

# Inequality Among World Citizens: 1820–1992

By FRANÇOIS BOURGUIGNON AND CHRISTIAN MORRISSON\*

*This paper investigates the distribution of well being among world citizens during the last two centuries. The estimates show that inequality of world distribution of income worsened from the beginning of the 19th century to World War II and after that seems to have stabilized or to have grown more slowly. In the early 19th century most inequality was due to differences within countries; later, it was due to differences between countries. Inequality in longevity, also increased during the 19th century, but then was reversed in the second half of the 20th century, perhaps mitigating the failure of income inequality to improve in the last decades. (JEL D31, F0, N0, O0)*

The revival of interest in empirical growth economics during the 1990's brought with it a revival of interest in the world distribution of income. Indeed, most of the recent literature on convergence of GDP per capita across countries goes beyond theoretical issues of the determinants of the economic growth of nations. It deals with the world distribution of income and with whether the distribution between rich and poor is likely to equalize or to become more polarized in the long run.<sup>1</sup>

This treatment of world inequality is oversimplified because it considers all citizens in a given country as perfectly identical. By ignoring income disparities within countries, the recent empirical growth literature gives a biased view of the evolution of world inequality over time, clearly underestimating it. This line of work focuses on "international" rather than "world" inequality. By 1820, for instance, this paper estimates that the Gini coefficient for world distribution of income was 0.50 whereas

it would have been only 0.16 if individual incomes had been equal within each country.

A possible justification for focusing on international differences in GDP per capita is that they tend to change more quickly and more dramatically than national differences. Therefore, the dynamics of the world distribution of income would derive mainly from the component of world inequality that arises from the evolution of differences between countries rather than within countries. Indeed, this paper shows that inequality among countries is a key factor in explaining world inequality. But it also shows that world inequality is not well approximated by the hypothesis that all citizens within a country have the same income.

Many attempts have been made to estimate changes in world inequality of personal incomes.<sup>2</sup> This paper, by updating previous work from the 1950's to the 1980's and extending it back to the beginning of the 19th century, is the first to take a broad historical view. This view of world inequality over almost two centuries differs substantially from the literature on world economic inequality in the post-World War II

\* Bourguignon: Delta, 48 Boulevard Jourdan, 75014 Paris, France (e-mail: bourg@delta.ens.fr) and World Bank; Morriçon: University Paris I and Delta, 36 Chemin Desvallières, 92410 Ville d'Avray, France. We thank Anthony Atkinson, Gary Fields, Branko Milanovic, and two anonymous referees for helpful comments on earlier drafts of this paper. We also thank participants at seminars sponsored by the World Bank and the International Labour Organization. Assistance by Bénédicte Sabatier is gratefully acknowledged. Any errors remain the authors' responsibility.

<sup>1</sup> See the 1997 symposium of the *Journal of Economic Perspectives* on the "Distribution of World Income," which deals with convergence issues, especially the articles by Charles I. Jones (1997) and Lant Pritchett (1997). See also Danny T. Quah (1996a, b).

<sup>2</sup> Studies on the postwar period until the 1980's include Alan P. Kirman and Luigi M. Tomasini (1969), John Whalley (1979), Albert Berry et al. (1983a, b, 1991), Irma Adelman (1984), Robert Summers et al. (1984), Margaret E. Grosh and E. Wayne Nafziger (1986), Henri Theil (1989), Pan A. Yotopoulos (1989), Martin Ravallion et al. (1991), Ronald V. A. Sprout and James H. Weaver (1992), Theil and James L. Seale, Jr. (1994), and T. Paul Schultz (1998). For recent estimates directly based on available national household surveys see Shaohua Chen and Ravallion (2000) and Branko Milanovic (2002).

era. It also differs from the limited, historically oriented literature (William J. Baumol et al., 1994; Pritchett, 1997) because it provides a quantitative rather than a qualitative picture of the evolution of world income inequality.

This paper shows that world income inequality was already high in the early 19th century (a Gini coefficient of 0.50), when the industrial revolution was under way in Britain and beginning in France. Then, with the spreading of the industrial revolution to Western Europe and to European-populated countries in the Americas and the Pacific—referred to, following Angus Maddison (1995), as the “European offshoots”—and increasing inequality within these booming countries, world inequality soared. From 1820 to the eve of World War I, inequality rose almost continuously. The Gini coefficient went from 0.50 to 0.61, and the Theil index from 0.52 to 0.79. The increase in inequality decelerated somewhat between the wars and slowed even more after 1950. By then, however, the world Gini coefficient had reached 0.64, a level of inequality unknown in most contemporary societies (even today’s more egalitarian countries have Gini coefficients less than 0.60). Roughly speaking, world inequality peaked in the middle of the 20th century after more than a century of continuous divergence. Changes during the last 50 years look minor compared with that dramatic evolution, and the situation appears to be stabilizing.<sup>3</sup>

This overall evolution of world inequality hides complex mechanisms and changes in the nationality of individuals at various levels in the world income hierarchy. For instance, during the initial period of world divergence, strong convergence was taking place among European countries and their offshoots in America and the Pacific after 1890, whereas income disparities between this group of countries and the rest of the world were growing. Likewise, the apparent stabilization of world income distribution since 1950 reflects a relative slowing of economic growth among European countries and their offshoots, a catching up by Japan and East Asia, and the take-off of China beginning in the 1980’s. However, differences in growth in GDP

per capita among countries are insufficient to explain this complex evolution in the 19th or 20th century. For instance, China’s growth performance has been important in shaping the evolution of the world distribution of income because of China’s exceptionally large demographic weight and its dramatic changes in income distribution. Similarly, the increased world disparities observed in the 19th century as a consequence of the industrial revolution had much to do with initial population size in Western Europe and its growth rate. This paper’s main contribution is a detailed description of the evolution of world income distribution over the last two centuries. Moreover, the paper quantifies the importance of aggregate economic growth, population growth, and the structure of domestic income inequalities in this process.

Income is only one dimension of economic well being. Any analysis of the evolution of world inequality should also take other dimensions into account. Unfortunately, finding historical data for these other dimensions is even more difficult than finding data for income. This paper considers the evolution of inequality in longevity around the world, using national estimates of life expectancy at various points in time. That evolution parallels the evolution of income for about a century, after which it reversed, unlike the evolution of income inequality. If life expectancy is taken as a proxy for the health of a population, then evidence suggests that health disparities are probably not much larger today than they were in the early 19th century. Whether this should be interpreted as mitigating the failure of world income inequality to decline is a difficult conceptual question and is not tackled here. However, it is worth noting that the evolution of world inequality may not be the same along income and nonincome dimensions of well being.

In Section I, the paper first looks at the data and the methodology used to reconstitute the world distribution of income while taking domestic income disparities into account rather than assuming no heterogeneity within countries, as most of the recent literature does. Section II presents the findings on the overall evolution of world income distribution since 1820 and the results of sensitivity analysis for several assumptions made in constructing the data base. It also compares this evolution with and without accounting for domestic income

<sup>3</sup> Note that the estimates obtained by Milanovic (2002) would not suggest such a deceleration in the increase of world inequality. This is discussed in more detail later in this paper.

inequality. Section III provides a partial explanation of changes in world income distribution by decomposing the changes into the contribution of three components: the evolution of the world structure of GDP per capita, the structure of population, and domestic income inequality. It also analyzes the movement of countries and world citizens along the world income scale. Section IV focuses on changes in world disparities in life expectancy. The main findings are summarized in the concluding section.

