

The size distribution of income among world citizens: 1820- 1990¹

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The revival of empirical growth economics during the 1990s brought with it a renewed interest for the world distribution of income. Indeed, beyond theoretical issues concerned with the determinants of the economic growth of nations, most of the recent literature on 'convergence' of GDP per capita across countries is essentially dealing with the world distribution of income and the question of whether that distribution is likely to equalize or on the contrary polarize in the long-run. An example of this analogy is given by the recent symposium of the Journal of Economic Perspectives devoted to the 'Distribution of World Income' which is exclusively concerned with macroeconomic convergence issues.¹

This treatment of world income inequality considers all citizen in a given country as perfectly identical. But by completely ignoring income disparities within countries it leads to underestimating the extent of inequality. In effect this line of work focuses on 'international' rather than 'world' inequality. By 1820, for instance, we estimate in the present paper that the coefficient of Gini for the world distribution was .50, whereas it would only have been .16 if individual incomes had been equal within each country. By disregarding country inequality, the recent empirical growth literature gives a biased view rather than an accurate representation of how the actual world distribution of individual incomes may have changed over time.

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 income distributions. Therefore the dynamics of the world distribution of income would mostly have its roots in the international component of world inequality which arises in differences *between* countries rather than in the evolution of the distribution of income *within* countries. We shall see that indeed inequality among countries is a key factor in explaining world inequality. However, we shall also see that changes in the world distribution of income arising from heterogeneous growth of GDP and population in presence of national income disparities are rather complex and not well approximated by the hypothesis that all citizen within a country have the same income.

There have been various attempts at estimating the world inequality of personal incomes and its evolution over time.² The present paper is the first to take a historical view at the evolution of the world size distribution of income. It does so by updating previous work on the evolution of world

¹ Pritchett (1997a, b), Jones (1997). In several papers on convergence and income mobility of countries Quah is also often referring to the world distribution of income. See Quah (1996a, b)

² See Kirman and Tomasini (1969), Whalley (1979), Berry et al. (1983a, 1983b, 1991), Summers and Kravis (1984), Adelman (1984), Grosh and Nafziger (1986), Theil (1989), Yotopoulos (1989), Ravallion et al. (1991), Theil and Seale (1994), Sprout and Weaver (1997), Schultz (1997), Milanovic (1999).

income inequality from the 50s to the 80s and extending it back to the beginning of the 19th century. The history that we unveil of world inequality over almost two centuries differs rather radically from what is usually seen in the current literature on world economic inequalities in the post-world-war II era. It also differs from the available historically oriented literature - Baumol et al. (1994), Pritchett (1997a,b) - because it provides a quantification of the evolution of world income inequality rather than a qualitative description of its evolution.

In the early 19th century, the industrial revolution is under way in Britain and beginning in France. The inequality of world incomes is already high but comparable to what may be observed in today's rather inegalitarian countries. The Gini coefficient is around .50. Then, the spreading of the industrial revolution first to Western Europe and European populated countries in America and the Pacific - which we shall refer to, following Maddison, as the 'European offshoots' - as well as the increase in income inequality within these booming countries produced a true explosion of world inequalities and actually shaped the inequalities of the world of today. From 1820 to the eve of World War I, this process was virtually continuous, the Gini coefficient increasing regularly from .50 to .61. It then decelerated between the wars and has come close to a stop since 1950. By that time the world Gini coefficient had reached .64, a level of inequality practically unknown in any contemporary society. Thus, the peak of world inequality was reached in the first half of the 20th century after more than a century of divergence. Since then, and in comparison with such a dramatic evolution, the situation seems to have somewhat stabilized.

This general evolution of world inequality hides complex mechanisms and constant changes in the nationality of the individuals at the various ladders of the world income hierarchy. For instance, the initial process of world divergence actually comprised a strong convergence process among European countries and their offshoots in America and the Pacific after 1870/1890, and at the same time growing income disparities between this group of countries and the rest of the world. Likewise, the apparent stabilization of the world distribution since 1950 resulted from the conjunction of a relative slowing down of economic growth in the preceding set of countries, the catching up of Japan and East Asia, and since the beginning of the 80s the take off of China. However, differences in GDP per capita growth rates among countries are insufficient to explain this complex evolution in the 19th or the 20th centuries. For instance, the growth performance of China is important in shaping the evolution of the world distribution of income because of the exceptionally large demographic weight of that country and also because of the dramatic changes which occurred in the distribution of income there. In the same way, the increased world disparities observed in the 19th century as a consequence of the industrial revolution had much to do with the initial size of the Western European population and its demographic growth rate. Beyond describing in some detail the evolution of the world distribution of

income over the last two centuries, a second contribution of this paper is precisely to quantify the respective importance of aggregate economic growth, population growth and the structure of domestic income inequalities in shaping the world distribution of income and explaining its evolution.

The general organization of the paper is as follows. Section 1 focuses on the data used throughout the paper, in particular for the historical period, and the methodology followed to reconstitute the world distribution of income. It also discusses the difference it makes to take into account domestic income disparities in comparison with assuming no heterogeneity within countries as usually done in the recent literature. Section 2 presents the basic facts on the overall evolution of the world income distribution since 1820 and the results of sensitivity analysis on several crucial assumptions made in the construction of the data base. It also compares the evolution with and without domestic income inequality. Section 3 provides partial explanations of that evolution by decomposing changes in the world distribution into contributions of the evolution of the world structure of GDP per capita, the structure of population and domestic income inequality. This decomposition analysis is essentially conducted in terms of a small number of regions or groups of countries the behavior of which may be considered as relatively homogeneous. Section 4 analyzes more systematically this mobility of both countries and world citizen along the world income scale. The main findings are summarized in the concluding section.

1) Methodology and data

The methodology to estimate the distribution of income relies on three types of data for each country, i , to be included in the analysis: a) real GDP per capita, Y_i ; b) population, N_i ; c) the distribution of income summarized by vintile income shares, V_{ij} , $j=1, \dots, 20$. The world distribution is then obtained by considering that each vintile of a country is made up of individuals with identical incomes. For each country, we thus define 20 groups of $.05.N_i$ individuals with income $y_{ij} = 20.Y_i.V_{ij}$.³ We then pool all these groups together, rank them by increasing income and compute the cumulative function and Lorenz curve of the world distribution of income. If there are n countries, these two functions are thus described by $20.n$ values. Comparisons of these functions over time is done by interpolating linearly so as to obtain the values of the cumulative function and the Lorenz curves for arbitrary values of their arguments - income level or world population shares. Income inequality measures are easily computed

³ Original distribution data actually consisted of decile shares. This was a problem because it was introducing some indivisibilities in the computation of the world distribution. Indeed, a decile of the Chinese population represents approximately 2 centiles of the world population. Using vintiles permitted avoiding this problem. An algorithm was thus designed to generate vintile shares out of decile shares. It simply consists of finding a split of each decile guaranteeing that the Lorenz curve is everywhere increasing and convex. It turned out that our estimates of the world distribution were little sensitive to the parameters of this algorithm.

on the basis of these functions. In addition, it is also possible to follow the country composition of the various quantiles of the world distribution -i.e. what share of the top centile of the world belongs to country X - as well as the world rank of the various vintiles of a given country - i.e. what share of the population of country X is in the top word centile, or any other quantile, of the world distribution.

An alternative to the preceding methodology in line with standard practice in the recent literature on the world distribution of income consists of estimating the density of the distribution on the basis of the available 20.n country-decile observations by Kernel techniques. Ideally, one would have preferred to rely on country density functions estimated with the same Kernel technique and to mix those estimates to get the world distribution. However, this was made difficult by the limited information available on national income distributions. This also explains why the analysis of the country composition of world quantiles is made with the discrete representation of the world distribution described above rather than with Kernel density estimates.

