

THE CHANGING SHAPE OF GLOBAL INEQUALITY 1820–2000; EXPLORING A NEW DATASET

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A new dataset for charting the development of global inequality between 1820 and 2000 is presented, based on a large variety of sources and methods for estimating (gross household) income inequality. On this basis we estimate the evolution of global income inequality over the past two centuries. Two sets of benchmarks about between-country inequality (the Maddison 1990 benchmark and the recent 2005 ICP round) are taken into account. We find that between 1820 and 1950, increasing per capita income is combined with increasing global inequality. After 1950, global inequality as measured by the Gini coefficient or the Theil index remains more or less constant. It also appears that the global income distribution was uni-modal in the nineteenth century, became increasingly bi-modal between 1910 and 1970 with two world wars, a depression and de-globalization, and was suddenly transformed back into a uni-modal distribution between 1980 and 2000.

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1. INTRODUCTION

The aim of this paper is to present a new dataset of global inequality between 1820 and the present, based on the available historical evidence, and to analyze the main results that emerge from these data. The importance of the subject hardly needs to be stressed: the enormous increase of inequality on a global scale is one of the most significant—and worrying—features of the development of the world

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economy in the past 200 years. For this reason, the subject has become one of the most discussed topics in the social sciences (e.g., Williamson and Lindert, 1980; Persson and Tabellini, 1994; Benabou, 1996; Barro, 2000; Bassino, 2006); in particular the debate on the measurement and interpretation of recent trends in global inequality—Is it still increasing? and Why or why not?—has attracted considerable attention (see Deininger and Squire, 1996; Jones, 1997; Bourguignon and Morrisson, 2002; Milanovic, 2007; Anand and Segal, 2008 for a review of the debate). Part of this debate is fuelled by the different measurement concepts. Inequality has been defined as (population-weighted) “inter-country inequality” of per capita incomes or as a combination of between- and within-country inequality. This last branch, in turn, can be divided into those studies that rely on the pooling of microdata, and those that combine population-weighted inter-country inequality of per capita incomes with intra-country inequality. Due to the availability of data, this last method will be the one employed in this paper.

Our aim is to present a new dataset of global inequality, because we think we lack the historical data to really analyze these patterns of changing global inequality in detail. The one paper that has attempted to do this, i.e. Bourguignon and Morrisson (2002), is for the period before 1950 largely based on the assumption that income inequality within countries is unchanging. They extrapolate their estimates of income inequality in certain periods to cover much longer time periods, as a result of which changes in income inequality within countries are clearly underestimated. For large parts of the world this means that estimates from the post-1914 or even the post-1945 period are used to infer income inequality in the nineteenth century. For Latin America and Africa, Bourguignon and Morrisson (B&M) rely completely on twentieth-century data to estimate inequality in the nineteenth century; for Asia they have in total four historical estimates: one for China in 1890, two for Indonesia, and one for Japan. The dataset for Europe and North America is somewhat better, but also uses only part of the evidence available. For a large majority of the world’s population, and almost all people living in the “developing countries,” their estimates are based on almost no historical evidence, implying that we really cannot rely on their work to analyze the long-term patterns of global inequality. Finally, it should be pointed out that the B&M estimates are based on Angus Maddison’s (2001, 2003) reconstruction of the long-term development of GDP per capita in different parts of the world economy between 1820 and 2000. He uses a 1990 benchmark of the ICP to get estimates of relative levels of income in the world economy. Recent research by the ICP has however resulted in a new set of PPPs, for 2005. This modification changes the relative level of per capita GDP across countries, and since per capita GDP is used to calculate between-country income inequality, clearly has consequences for the estimates of the long-term development of global inequality (World Bank, 2008).

For these reasons, we have set out to create a new dataset to measure the evolution of global inequality in the nineteenth and twentieth centuries. Our main contribution is that we greatly enlarge the number of observations of within-country inequality on which the estimates are based (B&M had 362 country Gini coefficients, we have more than a thousand). Moreover, we also aim at finding out the consequences of using the new 2005 benchmark (as will be shown below, our results are largely consistent with the detailed study by Milanovic (2009) on this

topic). However, because the new 2005 benchmarks have not been completely accepted by the international community of scholars (in particular the late Angus Maddison was quite critical about these new results), we present two sets of estimates of global inequality, one based on the 1990 (Maddison) benchmark (which is also comparable with the B&M results), and one based on the new, but still tentative, 2005 benchmark. For the latter set of estimates, we used the new 2005 PPPs as starting point, and applied for the different countries involved, the growth rates of GDP per capita as estimated by Maddison (2003) as the best summary of our knowledge for the changes over time.¹ We do not deal with the discussions about the reliability of the Maddison dataset and the underlying estimates of the growth of the countries concerned since this is sufficiently available in the existing literature.²

The paper is set out as follows. In Section 2 we outline how the new dataset was constructed. First, new research done since the 1990s and older research overlooked by B&M were incorporated in the new dataset. This, however, does not really solve the problem of the data gap between rich and poor—probably the gap even widens, as much more evidence is available and much more work has been done on Europe and the Americas than on Africa and Asia. Therefore, in order to get a more balanced set of estimates, we had to apply two alternative ways of estimating (changes in) income inequality suggested in the literature. The first one, which we particularly used for the nineteenth century (and for a few countries also to the interwar period), was to infer changes in income inequality from the development of the ratio between GDP per capita and real wages of unskilled laborers. The idea, initially suggested by Jeffrey Williamson (1998, 2000a, 2000b) and recently tested by Leandro Prados de la Escosura (2008), is that, if wages lag behind income per capita, inequality is probably increasing; conversely, if wages grow faster than GDP per capita, this points to a decline in income inequality. We tested this relationship for a set of countries for which we had independent estimates of inequality of income distribution, and found a small but (just) significant effect, which we used to extrapolate (or intrapolate) estimates of the Ginis of income distribution. The second new approach that we applied is to use data on the distribution of heights of the population that can be derived from different sources to estimate the Gini of the income distribution. Again, for a subset of countries for which we have both independent Gini coefficients of income distribution and data on the distribution of heights, we could establish the link between the two measures of socio-economic disparities. The resulting equation is then used to estimate income inequality for those countries and periods for which other

¹The debate about the quality of the 2005 ICP estimates has mainly focused on the Chinese PPPs; we follow Heston's re-estimates of the Chinese PPP's (which correct for the possible biases) by adopting the version of the 2005 PPPs published on the website of the Conference Board: (<http://www.conference-board.org/economics/database.cfm>); for further confirmation that the new—and for China the adapted version of the new—PPPs are of high quality, see Ravallion (2010).