### I. Methodology and Data for the World Distribution of Income

Estimation of the distribution of income relies on three types of data for each country (denoted by  $i$ ) included in the analysis: real GDP per capita,  $Y_i$ , expressed in constant purchasing power parity (PPP) dollars; population,  $N_i$ ; and the distribution of income summarized by nine decile income shares,  $D_{ij}$ ,  $j = 1, \dots, 9$  and the top two vintile shares,  $D_{ij}$ ,  $j = 10, 11$ . The world distribution is then obtained by assuming that each quantile in a country is made up of individuals with identical incomes. For each country, nine groups are defined of  $0.1N_i$  people with income  $y_{ij} = 10Y_i^* \times D_{ij}$ , for  $j = 1, \dots, 9$  and two groups of  $0.05N_i$  people with income  $y_{ii} = 20Y_i \times D_{ij}$ , for  $j = 10, 11$ . These groups are pooled and ranged by income and then the cumulative function and Lorenz curve of the world distribution of income are computed. With  $n$  countries, these two functions are thus described by  $11n$  points. Income inequality measures are computed on these  $11n$  groups. It is also possible to follow the country composition of the various quantiles of the world distribution (what share of the top centile of the world belongs to country X?) and the world rank of the various quantiles of a given country (what share of the population of country X is in the top world decile, or any other quantile, of the world distribution?)

Data on GDP per capita and population are from Maddison (1995), the first to construct a consistent historical series starting as early as 1820 for some countries and ending in 1992. Because the data series for many Eastern European and non-European countries did not start until some time between 1870 and 1913, the original series needed to be extended back to 1820. To fill in the gaps, growth rates observed

for comparable neighboring countries over the same period were used. Countries were also grouped in a slightly more aggregated way than in Maddison (1995) to avoid dealing with countries that were too small to affect world income distribution and to minimize problems of missing income distribution data (see the Appendix for groupings). The groupings were based on considerations of historical consistency and homogeneity. For instance, Austria, Hungary, and Czechoslovakia were grouped because they share obvious common characteristics over the 1820–1992 period, not just the post-World War II period. Similarly, Germany was kept united throughout the whole period. Argentina and Chile, two Latin American countries with recent European immigration, were also considered jointly, as were Taiwan and the Republic of Korea, two economies that shared a similar evolution over the last 40 years and similar histories of economic growth and income distribution during the previous hundred years or so.

Data were assembled for 33 countries or groups of countries. Each country or country group represents at least 1 percent of world population or world GDP in 1950. None of them can thus be thought of as negligible in the world economy. Countries like China,<sup>4</sup> India, Italy, and the United States, whose weight in the world is significant, are considered individually. The groups include small groups of comparable, medium-size countries and large groups of very small countries that came into existence only relatively recently and so could not be followed over a much longer period. For instance, Sub-Saharan Africa is broken down into four countries or groups: Nigeria, the largest country in the region; South Africa; Cote d'Ivoire, Ghana, and Kenya, three countries with a similar economic evolution; and the remaining 46 countries. Data are available, though very imperfectly, for the first three groups, whereas for the countries in the last group data are limited to the recent past.

To permit a simpler analysis of the evolution of the distribution of world income, the 33

<sup>4</sup> There has been some discussion on the recent growth performance of China. The calculations used here correspond to Maddison's (1995) "fast growth" scenario. Calculations assuming more modest growth performance were also made. They are not reported here for lack of space; however, they do not lead to fundamentally different conclusions.

groups were also aggregated into six blocks, defined geographically, economically, or historically: Africa; Asia excluding the “dragons” (Japan, Korea, and Taiwan); the Asian dragons; Latin America excluding Argentina and Chile; Eastern Europe (Bulgaria, Greece, Poland, Romania, Russia, Turkey, and Yugoslavia); and Western Europe and offshoots (all of Western Europe, including Austria, Hungary, and Czechoslovakia, and its offshoots in America, including Argentina and Chile, and in the Pacific).

Because of the obvious discrepancy between household purchasing power and GDP per capita, using GDP per capita in place of mean personal income may bias the estimation of the evolution of world inequality. Correcting for the share of nonhousehold income in GDP or the share of nonconsumption expenditures or taking into account the effects of changes in the terms of trade on the purchasing power of national agents proved impossible for the historical period. For comparability reasons, the GDP per capita convention was retained even after 1950, though a better approximation of international differences in mean living standards would have been possible.

Data sources for income distribution in the 33 country groups differ by period under analysis. Data are generally size-weighted disposable household income per capita.<sup>5</sup> For the post-World War II period, the data are updated from Berry et al. (1983a, b). For the pre-World War II period, data for today’s developed countries are from existing historical series and adapted to fit the decile/vintile definition. Data for the United States and the United Kingdom are from Peter Lindert (2000). Data for continental Europe are from Morrisson (2000). Distribution data are available or can be guessed from available historical evidence for a few other countries for a few dates prior to 1950. For the remaining countries and country groups, distribution was arbitrarily assumed to be the same as in a similar country for which some evidence was available for the appropriate period. (The data, data sources, and assumptions behind

them are available at: <http://www.delta.ens.fr/XIX>.)

In view of these assumptions, it would be unwise to take the resulting estimates of national income distribution at face value. This also holds for GDP per capita estimates for the distant past. To gauge the resulting imprecision in world distribution estimates, measurement errors were generated randomly on  $Y_i$  and  $D_{ij}$ , and Monte Carlo experiments were conducted to determine plausible confidence intervals for world inequality measures.

Multiplicative measurement errors on GDP per capita are assumed to be distributed normally with mean unity and a standard deviation of 10 percent during the 19th century, 5 percent for the first half of the 20th century, 2.5 percent after 1950, and 0 in 1992. These seemed reasonable orders of magnitude. For distribution data, stochastic deviations from central estimates,  $D_{ij}^0$  were specified as:

$$(1) D_{ij} = D_{ij}^0 + u_i(D_j^M - D_{ij}) + v_i(D_j^m - D_{ij})$$

where  $u_i$  and  $v_i$  are two independent, normally distributed, zero-mean random variables with identical standard deviation, and  $D_j^M$  and  $D_j^m$  are two arbitrary reference distributions corresponding to the most and the least inequalitarian distributions among all directly observed distributions. The standard deviation of the measurement error terms,  $u_i$  and  $v_i$ , was calibrated so that the resulting standard deviation of the Gini coefficient averaged 2 percentage points in the 19th century and 1 percentage point in the 20th century. With the width of the 95-percent confidence interval approximately equal to double these values, these seemed reasonable orders of magnitude. Indeed, a Gini coefficient of 0.44 rather than 0.40 would today imply a very significant difference in our knowledge of the distribution. All these measurement errors are drawn independently for all countries for all dates, for GDP per capita, and for the distribution of income.

## II. Evolution of World Distribution of Income Since 1820

Table 1 shows the shares of various income quantiles in world income and a set of standard inequality measures for selected years at 20- to 30-year intervals over the whole period. Stan-

<sup>5</sup> Distribution data in agreement with this definition are generally available for the recent period. For more distant periods, available distribution data have been corrected in an approximate way to fit the same definition.

TABLE 1—THE WORLD DISTRIBUTION OF INCOME AND LIFE EXPECTANCY:  
INEQUALITY AND POVERTY INDICES FOR SELECTED YEARS

Index	1820		1850	1870	1890	1910	
	Estimate	SE <sup>a</sup>				Estimate	SE <sup>a</sup>
Income shares (percents)							
Bottom 20 percent	4.7	0.16	4.3	3.8	3.4	3.0	0.11
Bottom 40 percent	13.5	0.39	12.1	11.0	9.9	8.8	0.24
Bottom 60 percent	25.7	0.61	23.3	21.4	19.5	17.6	0.37
Bottom 80 percent	43.7	0.74	40.7	38.0	35.0	33.0	0.48
Top 10 percent	42.8	0.64	45.2	47.6	49.8	50.9	0.52
Top 5 percent	31.8	0.51	32.2	33.4	34.9	36.7	0.54
Summary inequality measures							
Coefficient of Gini	0.500	0.009	0.532	0.560	0.588	0.610	0.005
Theil index	0.522	0.018	0.598	0.672	0.745	0.797	0.017
Mean logarithmic deviation	0.422	0.016	0.485	0.544	0.610	0.668	0.015
Standard deviation of logarithm	0.826	0.016	0.873	0.919	0.971	1.027	0.015
Mean world income (PPP \$ 1990)	658.7	23.2	735.7	890.0	1,113.8	1,459.9	24.1
World population (millions)	1,057.0		1,201.1	1,266.0	1,450.5	1,719.0	
Poverty							
Headcount (percents)							
Poverty	94.4	0.32	92.5	89.6	85.7	82.4	0.38
Extreme poverty	83.9	0.94	81.5	75.4	71.7	65.6	1.21
Headcount (millions)							
Poverty	997.8	3.4	1,110.5	1,134.3	1,243.6	1,416.5	8.2
Extreme poverty	886.8	9.9	978.8	954.0	1,040.5	1,127.7	24.1
Life expectancy							
Mean	26.5				29.9	32.8	
Theil index (between countries)	0.012				0.032	0.045	

<sup>a</sup> The computation of these standard errors is explained in the text.

standard errors of these inequality measures, computed in the Monte Carlo experiment described above, are reported for a few years. Figure 1 shows the evolution of density curves estimated using Kernel techniques on country decile observations. For the sake of clarity only four curves are shown, which delimitate in an obvious way the period under analysis.