Data on GDP per capita and population are borrowed from Maddison (1995) who was the first to construct consistent historical series over a period starting as early as in 1820 for some countries and ending in 1992. However, it proved necessary to complement and to slightly modify this data source. On one hand, series for many non-European countries, and even for Eastern European countries in Maddison begin some time between 1870 and 1913. We thus extended the original series so as to cover the whole 1820-1992 period. This was simply done by applying to countries with missing data in some period, the growth rates actually observed for 'comparable' countries over the same time interval. On the other hand, we regrouped all countries in a slightly more aggregate way than what is found in Maddison (1995). This was to avoid dealing with countries too small to really affect the world distribution and also to solve problems of missing distribution data. These groupings, the detail of which appears in the Appendix I, are based on criteria of consistency and homogeneity. For instance, we put together Austria, Hungary and Czechoslovakia, which share obvious common characteristics if one considers the entire 1820-1992 period, and not only the post-WWII period. Another example is that of Germany which is artificially kept united throughout the whole period, and in particular before the 19th century unification and during the 1945-90 split. Good arguments may also be found for considering jointly Argentina and Chile, two Latin-American countries with recent European immigration, or Taiwan and Korea, two economies which shared very much the same evolution over the last 40 years but also had similar economic histories both in terms of economic growth and distribution during the century or so before.

This grouping led us to consider a set of 33 groups of countries. These groups include some single countries like China,⁴ India, Italy or the US the weight of which in the world is significant at some stage or another either in demographic or in economic terms. They include small groups of comparable countries as in the examples given above. They also include large groups of very small countries which came to existence only in the rather recent history and, thus, could not be followed over a much longer period. So, Subsaharan Africa is broken down in only four groups: South-Africa, Nigeria - the largest country of the region -, three countries with a similar economic evolution - Cote d'Ivoire, Ghana and Kenya - and all the other countries, that is 46 countries. The reason for this choice is simply that something is known, even very imperfectly of the first three groups whereas much less can be said of the countries in the last group.

The definition of these 33 groups is such that each group represents at least one per cent of the world population or world GDP in 1950. None of them can thus really be considered as negligible in the world economy. For further analysis, these 33 groups are in turn aggregated into 6 'blocks' defined on a geographical, economic or historical basis. These regions are: Africa, Asia except the Asian 'tigers' (Japan, Korea and Taiwan), these Asian tigers, Latin America except Argentina and Chile, Eastern Europe (Russia, Poland, Rumania, Bulgaria, Yugoslavia, Greece and Turkey), and finally the 'western block' which comprises all western Europe, including Austria-Hungary and Czechoslovakia, and its offshoots in America including Argentina and Chile, and in the Pacific. The objective of this second level aggregation is both to permit a simpler description and analysis of the evolution of the world distribution and to test the kind of bias introduced by the aggregation procedure. Indeed, going from the 33 groups of countries to 6 blocks may in some sense be compared to going from approximately 200 countries in today's world to the 33 groups considered in this study. It must be noted, though that inequality within each of the 6 aggregate blocks is likely to be more volatile than within the 33 groups of countries defined so as to include countries with a comparable historical growth experience and comparable income distribution.

Data sources for the distribution of income in the 33 country groups differ according to the period under analysis. They generally refer to size-weighted household income per capita data.⁵ For the post-WWII period, the data are those used in Berry et al. (1983a,b) after updating. For the pre-WWII period, data for today's developed countries are taken from existing historical series and adapted so as

⁴ There has been some recent discussion on the recent growth performances of China. The computation reported here corresponds to the 'fast growth' scenario found in Maddison. Computations with more modest growth performances have also been made. We do not report them here for lack of space. However, it is worth stressing that they do not lead to fundamentally different conclusions.

⁵ 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. The complete set of distribution data may be obtained on request from the authors.

to fit the vintile definition used throughout the period. Raw data for the US and UK come from Lindert (1999) and for continental Europe from Morrisson (1999).⁶ For other countries, we essentially proceeded by analogy. In other words, we assumed that country, or country-group i at time t for which no distribution data was available had the same distribution as country or country-group j at time t' according to a set of assumptions which are summarized in Appendix II. The sensitivity of changes in aggregate inequality, as measured by two widely used decomposable measures, with respect to a change in the inequality within each of the 33 country group is given in Appendix III. On the basis of these figures, it may be checked that none of the conclusions obtained below on the evolution of the inequality of the world distribution is weakened by the imprecision of national income distribution data.

2) The evolution of the world income distribution since 1820

In this section, we discuss the aggregate characteristics of the evolution of the world income distribution as it comes out of the data just presented. Table 1 shows the shares of various quantiles of the world population as well as a set of standard inequality measures for selected years spaced 20 to 30 years over the whole period. Figure 1 shows the evolution of density curves estimated by Kernel techniques on the country-vintile observations discussed above. For the sake of clarity, only 4 curves are shown, which delimitate in an obvious way the period under analysis.

The evolution shown by these various indicators is quite clear. World inequality increased quickly and more or less continuously from 1820 to 1950, with a pause only between 1910 and 1929. In comparison with such a strong and continuous increase in most inequality measures, it would seem that world inequality almost leveled off since 1950. However, a careful inspection of the various indicators in Table 1 reveals that the distribution continued to worsen during most of that period, even though at a much slower rate than before. It is only between 1950 and 1960, and then between 1970 and 1992 that some signs of stabilization seem to appear. In the latter period the shares of the six bottom world deciles stop falling for the first time since 1820, but that of the top decile increases again after having fallen slightly in the 1950s. The general evolution is thus quite clear. The distribution worsened more or less continuously since the beginning of the 19th century, but this process considerably slowed down since 1950.

Although the comparison is difficult, this evolution is qualitatively comparable with the rough estimates given by Pritchett (1997b) on the basis of between country inequality between 1870 and 1990. He found that the standard deviation of the logarithm of income per capita might have doubled

⁶ Another source with a broad coverage of distribution data is Fields (1999).

during that period, from .5 to a little more than 1. Because we are taking into account the within country inequality, our estimates for both years are higher. But the increase in inequality is smaller because within inequality is still dominant around 1870.⁷

A slightly more rigorous version of that statement may be obtained by using Lorenz dominance, rather than relying on standard inequality measures (see Table 2). Comparing the ordinates of the Lorenz curve appearing in the top part of Table 1, it may be seen that there is almost systematically dominance of the distribution observed in the earlier years over all the others. The only exception before 1950 takes place between 1890 and 1910 on one hand, and 1929 on the other. This systematic worsening in terms of dominance stops with the 1950 distribution which dominates only 1992. It must be noticed, though, that the distribution of 1960 dominates that of all posterior years. This corresponds to the continuing slight trend toward more inequality observed in the inequality measures shown in Table 1. This also suggests that the changes in the distribution of world income became more complex since 1950.

It is well known that the Lorenz dominance criterion ignores gains in social welfare due to a higher mean income by focusing exclusively on the distribution of *relative* incomes. It is also interesting to consider changes in world social welfare by using the 'generalized Lorenz dominance' which compares the absolute income of successive poorest segments of the population.⁸ Simple calculations made from Table 1 shows that this dominance criterion breaks down only once between 1929 and 1950. This is due mostly to adverse conditions in China where war was almost permanent between 1933 and 1949. Except for that period the mean income of all lower income segments of the world distribution and therefore world social welfare increased continuously, even though almost insensibly for the poorest 60 per cent at the beginning of the 19th century.

That the shape of the world distribution tended to change over the last 40 years or so, is also confirmed by the evolution of the whole density curve shown in Figure 1. Income is on the horizontal axis in this figure, but to make the curves comparable over time, it is normalized by the mean income of the richest country. Under these conditions, the continuous rapid increase in world inequality is first noticeable with the leftward shift of the mode of the distribution and the lengthening of its right-hand tail. It may be seen that, indeed, this shift stopped after 1950. Another noticeable change is the shift in the secondary mode of the distribution which may be observed in the right-hand part of the figure.

⁷ A more detailed analysis of the evolution of between and within country inequality is shown in Table 3 and discussed below.

⁸ On this concept see Shorrocks (1983) or Cowell (1998)

This mode also tended to move rightward, at a distance approximately constant of the first mode, and to become more prominent over time. In 1992, however, this trend seems to be reversed.

