–18.
Milanovic, B. (2013). Global income inequality in numbers: In history and now. *Global Policy, 4*(2), 198–208.
Milanovic, B. (2015). Global inequality of opportunity: How much of our income is determined by where we live? *The Review of Economics and Statistics, 97*(2), 452–460.
Minton Beddoes, Z. (2012). *For richer, for poorer*. The Economist, print edition, 13 October.
Obama, B. H. (2011). Remarks by the president on the economy in Osawatomie, Kansas. Osawatomie High School, Osawatomie, Kansas, USA, 06 December.
Onaran, O., & Galanis, G. (2014). Income distribution and growth: A global model. *Environment and Planning A, 46*(10), 2489–2513.
Persson, T., & Tabellini, G. (1994). Is inequality harmful for growth? *American Economic Review, 84*(3), 600–621.
Pickett, K., & Wilkinson, R. (2010). *The spirit level: Why greater equality makes societies stronger*. London: Penguin.
Piketty, T. (2014). *Capital in the twenty-first century*. Cambridge Mass: Belknap Press of Harvard University Press.
Piketty, T. (2015). Putting distribution back at the Center of Economics: Reflections on capital in the twenty-first century. *Journal of Economic Perspectives, 29*(1), 67–88.
Pinkovskiy, M. & Sala-i-Martin, X. (2009). Parametric estimations of the world distribution of income. *NBER Working Paper*, (15433).
Pritchett, L. (1997). Divergence, big time. *Journal of Economic Perspectives, 11*(3), 3–17.
Ravallion, M. (2004). Competing concepts of inequality in the globalization debate. In Collins, S. M. & Graham, C. (Eds.), *Brookings trade forum 2004. Globalization, poverty, and inequality* (pp. 1–38.). Washington: Brookings Institution Press
Sala-i-Martin, X. (2006). The world distribution of income: Falling poverty and… convergence, period. *Quarterly Journal of Economics, 71*(2), 351–397.
Sen, A. (2000). Social Justice and the Distribution of Income. In A. B. Atkinson & F. Bourguignon (Eds.), *Handbook of income distribution* (pp. 60–85). Amsterdam: Elsevier.
Shiller, R.J. (2014). Better Insurance Against Inequality. The New York Times, April 13, pg. BU6.
Solt, F. (2009). Standardizing the world income inequality database. *Social Science Quarterly, 90*(2), 231–242.
Solt, F. (2013). The standardized world income inequality database, version 4.0. http://myweb.uiowa.edu/fsolt/swiid/swiid.html
Soltow, L. (1998). The Measures of Inequality. In L. Soltow & J. L. van Zanden (Eds.), *Income & wealth inequality in the Netherlands 16th–20th century* (pp. 7–22). Amsterdam: Het Spinhuis.
Stiglitz, J. E. (2012). *The price of inequality*. London: Penguin Books.
Svedberg, P. (2004). World income distribution: Which way? *Journal of Development Studies, 40*(5), 1–32.
van Zanden, J. L., Baten, J., Foldvari, P., & van Leeuwen, B. (2014). The changing shape of global inequality 1850–2000: Exploring a new dataset. *Review of Income and Wealth, 60*(2), 279–297.