The evolution shown by these indicators is unambiguous. World inequality worsened quickly and more or less continuously from 1820 to 1950, pausing only between 1910 and 1929. The rate of increase then decelerated considerably. On average, the Gini coefficient rose by 1 percentage point every decade from 1820 to 1950 and then almost leveled off between 1950 and 1992. On closer inspection, however, the indicators in Table 1 reveal a slightly more intricate picture for 1950–1992. Income distribution continued to worsen during the period, improving only between 1950 and 1960 and showing some signs of stability between 1970 and 1992. In particular, the share of the four bottom world deciles stopped falling between

1980 and 1992 for the first time since 1820, but that of the top decile increased again after a slight drop in the 1950's.

This finding is robust with respect to measurement errors. Since the distribution of all summary measures was close to normal, twice the standard error reported in Table 1 in each direction corresponds to a 95-percent confidence interval. With these confidence intervals, the overall imprecision in the change in the Gini coefficient during 1820–1950 does not exceed 2.5 percentage points, whereas the estimated increase is 14 percentage points. After 1950, however, measurement errors make the continuing increase in world income inequality ambiguous. Both conclusions apply to all summary inequality measures, including the ordinates of the Lorenz curve at the top of Table 1. All distributions observed in the 19th century Lorenz-dominate all distributions observed in the 20th century, even when measurement errors are taken into account. At the other end of the period, the distribution in 1992 is Lorenz-dominated by all distributions observed before

TABLE 1—Continued

1929	1950		1960	1970	1980	1992	
	Estimate	SE <sup>a</sup>				Estimate	SE <sup>a</sup>
2.9	2.4	0.04	2.4	2.2	2.0	2.2	0.03
8.2	6.8	0.10	6.8	6.1	5.7	6.4	0.07
16.7	14.2	0.17	14.1	12.8	12.5	13.5	0.10
32.3	31.1	0.23	31.9	30.4	29.5	28.2	0.13
49.8	51.3	0.31	50.0	50.8	51.6	53.4	0.14
35.0	35.5	0.31	34.1	34.2	35.0	36.0	0.19
0.616	0.640	0.002	0.635	0.650	0.657	0.657	0.001
0.777	0.805	0.009	0.776	0.808	0.829	0.855	0.005
0.690	0.775	0.008	0.766	0.823	0.850	0.827	0.005
1.064	1.154	0.007	1.161	1.210	1.234	1.184	0.005
1,817.1	2,145.5	16.1	2,798.6	3,773.8	4,544.0	4,962.0	—
2,042.1	2,511.3		3,024.7	3,664.5	4,414.0	5,459.1	
75.9	71.9	1.07	64.3	60.1	55.0	51.3	1.06
56.3	54.8	0.42	44.0	35.6	31.5	23.7	0.52
1,550.5	1,805.6	26.8	1,946.5	2,200.7	2,426.6	2,800.5	57.8
1,149.7	1,376.2	9.0	1,330.1	1,304.7	1,390.3	1,293.8	24.1
38.5	50.1			59.4		61.1	
0.046	0.025			0.012		0.013	

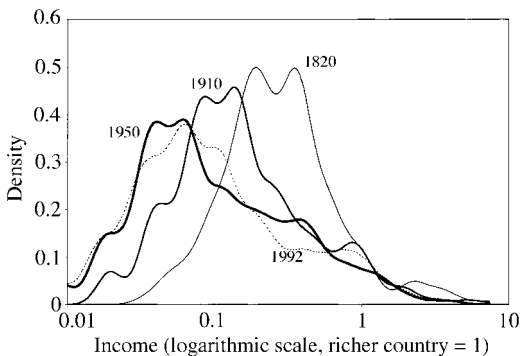


FIGURE 1. GAUSSIAN KERNEL ESTIMATE OF THE DENSITY OF THE WORLD INCOME DISTRIBUTION: 1820, 1910, 1950, AND 1992

1950. However, comparison with the 1950, 1970, and 1980 distributions yields ambiguous results when confidence intervals are taken into account.<sup>6</sup>

<sup>6</sup> Using estimates directly based on household surveys, Milanovic (2002) finds an unambiguous increase in world

The Lorenz-dominance criterion ignores gains in social welfare due to a higher mean income by focusing exclusively on the distribution of *relative* incomes. Changes in world social welfare may be gauged by using generalized Lorenz dominance, which compares the absolute income of successively poorer segments of the population.<sup>7</sup> Simple calculations made from the data in Table 1 show that this dominance criterion breaks down only once, between 1929 and 1950. Except for that interval, the mean income of all bottom quantiles of the world distribution increased continuously.

The change in the world distribution of income is dramatically illustrated by the evolution of the density curve, as shown in Figure 1. To

inequality between 1987 and 1997. This does not necessarily contradict the results here. World inequality may have increased since 1992 or the use of GDP per capita rather than mean household income as directly estimated in household surveys may cause some discrepancy over a relatively short period of time.

<sup>7</sup> On this concept, see Anthony F. Shorrocks (1983).

make the curves comparable over time, income was normalized by the mean income of the richest country. The continuous and rapid increase in world inequality is noticeable with the leftward shift of the main modes of the distribution and the lengthening of its right-hand tail. In conformity with the results reported above, this shift stops after 1950. Another noticeable change is the shift of the secondary mode in the right-hand part of the curve. This mode, representing the distribution of income in the richest countries, tends to move leftward at an approximately constant distance from the first mode and to become more prominent over time. Between 1950 and 1992, however, this evolution seems to have been reversed.

In addition to the relative income scales explored in Figure 1 and through inequality measures, it is interesting to look at absolute scales. The poverty and extreme poverty ratios reported in Table 1 show the proportion of the world population below two absolute income thresholds. The poverty lines were calibrated so that poverty and extreme poverty headcounts in 1992 coincided roughly with estimates from other sources (see World Bank, 1990, 2001; Chen and Ravallion, 2000): 2.8 billion and 1.3 billion people, respectively.<sup>8</sup> The poverty lines are then taken to be constant over time.

With this definition of poverty, the worsening of the world distribution of income was not severe enough to cause the proportion of poor people to increase despite the growth in world mean income. In effect, world economic growth, though strongly inegalitarian, contributed to a steady decline in the headcount measure of poverty throughout the period under analysis. Over the 172 years considered here, the mean income of world inhabitants increased by a factor of 7.6. The mean income of the bottom 20 percent increased only by a factor of slightly more than 3, that of the bottom 60 percent by about 4, and that of the top decile by almost 10. At the same time, however, the extreme poverty headcount fell from 84 percent of the world population in 1820 to 24 percent in 1992. Even with the weaker definition of pov-

erty, the drop is substantial: from more than 90 percent in 1820 to 51.3 percent in 1992.

While the poor declined steadily as a proportion of the population during the last two centuries, the number of poor people continued to rise. The number of people in extreme poverty rose as well, although the increase seems to have stopped in the last 20 years or so. Both evolutions result from a complex combination of effects linked to growth in the mean income of the world population, changes in its distribution, and differential rates of population growth along the world income scale. But changes in world distribution of income played a major role. World economic growth since 1820 could have caused poverty to decline dramatically, despite population growth, had the world distribution of income remained unchanged—that is, had the growth rate of income been the same across and within countries. Had that been the case, the number of poor people would have been 650 million in 1992 rather than 2.8 billion and the number of extremely poor people 150 million instead of 1.3 billion. Likewise, the leveling off in the number of extremely poor people since 1970 can be attributed to the stabilization of their relative position since then.