²The relative position of the U.S. versus the U.K. is still a matter of considerable debate (Broadberry, 2003; for underestimating GDP per capita of the U.S. during much of the nineteenth century, see Ward and Devereux, 2005), but it is not clear that this will affect the overall pattern of global inequality very much. There has also been some discussion about GDP per capita development in China (and other parts of Asia) after the late eighteenth century (Pomeranz, 2000; but see Li and Van Zanden (2012), who more or less confirm the Maddison estimates on the basis of independent benchmark estimates).

data were lacking. This procedure has been developed by Baten (1999) and Moradi and Baten (2005), and has now been extended to a much broader sample of countries (all details below).

Moreover, we identified a group of 30 countries—most of them relatively large, but spread more or less equally over the globe (with an inevitable overrepresentation of Western Europe, however)—for which we tried to get consistent estimates of income inequality for all the benchmark years, starting in 1820. These countries were: (in Europe) Belgium, Denmark, France, Germany, Italy, Netherlands, Norway, Poland, Portugal, Russia/USSR, Spain, Sweden, Czechoslovakia, U.K.; (in Asia) China, India, Indonesia, Japan, Thailand, Turkey; (in the Americas) Argentina, Brazil, Canada, Chile, Mexico, Peru, U.S.; (in Africa) Egypt, Ghana; and Australia. Together, these countries represent 70–80 percent of the world's population (according to the Maddison estimates). We think this dataset is more or less representative of global trends, although it is handicapped by the underrepresentation of, in particular, Africa and the overrepresentation of Western Europe. In the analysis presented below we therefore considered all countries with 500,000 and more inhabitants and added all countries for which we have observations, even those for which we have only a few—and sometimes only one—data point (Botswana in 1990, for example).

Finally, we aggregate these individual level data into Gini and Theil indices for the whole world. The Gini is by definition lower than the population weighted average country Ginis because the distributions of different countries overlap.³ Since these world income inequality estimates are, to a large extent, based on new data, we provide highly tentative error margins in Section 3. In Section 4 we discuss the development of inequality on a regional and world level. We end with a brief conclusion.

2. DATA

In the data appendix, we explain in detail how the estimates of income inequality were collected, standardized, and put together in one consistent dataset of global inequality. This involved the following steps:

- (1) Direct estimates of Gini coefficients of income inequality (see World Income Inequality Database, 2008) for the post-1945 period have generally widely divergent measurement concepts (e.g., Atkinson and Brandolini, 2001; Gruen and Klasen, 2001, 2008; van Leeuwen and Földvári, 2012). Hence, they were made comparable basically following the procedure as developed by François and Rojas-Romagosa (2005).
- (2) To this we added via a broad scan of the available literature a large number of estimates of Gini coefficients of income distribution before 1945 (e.g., Bigsten, 1985; Brandt and Sands, 1992; Terreblanche, 2002), and we

³Note that as the Theil is decomposable, it has an important advantage relative to the Gini which is only decomposable under strong assumptions. In general, both indices have conceptual advantages and disadvantages. But the key empirical difference is the sensitivity to different parts of the distribution, with the Gini being particularly sensitive to the middle of the distribution and the Theil to the top of the distribution. That might also explain the differences in findings between the two measures reported below.

converted other measures of income inequality—in particular the many available estimates of the share of the highest 1 or 5 percent in total income—into comparable Gini coefficients, making use of the assumption that income has a log-normal distribution (Soltow, 1998).

- (3) Most studies of income inequality in the past refer to developed countries, as a result of which the dataset resulting from steps 1 and 2 is very unbalanced; to deal with this, we applied the idea developed by Williamson (1998, 1999, 2000a, 2000b) and tested by Prados de La Escosura (2008) that changes in income inequality in developing countries may be proxied by the ratio between real wages and real GDP per capita; we also tested this idea for a set of (large) countries, and used it to find the relationship between unskilled wages and GDP in order to extrapolate or intrapolate Gini coefficients for a sample of countries for which we do not have direct estimates.
- (4) Finally, we fill the other gaps in our dataset by assuming a relationship between the distribution of heights (a measure of the “biological standard of living”) (e.g., Fiawoo, 1979; Steckel, 1995) and income distribution (cf. Schmitt and Harrison, 1988; Baten, 1999, 2000); such a link can be demonstrated for a set of countries for which we have both kinds of data, and we use the established relationship between height inequality and income inequality to further broaden our dataset (all details are provided in the data appendix).