Instead of considering relative income scales as in the preceding figure, or implicitly through inequality measures, it is also interesting to look at absolute scales. The poverty ratios reported in Table 1 show the proportion of the world population below two absolute income thresholds equal respectively to 1\$ and 2\$ a day (at purchasing power parity of 1985) used in the literature since the World Bank Development Report of 1990. After correcting for inflation between 1985 and 1990 and for an average GDP share of consumption, these values correspond approximately to annual incomes equal respectively to 625\$ and 1250\$ in 1990 ppp with our definitions of income. With these figures, it turns out that the worsening of the world income distribution has not been so severe as for the proportion of poor to increase in spite of the growth of the world mean income. In effect, even though it was strongly inegalitarian economic growth contributed to a steady decline in the headcount poverty measure throughout the whole period under analysis. On both accounts, the orders of magnitude suggested by the figures appearing in Table 1 are striking. On one hand, over the 172 years considered here, the mean income of world inhabitants was multiplied by 7.6. Meanwhile, the mean income of the bottom 20 per cent was multiplied by only slightly more than 3, that of the bottom 60 per cent by approximately 4, and that of the top decile by almost 10. On the other hand, this increased inequality did not prevent poverty to decline. Our estimates suggest that approximately 75 per cent of the world population in 1820 was below the most severe poverty line of 1\$ a day. This proportion was down to 16.5 per cent in 1992. Even with a weaker definition of poverty, the drop is quite substantial. Slightly more than 90 per cent of the world population was below the 2\$ a day poverty line in 1820. This proportion was only 40 per cent in 1992.

Another way of looking at the preceding 'absolute' figures consists of normalizing them by today's standard of living in a given country. The change in inequality looks still more impressive. For instance, the tenfold increase in the mean income of the top 5 or 10 per cent of the world distribution would be equivalent to jumping from the few bottom centiles to the very top decile in today's developed countries' income scale. By contrast, the change in the welfare of the 60 per cent poorest in the world during the same period was only equivalent to a jump from today's mean income of the bottom 20 per cent to that of the top 20 per cent in the U.S. or in most European countries.

Another view at the preceding figures consists of considering numbers of people rather than proportions of the world population. Was or was not economic growth able to reduce the absolute number of poor in the world, and if so, when has it been? Looking at the most demanding definition of poverty, Table 1 suggests that the absolute number of 'very poor' remained approximately constant

ever since 1820. It practically did not change until 1929, it then increased until 1950-1960 but fell again afterwards. With the 2\$ a day poverty line, the absolute number of poor increased continuously ever since 1820, and is still increasing. This evolution results from a complex combination of effects linked to the growth in the mean income of the world population, its changing distribution, and differential rates of population growth across the world income scale. Some simple simulations show that the second factor played a major role. Without change in the distribution of the world income, that is with the same growth rate of incomes across and within countries the absolute number of poor would have been decreasing continuously. It may be computed that it would be today less than 150 millions rather than 900 using the 1\$ a day line and 650 millions rather than 2200 using the 2\$ a day line.

Country specific growth rates explain that indeed poverty declined at a much slower pace than what was just suggested. It also explains the increase in world inequality observed at least until 1950. From that point of view, it is interesting to isolate that component of the evolution of the world distribution of income from what may be due to income disparities within each country or country group and changes in them. Table 3 shows the decomposition of inequality into a within and a between country components. The two inequality measures used here are part of the standard decomposable measures. The between component of inequality refers to the inequality that would be observed if incomes were identical within each country, or group of countries. The 'within' component is obtained by difference and corresponds to the average inequality within country using total income - for the Theil coefficient - or total population - for the mean logarithmic deviations - as weights.⁹ It can be seen quite clearly on Table 3 that: a) the within component represents a decreasing share of total inequality, but that b) it nevertheless remains an essential part of world inequality throughout the period. Interestingly enough, the within component represents 80 per cent and more of total inequality in the first half of the 19th century. Indeed, at that time, very few countries are in advance of the others in the world. These are essentially the United Kingdom, some continental European countries and the United States, the difference with other countries in the world being rather limited. GDP per capita in China or India is around 500 \$ (ppp-1990), that of UK is only three times larger. But then, the gaps between countries widens at a fast speed. The differential between UK and China is 6:1 in 1910 and 10:1 in 1950. At the end of that period within country inequality falls quite significantly. As a result, it can be seen in Table 3 that the increase in the inequality between countries has actually been larger than the increase in overall inequality - as measured by the Theil coefficient and the mean logarithmic deviation - during the 1820-1950 period. The increase in the within component, mostly due to increasing inequalities in the second wave of countries going through the industrial revolution –i.e. the US, Germany, Belgium,

... in the 1870s or 1880s - had little effect on the overall level of inequality. Likewise, the substantial drop in domestic inequality observed in developed countries from the pre-WWI to the post-WWII times was unable to offset the increase in the inequality across countries when using the mean logarithmic deviation. However, this may be a matter of inequality measure since the increase in between inequality was nearly fully compensated by the within component when the Theil coefficient is used. . The shares of the within and between components seem to have approximately stabilized in the postwar period, the former representing approximately 40 per cent of overall world inequality.

This within country component of world inequality is sufficiently important for the density function of the world distribution of income to be substantially different when using vintile-country observations as done in figure 1, or country observations as in figure 2. The same is true of the evolution of these density curves. In figure 2, the Kernel estimate of the density function is obtained every year on a set of 33 observations corresponding to the GDP per capita of the groups of countries included in the analysis. The density curve for 1820 is unimodal with a small increase at the bottom right end of the curve. The corresponding density curve in figure 1 was flatter with a main double peaked mode and a secondary mode on the right-hand side tail. With time the density curve shifts rightward as before. But two secondary modes appear in 1910 and become more prominent in 1950. Such an evolution is much less pronounced in figure 2. Likewise, contrarily to what was observed with the density curves accounting for within country inequality, the change between 1950 and 1992 is quite dramatic with a general flattening of the density curve and the appearance of double mode in the left half of the curve.

That a density based on 33 country observations should behave differently from a density function based on 660 vintile-country observations is to be expected. In effect the latter should tend to smoothen the irregularities of the former, and also to exhibit less variation over time. In other words, the inequality within country is expected to play some dampening role with respect to cross-country variations in mean incomes. This is exactly what is observed. On the basis of the comparison of figures 1 and 2, it would thus seem dangerous to interpret changes in the distribution of GDP per capita across countries in figure 2 as true changes in the distribution of world income, as this is done in very much of the recent literature on the subject. Depending on the degree of inequality in countries where relative income variations are the largest, changes in the world hierarchy of GDP per capita may have quite different impact on the actual distribution of income among world citizens. It may be the case that economic analysis leads naturally to consider countries as the logical statistical unit on which international convergence or divergence of income must be gauged. With the same reasoning, it may also be natural to ignore population size in such an exercise as this is usually done in the recent

⁹ Other members of the entropy family of decomposable inequality measures use combinations of income and population shares as weights with the consequence that these weights do not sum to unity. See Bourguignon

literature. However, if the object of the analysis is the world distribution of income and the degree of inequality or poverty among world citizens, the preceding results show that ignoring within country income disparities may be quite misleading.

3. Decomposition of the changes in the world distribution of income

We now go further than the preceding descriptive analysis by decomposing the changes in some inequality measures into various components meant to represent the various forces behind the observed evolution of the world income distribution. To do so we use the same decomposable measures as above, that is the Theil index and the mean logarithmic deviation, in a slightly different way.

The objective is to put into evidence the role of both the rates of economic and demographic growth of the various countries or country groups as well as that of changes in domestic income distribution upon the evolution of world inequality. Given the decomposability properties of the measures being used the last component is easy to determine. For the first two components, things are a little more difficult. We evaluate here the contribution of a country's economic growth to the change in inequality by computing what would have been the change in world inequality had the income per capita in that country grown at the same rate as the mean world income per capita during the period under analysis. In this way we are trying to capture the effect of the 'differential rate of growth' between a country and the rest of the world on world inequality. This does not raise problem when we consider relatively small countries, which by definition could not significantly affect world averages. This is not so for larger countries and a fortiori for regions of the world. Because of this, the decomposition methodology used below is not exact in the sense that the sum of national contributions to changes in inequality may differ from the observed change in inequality.¹⁰ However, as the objective is to put into evidence the major sources of change rather than to quantify them precisely, this is not a real problem. The same hypothetical scenario of a common growth rate is used for evaluating the contribution of the demographic growth of a country or a region to the change in world inequality.