Differences in country economic growth rates practically explain all of the increase in world inequality and in the number of poor people. Table 2 decomposes world inequality into that due to income disparities within a country or country group and that due to disparities between countries, using two inequality measures. The within-country component of inequality is obtained by difference and corresponds to average country inequality weighted by total income for the Theil index or total population for the mean logarithmic deviation (see Bourguignon, 1979; Shorrocks, 1980). The between-country component refers to the inequality that would be observed if incomes were identical within each country.

As expected, within-country inequality decreased as a share of world inequality over the 1820–1992 period, though it remained an essential part of total inequality throughout the period (see Table 2). It represented 80 percent and more of total inequality in the first half of the 19th century, a time when most countries were at about the same income level. Essentially, the United Kingdom, some continental European countries, and the United States were

<sup>8</sup> These definitions correspond to poverty lines equal to consumption per capita of \$2 and \$1 a day, expressed in 1985 PPP.

TABLE 2—DECOMPOSITION OF WORLD INCOME INEQUALITY INTO “WITHIN” AND “BETWEEN” INEQUALITY  
(VARIOUS INEQUALITY MEASURES)

Year	Theil index			Mean logarithmic deviation			Standard deviation of logarithm	
	Inequality within country groups	Inequality between country groups	Total inequality	Inequality within country groups	Inequality between country groups	Total inequality	Inequality between country groups	Total inequality
1820	0.462	0.061	0.522	0.370	0.053	0.422	0.300	0.826
1850	0.470	0.128	0.598	0.374	0.111	0.485	0.432	0.873
1870	0.484	0.188	0.672	0.382	0.162	0.544	0.515	0.920
1890	0.495	0.250	0.745	0.393	0.217	0.610	0.592	0.971
1910	0.498	0.299	0.797	0.399	0.269	0.668	0.668	1.027
1929	0.412	0.365	0.777	0.356	0.334	0.690	0.747	1.064
1950	0.323	0.482	0.805	0.303	0.472	0.775	0.907	1.154
1960	0.318	0.458	0.776	0.300	0.466	0.766	0.920	1.161
1970	0.315	0.492	0.808	0.304	0.518	0.823	0.977	1.210
1980	0.330	0.499	0.829	0.321	0.528	0.850	0.994	1.234
1992	0.342	0.513	0.855	0.332	0.495	0.827	0.926	1.184

the only exceptions. GDP per capita in China or India was around \$500 (in 1990 PPP); that of the United Kingdom was only three times larger. The gap between countries widened rapidly, however. By 1910 the differential between the United Kingdom and China had risen to 6:1 and by 1950 to 10:1. This widening gap plus the substantial decline in within-country inequality between 1910 and 1950 explain why, by 1950, within-country inequality accounted for only 40 percent of total world inequality—half its share in 1820. Thus the increase in between-country inequality was much larger than the increase in overall inequality—as measured by the Theil index or the mean logarithmic deviation—between 1820 and 1950. In the postwar period, the shares of the within-country and between-country components of inequality seem to have stabilized.<sup>9</sup>

The within-country component of world inequality is sufficiently important for the density function of the world distribution of income to be substantially different when country income decile information is used, as in Figure 1, and when they are not, as in Figure 2. The same is true of the evolution of density curves. Figure 2 shows Kernel estimates of the density func-

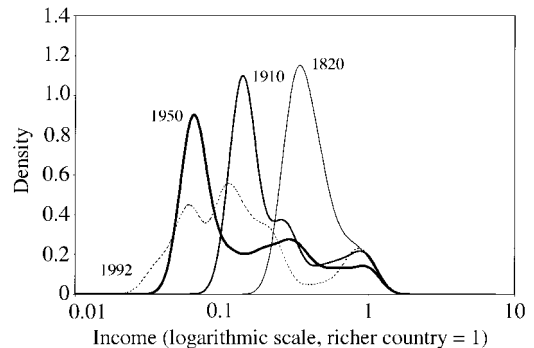


FIGURE 2. GAUSSIAN KERNEL ESTIMATE OF THE DENSITY OF THE WORLD INCOME DISTRIBUTION WHEN INEQUALITY WITHIN COUNTRIES IS IGNORED: 1820, 1910, 1950, AND 1992

tion using GDP per capita for the groups of countries in the analysis. The density curve for 1820 has a single mode and a small hump at the bottom right end of the curve. The corresponding curve in Figure 1 was flatter with a double-peaked main mode and a secondary mode on the right tail. Over time, the density curve shifts leftward, as in Figure 1, but two secondary modes appear in 1910 and become more prominent in 1950. This evolution is much less pronounced in Figure 1. Likewise, there is a dramatic flattening of the density curve between 1950 and 1992 and a double mode appears in the left half of the curve. No such dramatic

<sup>9</sup> The figures on the change in inequality between countries are consistent with the rough estimates by Pritchett (1997). He found that the standard deviation of the logarithm of income per capita might have doubled between 1870 and 1990, increasing from 0.5 to a little more than 1.



change is observed when inequality within countries is taken into account.

This comparison of Figures 1 and 2 points out the danger of interpreting changes in the distribution of GDP per capita across countries (Fig. 2) as true changes in the world distribution of income, as much of the recent literature does. Economic analysis tends to consider countries as the logical statistical unit for assessing international convergence or divergence of income and to ignore population size. However, if the intention is to analyze the world distribution of income and the degree of inequality or poverty among world citizens, ignoring income disparities within countries may be misleading. The effect of changes in the world hierarchy of GDP per capita may have very different impacts on the distribution of income among world citizens depending on the degree of inequality in countries where income variations are largest.

### III. Sources of Changes in the World Distribution of Income

What effect have economic and population growth and changes in domestic income distribution in the countries and country groups had on the evolution of world inequality? The contribution of changes in domestic income distribution is easily computed using the same decomposable measures as above.

The contributions of economic and population growth are a little more difficult to assess. The effect of a country's economic growth is evaluated by computing what the change in world inequality would have been had income per capita in that country grown at the same rate as mean world income per capita during the period under analysis. This permits capturing the effect on world inequality of the differential rate of growth between a country and the rest of the world.

The resulting decomposition is exact for relatively small countries, which cannot significantly affect world averages. Things are different for larger countries and a fortiori for regions. For that reason, the decomposition methodology is approximate—the sum of national contributions may differ from the observed change in inequality.<sup>10</sup> But since the

objective is to identify the major sources of change rather than to quantify them precisely, this is not a problem. The same hypothetical scenario of a common growth rate is used for evaluating the contribution of the population growth of a country or a region to the change in world inequality. Table 3 shows the results of that decomposition when the 33 country groups are aggregated into six regions. For simplicity, the period was broken into four intervals of 40–50 years each.

Whether inequality is measured by the Theil index or the mean logarithmic deviation, the dominant disequalizing force throughout the 19th century and the first half of the 20th century was the relatively slow economic growth of the Asian region, the most populated area of the world. Between 1820 and 1950, income per capita in that region, which represented almost two-thirds of the global population in the early 19th century, grew at an average annual rate of 0.2 percent, some 4.5 times slower than the world average and 6 times slower than the average for the Western European regions, including offshoots. India, the slowest growing large country in the world in that period, and China, which did little better, accounted for most of Asia's slow growth. Maddison's (1995) data suggest that income per capita increased slightly more than 10 percent in India and about 17 percent in China between 1820 and 1950 while the increase in European countries in which the industrial revolution started was around 400 percent—and bigger yet in their offshoots. True, the terminal years of this period were among the worst growth years for India and China for the last two centuries. The picture is less dramatic for the subperiod 1820–1910. Even so, however, Asia underperformed all the other regions of the world by a wide margin.

The second major world disequalizing factor was the rapid enrichment of the European population. The first century and a half after the beginning of the industrial revolution witnessed a dramatic divergence in the world economy as the richest countries became ever richer and the

---

perfect decomposition formula available in the present case. Ours generalizes the well-known methodology introduced by Dilip Mookherjee and Shorrocks (1982) to noninfinitesimal changes—which was also used in the context of the world distribution of income by Berry et al. (1983a).

