Riding the Elephants: The Evolution of World Economic Growth and Income Distribution at the End of the Twentieth Century (1980-2000)

Albert Berry and John Serieux

Abstract

This paper presents estimates of world economic growth for 1970-2000, and changes in the intercountry and interpersonal distribution of world income between 1980 and 2000. These estimates suggest that, while the rate of growth of the world economy slowed in the 1980-2000 period, and average within-country inequality worsened, the distribution of world income among individuals, nevertheless, improved a little. However, that result was wholly due to the exceptional economic performances of China and India. Outside these two countries, the slowdown in world growth was even more dramatic, the distribution of world income unequivocally worsened, and poverty rates remained largely unchanged.

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Keywords: world inequality trends; international income distribution, convergence, world poverty trends

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The huge gap between the world's rich and its poor[1] has made trends in world inequality a matter of much interest. That gap appears to have widened markedly during a period beginning in the early nineteenth century at the latest[2] and continuing until at least the middle of the twentieth. Since about 1950 it has been possible to follow the evolution of inequality with much more precision, given the availability of national accounts in all major countries and of intracountry inequality measures in an increasing share of them. Most prior studies have underscored three main points. First, the distribution of world income is highly unequal, considerably more so than that of any but the most inegalitarian countries (Whalley, 1979; Berry, Bourguignon and Morrisson, 1983; 1991); this is a natural result of the fact that both intracountry and intercountry inequalities contribute significantly to world inequality. Second, when the measure of income is absolute purchasing power (in international prices) the bulk of world inequality comes from intercountry income differences rather than from intracountry differences. Finally, the level of world inequality did not change markedly, in either direction, between 1950 and the mid-1980s (Berry, Bourguignon and Morrisson, 1991; Bourguignon and Morrisson, 2002; Peacock, Hoover and Killian, 1988; Schultz, 1998).

Updated and wider-ranging analysis of recent patterns and trends of world inequality is warranted, partly because the period since about 1980 has brought a wave of historic changes in several regions of the world and in the character of the world economy, and partly because a variety of theories and pieces of factual information suggest that past distributional patterns might be changing. Theories of economic convergence, which have received much attention in recent years, tend to support the presumption that globalization, with its increasing economic integration among countries, would strengthen the forces of convergence and lower world inequality (Barro, 1991; Barro and Sala-i-Martin, 1992; Ben-David, 1993). On the other hand, many countries have suffered significant increases in internal inequality over the last couple of decades, with some authors suggesting that this trend is causally related to globalization and market-friendly economic reforms (Wood, 1994; Robbins, 1996). Has this intracountry pattern of increasing inequality been strong enough to offset the effects of any impulse toward intercountry convergence, if indeed both of these effects can be shown to exist?

With slower world economic growth since the 1970s, any serious increase in inequality might mean a derailment of the process of poverty reduction that had been fairly continuous over the post-war period. Concern on this point has been fuelled by two studies from the World Bank (Milanovic, 2002; Dikhanov and Ward, 2001), referring to the period 1988-1993 and reporting significant increases in inequality (of 3-4 percentage points in the Gini coefficient) over that period.[3] If this result were accurate, and if the trend were

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1   Poverty is defined here by per capita income of the family to which a person belongs, with the income data for each country converted to a common base (international dollars) in such a way as to imply that the poverty line involves the same 'purchasing power' in each country. The many methodological and data difficulties confronted in trying to achieve this goal are discussed below.

2   Estimates by Bourguignon and Morrisson (2002) go only as far back as 1820, though Lindert and Williamson (2001) suspect that the widening may have been occurring for some time before that point.

3   Later calculations by Milanovic (2005) suggest that this 'spike' in inequality was not reproduced (in similar magnitude) for the 1988-1998 period.

to continue at anything close to the rate they estimate, the world could be in for an increase in inequality strong enough to imply an end to a long period of gradual reduction in the incidence of poverty.

With such issues in mind, this paper examines the evolution of world income and its distribution across regions, countries and individuals over the period 1980-2000. The aim is to identify the main trends, to determine whether they support common perceptions about regional and country performances, and to see how important these trends have been in the overall pattern of changing world inequality during that period. To that end, the next section examines the theoretical approaches to the issue of global income distribution since 1980 and the degree to which they inform current concerns. The following section presents estimates of the weighted average growth of the world economies from 1970 to 2000 and measures of the intercountry distribution of world income. The next three sections present estimates of the distribution of world income between persons (based on a methodology outlined in Appendix C) followed by caveats and clarifications related to those estimates. The penultimate section presents data on changes in world poverty during the 1980-2000 period. The paper concludes with a brief review of the issues, results and implications.

The world since 1980

The 1980s and 1990s have seen several profound changes both in the nature of economic interaction between countries and in the economic and political fortunes of certain regions and countries. Prominent among these changes have been:

- the break-up of the Soviet bloc and the transition of its former members toward the market system;
- accelerated growth and an increasing role of the market in the Chinese economy;
- a long-awaited period of good growth in India;
- the first prolonged slump for the Japanese economy in the post-war period, suggesting that its period as the only fast growing high-income country has come to an end;
- the international debt crisis of the 1980s, that made this a 'lost decade' in South and Central America;
- a severe regional crisis in sub-Saharan Africa due not only to the extended crisis of heavily indebted poor countries (HIPCs)—most of which are in sub-Saharan Africa—but also to an underlying failure of agriculture to grow at a satisfactory rate, rapid population growth and, more recently, the traumatic incursion of AIDS;
- the 'information revolution' featuring the arrival en masse of computer technology;
- a general policy shift in nearly all countries towards a greater use of the market in resource allocation; and finally
- 'globalization'—the increasingly tight interaction among national economies, to the point where the economic raison d'être of the national state is increasingly called into question.