Table 1 summarizes the sources of the newly constructed dataset. The overall dataset consists of 1082 estimates of Gini coefficients of income inequality, spread over more than 130 countries. The greatest number of new estimates is produced by using the height data, but because these often refer to relatively small countries, the total impact on the estimates of global inequality that will be presented is more limited. The other new sources of estimates—“new” direct estimates of income

TABLE 1
OVERVIEW OF THE SOURCES OF THE DATASET OF INCOME INEQUALITY, 1820–2000

	1	2	3	4	5	6	7
Year	All	WIID	“New” Ginis	GDP/Wage Ratio	Heights	Both 4&5 (50/50)	Interpolations
1820	39	0	6	6	18	6	3
1850	40	0	1	8	20	8	3
1870	54	0	11	5	27	11	0
1890	60	0	8	5	34	13	0
1910	71	1	10	7	43	10	0
1929	74	2	15	9	39	9	0
1950	81	12	10	8	42	9	0
1960	88	54	4	2	27	1	0
1970	94	60	2	2	29	1	0
1975	70	50	1	2	16	1	0
1980	83	71	0	0	12	0	0
1985	68	67	1	0	0	0	0
1990	99	98	1	0	0	0	0
1995	96	95	1	0	0	0	0
2000	65	65	0	0	0	0	0
Total	1082	576	71	55	306	68	6

inequality, and indirect estimates derived from the GDP/wage ratio—are more often used for the larger countries. When more than one estimate for a country was available, we applied the following rules: a direct estimate of income inequality superseded all indirect estimates, which were in that case ignored; when we had two different indirect estimates, based on heights and on the GDP/wage ratio, we used more or less arbitrarily the unweighted average of the two, which happened in 68 cases (column 6 of Table 1). Changing this assumption does not have a big impact on the final results. For example, using for 1850 the Williamson index only instead of the unweighted average will increase world income inequality by only 1.18 percent. To get a systematic set of estimates for the core group of 30 countries, we had to interpolate a few estimates for those countries.⁴

The unit of analysis and comparison so far has been the Gini coefficient of the individual countries. To move from them to global inequality, we (again) had to assume that the underlying distributions were log-normal, which allows us to translate the Gini coefficient into an estimate of the whole distribution of income in country X at time Y. This is then linked to the estimates of the average GDP per capita in the countries concerned.

The growth rate of per capita GDP is calculated from Maddison (2003), whereas the differences in GDP per capita across countries can be calculated using the Maddison 1990 GK dollars benchmark. Alternatively, recent research by the ICP has resulted in a new set of PPPs for 2005 (World Bank, 2008), which are based on a broader set of prices and on data from many more countries, probably making the 2005 benchmark more reliable than previous ones. This, and the use of a somewhat different method to estimate the PPPs, which solves the problem as noted by Afriat (1967) and more recently by Dowrick and Quiggin (1994), that PPPs in international prices tend to overestimate the level of real GDP in low income countries, results in a substantial widening of income disparities between countries (Deaton and Heston, 2008). Yet, since there recently has been some criticisms on the 2005 benchmark as well, we decided to provide the World Ginis both using the 1990 PPPs as used by Maddison (2003) and the new 2005 PPPs.

The resulting estimates for the 1990 and 2005 PPP benchmarks are reported in Tables 2 and 3 (Gini coefficients) and Tables 4 and 5 (Theil coefficients). Global inequality has two dimensions: within-country inequality, which is the same for these two sets of estimates, and between-country inequality. Tables 2 and 3 also show the overlap factor; because of the statistical features of the Gini coefficient, the sum of the within-country Gini and the between-country Gini is larger than the global Gini. The difference between them is the overlap factor, which is in essence nothing more than that share of the within-group inequality of country A that overlaps with within-group inequality of country B.⁵ The Gini coefficients of Table 2 are directly comparable to the estimates by Bourguignon and Morrisson (2002).

⁴Estimates are complete for the following countries: Belgium, Brazil, China, Spain, France, U.K., Indonesia, Italy, Netherlands, Portugal, Sweden, U.S., Germany, India, Poland, Norway, Ghana, and Mexico; interpolations were necessary for Thailand (1850, 1910), Turkey (1850, 1890, 1980), Australia (1820 is assumed to be identical to 1850), Russia/USSR (1850, 1890), Canada (1870), Czechoslovakia (1910), Denmark (1850), Egypt (1890, 1929, and 1820 derived from Turkey), and Peru (1910); for Argentina and Chile in 1820 we did not find a suitable proxy.

⁵This has led Milanovic (2002, p. 70) to claim that “the more important the overlapping component . . . the less one’s income depends on where she lives.”

TABLE 2
GINI COEFFICIENTS OF WITHIN-COUNTRY AND BETWEEN-COUNTRY INEQUALITY, 1820–2000
(1990 BENCHMARK)

	Within-Country Inequality	Between-Country Inequality	Sum	Actual World Gini	Overlap Factor
1820	0.45	0.16	0.61	0.49	0.11
1850	0.38	0.23	0.62	0.46	0.16
1870	0.45	0.32	0.77	0.55	0.22
1890	0.36	0.38	0.74	0.52	0.22
1910	0.40	0.44	0.84	0.58	0.26
1929	0.44	0.49	0.92	0.63	0.29
1950	0.38	0.55	0.93	0.65	0.33
1960	0.38	0.54	0.92	0.64	0.28
1970	0.37	0.56	0.93	0.65	0.28
1975	0.37	0.58	0.96	0.68	0.28
1980	0.36	0.56	0.91	0.65	0.27
1985	0.37	0.55	0.92	0.64	0.28
1990	0.39	0.56	0.95	0.66	0.29
1995	0.43	0.55	0.98	0.66	0.32
2000	0.45	0.53	0.99	0.70	0.29

TABLE 3
GINI COEFFICIENTS OF WITHIN-COUNTRY AND BETWEEN-COUNTRY INEQUALITY, 1820–2000
(2005 BENCHMARK)