<sup>10</sup> This decomposition discrepancy is reported at the bottom of each panel of Table 3. Note that there is no

TABLE 3—DECOMPOSITION OF CHANGE IN INEQUALITY BY REGIONAL INCOME, POPULATION, AND INEQUALITY EFFECTS

Source of change in world inequality	Africa	Asia	Japan, Korea, and Taiwan	Latin America	Eastern Europe	Europe and European settlements	Total	Total observed change in inequality	Discrepancy
<i>A. Theil Index:</i>									
<i>1820–1870</i>									
Difference in income growth from world average	0.005	<b>0.050</b>	0.002	0.000	0.000	<b>0.039</b>	<b>0.095</b>		
Difference in population growth from world average	0.000	0.003	0.000	0.001	0.001	0.010	<b>0.015</b>		
Within-country group inequality	0.001	0.001	0.000	0.000	0.000	<b>0.013</b>	<b>0.016</b>		
Total							<b>0.126</b>	0.149	–0.023
<i>1870–1910</i>									
Difference in income growth from world average	0.008	<b>0.068</b>	0.000	0.000	0.002	<b>0.032</b>	<b>0.110</b>		
Difference in population growth from world average	0.000	0.003	0.000	0.000	–0.002	0.007	<b>0.007</b>		
Within-country group inequality	0.001	0.004	0.000	0.001	0.006	–0.001	<b>0.010</b>		
Total							<b>0.127</b>	0.125	0.002
<i>1910–1950</i>									
Difference in income growth from world average	0.005	<b>0.110</b>	0.001	–0.003	–0.004	<b>0.050</b>	<b>0.159</b>		
Difference in population growth from world average	–0.001	0.000	–0.003	–0.001	0.003	–0.002	–0.004		
Within-country group inequality	0.004	<b>–0.010</b>	–0.003	0.000	<b>–0.038</b>	<b>–0.093</b>	<b>–0.139</b>		
Total							<b>0.016</b>	0.008	0.009
<i>1950–1992</i>									
Difference in income growth from world average	<b>0.015</b>	<b>–0.064</b>	0.003	0.001	<b>0.011</b>	<b>0.072</b>	<b>0.038</b>		
Difference in population growth from world average	0.003	<b>0.009</b>	0.004	–0.003	<b>0.015</b>	–0.005	<b>0.023</b>		
Within-country group inequality	0.005	<b>0.010</b>	0.000	0.002	0.000	<b>–0.035</b>	<b>–0.018</b>		
Total							<b>0.043</b>	0.050	–0.007
<i>B. Mean Logarithmic Deviation</i>									
<i>1820–1870</i>									
Difference in income growth from world average	0.004	<b>0.042</b>	0.000	0.001	0.000	<b>0.030</b>	<b>0.077</b>		
Difference in population growth from world average	0.000	0.004	0.000	0.001	0.003	<b>0.009</b>	<b>0.017</b>		
Within-country group inequality	0.001	0.001	0.000	0.000	0.000	0.008	<b>0.010</b>		
Total							<b>0.103</b>	0.121	–0.018
<i>1870–1910</i>									
Difference in income growth from world average	0.007	<b>0.063</b>	0.000	0.000	0.000	<b>0.026</b>	<b>0.095</b>		
Difference in population growth from world average	0.001	0.005	0.000	0.000	0.000	<b>0.009</b>	<b>0.014</b>		
Within-country group inequality	0.001	0.004	0.000	0.001	0.004	0.002	<b>0.011</b>		
Total							<b>0.121</b>	0.124	–0.003
<i>1910–1950</i>									
Difference in income growth from world average	0.005	<b>0.123</b>	0.001	–0.002	0.000	<b>0.046</b>	<b>0.174</b>		
Difference in population growth from world average	–0.004	0.002	–0.003	–0.001	0.002	–0.004	<b>–0.008</b>		
Within-country group inequality	0.006	<b>–0.016</b>	–0.003	0.000	<b>–0.035</b>	<b>–0.020</b>	<b>–0.069</b>		
Total							<b>0.097</b>	0.107	–0.010
<i>1950–1992</i>									
Difference in income growth from world average	<b>0.020</b>	<b>–0.083</b>	<b>0.042</b>	0.000	–0.001	<b>0.077</b>	<b>0.055</b>		
Difference in population growth from world average	–0.003	0.000	0.005	–0.004	<b>0.012</b>	<b>–0.041</b>	<b>–0.031</b>		
Within-country group inequality	<b>0.012</b>	<b>0.030</b>	–0.001	0.001	–0.002	<b>–0.011</b>	<b>0.029</b>		
Total							<b>0.053</b>	0.053	0.000

Note: Entries in bold correspond to dominant sources of change.

poorest countries were virtually cut off from economic growth.<sup>11</sup> The income differential between Europe and its offshoots on the one hand and Asia or Africa on the other—between the richest 20 percent of the world and the poorest 60 percent—soared from 1:3 in 1820 to 1:5 in 1910 to 1:9 in 1950. This enrichment of Europe plus the growing relative impoverishment of Asia between 1820 and 1950 represented an increase in inequality nearly equivalent to the total increase in world inequality for the whole 1820–1992 period.

The disequalizing contribution of European economic growth to world inequality did not vanish after 1950. Growth in Europe and its offshoots remained systematically higher than the world average during that period too. At the other extreme, however, a big change was taking place. Slow economic growth in Africa was now significantly increasing world inequality, while Asia's improving growth performance was resulting in a substantial drop in world inequality. Driving the dramatic evolution in the Asia region was China's impressive growth, especially in the last 12 years of the period under analysis.<sup>12</sup> Although other countries in Asia also grew faster than the world average during the last 40 years or so (except India<sup>13</sup>), China's growth dominates because of its size.

In addition to Asia's economic growth, a second set of equalizing forces has been the evolution of inequality within regions and countries. The most important change was the decline in inequality in Western Europe during the first half of the 20th century. Two primary forces lay behind that drop. First was the redistribution that took place in most developed countries in the period from before World War I until after World War II. Its impact on the world distribution of income was substantial as measured by an inequality measure like the Theil index, which gives more weight to changes at the top of the distribution. Together with the equalizing effect of the Soviet revolu-

tion in Russia and the socialization of Eastern European countries, this equalization of incomes within Western Europe offset a large part of the increase in world inequality arising from divergences in national economic growth rates. This compensation is less important with the mean logarithmic deviation than with the Theil index because of the lower weight it gives to richer countries.

The second force behind the drop in inequality in the Western Europe region was the convergence of mean incomes among European countries and their offshoots during the 20th century. Overall inequality within this group of countries increased slightly between 1820 and 1870, remained stable until 1910, and then fell substantially, causing a drop in the world Theil index of more than 12 percentage points (Table 3). Approximately half of this fall was due to the equalization of national income distributions just mentioned. The rest was due to the evolution of inequality *across* European countries.<sup>14</sup> The increase in European inequality between 1820 and 1870 reflects the divergent evolution of the Anglo-Saxon countries (Australia, Canada, the United Kingdom, and the United States) and the rest of Europe. Income per capita in the United Kingdom was about 40 percent higher than in continental Europe at the beginning of the 19th century. By 1870, this difference had doubled. In the aggregate, inequality changed only slightly between 1870 and 1910. But there was much underlying mobility. The United States and the United Kingdom switched ranks in the world income distribution, Germany returned to its initial position in the group, and Spain and Portugal replaced Chile and Argentina at the bottom of the scale. Some true convergence took place among European countries at the beginning of the 20th century, even though the U.S. advantage over other countries was reinforced at the end of World War II. Europe began to catch up with the United States afterward. As a consequence, inequality between countries in the European group in 1992 dropped back to the level observed in 1820. This very strong convergence, which also included the effects of the

<sup>11</sup> This finding corroborates the intuition developed by Pritchett (1997).

<sup>12</sup> This conclusion would still hold if the lowest estimate of Chinese growth found in the literature were used.