(1979) and Shorrocks (1980).

¹⁰ There is no perfect decomposition formula available in the present case. Ours generalizes the well-known methodology introduced by Mookherjee and Shorrocks (1982) to non-infinitesimal changes - the same methodology was used in the context of the world distribution of income by Berry et al. (1983a). The same linear approximation methodology leads here to important residuals in the decomposition formula because actual differential changes in income or population are too big for a linear approximation to work satisfactorily.

Table 4 shows the results of that decomposition when the original 33 country groups are aggregated into the 6 large regions mentioned above. Even at that low level of disaggregation, the decomposition methodology permits identifying very clearly the main forces which have influenced the evolution of the world distribution of income over the last 170 years. To make things simpler, we have broken down the whole period into three intervals: the 19th century, the inter-war period, and the post world war II period. It is possible, however, that this breakdown tends to smoothen some phenomena which would show up more markedly with another periodicity.

Whether inequality is measured by the Theil coefficient or the mean logarithmic deviation, the dominant unequalizing force throughout the 19th century and the first half of the 20th century is 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 per cent, that is 4.5 times less than the world average and 6 times less than the group of European countries and their offshoots in America and in the Pacific. This slow growth of Asia is due to India which proved to be the slowest growing important country in the world, but also to China, which did not much better. The evidence collected by Maddison suggests that income per capita increased overall by a little more than 10 per cent in India and by about 17 per cent in China between 1820 and 1950. The corresponding figure was around 400 per cent for those countries where the industrial revolution started in Europe, and still much bigger in their settlements abroad. True, the terminal years of this period were among the worse both in India and in China during practically all the period under analysis and the picture is a little less dramatic if one considers only the sub-period 1820-1910. Even so, however, Asia under-performed all the other regions of the world. Its overall growth has been a little above 30 per cent, whereas it was 200 per cent in Europe, 60 per cent in Latin America and even 45 per cent in Africa. The reasons for the growth under-performance of Asia may be different during the 19th century and during the first half of the 20th century, but this is the phenomenon which most affected the world distribution of income until 1950.

The vigorous enrichment of the European population is the second major unequalizing factor in the world distribution. Following on the intuition developed by Pritchett (1997b), the first century and a half after the beginning of the industrial revolution witnessed a dramatic 'divergence' in the world economy, the richest becoming continuously richer and the poorest being practically cut off from economic growth. The income differential between on one hand Western Europe and its offshoots and, on the other hand, Asia or Africa, that is practically between the richest 20 per cent of the world and the poorest 60 per cent went up from 1:3 in 1820 to 1:5 in 1910 and to 1:9 in 1950! Interestingly enough, the enrichment of Europe and impoverishment of Asia between 1820 and 1950 together

represent a total increase in inequality approximately equivalent to the actual increase observed in the world during the whole 1820-1992 period.

The contribution of European economic growth to world inequality continued after 1950. This means that the rate of growth of European countries and their offshoots has been systematically higher than the average economic growth in the world throughout all the period under analysis. The difference with the previous period is that the slow growth of Africa then became the second significant positive contribution to world inequality. Historically, the slowing down of Africa with respect to world average income growth thus appears as a feature of the post-colonial era.

There are forces toward more equality of the world distribution, too. If we keep focusing on the effect of regional economic growth, that is the income columns of Table 4, we see that the main equalizing force came from the growth performance of the Asian region during the post-war period. However, getting into more detail shows that it is undoubtedly China, and still more precisely China in the last 12 years of the period under analysis which is responsible for that evolution. Except for India other countries in Asia have also grown faster than the world average during the last 40 years or so. But, because of relative population sizes, China's growth is the dominant factor.

A second set of equalizing forces is to be found in the evolution of inequality within regions and within countries. From that point of view, the most important movement undoubtedly took place within European countries during the first half of the 20th century. This drop in within inequality partly corresponds to the important redistribution undertaken in most developed countries from before World War I until just after World War II. The impact of this evolution upon the world distribution of income has been substantial if one considers an inequality measure like the Theil index which gives relatively more weight to changes at the top of the distribution. Together with the equalizing effect of the Soviet revolution in Russia and the socialization of Eastern European countries this equalization of incomes within European societies offset a large part of the increase in world inequality which arose from divergences in national economic growth rates. This compensation is less important with the mean logarithmic deviation because of the lesser weight given to richer countries in that measure. In fact, Table 1 shows that the only noticeable equalizing change in the world distribution between 1910 and 1950 is a small drop in the income share of the richest 5 per cent of the world population.

Changes in the inequality within the group of European countries also played a significant unequalizing role in the first half of the 19th century and an equalizing role in the second half of the 20th century. In both cases, however, the explanation is to be found not so much in a change in

national income distributions as in the evolution of the inequality *among* European countries.¹¹ The increase in European inequality between 1820 and 1870 is before all the reflection of a divergent evolution between the United Kingdom and its old colonies in America and in the Pacific, on one hand, and the rest of Europe on the other hand. The income per capita advantage of the 'Anglo-Saxon' countries over the other European countries was around 40 per cent at the beginning of the 19th century. It was close to 80 per cent in 1870. Things change only slightly between 1870 and 1910. The United States and the United Kingdom simply switch ranks in the world distribution and Germany comes back to its initial relative income position with respect to the richest country of the world. In 1950, the distance between the United States and other countries substantially increased in comparison with 1910, but part of that evolution may probably be explained by the effects of the WWII in Europe. The catching up really takes place after the war, and the inequality between the countries of the European group gets back in 1992 to a level which is intermediate between that observed in 1820 and 1870. If it were not for the persistent lag in the development of Argentina and Chile, and the slowing down of the old Austro-Hungarian empire linked to the temporary communist rule in Czechoslovakia and Hungary, the distribution of income across European countries would have been in 1992 almost identical to what it was almost 200 years before. That final convergence, which also includes the effects of the economic recovery after the war, is what explains the drop in European inequality in Table 4 and its contribution to less world inequality after 1950.

One could have expected a similar story of convergence to show up in the contribution of the Asian tigers, Japan, Korea and Taiwan, to the evolution of the world distribution. That this group of countries had no effect on the level of world inequality before 1950 is not too surprising. They grew more or less like other non-industrial countries. Between 1950 and 1992, however, they made an extraordinary jump in the world hierarchy of income, multiplying their income per capita by approximately 10 and moving from a level slightly below the world mean to the mean of the richest group of countries. It turns out that this contributed to an increase in inequality across countries both with the Theil index and the mean logarithmic deviation. This effect is less pronounced for the former measure which gives more weight to the fact that these new rich economies are more egalitarian than the rest of the world.

Summarizing the preceding points, the main forces which contributed to the change in the world distribution of income since 1820 were as follows. On the unequalizing side, the dominant force is: a) the divergence between Anglo-Saxon and the other European countries in the first half of the 19th century; b) the relatively poor growth performances of China and India until late in the 20th century

¹¹ Indeed the within component of inequality in Table 4 is defined at the *regional* level. It thus includes inequality across countries of the same region.

together with the exceptional relative growth of the group of countries which had already begun to industrialize by 1820; c) the slow growth of Africa over the second half of the 20th century. On the equalizing side, the main factors were: a) the equalizing of incomes in European countries, Russia and Eastern Europe in the inter-war period and just after WW II; b) the quick catching up of European countries over the United States after WWII; c) the outstanding growth performance of China in the last one or two decades. Another important phenomenon which characterizes the same period is the miracle growth of the Asian tigers. We have seen, however, that its effect on the world distribution was inegalitarian and somewhat limited.

Two factors have not been considered. First, nothing has been said of Latin America. The reason for this is that the pace of economic growth in that region has approximately coincided over the last two centuries with the world average. In other words, it has always been midway between the high rates of growth of the group of European countries and the relatively slow rates observed elsewhere in the world, for a very long time in Asia and now in Africa. Second, it is rather remarkable that no big change in the distribution of world income seems to be associated with demographic growth rates. The reason is to be found first of all in the fact that changes in the regional structure of the world population have not been very big after all. 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, Argentinian and Chilean populations being in the present analysis amalgamated with that of old Europe. Overall this has been equivalent to Asia losing part of its importance for the profit of the two preceding regions, certainly not a very important 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 relatively more one extreme of the distribution or the other. Indeed, it is easily seen that they then lead to crossing Lorenz curves. An example of this ambiguity is provided in Table 4 by the population effect for the 1950-1992 period which is inegalitarian with the Theil index but egalitarian with the mean logarithmic deviation.