	Within-Country Inequality	Between-Country Inequality	Sum	Actual World Gini	Overlap Factor
1820	0.45	0.29	0.74	0.54	0.19
1850	0.38	0.24	0.62	0.53	0.09
1870	0.45	0.43	0.88	0.61	0.27
1890	0.36	0.48	0.83	0.59	0.25
1910	0.40	0.51	0.91	0.64	0.28
1929	0.44	0.55	0.98	0.67	0.31
1950	0.38	0.59	0.97	0.68	0.29
1960	0.38	0.58	0.96	0.68	0.29
1970	0.37	0.60	0.97	0.68	0.28
1975	0.37	0.63	1.00	0.72	0.28
1980	0.36	0.60	0.95	0.68	0.27
1985	0.37	0.60	0.96	0.68	0.29
1990	0.39	0.60	0.99	0.69	0.30
1995	0.43	0.59	1.02	0.69	0.33
2000	0.45	0.58	1.03	0.72	0.31

The effect of moving from the 1990 benchmark to the 2005 benchmark is very clear from these estimates. The latter imply a higher level of between-country inequality throughout the whole period under study, which results in substantially higher estimates of total global inequality (in most years 4 to 5 points on the Gini scale). Yet, both sets show the same pattern of already quite high levels of global inequality at the start of the period (0.49 and 0.54, respectively), but the nineteenth century is also characterized by fluctuations in global inequality. The 1850 level of within-country inequality is much lower than that of either 1820 or 1870, and the same applies to 1890. At the present state of knowledge, no historical explanation (such as more wars or deeper economic crisis of rich countries, relative to poor

TABLE 4
THEIL COEFFICIENTS OF WITHIN-COUNTRY AND
BETWEEN-COUNTRY INEQUALITY, 1820–2000 (1990 BENCHMARK)

	Within-Country	Between-Country	Total
1820	0.26	0.06	0.31
1850	0.24	0.12	0.35
1870	0.26	0.20	0.46
1890	0.23	0.27	0.50
1910	0.25	0.33	0.58
1929	0.26	0.41	0.67
1950	0.24	0.53	0.76
1960	0.23	0.50	0.74
1970	0.23	0.55	0.78
1975	0.23	0.62	0.85
1980	0.23	0.54	0.77
1985	0.23	0.52	0.75
1990	0.23	0.56	0.79
1995	0.24	0.55	0.79
2000	0.25	0.54	0.79

TABLE 5
THEIL COEFFICIENTS OF WITHIN-COUNTRY AND
BETWEEN-COUNTRY INEQUALITY, 1820–2000 (2005 BENCHMARK)

	Within-Country	Between-Country	Total
1820	0.26	0.16	0.43
1850	0.24	0.25	0.49
1870	0.26	0.33	0.59
1890	0.23	0.39	0.62
1910	0.25	0.45	0.70
1929	0.26	0.51	0.77
1950	0.24	0.61	0.85
1960	0.23	0.60	0.83
1970	0.23	0.64	0.87
1975	0.23	0.73	0.97
1980	0.23	0.64	0.86
1985	0.22	0.63	0.85
1990	0.23	0.64	0.87
1995	0.24	0.63	0.87
2000	0.24	0.63	0.87

ones) for the exceptions in 1850 and 1890 exists. The data for these years must possibly be revised if further research does not find support and explanation for these estimates. Inequality increases steeply from 0.54 in 1820 to 0.67 in 1929 and 0.68 in 1950 according to the 2005 benchmark, after which, in both sets of estimates, it more or less stabilizes at that (extremely high) level during the second half of the twentieth century. The Theil coefficients tell a similar story but are less volatile (with the exception of a sudden jump in 1975, which is also a bit of an outlier in the series of Gini coefficients).⁶ Also the somewhat higher Ginis for 2000

⁶But for 1975 the coverage is more limited than for other data points; in the series of Ginis, 2000 is also a bit of an outlier—in spite of a decline in between-country inequality the Gini of global inequality in higher than in 1995 (both series); we do not observe this peak in 2000 in the Theil indices.

TABLE 6
THE COVERAGE OF THE DATASET, 1820–2000 (1990 BENCHMARK)

	Population Covered (million)	Share of Global Population	Average Income Covered Population (1990 dollars)	Average Income World (1990 dollars)	Ratio Coverage/All
1820	912	0.88	689	667	1.03
1850	1061	0.90	791	791	1.00
1870	1138	0.89	913	873	1.05
1890	1356	0.92	1126	1133	0.99
1910	1629	0.94	1477	1465	1.01
1929	1922	0.93	1831	1784	1.03
1950	2312	0.92	2196	2113	1.04
1960	2844	0.94	2882	2775	1.04
1970	3483	0.94	3851	3736	1.03
1975	3185	0.78	4235	4095	1.03
1980	4028	0.91	4762	4521	1.05
1985	4105	0.85	5258	4763	1.10
1990	4894	0.93	5443	5162	1.06
1995	5134	0.90	5641	5452	1.03
2000	5110	0.84	6505	6029	1.08

fall within the margins of error that are inherent to studies of this kind (Anand and Segal, 2008).

Table 6 demonstrates that we normally cover between 85 and 94 percent of global population with real data, which is quite high; this percentage tends to increase somewhat during the period under study. On the basis of the Maddison dataset, we estimate that the average income of this 85 to 94 percent share is usually slightly higher than that of the world as a whole, but the average income of the uncovered rest is clearly lower than of the countries covered by this experiment (for example, in 1820, the average income of “the rest” can be estimated to be about 500 1990 international dollars). We therefore more or less consistently underestimate inequality, but the bias does not change (much) over time.

Compared to Bourguignon and Morrisson (2002), our estimates based on the 1990 benchmark are somewhat lower than theirs, and using the 2005 benchmark substantially higher by, on average, 4 points on the Gini index. Their estimates of global inequality increase from a Gini of 0.50 in 1820 to 0.61 in 1910, 0.64 in 1950, and 0.657 in 1980, whereas the Gini estimated here (in 1990 dollars as well) is 0.49 in 1820, and rises to 0.58 in 1910, 0.65 in 1950, and 0.65 in 1980. After 1950 the B&M estimates continue to increase a bit, whereas our estimates show more or less stability (with the exception of the estimates for 1975 and 2000, both based on a more limited number of observations). Comparison with the Theil coefficients for the same distributions demonstrates that they show a much larger increase, by more than 100 percent, whereas the Ginis increase less than 50 percent (Tables 2–5).