<sup>13</sup> Of course, the equalizing effect of Asian growth would be still stronger if the analysis were extended by a few years to take into account India's recent acceleration of growth.

<sup>14</sup> Indeed, the within-country component of inequality in Table 3 is defined at the *regional* level. It thus includes inequality across countries of the same region.

economic recovery after the war, explains the drop in European inequality shown in Table 3 and its important equalizing effect on the world distribution of income during the 20th century. This effect is less pronounced with the mean logarithmic deviation than with the Theil index, which emphasizes the top of the distribution, which includes most of the European population.

A similar convergence might have been expected as a result of the contribution of the Asian dragons—Japan, Korea, and Taiwan—to the evolution of the world distribution. It is not surprising that this group had no effect on the level of world inequality before 1950, when their growth was like that of other nonindustrial countries. Between 1950 and 1992, however, they leaped over several rungs in the world hierarchy of income, multiplying their income per capita by approximately 10 and moving from slightly below the world mean to the mean of the richest group of countries. This contributed to a worsening of world inequality, although the effect is substantial only with the mean logarithmic deviation (see Table 3).<sup>15</sup>

In sum, both disequalizing and equalizing forces contributed to the change in the world distribution of income from 1820 to 1992. On the disequalizing side, the main forces were the consistently better economic performance of European countries and their offshoots, the relatively poor growth performances of China and India until late in the 20th century, the divergence between Anglo-Saxon and the other European countries in the first half of the 19th century, and the slow growth of Africa in the second half of the 20th century. On the equalizing side, the main forces were the equalizing of incomes within Western European countries, Russia, and Eastern Europe in the interwar period and after World War II; the European countries quick catch-up to the United States after World War II; and China's outstanding growth performance in the last decade or two of the period. While the rapid growth of the Asian dragons was another important phenomenon in this period, the effect on world income distribution was ambiguous and limited.

Two factors have been ignored in this discussion. First, nothing has been said of Latin America because its economic growth over the last two centuries has roughly coincided with the world average. In other words, it has always been midway between the high rates of growth of the European group and the relatively slow rates observed in Asia and Africa. Second, it is remarkable that population growth rates do not seem to be associated with any big change in the world distribution of income. One reason is that changes in the regional structure of world population have not been very big. Over 170 years, the major change has been that the less populated regions in 1820, Africa and Latin America, have grown more rapidly than the others—the growth of the North American, Australian, Argentine, and Chilean populations being amalgamated with that of old Europe. Overall, this has been equivalent to Asia losing some of its demographic importance in favor of Africa and Latin America—not a very significant change for the world distribution of income. It must also be stressed that pure demographic changes have ambiguous effects on the distribution of income when they affect one end of the distribution more than the other, which leads to crossing Lorenz curves. As an example of this ambiguity, the population effect for 1950–1992 is egalitarian with the Theil index but egalitarian with the mean logarithmic deviation (see Table 3).

Another dimension of the changes in the world distribution of income is the mobility of world citizens within the world income scale. Country differences in GDP per capita, population growth, and income distribution are responsible for changes in the world distribution of income, as analyzed above, and for mobility within the world income scale.

Table 4 shows the regional composition of various quantiles of the world distribution for selected years. Mobility of regional groups of individuals within the world income scale is responsible for changes in that composition, and results from a complex combination of relative changes in countries' relative mean income, population, and domestic income distribution. For instance, the increasing share of European countries and their offshoots in the top world decile between 1820 and 1950 resulted from both their relative increase in population and mean income between 1820 and 1910 and from

<sup>15</sup> This difference between the Theil index and the mean logarithmic deviation suggests that the growth of Asian dragons produced an ambiguous shift in the world Lorenz curve.

TABLE 4—REGIONAL COMPOSITION OF SELECTED WORLD QUANTILES: SELECTED YEARS (PERCENTS)

World quantiles	Africa	Asia	Japan, Korea, and Taiwan	Latin America	Eastern Europe	European countries and offshoots	Total
1820							
Total	6.9	64.9	3.6	1.8	8.2	14.6	100
Bottom 60 percent	7.9	75.8	3.2	1.7	6.0	5.3	100
Mid 30 percent	5.8	55.3	4.4	1.4	12.5	20.5	100
Top 10 percent	4.1	32.5	3.5	3.0	8.0	48.9	100
1910							
Total	6.2	51.6	3.7	3.8	12.9	21.7	100
Bottom 60 percent	8.1	71.1	2.9	4.1	9.5	4.4	100
Mid 30 percent	4.6	25.0	5.6	4.1	21.2	39.6	100
Top 10 percent	0.9	25.0	1.8	1.9	6.3	64.1	100
1950							
Total	8.9	49.6	4.5	5.5	10.9	20.7	100
Bottom 60 percent	12.7	74.4	2.7	4.6	3.5	2.1	100
Mid 30 percent	4.2	18.2	8.7	8.3	25.8	34.8	100
Top 10 percent	1.2	4.4	2.1	3.0	8.3	81.1	100
1992							
Total	12.0	54.8	3.5	7.6	8.3	13.8	100
Bottom 60 percent	17.4	72.7	0.0	6.5	3.2	0.3	100
Mid 30 percent	5.0	36.2	5.3	11.1	19.7	22.6	100
Top 10 percent	1.4	6.1	18.2	3.8	4.1	66.4	100

the increase in their mean income 1910 and 1950. Their declining share between 1950 and 1992 was due to a slower rate of population growth than in the rest of the world and to the rapid economic growth of the Japan, Korea, and Taiwan group, which moved a substantial number of people in that country group into the top world decile. In other words, Europe's ascending supremacy from 1820 to 1950 was checked by the economic rise of the Asian dragons and the relative decline in the European population.

At the other end of the spectrum, the dominant change has been the continuously increasing share of Africa among the world poor, an evolution that accelerated sharply during the 20th century. Because of Africa's rapid population growth and its lower than average economic growth, this region's share among the world's poorest 60 percent increased from 8 percent at the end of the 19th century to 17.5 percent in 1992. This evolution would be even more pronounced with a more restrictive definition of poverty. In 1950, only 12 percent of world inhabitants with incomes of less than half the world median income lived in Africa. By 1992, 30 percent did. Poverty, largely an Asian problem until just after World War II, is fast becoming an African problem. Asia, after a sharp decline from 1820 to 1950, is catching up

with more developed regions. Its share in the three mid-deciles of world income doubled from 18 to 36 percent between 1950 and 1992. Finally, Latin America's shares in world income followed its increasing share of the world population, with an increasing concentration in the middle deciles.

Another way of looking at the dynamics of the world distribution of income is to consider how citizens within countries perform on an income scale defined at the world level, the approach taken in the recent literature on convergence and mobility (see, in particular, Quah, 1996a). The corresponding transition matrices are shown in Table 5, with four income bands defined (as in Quah, 1996a) as simple proportions of the world mean.

The dominant impression from Table 5 is of extremely low mobility of individuals throughout the period of analysis. Less than 30 percent of people changed income band during successive 40-year intervals, and less than 10 percent did in the two extreme bands, except between 1910 and 1950. Mobility increased over time, though, by approximately 15 percentage points overall—and it changed direction. Until 1910, mobility was predominantly downward, whereas it was more balanced after 1910. Finally, the implications of the transition matrices shown in