Viewing these changes along more 'systemic' lines, a number of authors have argued that the years around 1980 have constituted a 'watershed' between a previous relatively successful phase of Third World growth during which per capita output rose at a healthy rate (by about 2.2 per cent from the end of World War II until 1978), in Bairoch's periodization (Bairoch, 1997, vol. 3: 997-1000), that allowed some narrowing of the (intercountry per capita income) gap with the rich industrial world, and a subsequent period of slow and erratic growth, during which most of the Third World lost ground to the rich countries of the West. Arrighi (2002) attributes the transition to the fact that the United States of America, previously a major capital

exporter, became a major importer of capital, leading directly to the debt crisis of the 1980s and to the rise in real interest rates, a shift to which many authors give great weight in explaining subsequent problems (Easterly, 2001; Galbraith, 2002). While a few developing countries did manage to achieve sustained growth over this period, it is often seen as one of bifurcation within the Third World, with the majority of countries doing badly in this most recent phase (Easterly, 2001; Milanovic, 2005).

Opinions vary widely on the anticipated effects of some of these events and trends. One prominent view, derived in part from trade theory, is that national economies which interact increasingly with each other will converge (Barro, 1991; Barro and Sala-i-Martin, 1992; Ben-David, 1993), either through a tendency for such interaction to equalize the returns to factors of production across countries and/or through technological diffusion, which suggests important advantages to being a follower, rather than a leader, and thus being able to borrow abroad to invest and to have low-cost access to the technological innovations made elsewhere. Much of the vast literature that relates overall economic growth in developing countries to export performance may be considered to fall broadly into this latter category (see the reviews in Bliss, 1989, and Evans, 1989). Similarly, the neoclassical growth model predicts convergence in per capita incomes among countries because poorer countries with higher marginal rates of return to capital will grow faster than (and attract capital from) richer countries with lower marginal rates of return (Solow, 1956). Allowing for different steady states or augmenting the neoclassical model with human capital, and some specifications of new growth models, predict less strong or *conditional* convergence, which maintains the expected higher growth rate for poorer countries but allows for persistent differences due to varying rates of physical and human capital accumulation and population growth between countries (Mankiw, Romer and Weil, 1992).[4]

Counterpoised against these theories is the idea that there are powerful centrifugal forces in the world economy, ranging from the extreme case in which rich countries straightforwardly control and exploit the weaker through the use of power, to less directly power-related mechanisms, as in the core-periphery model, that nonetheless produce a similar outcome. Beyond these propositions, the majority of new growth models predict either sustained inequality in country incomes or outright divergence. Several empirical studies have concluded that, at the world level, divergence among mean country incomes has been the prevailing pattern (Pritchett, 1995; UNCTAD, 1997) and hence that the world distribution of income has become substantially more unequal over the last few decades (Korzeniewicz and Moran, 1997; UNDP, 1999).

Dramatic conditions at the two ends of the world distribution persuade many people that inequality must have risen. The *Forbes* 1999 survey of the world's richest put Bill Gates well ahead of the pack of 465 billionaires with a wealth of 90 billion, and reported that this group had a total wealth of around 1.5 trillion dollars (Dolan, 1999). In 1997 the low-income countries, with just over 2 billion people, had a combined gross national product (GNP) of just half this amount when converted to US dollars at the countries' exchange rates, or about twice that level when converted at purchasing power parity (PPP)(World Bank, 1999: 191). In a similar vein, the United Nations Development Programme's *Human Development Report 1999* (UNDP, 1999) reported that the three richest people in the world have more than the combined GNP of all (43) least developed countries and their 600 million people. Meanwhile, conditions at the bottom end remain abysmal, not only in income terms per se but also in other respects. Bales (1999) estimated that 27 million people around the world remain in 'violent economic bondage', from prostitutes in Thailand to bonded farmers in India and child workers in many countries. Chen and Ravallion (2004) reported that 1.1

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4   A more technical interpretation is that countries with different rates of accumulation are evolving to different steady states, and thus, convergence is conditioned on the steady state.

billion people (or 21 per cent of the world's population) were living on less than one 1993 international dollar a day in 2001, and that that number had remained essentially unchanged since 1996.

Whether the sources of convergence or of divergence have, on balance, been the stronger, the pattern is unlikely to have been a very simple one. During much of the twentieth century there was a partial convergence in the sense that the fastest growing countries were neither those at the top nor those at the bottom of the income hierarchy, but rather a subset of middle-income 'follower' countries, among which Japan and the Soviet Union were, for much of the period, the most prominent. While these countries were gaining on the leaders, the group of low-income countries below them was not. This pattern has changed since the late 1970s when China, a (then) low-income country with about a fifth of the world's population, began to register fast growth, thereby contributing to the equalization of world distribution. Since the early 1980s, India's growth has also accelerated, albeit less dramatically than China's. Two other large low-income countries, Indonesia and Pakistan, have (until recently) put in relatively strong growth performances. The poorer performing countries of Africa, a region yet to achieve a strong take-off and still experiencing rapid, though now falling, population growth, are home to an increasing share of the world's poor.

There is little overlap between theories that address the question of convergence among countries in per capita income and those which focus on intracountry distribution although, naturally, some of the same aspects of economic life are assumed to be at work in both cases (e.g., international trade, technological change). The benchmark theory with respect to intracountry distribution is Kuznets' (1955) idea that the level of inequality would first rise, then fall, over the course of development. That view has lost currency over the last few decades, and similar results could be expected from the combined implications of the dual economy model and the efficiency wage theory or the Harris-Todaro models of development economics.[5] But any current consensus on the long term changes in internal distribution is probably limited to a few rather obvious points, e.g., that an equalization over time in the distribution of such important assets as agricultural land and human capital will tend to produce a more equitable distribution of income.

Whatever the expectations may have been for the pattern of intracountry distribution, the overall experience of the 1980s and 1990s is generally recognized to have been negative, in both developed and developing countries (Corry and Glyn, 1994; Berry and Stewart, 1997; Cornia, 2004). Increases in international trade and technological change have been cited as possible causes of the frequent episodes of increasing inequality within both developed and developing countries. In the United States they are the main candidates discussed (Wood, 1994; Bound and Johnson, 1992). In developing countries the analysis is less far advanced but these phenomena are again among the suspects. Both are discussed in the context of the increasing earnings gaps between more and less skilled workers that have been observed in many less developed countries (Robbins, 1996).