3. RELIABILITY INTERVALS

Our estimates are all based on direct information. However, since we use a large amount of new data, and we use a diverse methodology of creating the world income inequality series, it seems necessary to gauge its imprecision. Basically, our

TABLE 7
RELIABILITY INTERVALS OF WITHIN-COUNTRY INEQUALITY
BASED ON THE THOMAS/FEINSTEIN PROCEDURE

	Within Inequality (2005 benchmark)	±95% Reliability Interval
1820	0.45	0.027
1850	0.38	0.035
1870	0.45	0.027
1890	0.36	0.023
1910	0.40	0.024
1929	0.44	0.023
1950	0.38	0.011
1960	0.38	0.010
1970	0.37	0.004
1975	0.37	0.004
1980	0.36	0.003
1985	0.37	0.002
1990	0.39	0.004
1995	0.43	0.005
2000	0.45	0.006

estimates consist of two components, the within- and the between-country inequality. Since the within-country inequality is estimated based on several different sets of data, we follow Chapman (1953) and Feinstein and Thomas (2001), who attach standard reliability intervals of 1.25 percent for firm figures, 3.75 percent for good figures, 8.75 percent for rough estimates, and 20 percent for conjectures. They argue that the point of such an exercise is that it makes explicit how the “producers” of new estimates assess their reliability. We copy this procedure, and ascribe an error margin of 1.25 percent to the best data, the actual gross household Ginis. The net household and expenditure Ginis that had to be converted into gross household Ginis we give an error margin of 3.75 percent. Finally, the Williamson index and height Ginis are assessed as having a reliability interval 8.75 percent. The results are presented in Table 7: the estimated (highly subjective) reliability interval (at 95 percent) declines from around 8 percent in 1820 to 1.4 percent in 2000.

For the between-country inequality, we follow Bourguignon and Morrisson (2002, p. 730) and run a Monte Carlo simulation (we experimented with this only with the 2005 benchmark data, but using the 1990 benchmark would give very similar results). A more detailed description is reported in Appendix 1. We assume 100 countries, where the GDP/cap follows an exponential distribution (our empirical distribution tests showed that in the majority of the cases we cannot reject at 5 percent that the per capita GDP followed this probability distribution), and the population follows a log-normal distribution (again in most cases log-normality seems a very good approximation for population according to empirical tests. For each year we use the parameters estimated from the actual data, and carry out 5,000 experiments to estimate the mean, the standard error, and the confidence interval of the between-country Gini. We follow Bourguignon and Morrisson (2002) in assuming that there is a random (normally distributed) multiplicative measurement error. We apply a mean value of 1 and 0.2 standard deviations for the error. This 0.2 standard deviation is an absolute maximum since it requires

TABLE 8
RELIABILITY INTERVALS OF BETWEEN-COUNTRY INEQUALITY
BASED ON MONTE CARLO SIMULATIONS

	Between Inequality (2005 benchmark)	$\pm 95\%$ Reliability Interval
1820	0.29	0.037
1850	0.24	0.042
1870	0.43	0.049
1890	0.48	0.051
1910	0.51	0.063
1929	0.55	0.068
1950	0.59	0.074
1960	0.58	0.077
1970	0.60	0.080
1975	0.63	0.090
1980	0.60	0.083
1985	0.60	0.070
1990	0.60	0.086
1995	0.59	0.089
2000	0.58	0.081

more than double the actual standard deviation in the underlying data. This results in a 95% confidence interval with about 30 percent higher or lower Gini (Table 8). Given the strong increase of the between Gini between 1820 and 2000, the chances that the general trend is wrong are quite small.

4. THE LONG-TERM DEVELOPMENT OF GLOBAL INEQUALITY

As outlined above, global inequality increases strongly between 1820 and 2000. Most of the increase occurred before 1950, while global inequality remained virtually stable afterwards. This pattern, however, is largely driven by between-country inequality, which increased strongly between 1820 and 1910, to decline until the 1980s, and to rise again in the late twentieth century (Tables 2–5).⁷ This is also consistent with the finding of Bourguignon and Morrisson (2002), who find a similar decrease, followed by an increase in inequality for the 1970s/1980s onwards.

Indeed, the initial decline already took place between 1910 and 1950 when socialism slowly became implemented in large parts of the world (most notably China, the USSR, and Eastern Europe). Even though the decline was small in the first phase of the implementation of socialism (1910–50), which was largely caused by a rising inequality until the 1930s and a decline in inequality afterwards (e.g., Atkinson, 2007; Földvári, 2009), the net effect was a decrease in within-country inequality in the world.⁸

⁷The most recent estimates for the period 1990–2008 show a significant decrease of between inequality, as in Bourguignon (2009) for 1989–2006, Sala-i-Martin and Pinkovskiy (2009, figure 25) for 1990–2006, and Morrisson and Murtin (2011) for 1992–2008.

⁸Note that this decline is partially measure dependent since the decline using a Theil index is more substantial than using a Gini. It is even possible to find a small increase in the Gini coefficient which is accompanied by a decline in the Theil index. Since the Gini is more theoretically sound in terms of inequality though, we prefer to focus mainly on the Gini coefficient.