4) Mobility

Another way of looking at the origin of changes in the world distribution of income is to consider how the nationality composition of specific quantiles of the world distribution has changed over time and, symmetrically, how various income groups fared relatively to the world scale of income. This is equivalent to considering the general issue of mobility of countries, and of income groups within countries in the world income scale.

To get a first idea of mobility, Table 5 shows the regional composition of various quantiles of the world distribution at various points of time during the last two centuries. If the distribution of income

were the same in all countries, the regional composition of all quantiles would be the same as that of the world population. A country or a region poorer than average would then be over-represented among the bottom quantiles of the world population and vice-versa. This may be seen for Asia in Table 5, whose weight in the world population in 1820 was 65 per cent but which accounted for 75 per cent of the world's poor and 32 per cent of the rich.

Table 5 shows a rather clear evolution over the period under analysis. The divergence between rich European countries and their offshoots on one hand and the other regions on the other, which continuously increased over the whole period, explains the substantial increase in their share in the richest 10 per cent of the world observed until 1950. This share increased from 49 per cent in 1820 to 64 per cent in 1910 and 81 per cent in 1950. The latter figure is affected by very adverse conditions in China and India, which produced an abnormal temporary impoverishment of that region and consequently a rise in the share of other regions, including Europe, in the richest world group. In any case, the interesting point is that the relative share of Europe among world rich fell after 1950. In 1992, they represented a little more than 60 per cent of the top decile of the world population versus 64 per cent in 1910.

This stop in the ascending European supremacy may be explained by two factors. On one hand, the rise of economic affluence among the Asian tigers, Japan, Korea and Taiwan which led them to represent 16.5 per cent of the top world decile in 1992 severely reduced the relative importance of the European component of the world's top 10 per cent. If it had not been for this factor, the European share would have been considerably higher in 1992 than what was actually observed. On the other hand, the European rate of population growth started to decline in comparison with the rest of the world around the middle of the 20th century.

At the other extreme of the income spectrum, the dominant change in the composition of the world poor is without any doubt the continuously increasing share of the African continent, an evolution which sharply accelerated during the last century. Both because of its specific population and economic growth performances, the share of this region among the world's poorest 60 per cent remained constant at 8 per cent throughout the 19th century and then increased to 12 per cent around 1950 - a figure likely to be an under-estimation because of the adverse political and climatic events in Asia at that time- and 17.5 per cent in 1992. This evolution is still more pronounced if a more restrictive definition of poverty is used. Only 11 per cent of world inhabitants with income less than 625 \$ lived in Africa in 1950. This proportion was above 40 per cent in 1992. Poverty which was above all an Asian problem until just after WorldWar II is becoming more and more an African problem. On the contrary after a deep decline from 1820 to 1950 Asia is catching up with more

developed regions. Its share in the top world decile increased from 4.5 to 14.8 per cent between 1950 and 1992, and its share in the world mid three deciles almost doubled from 18.8 to 36 per cent. Finally, Latin America and Eastern Europe concentrated mostly in the mid three deciles throughout the whole 1820-1992 period.

Another way of looking at the dynamics of the world income distribution is to consider how countries, and citizen within countries perform within a scale defined at the world level. This fits the more standard view taken in the recent literature on convergence and mobility - see in particular Quah (1996a). The corresponding transition matrices are shown in Table 6. In these matrices income groups are defined as in Quah relatively to the world mean - .25, .5, 1 and 2 times the world mean respectively.

The dominant feeling in examining the matrices shown in Table 6 is that of the extreme immobility of national citizen within the world population at the beginning of the period under analysis. More than 80 per cent individuals stayed in their world income groups between 1820 and 1870, and only a little less between 1870 and 1910. Also downward mobility is much higher than upward mobility. Things are substantially modified in the 20th century. On one hand, overall mobility increases since the immobility ratio goes down to 65 per cent for 1950-92. More importantly, however, upward mobility is becoming substantial since 1910-50. In the long-run, one would not observe a bunching of national deciles toward the bottom of the distribution as with the transition matrices of the 19th century but an ergodic distributions resembling the 'twin peaks' recently popularized by Quah. This 'polarization' of the world income distribution is already noticeable when comparing the column and row margins of the transition matrices in Table 6, which correspond to what would have been the evolution of the distribution in the absence of heterogeneity in demographic growth rates.

For a better understanding of the present convergence literature, it is important to realize that this evolution, and this difference with respect to the 19th century is essentially due to a small number of national growth performances during the 20th century. The drop in inequality among European countries and their offshoots between 1910 and 1950 is the major factor explaining the increase in upward mobility during that period. Likewise, the acceleration of growth in China and among the 3 Asian tigers is responsible for the increase in the upward mobility observed during the last 40 years. It is difficult not to recognize that both phenomenon seem in some sense exceptional and that it is uncertain whether the transition matrices observed in the recent history are stationary, as it is so often assumed in the recent literature on convergence. At this respect, it is also worth stressing that the mobility pattern in the world income distribution during the last 170 years fail to pass the most elementary test of being Markovian. For instance, multiplying the transition matrix of 1820-1870 by

that of 1870-1910 leads to a matrix which is substantially different from that actually observed between 1820 and 1910. Thus, the historical perspectives as well as the introduction of national income disparities in the analysis significantly alter the conclusions suggested by mobility analysis performed across countries over the last 30 or 40 years.

Conclusion

Contrary to the recent literature on income inequality which focuses on the divergence of GDP per capita across countries during the last 40 years, and more rarely the last century, this paper emphasized a longer period and a more general perspective on the world distribution of income. On one hand, owing to our beginning the analysis in 1820 we can observe the major effects the Industrial Revolution had on the distribution of world income. On the other hand, because we take into account the distribution of income within countries we measure world inequalities among individuals instead of among countries.

First, world income inequalities have truly exploded since the early 19th century. The Gini coefficient has increased by 30 per cent and the Theil index has increased by 60 per cent between 1820 and 1992. Second, this evolution is essentially due to a dramatic increase of inequality among countries or regions of the world. The between country component of inequality as measured by the Theil index is estimated to have been .06 in 1820; it was above .50 in 1992. Changes in inequality within countries have been important at some stages in history, and in particular the drop in inequality within European countries and their offshoots in America and in the Pacific during the first half of this century. In the long run, however, the increase of inequality across countries was the leading factor in the evolution of the world distribution of income. Third, it seems that the most important changes in that distribution now lie behind us. There is comparatively little difference between the world distribution as it is today and as it was in 1950 in comparison with the soaring inequality observed in the previous 130 years. This does not mean that the distribution has become stable, however, or that a convergence process analogous to the one we have stressed for Europe and its offshoots is starting to take place at the world scale. In particular, the increasing concentration of world poverty in some regions of the world is worrying. Fourth, lengthening the time horizon and taking into account inequality within countries also leads to a change in our perception of mobility within the world income scale. It suggests in particular that mobility of individuals in the world distribution of income is strongly history dependent.