Growth trends and changes in the intercountry distribution of income

This paper presents evidence on the world distribution of income among persons over the period 1980-2000, and notes some of the more obvious possible links to the monumental events of the last two decades.

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5   The predictions of these models combined would suggest that, at the very earliest stages of development, the distribution of income in the dominant traditional sector would tend to determine overall inequality. However, as the high-wage modern sector grows at the expense of the low-wage traditional sector, intersectoral inequality would add to intrasectoral inequality to cause overall inequality to increase. Eventually, as the modern sector begins to dominate the economy, intrasectoral inequality (this time in the modern sector) would again become the dominant contributor to overall inequality as intersectoral inequality fades in importance with the disappearing traditional sector.

Of particular interest is the question of whether or not the impact of economic integration has been closer to the hopeful predictions of the optimists or the worrisome prognoses of the pessimists.

The period 1980-2000 was punctuated by economic crisis in many countries of the Third World, especially those of South and Central America, sub-Saharan Africa, and most of the former Soviet bloc. However, this was also a period of continuing fast growth for most of East Asia (including China at an impressive 6-9 per cent per year),[6] and of a stronger performance by the Indian subcontinent than had been the case during most of the post-colonial period, especially by India itself with a rate of nearly 6 per cent per year. The developed countries of Europe and North America grew at 2 to 3 per cent per year (see table 1), Japan decelerated substantially to a low of 1.6 per cent in the 1990s, and the former Soviet bloc countries underwent marked economic contractions in the early 1990s.

The 1980s saw a slowdown in the weighted average rate of growth of the world's economies to 2.9 per cent from the 3.8 per cent achieved in the 1970s. This deceleration was the net result of three divergent patterns among the various regions (table 1). South Asia joined East Asia as a high-growth region; Western Europe and North America experienced moderate slowdowns; and all the other regions (sub-Saharan Africa, South and Central America, Eastern Europe, and the Middle East) suffered sharp declines in growth.

The 1990s brought modest changes to most regions. In particular, a moderate slowdown in East Asia (the combined result of the slowdown in the Japanese economy and the East Asian crisis), a moderate decline in Western Europe, a moderate increase in North America, continued brisk growth in South Asia, and slow growth in sub-Saharan Africa. The exceptions were South and Central America and the Middle East with marked accelerations, and the dramatic collapse of the former Soviet bloc (Eastern Europe and Central Asia). The net effect was a further deceleration in world economic growth to just 2.5 per cent.[7]

At the income-group level, the pattern of world growth was similarly complex (table 2). Africa's weak performance notwithstanding, the per capita income in the poorest countries as a group (i.e., the

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6   Several authors have argued that the official figures overestimate the actual growth of the Chinese economy, though the exact degree of overestimation is not clear. Reasonable accuracy is especially important in light of the size of that country. We conclude that, even with the most extreme assumptions, the growth rate would almost certainly fall between 6 per cent and 9 per cent per annum. Wu (1998), after examining official and alternative estimates, concluded that China's official figures underestimated output up until the late 1980s and that the growth rate was overestimated by at least 2 per cent since the late 1970s. Using these presumptions and the range of alternative estimates provided by various authors (Keidel, 1992; Maddison, 1999; Ren, 1997; Wu, 1998) we recalculated China's output levels (in international dollars) for the 1979-2000 period based on an assumption of a 10 per cent underestimate of (World Bank-reported) GDP (in domestic currency) in 1987, and a consistent overestimate of growth of 2.5 per cent. Fortunately, though these adjustments to the official data lower both the estimated average growth of the world economy and the degree of improvement in the distribution of world income, the impact is not overly sensitive to the size of the adjustments themselves. In effect, any combination of adjustments within the range suggested by Keidel (1992), Wu (1998) and Maddison (1999) leads to similar results. Appendix table B1 compares our output estimates for various years with the official estimates. Appendix table B2 reports the sensitivity of world distribution to the choice of assumptions about the level of underestimation of 1987 GDP and the overestimation of the GDP growth rate. While acceptance of the official Chinese data implies a more positive trend in global income inequality and slightly faster world income growth than does the use of our adjusted figures, the general pattern of change is the same.

7   Estimates of world economic growth rates vary according to the details of the methodology, including such factors as the base years chosen at which to make PPP conversions to a standard currency. But there seems to be no disagreement that world growth did slow down since about 1980. Milanovic (2005: 57), for example, gives per capita GDP growth rates of 3.3 per cent over 1960-1978 and 1.6 per cent over 1978-2000, somewhat higher than ours for similar but not identical periods, but showing about the same amount of deceleration.

Table 1.
Average annual rate of output growth by region and sub-period, 1970-2000[a]

	Weighted country averages[b]					
	Real GDP			Real per capita GDP		
Region	1970-1980	1980-1990	1990-2000	1970-1980	1980-1990	1990-2000
Sub-Saharan Africa	3.16	1.97	2.01	0.29	-0.96	-0.62
East Asia	4.63	4.98	4.06	2.75	3.50	2.92
South Asia	3.31	5.65	5.53	0.90	3.42	3.67
Central and South America	5.56	1.24	3.11	3.21	-0.77	1.44
Middle East	6.04	2.21	3.38	3.19	-0.79	1.35
Eastern Europe	5.17	1.70	-3.47	4.31	0.98	-3.40
Western Europe	2.99	2.48	2.06	2.38	1.97	1.57
North America	3.16	2.55	3.15	1.73	1.34	1.84
Industrial countries	3.14	2.75	2.41	2.35	2.16	1.74
Transitional economies	5.17	1.70	-3.41	4.31	0.98	-3.40
Developing countries	4.75	3.59	4.63	2.47	1.53	2.94
World	3.81	2.86	2.46	1.94	1.16	1.06

Sources: Authors' calculations using data from the WDI (online), UN Common Database (UN) and the Penn World Tables -- Mark 5.6 (CIC).

a. The sample used for the construction of this table consists of 136 countries, a smaller sample than that used for income distribution estimates. This is largely because of the extension of coverage to the 1970s (a time during which many of the countries did not yet exist, were at war, or had poor statistical data). Also, because no data on the former Soviet Republics is available for the 1970s, for comparison purposes the Soviet Union is treated as a single (lower middle-income) country through to 2000.
b. The regional and world growth rates are the output-weighted sums of the individual country growth rates. These (average annual) country growth rates were estimated from constant price measures of output in local currency then, to ensure comparability (in purchasing power values of output) growth estimates were weighted by current international dollar (PPP) estimates of GDP at the beginning of each decade.