This pattern was reversed though in the 1970s–1980s, when within-country inequality started to increase in all countries (from a Gini of 0.36 in 1980 to 0.39 in 1990 and 0.45 in 2000), but especially in the former socialist countries. The development received an extra impetus after the collapse of socialism in many countries in the late 1980s and early 1990s (for similar observations, see also Bhalla, 2002; Lemieux, 2006; Atkinson, 2007; Bourguignon, 2009). This increase of within-country inequality in the final decades of the twentieth century thus brings within-inequality in 2000 back to the level before the “egalitarian revolution” of the twentieth century.⁹

Between-country inequality, however, grows strongly between 1820 and 1970. After 1970, however, we witness a decline in between-country inequality, largely caused by the fast growth of several developing economies. Combining this between- and within-country inequality, we arrive at total world income inequality. In the nineteenth century, the combination of stable within-country inequality and rising between-country inequality causes world inequality to increase. This pattern continued in the first half of the twentieth century, even though it was slowed down by the egalitarian revolution that was already visible in within-country inequality from the 1910s onwards. However, after the 1970s this pattern changed completely: within-country inequality increased, combined with decreasing between-country inequality. The overall effect is a small, but persistent increase of world income inequality since the 1980s, suggesting that the effect of the reversal of the egalitarian revolution of within-country inequality outweighed the decline in between-country inequality.¹⁰

These changes in within- and between-inequality also affected the income distribution. Indeed, with the rise of global inequality between 1820 and 1950, the overlap factor increases (see Table 2), but it then declines between 1950 and 1980, a sign of growing polarization of the income pyramid discussed below (see Figure 1). This is followed by an increase in the overlap factor again between 1980 and 2000. What this suggests is that behind the apparent stability of the global Gini index during the 1950–2000 period, major changes in income distribution occurred, which express themselves (amongst others) in a changing overlap factor.

These changes in the income distribution are apparent in Figure 1. This figure charts the different global income distributions in one picture, indicating the increase in income levels, the growth of the population, and the changes in its distribution (all in 1990 dollars) (the comparable figure in 2005 prices is very similar). What is particularly striking, is the change in the structure of the income

⁹However, in several countries the internal inequality has been stable since 1985–90, such as in Japan, France, Italy, or Norway. In some countries it has decreased: this was the case in Brazil, Chile, Mexico, Peru, Thailand, and Turkey. This is also shown for OECD countries’ members by Cornia and Martorano (2011) as well as for the UNICEF countries by Lopez-Calva and Lustig (2009).

¹⁰But other authors like Bourguignon (2009), Sala-i-Martin and Pinkovskiy (2009), and Morrisson and Murtin (2011), each using a different methodology, found that the decline in between-country inequality has outweighed the increase of within-country inequality, so that global inequality has decreased. Some studies argue that the effect of between-country inequality is bigger, and hence that there is a decline of total world inequality in the 1990s (e.g., Sala-i-Martin and Pinkovskiy, 2009). However, this method is not comparable to ours since it deviates in data, interpolation method, and construction of the Ginis. We also tried to see whether sampling issues (the number of countries in the dataset) did make a difference. However, even correcting for sampling issues we arrived at the same result: a small but persistent increase in world income inequality in the 1990s.

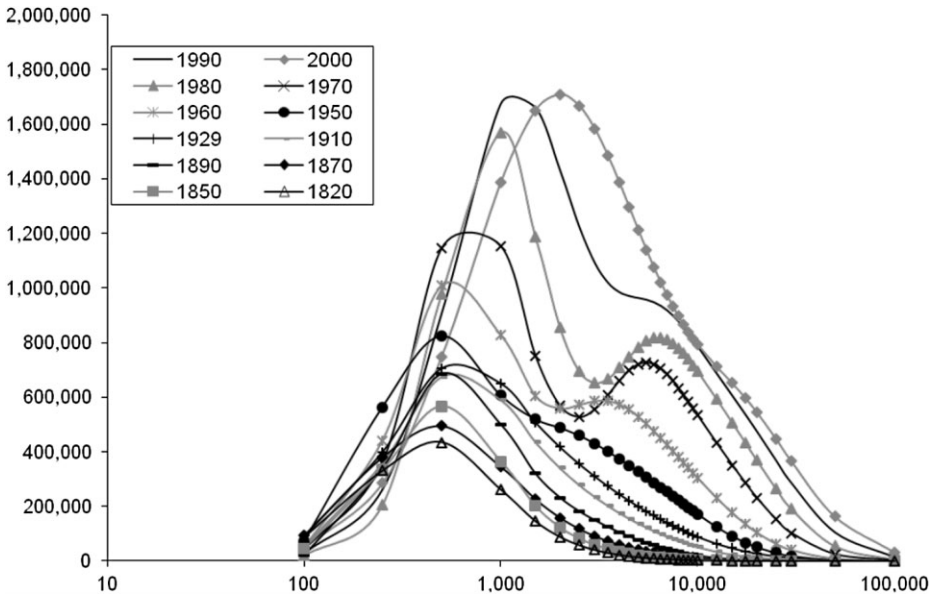


Figure 1. Global Income Distributions: Number of People with Certain Level of Income (in dollars of 1990), 1820–2000

pyramid through time (for similar analyses of the more recent period, see Milanovic, 2002, Sala-i-Martin, 2006). Between 1820 and 1910, the world income distribution is uni-modal and basically log-normal, although, looking at the 1910 distribution, an extension of its right “wing” can already be noticed. In the next few decades a different distribution emerges with two separate peaks; this is already very clear in 1950 (when the two peaks have almost the same size), and becomes more pronounced in the 1960s and 1970s, when a big gap between rich and poor “peaks” appears. However, in the 1980s and 1990s the two modes begin to merge, and in 2000 the distribution has become consistently uni-modal again.