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Table 1. Inequality and poverty indices for the world income distribution, 1820-1992: selected years

	1820	1850	1870	1890	1910	1929	1950	1960	1970	1980	1992
<i>Income shares</i>											
Bottom 20 per cent	4.5	4	3.6	3.3	2.9	2.8	2.4	2.3	2	1.9	2
Bottom 40 per cent	13.2	11.7	10.6	9.6	8.6	8	6.8	6.7	5.8	5.6	6
Bottom 60 per cent	25.6	23.1	21.2	19.4	17.5	16.3	14.1	14.1	12.5	12.5	13.2
Bottom 80 per cent	43.4	40.2	37.6	34.7	32.8	32	31.1	32.1	30.2	29.8	27.8
Top 10 per cent	43.1	45.6	48	50.1	51	50.1	51.4	49.8	50.9	51.4	53.4
Top5 per cent	32.2	32.6	33.7	36	36.6	35.1	35.6	33.9	34.4	34.9	36
<i>Inequality measures</i>											
Coefficient of Gini	0.504	0.538	0.565	0.592	0.614	0.621	0.641	0.635	0.654	0.657	0.663
Theil index	0.533	0.605	0.673	0.749	0.799	0.778	0.805	0.771	0.814	0.824	0.864
Mean Logarithmic Deviation	0.441	0.504	0.561	0.625	0.682	0.707	0.781	0.772	0.845	0.864	0.857
Standard deviation of logarithm	0.846	0.903	0.947	0.996	1.046	1.088	1.164	1.178	1.242	1.266	1.224
Mean world income (\$ 1990)	652	736	890	1114	1460	1817	2145	2827	3778	4609	4962
World population (Billions)	1.1	1.2	1.3	1.5	1.7	2	2.5	3	3.7	4.4	5.5
<i>Poverty</i>											
Headcount (%)											
Less than 2 \$ a day (consumption, 1985)	91.8	89.2	85.5	81.2	74.9	68.2	63.4	56.6	51.2	44.2	39.9
Less than 1 \$ a day (consumption, 1985)	76.4	71.1	66.3	56.1	48.2	41.5	41.7	31.6	23.7	19.8	16.5
Headcount (Millions)											
Less than 2 \$ a day (consumption, 1985)	1010	1070	1112	1218	1273	1364	1585	1698	1894	1945	2195
Less than 1 \$ a day (consumption, 1985)	840	853	861	842	819	830	1043	948	877	871	905

Table 2. Lorenz dominance map

	1850	1870	1890	1910	1929	1950	1960	1970	1980	1992
1820	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
1850		TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
1870			TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
1890				TRUE	FALSE	TRUE	FALSE	TRUE	TRUE	TRUE
1910					FALSE	TRUE	FALSE	FALSE	TRUE	TRUE
1929						TRUE	FALSE	TRUE	TRUE	TRUE
1950							FALSE	FALSE	FALSE	TRUE
1960								TRUE	TRUE	TRUE
1970									FALSE	FALSE
1980										FALSE
1992										

Lorenz dominance of the distribution in the years shown in row over distribution in years shown in column

Table 3. Decomposition of world inequality into inequality within and between country groups

	1820	1850	1870	1890	1910	1929	1950	1960	1970	1980	1992
<i>Theil coefficient</i>											
Inequality within country groups	0.472	0.477	0.485	0.498	0.500	0.413	0.323	0.320	0.324	0.337	0.351
Inequality between country groups	0.061	0.128	0.188	0.251	0.299	0.365	0.482	0.451	0.490	0.487	0.513
Total inequality	0.533	0.605	0.673	0.749	0.799	0.778	0.805	0.771	0.814	0.824	0.864
<i>Mean logarithmic deviation</i>											
Inequality within country groups	0.388	0.393	0.399	0.408	0.413	0.372	0.309	0.312	0.330	0.350	0.362
Inequality between country groups	0.053	0.111	0.162	0.217	0.269	0.335	0.472	0.460	0.515	0.514	0.495
Total inequality	0.441	0.504	0.561	0.625	0.682	0.707	0.781	0.772	0.845	0.864	0.857

Table 4. Decomposition of change in inequality by regional income, population and inequality effects

(Regional contributions to overall change in inequality)

Change between	1820-1870			1870-1910			1910-1950			1950-1992		
	Change in inequality due to:			Change in inequality due to:			Change in inequality due to:			Change in inequality due to:		
	Differential Income growth	Differential population growth	Within country groups inequality	Differential Income growth	Differential population growth	Within country groups inequality	Differential Income growth	Differential population growth	Within country groups inequality	Differential Income growth	Differential population growth	Within country groups inequality
<i>(Theil Coefficient)</i>												
Africa	0.005	0.000	0.001	0.008	0.000	0.001	0.005	-0.001	0.002	0.016	0.002	0.012
Asia	0.047	0.002	0.002	0.065	0.002	0.001	0.097	-0.001	0.007	-0.060	0.011	0.005
Japan, Korea and Taiwan	0.002	0.000	0.000	0.000	0.000	0.000	0.001	-0.003	-0.003	0.002	0.004	0.000
Latin America	0.000	0.002	0.000	0.000	0.001	0.000	-0.002	0.000	0.000	0.001	-0.002	0.000
Eastern Europe	0.000	0.001	0.000	0.002	-0.003	0.006	-0.004	0.003	-0.038	0.011	0.015	0.000
Europe and European settlements	0.037	0.007	0.011	0.031	0.005	-0.005	0.048	-0.001	-0.075	0.071	0.000	-0.042
Total	0.091	0.013	0.014	0.106	0.005	0.003	0.146	-0.002	-0.106	0.039	0.030	-0.026
Total observed change in inequality			0.140			0.126			0.006			0.059
<i>(Decomposition discrepancy)</i>			-0.022			-0.012			0.031			-0.016
<i>(Mean logarithmic deviation)</i>												
Africa	0.004	0.000	0.001	0.007	0.001	0.001	0.005	-0.005	0.003	0.020	-0.006	0.028
Asia	0.042	0.003	0.002	0.063	0.004	0.001	0.113	0.002	0.013	-0.083	0.002	0.017
Japan, Korea and Taiwan	0.000	0.000	0.000	0.000	0.000	0.000	0.001	-0.003	-0.002	0.042	0.005	-0.001
Latin America	0.000	0.001	0.000	0.000	0.001	0.001	-0.002	-0.001	0.000	0.000	-0.004	0.000
Eastern Europe	0.000	0.002	0.000	0.000	-0.001	0.004	0.000	0.002	-0.035	-0.001	0.014	-0.002
Europe and European settlements	0.030	0.008	0.007	0.026	0.008	0.001	0.046	-0.004	-0.013	0.077	-0.039	-0.013
Total	0.077	0.015	0.009	0.095	0.012	0.007	0.164	-0.008	-0.034	0.055	-0.028	0.029
Total observed change in inequality			0.120			0.121			0.099			0.076
<i>(Decomposition discrepancy)</i>			-0.019			-0.006			0.023			-0.020

Table 6. Mobility of world citizens across world relative income groups

(All income ranges as proportions of world mean)

Income ranges 1870						
Income ranges 1820	Less than .25	.25 -.5	.5 - 1	1 - 2	More than 2	Total
Less than .25	98.9%	1.0%	0.1%	0.0%	0.0%	12.8%
.25 -.5	23.7%	74.5%	1.7%	0.0%	0.0%	26.3%
.5 - 1	0.0%	35.0%	63.2%	1.8%	0.0%	39.2%
1 - 2	0.0%	0.0%	10.9%	80.2%	8.9%	14.0%
More than 2	0.0%	0.0%	0.0%	3.7%	96.3%	7.7%
Total	18.9%	33.4%	26.8%	12.2%	8.6%	100.0%
Immobility ratio	82.6%	Downward mobility		14.7%		
		Upward mobility		2.7%		
Income ranges 1910						
Income ranges 1870	Less than .25	.25 -.5	.5 - 1	1 - 2	More than 2	Total
Less than .25	98.1%	1.9%	0.0%	0.0%	0.0%	17.8%
.25 -.5	26.0%	73.2%	0.8%	0.0%	0.0%	31.1%
.5 - 1	0.0%	38.3%	60.1%	1.6%	0.0%	26.8%
1 - 2	0.0%	0.0%	32.6%	63.1%	4.3%	13.8%
More than 2	0.0%	0.0%	0.0%	7.5%	92.5%	10.5%
Total	25.5%	33.4%	20.9%	10.0%	10.3%	100.0%
Immobility ratio	77.4%	Downward mobility		20.9%		
		Upward mobility		1.7%		
Income ranges 1950						
Income ranges 1910	Less than .25	.25 -.5	.5 - 1	1 - 2	More than 2	Total
Less than .25	88.3%	7.7%	4.0%	0.0%	0.0%	24.3%
.25 -.5	47.6%	40.7%	11.5%	0.1%	0.0%	31.6%
.5 - 1	0.0%	31.3%	47.5%	21.2%	0.0%	21.4%
1 - 2	0.0%	0.0%	6.1%	65.8%	28.1%	11.1%
More than 2	0.0%	0.0%	0.0%	19.6%	80.4%	11.7%
Total	36.5%	21.4%	15.5%	14.2%	12.5%	100.0%
Immobility ratio	77.4%	Downward mobility		20.9%		
		Upward mobility		14.5%		
Income ranges 1992						
Income ranges 1950	Less than .25	.25 -.5	.5 - 1	1 - 2	More than 2	Total
Less than .25	76.0%	22.3%	0.9%	0.8%	0.0%	36.8%
.25 -.5	13.9%	61.6%	19.2%	3.3%	2.0%	22.3%
.5 - 1	1.9%	18.6%	49.5%	18.4%	11.6%	15.5%
1 - 2	0.0%	0.0%	20.2%	45.2%	34.6%	13.0%
More than 2	0.0%	0.0%	0.0%	4.8%	95.2%	12.4%
Total	31.4%	24.8%	14.9%	10.4%	18.5%	100.0%
Immobility ratio	65.5%	Downward mobility		11.9%		
		Upward mobility		22.6%		