Table 2.
Average annual rates of output growth by country income group (1970-2000)

	Weighted country averages					
	Real GDP (Domestic currency)			Real per capita GDP (Domestic currency)		
Country income categories	1970-1980	1980-1990	1990-2000	1970-1980	1980-1990	1990-2000
Low-income	3.58	4.87	4.66	1.08	2.49	2.59
Lower middle-income	4.87	3.42	1.32	3.05	1.85	0.23
Upper middle-income	5.94	1.52	3.27	3.81	-0.31	1.87
High-income	3.14	2.75	2.42	2.35	2.16	1.74
Low-income without India	4.18	3.90	3.39	1.46	1.28	1.06
Lower middle-income without China	5.23	2.55	-1.10	3.44	0.83	-2.23
China and India	3.74	6.32	6.85	1.72	4.57	5.46
World without China	3.78	2.69	2.14	1.91	0.92	0.63
World without China and India	3.82	2.58	1.96	2.05	0.91	0.53
World without Eastern Europe	3.64	3.03	3.18	1.68	1.24	1.67
World without China and Eastern Europe	3.60	2.84	2.86	1.59	0.94	1.20
World without China, India and E. Europe	3.63	2.71	2.70	1.71	0.90	1.08
World	3.81	2.86	2.47	1.94	1.16	1.06

Sources: Authors' calculations using data from the WDI (online), UN Common Database (UN) and the Penn World Tables -- Mark 5.6 (CIC).

World Bank's 'low income' category) grew faster than in the rich ones during both the 1980s and the 1990s, with an average gap of 0.6 per cent over the two decades. This differential would have been even wider, and contributed to a greater reduction in world inequality, had demographic trends been similar between these country groupings. With both the substantially faster population growth in the low-income countries taken into account and India excluded from that group, the result is slower per capita growth than in the high-income countries, creating a source of income divergence. India's presence in the low-income group of countries can, therefore, be thought of as the source of convergence of that category towards the higher ones.[8]

In a departure from the pattern of the 1970s, when the middle-income countries as a whole substantially outgrew both the low-income and the high-income groups, this category suffered serious deceleration in the 1980s and 1990s (table 2). In the 1980s it was the upper middle-income countries that suffered the largest drop in output growth (from 5.9 to 1.5 per cent) as per capita growth became negative—a reflection of the crises in South and Central American economies. In the 1990s the lower middle-income group met this fate. Even with the impressive performance of China, that category showed almost zero growth in per capita income (0.23 per cent). Excluding China, the average decline in per capita income was a dramatic 2.2 per cent per year—reflecting the economic implosion that occurred in Eastern Europe and Central Asia.

The crucial role of China and India in determining changes in the intercountry pattern of distribution of world output since 1980, suggested by tables 1 and 2, is confirmed by the conventional measures of income inequality. The Gini, Theil, and three Atkinson measures reported in table 3 all indicate a moderate improvement in world intercountry inequality in each decade between 1980 and 2000.[9] However, when China and India are excluded the pattern is reversed, with all measures indicating deterioration in the distribution of world income, often of roughly comparable magnitude to the improvement that occurs when they are included. The exclusion of India alone does not reverse the trend. The exclusion of China alone does so for the Gini coefficient and to a lesser extent the Theil and Atkinson (0.5) measures as well, but the Atkinson (1) suggests no change and the Atkinson (2), which gives most weight to changes at the bottom of the income ladder, continues to suggest an improvement—an effect of the improving situation in India. The exclusion of Eastern Europe alone generally reinforces the overall trend of improvement. (Figure 1 presents the changes in Gini coefficient values depending on which countries are excluded).

The dramatic effect of the growth performance of China and India on measures of intercountry income inequality is perhaps best illustrated by a disaggregation of the Theil coefficient, presented at the bottom of table 3. In 1980, over a quarter of estimated intercountry income inequality could be attributed to the low income levels of China and India. In 2000, however, these countries' contribution to world inequality was negative, i.e., their presence made the intercountry distribution of world income more equal!

The distribution of world income among persons

Although prior analyses concur on the conclusion that, at the world level, most of the inequality among persons is the result of differences in average incomes across countries, intracountry inequality is also significant and changes therein could have an important impact on the level of world inequality among people. The fact

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8   Though China was also a low-income country through most of that period, it had graduated to the lower middle-income category by 2000 and is thus included in that group for these calculations.