One might argue that the switch to a bi-modal distribution is caused by de-globalization after 1914: a lack of trade caused by two world wars, a depression, and a bi-polar world system. This, however, is a topic for further research—here we can only speculate about the fact that this change from a uni-modal distribution toward a bi-modal system is accompanied by the decline of inequality within countries (the “egalitarian revolution” of the twentieth century is a typical phenomenon of the developing nation state, which allows itself more degrees of freedom in the de-globalized world of 1914–60). After 1980 globalization, the increase of inequality within countries and the decline of inequality between countries were, in a similar way, closely interrelated processes.

The dataset also makes it possible to study within-country inequality of the main regions of the world, in order to see to what extent they were affected by these long-term trends. It is well known that in the post-1950 period there are more or less persistent differences in the level of within-country income inequality in different regions of the world. Latin America and Africa have, on average, relatively high

TABLE 9
UNWEIGHTED AVERAGES OF THE GINI COEFFICIENTS BY REGION AND PERIOD, 1820–2000
(1990 BENCHMARK)

	Western Europe	Eastern Europe	Asia	Middle East & North Africa	Sub-Saharan Africa	Latin America	N. America/Australia	World
1820	52.0	44.1	46.0	57.7	51.1	47.8	51.1	49.8
1850	43.4	38.5	34.6	50.3	46.8	42.2	37.3	40.2
1870	49.3	47.4	46.2	52.2	50.9	51.8	47.6	48.8
1890	40.4	35.2	36.5	32.5	35.3	41.1	42.0	37.3
1910	44.2	38.2	41.2	42.3	41.2	44.8	42.7	41.6
1929	45.9	41.3	42.3	46.2	46.4	50.5	43.1	45.2
1950	39.2	36.6	40.3	42.1	41.5	42.9	37.0	40.3
1960	42.2	34.6	42.5	50.8	51.7	50.0	34.6	45.4
1970	38.0	35.5	40.2	50.6	50.1	49.0	35.9	44.2
1980	35.5	27.9	39.1	42.8	49.0	46.8	37.4	41.4
1990	35.1	27.8	40.4	44.1	45.7	49.6	38.3	39.7
2000	37.0	37.8	44.5	47.3	47.6	51.7	41.6	43.1
As percentage of world average								
1820	104	88	92	116	102	96	102	100
1850	108	96	86	125	116	105	93	100
1870	101	97	95	107	104	106	98	100
1890	108	94	98	87	94	110	113	100
1910	106	92	99	102	99	108	103	100
1929	102	91	94	102	103	112	95	100
1950	97	91	100	104	103	106	92	100
1960	93	76	93	112	114	110	76	100
1970	86	80	91	114	113	111	81	100
1980	86	67	94	103	118	113	90	100
1990	88	70	102	111	115	125	97	100
2000	86	88	103	110	110	120	97	100

levels of inequality, whereas Western Europe and Asia tend to have lower levels (Deininger and Squire, 1998). These patterns also emerge when we look at the unweighted averages of the Ginis of the different countries in the different regions and the world as a whole (Table 9): Latin America and Africa almost always have a higher average Gini than Europe; the Middle East is also often above average, whereas Asia is usually below average.¹¹ Before 1950 the differences between the continents are relatively small, however, and Western Europe is still among the regions with, on balance, above average within-country inequality. It only moves to below average after 1945. The industrial revolution therefore emerged in a region with rather high levels of income inequality, but levels of income were also high there, as a result of which the extraction ratio was much lower than elsewhere (Milanovic *et al.*, 2007). This decline of inequality is even more pronounced in (centrally planned) Eastern Europe, which has by far the lowest Ginis during the

¹¹We split up the regions according to economic and political characteristics. The first group is Western European countries, consisting of all European countries, except the former socialist ones. The Eastern Europe and the former USSR group consists of all former socialist countries of Eastern Europe and the former USSR. “Asia” consists of all Asian countries, except the Middle East. “Middle East and North Africa” consists of the Middle Eastern countries and Africa above the Sahara. “Sub-Saharan Africa” contains all other African countries. “Latin America” contains all Latin American (and Caribbean) countries. Finally, “Western Offshoots” contains Canada, the U.S., New Zealand, and Australia.

1950–90 period. The “egalitarian revolution” of the twentieth century is also apparent in North America/Australia, and can even be found in the (unweighted) global averages, which decline between 1929 and 1980. In all regions we see an increase in inequality in the last decade of the twentieth century; it is most striking in post-communist Eastern Europe and modest in Western Europe.¹² Between 1820 and 1929 no clear trends in within-country inequality are apparent.

We can also estimate “within-region” income inequality of the various parts of the world, which is the product of inequality within the countries of that region and income disparities between those countries. It takes into account that within Western Europe there were large income differences between rich countries such as the U.K. and the Netherlands, and poor countries such as Portugal or Finland. This addresses the problem that countries form the basic unit of analysis in this kind of research, but that their size varies enormously as well as the problem that income differences across countries may vary widely. Hence, even when average within-country inequality is low, actual inequality in a certain region may be much higher because the income differences across countries are higher. Indeed, income inequality in large countries such as China, the U.S., or India, tends to be higher than that of small, homogenous countries such as Denmark or Belgium, because it also includes the income disparities between the different parts of such a large state.

In Table 10 we present estimates of “within-region” income inequality of seven regions, which are, however, still quite different in size (Asia is by far the largest region, with currently 55 percent of the global population). A number of patterns emerge from these estimates. In Europe and the Western Offshoots, regional inequality declines in the long run and moves from above the world average to much below that average, but in the last two decades of the twentieth century this process appears to come to an end. Regional inequality in Asia changes in the opposite direction: it is relatively low during the nineteenth century, but increases sharply in the twentieth century. Increasing “within-region–between-country” inequality is driving this process—first Japan is the main mover, later followed by other countries which are successfully catching up, whereas large parts of the region remain poor. Regional inequality in Sub-Saharan Africa offers a third pattern: the Gini is very high at the beginning of the period (but the number of observations is quite limited), and continues to be so throughout the twentieth century. The gap between the unweighted average Gini of Table 9 and the regional inequality Gini of Table 10 implies that between-country inequality in Africa is quite large, which is caused by some relatively successful economies (South Africa in particular), and many quite unsuccessful ones (with the lowest GDP per capita values in the world). In this comparison, it is not Latin America that comes forward as the most unequal continent (which in other studies is usually the case). Between-country inequality in that part of the world is more limited, as a result of which “within-region” inequality is, initially, even smaller than the unweighted average of the country Ginis. This changes the course of the nineteenth century,

¹²The exception is Latin America, where internal inequality has decreased (see Lopez-Calva and Lustig, 2009; Cornia and Martorano, 2011).