TABLE 5—RELATIVE INCOME MOBILITY MATRIX AND MOBILITY RATIOS:  
SELECTED PAIRS OF YEARS

Income in final year relative to world mean income (wmi)	Income in initial year relative to world mean income (wmi)				Total (share in world population)	Mobility ratios
	Less than 1/2 wmi	From 1/2 to 1 wmi	From 1 to 2 wmi	More than 2 wmi		
<b>1820–1870</b>						
Less than 1/2 wmi	98.8	35.0	0.0	0.0	52.3	
From 1/2 to 1 wmi	1.2	63.2	10.9	0.0	26.8	
From 1 to 2 wmi	0.0	1.8	80.2	3.7	12.2	
More than 2 wmi	0.0	0.0	8.9	96.3	8.6	
Total	39.1	39.2	14.0	7.7	100.0	
(Immobility ratio)						84.6
(Upward mobility)						3.0
(Downward mobility)						12.4
<b>1870–1910</b>						
Less than 1/2 wmi	99.5	38.3	0.0	0.0	58.9	
From 1/2 to 1 wmi	0.5	60.1	32.6	0.0	20.9	
From 1 to 2 wmi	0.0	1.6	63.1	7.5	10.0	
More than 2 wmi	0.0	0.0	4.3	92.5	10.3	
Total	48.9	26.8	13.8	10.5	100.0	
(Immobility ratio)						78.8
(Upward mobility)						1.6
(Downward mobility)						19.6
<b>1910–1950</b>						
Less than 1/2 wmi	91.7	31.3	0.0	0.0	57.9	
From 1/2 to 1 wmi	8.3	47.5	6.1	0.0	15.5	
From 1 to 2 wmi	0.1	21.2	65.8	19.6	14.2	
More than 2 wmi	0.0	0.0	28.1	80.4	12.5	
Total	55.8	21.4	11.1	11.7	100.0	
(Immobility ratio)						71.4
(Upward mobility)						14.4
(Downward mobility)						14.2
<b>1950–1992</b>						
Less than 1/2 wmi	89.7	20.5	0.0	0.0	56.2	
From 1/2 to 1 wmi	7.8	49.5	20.2	0.0	14.9	
From 1 to 2 wmi	1.7	18.4	45.2	4.8	10.4	
More than 2 wmi	0.8	11.6	34.6	95.2	18.5	
Total	59.1	15.5	13.0	12.4	100.0	
(Immobility ratio)						78.3
(Upward mobility)						15.2
(Downward mobility)						11.4

*Notes:* The table entries are initial year's population in each income band by income in the final year (percentage). The immobility ratio is the share of world population not changing relative income band. Upward (downward) mobility is the share of world population moving up (down) one income band or more.

Table 5 for the evolution of the world distribution of income changed over time too. In particular, the “twin peaks effect” noted by Quah (1996b), in which mobility leads to a polarized distribution of world income, is noticeable in the 1950–1992 period and to a much lesser extent in 1820–1870. In the two middle periods, comparing the “total” rows and columns of Ta-

ble 5 simply shows a straight increase in the inequality of the distribution of relative income between the initial and the terminal year.

It is important to note that the changes in the mobility matrices are due largely to the growth performance of a small number of countries or country groups. Thus, the drop in inequality within and across European countries and their

offshoots between 1910 and 1950 explains most of the increase in upward mobility in that period. Likewise, the acceleration of growth in China and the Asian dragons is responsible for the upward mobility observed from 1950 to 1992. Both phenomena can be viewed as exceptional. Thus, to consider the transition matrices for recent periods as stationary, as is often done in the convergence literature, seems largely unjustified in a historical perspective.<sup>16</sup>

#### IV. Other Dimensions of World Inequality: Life Expectancy

The current income of individuals, even aside from the question of whether average income per capita is satisfactorily proxied by GDP per capita, is a restricted definition of welfare. A more comprehensive definition of economic well being would consider individuals over their lifetime, and inequality would be evaluated not just within the population alive at a point in time but within successive cohorts. To the extent that life expectancy is a summary of people's health conditions, it is another dimension of individual welfare, independent of income and comparable to, but easier to evaluate than other nonincome dimensions like safety, freedom, or access to justice or education. Thus, life expectancy could be another source of inequality, both within and across countries.

Estimates of life expectancy for the 33 countries and country groups considered here were gathered from the historical demography literature for the pre-1950 period and from the United Nations *Demographic Yearbook* for the 1950–1992 period. For countries or periods for which no direct estimate was available, life expectancy was set arbitrarily to that of a comparable neighboring country.<sup>17</sup> Note that all individuals within a country or group of countries are assumed to have the same life expectancy. Thus,

<sup>16</sup> It is also worth noting that the mobility pattern in world distribution of income during the last 170 years seems far from Markovian, as is generally assumed in the convergence literature. For instance, multiplying the transition matrix of 1820–1870 by that of 1870–1910 results in a matrix that is substantially different from the one actually observed between 1820 and 1910.

<sup>17</sup> Statistical sources and data may be consulted at <http://www.delta.ens.fr/XIX>.

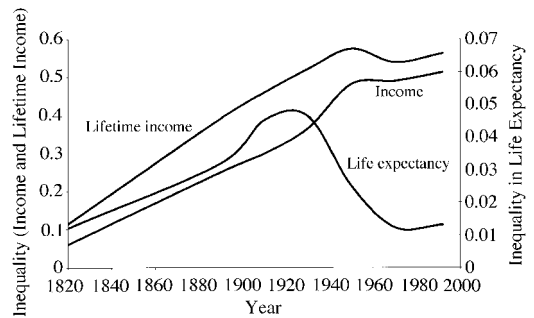


FIGURE 3. EVOLUTION OF INTERNATIONAL INEQUALITY IN INCOME, LIFETIME INCOME, AND LIFE EXPECTANCY (THEIL INDEX)

unlike for income, within-country inequality of life expectancy is assumed to be zero.

Average life expectancy in the world has more than doubled, rising from 26 years in 1820 to 60 years today (see bottom of Table 1). Progress was initially slow and deeply egalitarian. Mean world life expectancy was only 33 years prior to World War II—an improvement of only seven years in more than a century. Underlying this evolution of the mean, however, was near stagnation in Asia and Africa, a seven-year increase in Latin America, and a nearly 17-year increase in European countries and their offshoots. As with income, inequality in life expectancy thus worsened considerably during the 19th century. Unlike income, however, world inequality in life expectancy fell considerably after 1930, as improvement in world mean life expectancy accelerated. Both trends were strongly influenced by the rapid catching up of countries left behind during the 19th century. Average life expectancy increased more than 20 years in several Asian countries between 1930 and 1992, but only 12 to 15 years in European countries. In relative terms, the difference is bigger still.

Thus the evolution of world inequality in life expectancy is quite different from that of GDP per capita (see Figure 3). Around 1930, divergence in life expectancy gave way to convergence.<sup>18</sup> There was no such turning point for income. At best, divergence decelerated after 1950, but it was not reversed.

<sup>18</sup> The burst of HIV in Africa might well reverse this trend in the future.

The evolution of life expectancy and of GDP per capita can be combined to determine the time path of world inequality of lifetime income. The upper curve in Figure 3 shows the evolution of world inequality of lifetime income,  $LY$ , defined in a standard way as (constant) current income ( $y$ ) discounted over life expectancy ( $L$ ):

$$(2) \quad LY = y(1 - e^{-\delta L})/\delta.$$

The curve shown in Figure 3 is based on discount rate  $\delta$  set to 2 percent per annum.<sup>19</sup>

As expected, the evolution of world inequality of lifetime income differs slightly from that of income alone. The initial divergence is reinforced since the increasing disparities in life expectancy compound the divergence in income. After 1950, however, the drop in world inequality in life expectancy combines with the deceleration of income divergence to produce a convergence of world lifetime income. However, the convergence of life expectancy seems to have stopped or slowed considerably during the last two decades of the period so that the evolution of world inequality of lifetime income parallels that of income. Simple simulation shows that this evolution is not very sensitive to changes in the discount rate within a reasonable range or, equivalently, to the inclusion of the growth rate of income in the equation. This combination of the two effects does not take into account the interaction between changes in life expectancy and changes in population growth rates. Life expectancy increased rapidly in developing countries after 1950, reducing the inequality that had built up in the 19th century. But population began to grow faster in these countries, with some nonneutral effects on the distribution of income.

## V. Summary of Findings

Unlike the recent literature on income inequality, which focuses on the divergence of

GDP per capita across countries in the last 40 years, this paper focuses on a longer period and takes a more general perspective on world inequality. Because the analysis begins in 1820, it takes into account the major effects that the Industrial Revolution had on the world distribution of income. Because the analysis looks explicitly at the distribution of income within countries, it evaluates world inequality among individuals rather than countries. And because the analysis also takes into account the contribution of changes in world disparities in life expectancy, it incorporates a broader view of individual welfare.