9   The Atkinson coefficients are implied welfare-based measures of inequality. As the number shown in brackets increases, income transfers near the bottom of the distribution have a stronger effect on the inequality measure. See Appendix C for a more detailed description of these measures.
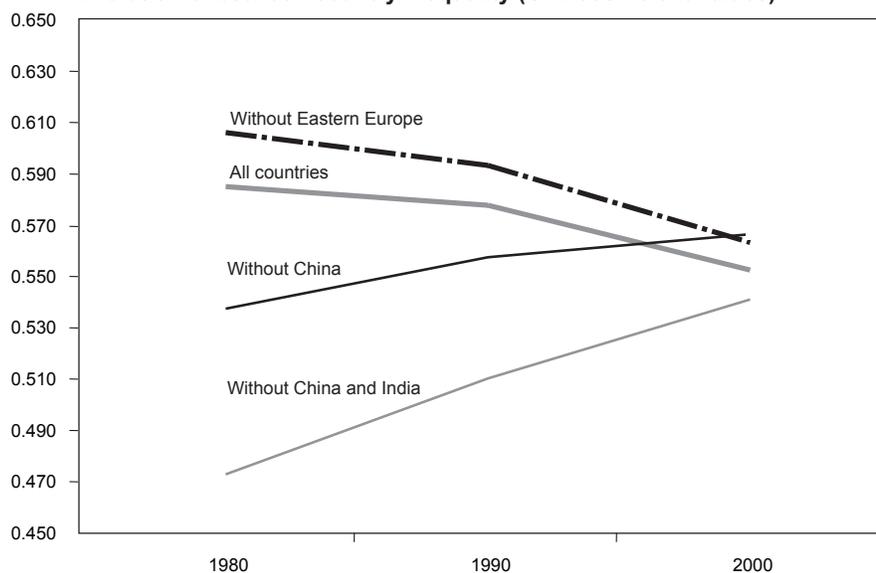
Table 3.
Intercountry income inequality measures

Country group	Year	Gini	Theil	Atkinson (0.5)	Atkinson (1)	Atkinson (2)
All countries	1980	0.585	0.700	0.288	0.503	0.695
	1990	0.578	0.636	0.275	0.471	0.654
	2000	0.553	0.559	0.251	0.428	0.623
World without China	1980	0.537	0.622	0.247	0.463	0.695
	1990	0.558	0.629	0.258	0.467	0.688
	2000	0.567	0.630	0.264	0.467	0.685
World without India	1980	0.560	0.674	0.268	0.490	0.709
	1990	0.564	0.631	0.263	0.468	0.678
	2000	0.547	0.574	0.246	0.436	0.658
World without China and India	1980	0.473	0.512	0.198	0.401	0.680
	1990	0.510	0.572	0.224	0.436	0.706
	2000	0.541	0.634	0.249	0.469	0.730
World without Eastern Europe	1980	0.606	0.751	0.313	0.528	0.702
	1990	0.593	0.678	0.296	0.492	0.662
	2000	0.563	0.591	0.263	0.446	0.637
Contribution of China and India to world inequality (Theil coefficient-based analysis)						
				1980	1990	2000
China's contribution to international inequality				11.1%	1.0%	-12.6%
India's contribution to international inequality				3.7%	0.8%	-2.6%
The combined contributions of China and India				26.9%	10.0%	-13.3%

Sources: Authors' calculations using data from the WDI (online), UN Common Database (UN) and the Penn World Tables – Mark 5.6 (CIC).

Note: Because this analysis is based on country per capita GNP figures, the effect of changes in intracountry distributions of income is absent. The above results, therefore, overstate the positive contribution of rapid growth in China to distribution of world income among persons because the distribution of income within China was deteriorating during these periods. However, as is seen in table 6 below, when intracountry distribution is included the effect remains positive (though less pronounced).

Figure 1:
Evolution of between country inequality (Gini coefficient values)

Source: Table 3.

that many developing and most major developed countries suffered worsening income distribution during the 1980s (known, especially in the United States, as the 'greed decade') or the 1990s, makes this a possibility to be reckoned with.

Among the 25 large countries[10] for which reasonably comparable Gini coefficient estimates from the beginning and end of the 1980s are available (from the WIDER World Income Inequality Database and the 2001 World Development Indicators), 14 recorded increases in the Gini coefficient[11] (i.e., a worsening distribution of income) while 10 recorded decreases (i.e., improved distribution) and one saw no change.[12] In the 1990s, the general deterioration of intracountry income distribution appears to have been even more acute. Of 27 countries for which comparable Gini coefficient estimates were available, 18 suffered increasing inequality and only eight recorded an improvement. In the 1990s, as they attempted the transition to capitalism, the great majority of the Eastern European and Central Asian countries with available data experienced worsening inequality. China, while going much less far along the path of economic reform than the former Soviet bloc countries, also appears to have experienced the negative effects of growing market forces on distribution.

To include within-country income in our estimates of the distribution of world income, all large countries were divided into five, ten or forty income groups based on estimates of the distribution of income among persons for the relevant years (1980, 1990 and 2000). Thus, the world of 163 countries (used for estimating intercountry inequality) was decomposed into one of 383 income groups, of which 255 were subnational income groups with an identifiable range of income.[13] These income groups accounted for 85 per cent of the population of the countries represented and 81 per cent of total world population in 2000. This methodology is detailed further in Appendix C.

With both intra and intercountry income differences taken into account, our best estimate of the 1980 decile distribution of world income among individuals (ranked by per capita household income, and converted to current international dollars using PPP rates) implies a Gini coefficient of 0.651, a Theil coefficient of 0.891 and a ratio of 73.7-fold between the average income of the top decile and that of the bottom one (table 4).[14]

Between 1980 and 1990, all of the indicators we use suggest that the overall level of world inequality declined at least slightly. The Gini coefficient fell to 0.648 (from 0.651) and each of the various Atkinson coefficients dropped a little (table 4). The Theil coefficient fell more noticeably, from 0.891 to 0.845. Between 1990 and 2000 all of the indicators fell again, some by a bit more than in the 1980s and some by a bit less.

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10 By our definition, large countries are those with populations of over 25 million.

11 Gini coefficient estimates are considered comparable if they derive from similar enumeration and measurement approaches. Thus, income distribution estimates that use households as the enumeration and income as the measurement unit are not compatible with those that use persons as the enumeration unit or those that use expenditure as the measurement unit.

12 Since very few countries have annual measurements of income inequality, the end/beginning of decade inequality measures had to be approximated in most instances from years close to the beginning or end of the decade. Thus, the 1980 distribution was often approximated by an estimate from the period 1978-1983; the 1990 distribution from measures from the period 1988-1992; and the 2000 estimate from the latest distribution beyond 1995.