Appendix I. Data definition : sources and problems

(i) Population and GDP

All available data on population and GDP in Maddison (1995) have been used or taken into account. For 1950-92, the original data was collected from publications by various international organizations (OECD, World Bank, etc.). For previous years, Maddison carried out a huge work of critical assessment of existing data and consistency checks. He also adjusted all data in order to take into account changes of national frontiers. All GDP data are expressed in Geary-Khamis 1990 Dollars.

For several countries Maddison's series begin after 1820 (for example, 1870 for Argentina, 1900 for Chile, Colombia, Peru and Venezuela, etc.). For each of these countries and each missing period, it was assumed that both GDP and the population grew at the same rate as in the nearest country in the same region - see below- for which data was available. For example, we estimated the GDP of Portugal in 1820 using rate of growth of Spain GDP between 1820 and 1850 and Portugal's GDP figure for 1850 (a figure given by Maddison).

(ii) Income distribution

It is rather easy to find estimates of income distribution for the 1950-92 period. The literature on international comparisons of income distribution is indeed abundant (see below). In general all distribution figures in this paper refer to household disposable income per capita, or possibly per adult equivalent, with households being weighted in the data base by their size. In some cases, however, other definitions are used. This is true mostly for developing countries. The difference with the previous definition does not lead to big discrepancies, however – on this point see Lecaillon et al. (1984).

Things are much more difficult for the 1820-1950 period. Estimates for Europe and European settlements are drawn from Lindert (1999) and Morrisson (1999). As these authors studied only a limited number of countries, we followed the same methodology as above. We chose as a reference the nearest and the most similar country for which some estimates of the income distribution was available. For example, we assumed distribution in Austria-Hungary and in Czechoslovakia was the same as in Germany throughout the whole period. As some estimates are available for Russia, we assumed the distribution was the same in Poland and in the country group made of Bulgaria, Greece, Romania and Yugoslavia.

No source is available for Latin American, African and Asian countries prior to 1950. We assumed the distribution was the same as that observed in 1950 in all previous years, except in 5 cases : China, India, Indonesia, North Africa and the Philippines-Thailand country group. In the latter cases, rough estimates were obtained from the shares of Europeans in total income and known figures on the income gap between rural and urban zones.

In most cases, the internal distribution for a group of countries was taken to be identical to that of a representative country in that group, e.g. Sweden for the Scandinavian group.

Appendix III gives the sensitivity of some world inequality measures to inequality within each particular country or group of countries considered in this study. In general they are very small so that one may expect that measurement errors tend to compensate each other without very much influence upon aggregate estimates. This is not true for big countries, however. Special care has been taken for them in order to make sure that the evolution of inequality over time in our data base, rather than the distribution itself, was in agreement with what is known in the literature.

(iii) Country grouping

The annual series of Maddison relate to 56 countries, including some very small ones like Norway. Maddison regrouped all other countries into 4 groups of countries - 15 in Europe, 37 in Latin America, 45 in Asia and 46 in Africa - representing altogether less than 10% of world GDP. Estimates for these groups are available for 1820, 1870, 1900, 1913, 1929 and every year since 1950.

We started with Maddison's definitions of countries and country groups and made some additional aggregations so as to obtain country groups B or single countries- representing at least 1 per cent of the world population. Indeed, it was assumed that single countries smaller than this limit could not have any significant influence on the world distribution of income. In some other cases, the aggregation was done for more obvious reasons. For instance we put all Scandinavian countries together and we merged West Germany and East Germany, which Madison included in the 15 European countries mentioned above. Likewise, we put together Austria, Hungary and Czechoslovakia because they all belonged to the Habsburg empire from 1820 to 1918 and had a rather similar economic evolution until 1950. We also added Ethiopia, Tanzania, Zaire to the 46 African countries, but we took 3 countries - Algeria, Morocco and Tunisia deemed to have behaved in a very similar way from 1820 to 1950 - out of this group to set up a North Africa group.

In some cases, this clustering process was convenient for other reasons. When missing data for some countries were systematically replaced by data referring to some specific country, it made sense to consider all these countries as a single group. This is the reason why Bangladesh, Burma and Pakistan are considered as a single country group.

At the end of this grouping process we eventually obtained a set of 15 single countries and 18 country groups. Of course every grouping may be criticized in one way or another. But given the length of the total period under analysis (172 years), these choices seem rather satisfactory.

For analytical purposes -i.e. decomposing the evolution of world income inequality - it was necessary to consider broader country groups. We thus defined 6 ‘classes’ or ‘regions’: Asia (excluding Japan, Korea and Taiwan) ; Japan Korea and Taiwan; Latin America (excluding Chile and Argentina) ; Eastern Europe (Russia, Poland , Bulgaria, Greece, Romania, Yugoslavia and Turkey); Western Europe and ‘Western offshoots’. This last ‘region’ comprises all Western European countries and all countries in the rest of the world where a very large majority or the whole population were of European origin still at the beginning of the 20th century. These countries are the U.S.A , Canada, Australia, New-Zealand, Argentina and Chile. Considering them together with Western Europe makes very much sense in an economic history context. European labor and European capital were the main factors of growth for these countries between 1820 and 1914. They also all had a very close relationship with Western Europe in most fields: trade, finance, technology, etc. In other regions, the only departure from a geographical definition of regions is our setting aside of Japan , Korea and Taiwan. The reason for this choice is that we wanted to evaluate the effect of the huge gap between economic growth in these countries and in the rest of Asia ever since 1950. No such heterogeneity was present among Africa or Latin America countries.

(iv) List of country groups (by ‘regions’) 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

Mexico

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

g) Main sources for distribution data not appearing in general references

A. Atkinson and J. Micklewright (1992), *Economic transformation in Eastern Europe and the distribution of income*, Cambridge U.P., Cambridge

A. Atkinson, L. Rainwater, T. Smeeding (1995), *Income distribution in O.E.C.D. countries: Evidence from the L.I.S.*, O.E.C.D., Paris

F. Bourguignon and C. Morrisson (1998), *Inequality and development : the role of dualism*, *Journal of Development Economics*.