TABLE 10
GINI COEFFICIENTS OF INCOME INEQUALITY OF VARIOUS WORLD REGIONS, 1820–2000
(1990 BENCHMARK)

	Western Europe	Eastern Europe	Asia	Middle East & North Africa	Sub-Saharan Africa	Latin America	N. America/ Australia	World
1820	55.3	52.8	42.8	60.3	56.6	45.7	56.8	49.3
1850	47.2	50.2	35.9	48.3	48.8	39.0	42.8	46.1
1870	52.8	48.6	42.7	53.7	55.1	51.5	51.1	55.0
1890	45.1	36.9	34.3	28.9	41.1	45.3	45.5	51.7
1910	48.3	38.7	40.0	57.9	50.6	55.2	50.1	57.9
1929	50.3	42.8	45.8	49.2	57.6	59.6	53.0	63.0
1950	46.7	36.0	44.2	45.5	55.3	50.8	39.3	64.5
1960	43.9	29.5	47.3	53.7	62.3	58.0	37.7	64.1
1970	39.7	25.2	56.5	53.0	58.6	57.0	35.6	65.2
1980	37.3	25.7	57.0	50.2	58.6	54.1	36.4	65.2
1990	38.7	28.6	57.7	49.5	57.7	54.3	38.7	64.4
2000	40.0	40.9	57.9	52.9	59.8	56.2	42.9	68.6
As percentage of world average								
1820	112	107	87	122	115	93	115	100
1850	102	109	78	105	106	85	93	100
1870	96	88	78	98	100	94	93	100
1890	87	71	66	56	79	88	88	100
1910	83	67	69	100	87	95	87	100
1929	80	68	73	78	91	95	84	100
1950	72	56	68	71	86	79	61	100
1960	68	46	74	84	97	90	59	100
1970	61	39	87	81	90	87	55	100
1980	57	39	87	77	90	83	56	100
1990	60	44	90	77	90	84	60	100
2000	58	60	84	77	87	82	63	100

Note: Because the world estimate includes the overlap factor, the weighted average of all the continental Ginis does not add up to 100%.

but still the overall level of inequality in the region remains at par or, after 1950, below that of Africa (and of the world as a whole).

5. CONCLUSION

We have reconstructed a new dataset of estimates of the inequality of the income distribution for a large set of countries for benchmark years starting in 1820 and ending in 2000. This was, in comparison with the estimates produced by Bourguignon and Morrisson (2002), based on the use of new (and old) historical studies of income inequality in different countries, and on different sets of indirect estimates of the development of the Gini index.

From these within-country inequality estimates, we aggregated to a World Gini using income differences between countries. We used the new 2005 PPPs of the ICP project, which may give a more accurate picture of disparities in GDP per capita than the previous ICP rounds. Since many estimates use the Maddison (2003) data, we also provided a second set of World Ginis based on these numbers. The combination of these estimates of within- and between-country inequality have been used to reconstruct the evolution of global inequality between 1820 and 2000. We present estimates in both Gini and Theil coefficients.

The long-term evolution of global inequality that emerges from this is not very dissimilar from the results presented by B&M. Our estimates show a more or less similar increase during the 1820–1950 period, and stability (instead of a small increase) during the second half of the twentieth century. Within-country inequality did not change a lot in the very long run, although in many countries inequality tended to decline during the middle decades of the twentieth century, which was often followed by a rise of inequality after 1980. Between-country inequality increased a lot and was the main cause behind the very strong increase in global inequality in these two centuries. This process appears to have come to an end during the second half of the twentieth century, however—between 1950 and 1980 there was a high level stagnation of between-country inequality, followed by a small decline during the final decades of the century. This decline in between-country inequality between ca 1975 and 2000 was being “undone” however, by the increase of within-country inequality in the same period.

Our most striking results point to important changes in the structure of global inequality. It was a clear uni-modal distribution in the nineteenth century, but it became increasingly bi-modal during the middle decades of the twentieth century, when a clear separation between “rich” and “poor” peaks in the global income distribution emerged. Between 1980 and 2000, the shape of the global distribution changed “suddenly” from a bi-modal to a uni-modal distribution, mainly due to the rapid growth in countries such as China, India, and Indonesia. Our speculation that these changes in the global income distribution were linked to processes of globalization and de-globalization in the world economy, clearly requires further work. The globalized world of the (late) nineteenth century produced a uni-modal distribution. The processes of de-globalization in the middle decades of the twentieth century had two effects on global inequality: nation states acquired the freedom to build a welfare state that sharply reduced income inequality within countries (in the richer part of the world), but at the same time it seems to have led to the emergence of a bi-modal distribution on a global scale. The dramatic process of globalization of the final decades of the twentieth century reversed both changes: it led to a strong increase in within-country inequality (bringing it back to its level from before the “egalitarian revolution” of the twentieth century), and it resulted in the sudden appearance of a uni-modal income distribution on a global scale (and a small decline in between-country inequality).

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Appendix 1: The Estimation of Confidence Intervals with Monte Carlo Simulations for the Between-Country Gini Coefficients

Data Appendix