13 This means, of course, that 128 small countries are still treated as single income groups, but sensitivity analyses indicate that, because they represent only 15 per cent of the total population, further subdivision of these countries (into income groups) would add little to the accuracy of the inequality estimates.

14 See Appendix C for a description of the method used in estimating the distribution of world income among persons or, more precisely, among sub-country income groups.

Table 4.
Decile distribution of world income among persons, and associated inequality measures

	Income shares by decile of world population (%)			Change in share of total world income	Annual income growth (1985 PPP value of income)	
	1980	1990	2000	1980-2000	1980-1990	1990-2000
Decile 1	0.63	0.71	0.74	0.11	2.4%	1.8%
Decile 2	1.09	1.29	1.32	0.23	3.0%	1.6%
Decile 3	1.45	1.69	1.90	0.44	2.8%	2.5%
Decile 4	1.90	2.12	2.46	0.56	2.4%	2.9%
Decile 5	2.51	2.75	3.18	0.67	2.2%	2.8%
Decile 6	3.71	4.07	4.39	0.68	2.2%	2.1%
Decile 7	6.73	6.23	6.41	-0.32	0.5%	1.6%
Decile 8	12.34	10.89	10.19	-2.16	0.0%	0.7%
Decile 9	23.06	21.61	20.13	-2.93	0.6%	0.6%
Decile 10	46.57	48.64	49.28	2.71	1.7%	1.5%
World	100.00	100.00	100.00			
Measures of inequality				20-year change in inequality measure		
Gini coefficient	0.651	0.648	0.639	-0.012		
Theil coefficient	0.891	0.845	0.802	-0.089		
Atkinson (0.5)	0.349	0.343	0.332	-0.017		
Atkinson (1)	0.590	0.570	0.552	-0.038		
Atkinson (2)	0.792	0.773	0.763	-0.029		
Ratio of top to bottom decile incomes	73.7	69.0	66.7			

Sources: Authors' calculations using data from the WDI (World Bank), UN Common Database (UN), Penn World Tables – Mark 5.6 (CIC) and WIID (WIDER).

The ratio of average top decile income to average bottom decile income fell from 73.7 in 1980 to 69.0 in 1990 and to 66.7 in 2000. Though all of the inequality measures we use indicate at least a mild improvement in the distribution of world income over the two decades, the 2000 distribution does not Lorenz dominate either the 1990 or 1980 distributions, nor does the 1990 distribution Lorenz dominate the 1980 distribution.[15]

All of the bottom six deciles gained in income share in both decades; the six combined moved up markedly from a share of 11.3 per cent in 1980 to 12.6 per cent in 1990 and 14.0 per cent in 2000. The losing deciles were 7, 8 and 9, their share falling sharply from 42.1 per cent in 1980 to 36.7 per cent in 2000, while the top decile gained over two percentage points, from 46.6 per cent in 1980 to 49.3 per cent in 2000. Much of the gain achieved by the bottom deciles reflects the fast growth in China and India. The fact that the deciles near the top were unable to hold onto their share was the combined result of poor growth of per capita income in the upper middle-income countries (South and Central America in the 1980s and Eastern Europe in the 1990s) and the widening income gaps within the high-income countries.[16] The world's poorest were, generally speaking, substantially better off in 2000 than in 1980. The bottom 20 per cent (40 per cent) enjoyed an income increase of 50 per cent (59 per cent) over the 20-year period. The temporal and geographic nature of that improvement will be discussed in the next section.

15   One distribution is said to Lorenz dominate another one if the Lorenz curve corresponding to the former lies nowhere below and is at least sometimes above the Lorenz curve corresponding to the other distribution.

16   In effect, these income groups consist largely of small upper middle-income countries and the middle classes of the large upper middle-income countries, together with the lower-income groups of the large wealthy countries.

What is perhaps most intriguing, and at first glance paradoxical, about the outcome for 1980-2000 is that, though no previous post-war period seems to have been characterized by as general a pattern of intracountry worsening of distribution as this one, the overall level of inequality has moved in the opposite direction, again in contrast to the previous tendency of near constancy over the preceding decades (Berry, Bourguignon and Morrisson, 1991: 73; Bourguignon and Morrisson, 2002: Table 1).

Among other studies using the same methodology (conversion among currencies by International Comparison Programme (ICP) indices of the United Nations Statistics Division and the University of Pennsylvania, and national accounts-based figures for average income of each country), the finding of constancy or decline in global inequality over the past couple of decades appears to be the norm. Studies differ more in the absolute level of inequality that they report. This is not surprising because most methodological differences are likely to lead to fairly systematic differences over time between any two studies. Judged by the Gini coefficients, whereas our figures indicate a very small decrease in inequality (from 0.651 in 1980 to 0.639 in 2000), Bhalla (2002: 84) finds a somewhat greater decline from a higher level (0.687 in 1979 to 0.676 in 1989 and 0.660 in 1999) while Sala-i-Martin (2002: 60) reports a decline from 0.638 in 1980 to 0.630 in 1990 and 0.609 in 1998. Perhaps the faster fall in inequality reported by these two studies than ours is substantially due to the fact that we adjusted the official Chinese data and they did not. When we used the unadjusted official figures, our Gini estimates also fell by one percentage point in the 1980s and two in the 1990s (table B2).[17] If we include Bourguignon and Morrisson (2002) data for 1980 to 1992 (Ginis of 0.657 and 0.663, respectively) as approximating the story of the 1980s, all four studies come up with minimal change in the Gini coefficient over that decade (one percentage point or less), but Bhalla (2002) and Sala-i-Martin (2002) find larger declines of a couple of percentage points in the 1990s compared to our 0.9 percentage point. Milanovic (2005: 118) reports a decline of 0.6 over the slightly different period 1988-1998 for a common sample of countries, a decline that might be a little bigger had he converted to a common currency only in one year, as we did. Overall then, in light of a variety of differences in details of the methodology, adjustment of official data made or not made, and decisions with respect to which source of intracountry inequality to accept, these modest differences in estimates and in trends are reassuring.