To summarize, this analysis shows that world income inequality worsened dramatically over the past two centuries. The Gini coefficient increased 30 percent and the Theil index 60 percent between 1820 and 1992. This evolution was due mainly to a dramatic increase in inequality across countries or regions of the world. The “between” component of the Theil index went from 0.06 in 1820 to more than 0.50 in 1992. Changes in inequality within countries were important in some periods, most notably the drop in inequality within European countries and their offshoots in America and in the Pacific during the first half of the 20th century. In the long run, however, the increase in inequality across countries was the leading factor in the evolution of the world distribution of income. The burst of world income inequality now seems to be over. There is comparatively little difference between the world distribution today and in 1950. This does not mean that the distribution has become stable or that a convergence analogous to that witnessed among European countries and their offshoots in the early 20th century is beginning to take place on a world scale. On the contrary, the increasing concentration of world poverty in some regions of the world is worrying. When world inequality in lifetime income rather than current income is analyzed, 1950 seems to be an important turning point. World inequality seems to have fallen since 1950 as a result of the pronounced drop in international disparities in life expectancy. But now that disparities in life expectancy are back to the levels before the big divergence of the 19th century, this source of convergence has lost its influence.

<sup>19</sup> Note that equation (2) combines income and life expectancy in a very specific way. Another particular combination would be the equal-weight linear formula used by the United Nations Development Programme in computing the Human Development Index. For an in-depth discussion of the measurement of the resulting “multidimensional” inequality see Anthony B. Atkinson and Bourguignon (1982).



## APPENDIX: LIST OF COUNTRIES AND COUNTRY GROUPS USED IN THE ANALYSIS

**A) Africa**

Côte d'Ivoire, Ghana, Kenya  
 Egypt  
 Nigeria  
 North Africa  
 South Africa  
 46 African countries

**B) Asia**

China  
 India  
 Indonesia  
 Bangladesh, Burma, Pakistan  
 Thailand, Philippines  
 45 Asian countries

**C) Japan, Korea, Taiwan**

Japan  
 Korea, Taiwan

**D) Latin America**

Brazil  
 México  
 Colombia, Peru, Venezuela  
 37 Latin American countries

**E) Eastern Europe**

Bulgaria, Greece, Romania, Yugoslavia  
 Poland  
 Russia  
 Turkey

**F) Western Europe and European offshoots**

Argentina, Chile  
 Australia, Canada, New Zealand  
 Austria, Czechoslovakia, Hungary  
 France  
 Germany  
 Italy  
 Scandinavian countries  
 Spain, Portugal  
 Switzerland, Benelux, and microstates  
 United Kingdom, Ireland  
 United States

## REFERENCES

- Adelman, Irma.** "Development Strategies and the Size Distribution of World Income." *Middle East Technical University Studies in Development*, 1984, 11(1-2), pp. 177-93.
- Atkinson, Anthony B. and Bourguignon, François.** "The Comparison of Multi-Dimensioned Distributions of Economic Status." *Review of Economic Studies*, April 1982, 49(2), pp. 183-201.
- Baumol, William J.; Nelson, Richard R. and Wolff, Edward N.** "The Convergence of Productivity, Its Significance, and Its Varied Connotations," in William J. Baumol, Richard R. Nelson, and Edward N. Wolff, eds., *Convergence of productivity: Cross-national studies and historical evidence*. New York: Oxford University Press, 1994, pp. 3-19.
- Berry, Albert; Bourguignon, François and Morrisson, Christian.** "Changes in the World Distribution of Income between 1950 and 1977." *Economic Journal*, June 1983a, 93(37), pp. 331-50.
- \_\_\_\_\_. "The Level of World Inequality: How Much Can One Say?" *Review of Income and Wealth*, September 1983b, 29(3), pp. 217-41.
- \_\_\_\_\_. "Global Economic Inequality and Its Trends since 1950," in Lars Osberg, ed., *Economic inequality and poverty: International perspectives*. Armonk, NY: Sharpe, 1991, pp. 60-91.
- Bourguignon, François.** "Decomposable Income Inequality Measures." *Econometrica*, July 1979, 47(4), pp. 901-20.
- Chen, Shaohua and Ravallion, Martin.** "How Did the World's Poorest Fare in the 1990s?" Mimeo, World Bank, 2000.
- Grosh, Margaret E. and Nafziger, E. Wayne.** "The Computation of World Income Distribution." *Economic Development and Cultural Change*, January 1986, 34(2), pp. 347-59.
- Jones, Charles I.** "On the Evolution of the World Income Distribution." *Journal of Economic Perspectives*, Summer 1997, 11(3), pp. 19-36.
- Kirman, Alan P. and Tomasini, Luigi M.** "A New Look at International Income Inequalities." *Economia Internazionale*, August 1969, 22(3), pp. 437-61.
- Lindert, Peter.** "Three Centuries of Inequality in

- Britain and America," in Anthony B. Atkinson and François Bourguignon, eds., *Handbook of income distribution*. Amsterdam: Elsevier, 2000.
- Maddison, Angus.** *Monitoring the world economy*. Paris: OECD, 1995.
- Milanovic, Branko.** "True World Income Distribution, 1988 and 1993: First Calculation Based on Household Surveys Alone." *Economic Journal*, January 2002, 112(476), pp. 51–92.
- Mookherjee, Dilip and Shorrocks, Anthony F.** "A Decomposition Analysis of the Trend in UK Income Inequality." *Economic Journal*, December 1982, 92(368), pp. 886–902.
- Morrison, Christian.** "Historical Perspectives on Income Distribution: The Case of Europe," in Anthony B. Atkinson and François Bourguignon, eds., *Handbook of income distribution*. Amsterdam: Elsevier, 2000.
- Pritchett, Lant.** "Divergence, Big Time." *Journal of Economic Perspectives*, Summer 1997, 11(3), pp. 3–17.
- Quah, Danny T.** "Empirics for Economic Growth and Convergence." *European Economic Review*, June 1996a, 40(6), pp. 1353–75.
- \_\_\_\_\_. "Twin Peaks: Growth and Convergence in Models of Distribution Dynamics." *Economic Journal*, July 1996b, 106(437), pp. 1045–55.
- Ravallion, Martin; Datt, Gaurav and van der Walle, Dominique.** "Quantifying Absolute Poverty in the Developing World." *Review of Income and Wealth*, December 1991, 37(4), pp. 345–61.
- Schultz, T. Paul.** "Inequality in the Distribution of Personal Income in the World: How it is Changing and Why." *Journal of Population Economics*, August 1998, 11(3), pp. 307–44.
- Shorrocks, Anthony F.** "The Class of Additively Decomposable Inequality Measures." *Econometrica*, April 1980, 48(3), pp. 613–25.
- \_\_\_\_\_. "Ranking Income Distributions." *Economica*, February 1983, 50(197), pp. 3–17.
- Sprout, Ronald V. A. and Weaver, James H.** "International Distribution of Income: 1960–1987." *Kyklos*, 1992, 45(2), pp. 237–58.
- Summers, Robert; Kravis, Irving B. and Heston, Alan.** "Changes in the World Income Distribution." *Journal of Policy Modeling*, May 1984, 6(2), pp. 237–69.
- Theil, Henri.** "The Development of International Inequality: 1960–1985." *Journal of Econometrics*, September 1989, 42(1), pp. 145–55.
- Theil, Henri and Seale, James L., Jr.** "The Geographic Distribution of World Income, 1950–1990." *De Economist*, November 1994, 142(4), pp. 387–419.
- United Nations.** *Demographic yearbook*. New York: United Nations Publications, various years.
- Whalley, John.** "The Worldwide Income Distribution: Some Speculative Calculations." *Review of Income and Wealth*, September 1979, 25(3), pp. 261–76.
- World Bank.** *World development report 2000/2001: Attacking poverty*. Oxford, U.K.: Oxford University Press, 2001.
- \_\_\_\_\_. *World development report, 1990*. Oxford, U.K.: Oxford University Press, 1990.
- Yotopoulos, Pan A.** "Distribution of Real Income: Within Countries and by World Income Classes." *Review of Income and Wealth*, December 1989, 35(4), pp. 357–76.