K. Deininger and L. Squire (1996), *A new data set measuring income inequality*, *World Bank Economic Review*

J. Lecaillon, F. Paukert, C. Morrisson, D. Germidis (1984), *Income distribution and economic development*, I.L.O. Geneva

P. Lindert (1999) *Three centuries of inequality in Britain and America*, in A. Atkinson and F. Bourguignon (eds), *Handbook of Income Distribution*, Elsevier (forthcoming)

C. Morrisson (1984), *Income distribution in East European and Western Countries*, *Journal of Comparative Economics*

C. Morrisson (1999), *Historical perspectives on income distribution : the case of Europe*, in A. Atkinson and F. Bourguignon (eds), *Handbook of Income Distribution*, Elsevier (forthcoming)

M. Sawyer (1976), *Income distribution in O.E.C.D. countries 1976*, O.E.C.D. , Paris

W. Van Ginneken and J-G Park (1984), *Generating internationally comparable income distribution estimates*, I.L.O. Geneva

Appendix II. Analogy assumptions for country groups without historical income distribution data

No entry for countries and years with direct information available

'=' means the distribution is assumed to be the same as the next available

	1820	1850	1870	1890	1910	1929	1950	1970	1992
37 LAC countries	=	=	=	=	=	=	Brazil	=	
45 Asian countries	=	=	=	=	=	=	=	=	Pakistan
46 African countries	=	=	=	=	=	=	Cote d'Ivoire	=	
Argentina, Chile	=	=	=	=	=	=	=		
Australia, Canada, New Zealand	=	=	=	=	=				
Austria, Czechoslovakia, Hungary	Germany	Germany	Germany	Germany	Germany	Germany	=	=	
Benelux, Switzerland, and other small European	=		=	=			=	=	
Brazil	=	=	=	=	=	=	=		
Bulgaria, Greece, Rumania, Yugoslavia	Russia	Russia	Russia				Russia	Russia	Russia
China	=	=	=	=	=	=			
Colombia, Peru, Venezuela	=	=	=	=	=	=	=	Brazil	Brazil
Cote d'Ivoire, Ghana and Kenya	=	=	=	=	=	=	=		
Egypt	=	=	=	=	=	=	=		
France									
Germany									
India	=	=	=	=	=	=	=	=	
Indonesia	=	=	=						
Italy	=	=	=	=					
Japan	=	=	=	=					
Korea, Taiwan	=	=	=	=	=	=			
Mexico	=	=	=	=	=	=	=	Brazil	Brazil
Nigeria	=	=	=	=	=	=	=		
North-Africa	=	=	=	=					
Pakistan, Bengal, Burma	=	=	=	=	=	=	=	=	
Philippines, Thailand	=	=	=	=	=	=			
Poland	Russia	Russia	Russia				Russia	Russia	Russia

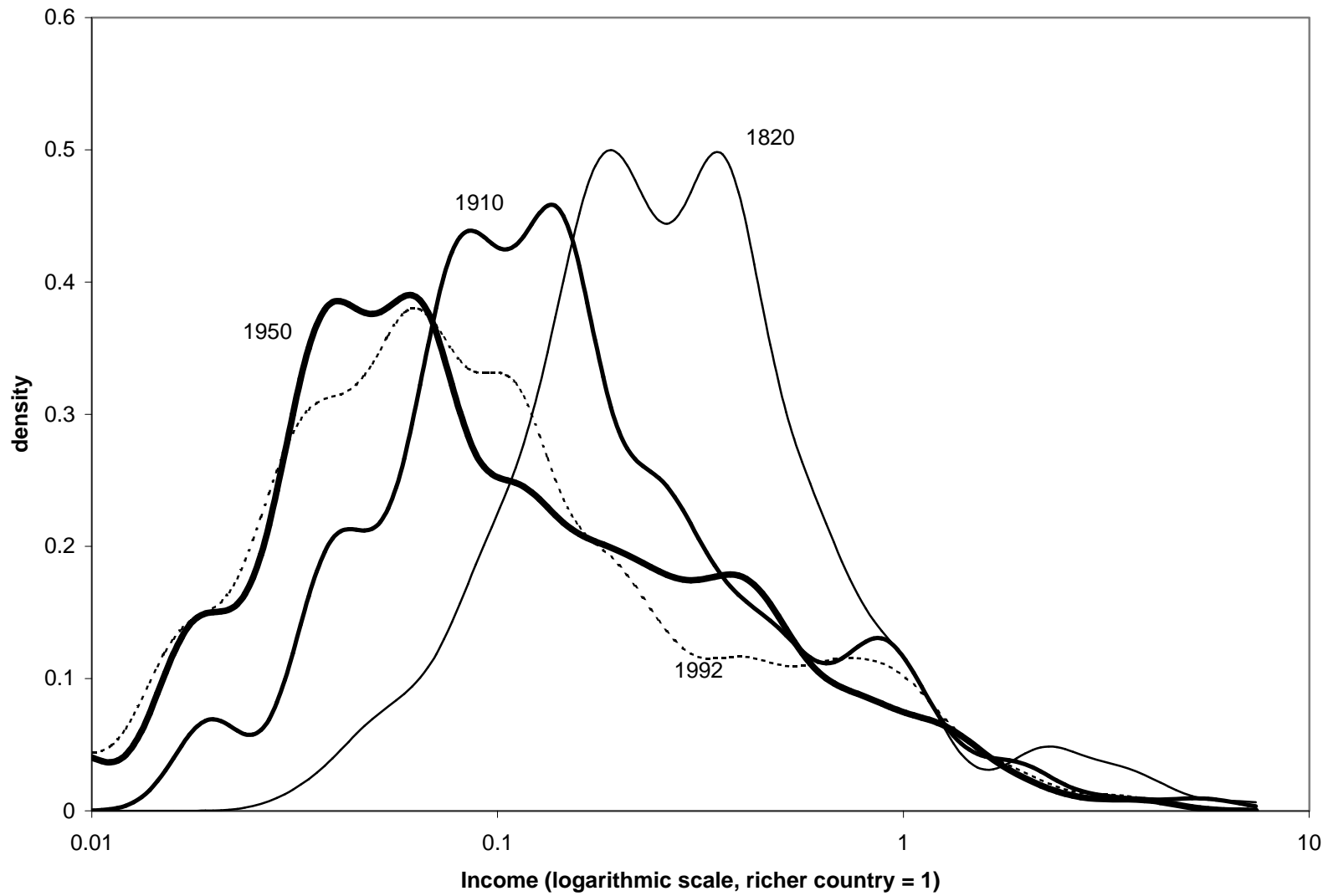
Portugal, Spain	=	=	=	=	=			
Russia	=	=						
Scandinavian countries	=							
South-Africa	=	=	=	=	=	=	=	
Turkey	=	=	=	=	=	=	=	=
United Kingdom, Ireland								
United States								

Appendix III. Sensitivity of world inequality to national characteristics

Elasticity of world inequality (Theil index) in 1950 to changes in national:

	Inequality	Population	Income per capita
37 LAC countries	0.0114	-0.0014	-0.0023
45 Asian countries	0.0151	0.0021	-0.0252
46 African countries	0.0047	0.0105	-0.0264
Argentina, Chile	0.0142	-0.0024	0.0108
Australia, Canada, New Zealand	0.0115	-0.0052	0.0219
Austria, Czechoslovakia, Hungary	0.0055	-0.0096	-0.0026
Benelux, Switzerland, and other small European	0.0092	-0.0091	0.0129
Brazil	0.0139	-0.0004	-0.0059
Bulgaria, Greece, Rumania, Yugoslavia	0.0041	-0.0055	-0.0123
China	0.0364	0.0880	-0.0995
Colombia, Peru, Venezuela	0.0127	-0.0016	0.0044
Cote d'Ivoire, Ghana and Kenya	0.0006	0.0007	-0.0033
Egypt	0.0016	0.0021	-0.0041
France	0.0140	-0.0147	0.0141
Germany	0.0162	-0.0253	0.0026
India	0.0232	0.0598	-0.0646
Indonesia	0.0075	0.0065	-0.0159
Italy	0.0104	-0.0157	-0.0022
Japan	0.0066	-0.0175	-0.0226
Korea, Taiwan	0.0027	0.0022	-0.0057
Mexico	0.0091	-0.0012	-0.0016
Nigeria	0.0011	0.0057	-0.0072
North-Africa	0.0034	-0.0017	-0.0043
Pakistan, Bengal, Burma	0.0060	0.0178	-0.0173
Philippines, Thailand	0.0060	0.0024	-0.0070
Poland	0.0035	-0.0067	-0.0050
Portugal, Spain	0.0055	-0.0088	-0.0072
Russia	0.0292	-0.0557	-0.0279
Scandinavian countries	0.0070	-0.0061	0.0093
South-Africa	0.0050	-0.0007	-0.0004
Turkey	0.0037	0.0003	-0.0036
United Kingdom, Ireland	0.0202	-0.0172	0.0367
United States	0.0976	0.0081	0.2613

Figure 1. Evolution of the world income distribution: 1820-1992



**Figure 2. Evolution of the world income distribution without inequality within countries:
1820-1992**