As noted, world inequality reflects, in large part, the huge differences in average income levels across countries. Expressed in terms of the Theil index, which has the advantage of being decomposable in a straightforward way, this factor accounted for over three-quarters (75.8 per cent) of overall world inequality in 1980, while just 24.2 per cent reflected intracountry inequality (table 5). These proportions had changed to 66.1 per cent and 33.9 per cent respectively by 2000, reflecting the general deterioration of intracountry distribution evidenced by the rising Gini coefficients mentioned earlier, as well as the rapid decline of the intraregional between-country component of overall inequality over the period. Differences in average incomes across the six regions by themselves accounted for around 45 per cent of total inequality in all three decades (though the Gini coefficient reflecting the actual level of inequality fell from 0.426 in 1980 to 0.370 in 2000). The average level of intraregional between-country inequality (i.e., the weighted mean of inter-country income differences within a region) fell by nearly one third (from 0.274 in 1980 to 0.189 in 2000) leading to a rapid contraction in its share of overall inequality (from three-fifths to only slightly more than two-fifths).

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17   Another source of difference with Bhalla's study is that his distribution data for India show no net change over the decades (Bhalla, 2002: 46) whereas our estimate is of an increase from 0.417 to 0.445. (Our estimate is higher in absolute terms since we have adjusted the expenditure Ginis to the income concept in order to make them comparable to the data for other countries).

Table 5:
Sources of world income inequality
(Based on the additive separability property of the Theil coefficient)

Theil inequality measures	1980	%	1990	%	2000	%
As measured (with only large-country inequality considered)						
Interregional inequality	0.426	47.8	0.393	46.6	0.370	46.1
Average intraregional (intercountry) inequality	0.274	30.8	0.243	28.7	0.189	23.6
Total intercountry inequality	0.700	78.6	0.636	75.3	0.559	69.7
Average intracountry inequality (when limited to large countries)	0.191	21.4	0.209	24.7	0.243	30.3
World income inequality (as measured in this paper)	0.891	100.0	0.845	100.0	0.802	100.0
Including small-country inequality						
Interregional inequality	0.426	46.1	0.393	44.6	0.370	43.7
Average intraregional (intercountry) inequality	0.274	29.7	0.243	27.6	0.189	22.4
Total intercountry inequality	0.700	75.8	0.636	72.2	0.559	66.1
Average intracountry inequality (when extrapolated to all countries)	0.223	24.2	0.245	27.8	0.287	33.9
World income inequality (implied)	0.923	100.0	0.881	100.0	0.846	100.0

Sources: Authors' calculations using data from the WDI (World Bank), UN Common Database (UN), Penn World Tables – Mark 5.6 (CIC) and WIID (WIDER).

Notes: The first part of the table presents inequality estimates (and percentage measures) derived directly from the data where large countries (those with populations of over 25 million) have been disaggregated into income groups but small countries have not and are thus not included (see Appendix C for the methodology). In the second part of the table, intracountry inequality is extrapolated to all countries (i.e., small countries are assumed to have average levels of inequality similar to those of large countries).

With its large share of world population, China's economic evolution is obviously important to what happens at the world level. Since its growth performance has substantially outpaced other countries' in the period under discussion, and since its economic system has unique features, it is also of interest to ask what happened to distribution (and to growth) in the world outside China over these years. With China excluded, the Gini coefficient rises by about three percentage points, the Theil coefficient by about four points and the Atkinson (0.5) by nearly three points, while the other two Atkinson indices show less or no significant change. Noticeably, the indices that do not rise are those more sensitive to what happens at the bottom of the distribution. This is because, even without China, the bottom deciles did better than those in the upper-middle part of the distribution (table 6). Thus the presence of China significantly changes our estimated outcome over this twenty-year period from a modest, but clear, decrease in inequality to a worsening—at least as judged by most of the indicators. Interestingly, the pattern of change varies less than do the summary measures. Even with China excluded, the bottom deciles gain in income share though now only the bottom four instead of six, and by a more modest amount (from 4.9 per cent of total income to 5.4 per cent). Meanwhile, the top decile records a dramatic gain of over 6 percentage points, while the second highest decile almost holds its own and deciles 5-8 suffer a sharp net loss of share from 31.8 per cent to 25.5 per cent. With gains by the top and bottom at the expense of the middle, the ratio of the income of the top decile to that of the bottom one rises from about 76 in 1980 to 80 in 2000. It is noteworthy that to a considerable degree the same trends characterized both the 1980s and the 1990s, despite the markedly different events taking place in each.

The major redistribution of income within the top two-thirds of the (China excluded) world distribution reflects both differential growth (e.g., the poor performance of the former Soviet Union) and increases in intracountry inequality in the higher income countries. Since the growth of the world without

Table 6.
Decile distribution of world income among persons when China is excluded

	Income shares by decile of world population (%)			Change in share of total world income	Annual income growth (1985 PPP value of income)	
	1980	1990	2000	1980-2000	1980-1990	1990-2000
Decile 1	0.54	0.58	0.59	0.05	1.9%	1.0%
Decile 2	1.01	1.12	1.09	0.08	2.2%	0.6%
Decile 3	1.38	1.49	1.63	0.25	1.9%	1.8%
Decile 4	2.03	1.97	2.12	0.09	0.8%	1.6%
Decile 5	3.22	2.95	2.83	-0.39	0.2%	0.5%
Decile 6	5.50	4.71	4.32	-1.18	-0.5%	0.0%
Decile 7	8.88	7.95	6.88	-2.00	-0.1%	-0.5%
Decile 8	14.19	13.00	11.45	-2.73	0.2%	-0.4%
Decile 9	22.40	22.25	22.15	-0.26	1.0%	0.9%
Decile 10	40.86	43.98	46.95	6.09	1.8%	1.6%
World	100.00	100.00	100.00			
Measures of inequality				20-year change in inequality measure		
Gini coefficient	0.612	0.630	0.644	0.033		
Theil coefficient	0.826	0.842	0.865	0.039		
Atkinson (0.5)	0.313	0.328	0.341	0.028		
Atkinson (1)	0.562	0.569	0.579	0.017		
Atkinson (2)	0.801	0.798	0.800	-0.001		
Ratio of top to bottom decile incomes	76.2	75.8	80.0			

Sources: Authors' calculations using data from the WDI (World Bank), UN Common Database (UN), Penn World Tables – Mark 5.6 (CIC) and WIID (WIDER).

China has been slower than that of the world with it (just 2.7 per cent and 2.1 per cent a year for the 1980s and 1990s respectively), it is not surprising that the falling income shares of middle deciles 6, 7 and 8 also meant that they lost ground in absolute as well as relative terms, with overall negative growth in their (1995 international dollar equivalent) per capita income (table 6).[18]

The inequality trend is affected further if India is excluded along with China (table 7). For the remaining 62 per cent of the world population there was a clear worsening of the distribution of income, as the Gini coefficient rose sharply from 0.559 to 0.621 between 1980 and 2000 and the ratio of average income of the top decile to that of the bottom rose from 61.5 to 85.2. With two of the fastest growing countries (as well as the two largest) excluded, average income per capita for the rest of the world grew at only 0.9 per cent per year between 1980 and 1990, and 0.5 per cent per year during the 1990s (table 2).

Although the bottom three deciles still recorded marginal income growth, the next four all lost in absolute terms; only the top two showed substantial income increases, with the share of the top decile rising sharply from 36.1 per cent in 1980 to 42.9 per cent in 2000 (about the same amount as in the case where only China is excluded). Though the biggest losers are in the middle deciles, the fall in the income shares of the bottom deciles, as well, exposes and highlights the fact that growth in China and India offset the poor economic performance of other low-income countries, particularly those in Africa.

18   The rates of decile income growth in the last two columns of table 6 (or table 4) do not average the rates of growth in table 2 because the latter are a weighted average of domestic growth rates while the former are direct estimates of growth after translating all income to 1985 PPP equivalents.

Table 7.
Decile distribution of world income among persons when both China and India are excluded

	Income shares by decile of world population (%)			Change in share of total world income	Annual income growth (1985 PPP value of income)	
	1980	1990	2000	1980-2000	1980-1990	1990-2000
Decile 1	0.59	0.54	0.50	-0.08	0.2%	0.1%
Decile 2	1.07	1.06	0.99	-0.08	0.9%	0.2%
Decile 3	1.78	1.56	1.52	-0.26	-0.3%	0.5%
Decile 4	2.83	2.46	2.21	-0.62	-0.4%	-0.2%
Decile 5	4.65	3.84	3.33	-1.31	-0.9%	-0.6%
Decile 6	7.05	6.16	5.13	-1.92	-0.3%	-1.0%
Decile 7	10.13	9.21	7.89	-2.25	0.1%	-0.7%
Decile 8	14.77	14.11	13.60	-1.17	0.6%	0.4%
Decile 9	21.00	21.45	21.92	0.92	1.3%	1.0%
Decile 10	36.13	39.62	42.90	6.77	2.0%	1.6%
World	100.00	100.00	100.00			
Measures of inequality				20-year change in inequality measure		
Gini coefficient	0.559	0.591	0.621	0.062		
Theil coefficient	0.692	0.768	0.840	0.148		
Atkinson (0.5)	0.264	0.293	0.321	0.057		
Atkinson (1)	0.499	0.536	0.568	0.069		
Atkinson (2)	0.775	0.804	0.818	0.043		
Ratio of top-to-bottom decile income	61.5	73.2	85.2			

Sources: Authors' calculations using data from the WDI (World Bank), UN Common Database (UN), Penn World Tables – Mark 5.6 (CIC) and WIID (WIDER).

The deterioration in the distribution of world income when China and India are excluded is more unequivocal than both the improvement when these countries are included and the deterioration when only China is excluded. There is no Lorenz dominance in either of the latter two cases but, when both India and China are excluded, the 1980 distribution of world income Lorenz dominates both the 1990 and 2000 distributions and the 1990 distribution Lorenz dominates that for 2000.

Given the dramatic events befalling the former Soviet bloc, it is also of interest to see what effect they had on the trajectory of growth and inequality (table A4, Appendix A). During the 1990s the world economy grew at just 2.5 per cent while the world outside the former Soviet bloc grew at 3.2 per cent, highlighting the major impact of its collapse on world growth. However, the significant increase in inequality reported for most countries of the bloc, even when combined with the effect of their falling income on intercountry inequality, contributes only modestly to the pattern of world income distribution. Excluding the countries of the former Soviet bloc leads to a moderate exaggeration of the pattern of decreasing overall inequality. In the world outside the former Soviet bloc the Gini coefficient fell by 0.017 points; with that bloc included, the decline was of 0.009 points. The world Theil coefficient fell by 0.043 points, while that of the world outside the former Soviet bloc fell by 0.055 points. Qualitatively similar stories emerge for the other indicators of inequality. Exclusion of this part of the world, however, does not lead to Lorenz dominance by later distributions over earlier ones.

Major caveats

Given the number of data problems and possible methodological flaws in calculations like those reported above, it is a foregone conclusion that the results are, at best, approximations to the true reality. It is almost certain that the country-level figures in most developing counties understate inequality, mainly because of the incomplete reporting of capital incomes (especially large ones) relative to labour incomes,[19] but also because of the exclusion of income from asset appreciation. This creates a presumption that the estimates of world inequality are also downward biased, but since the methodological flaws involved in merging the data for different countries can create either upward or downward biases, this is less certain.[20]

Our main concern here, however, is with possible biases in the estimated trends in inequality.[21] These are far too numerous to list; much additional research will be required to sort out their impacts and their relative importance.[22] Probably the two phenomena most capable of leading to significant bias are changes in the degree of the under-coverage of capital incomes, already mentioned, and differences in the price trends for different income groups within countries. The latter relates to the fact that each datum on inequality is based on current prices. If, in a given country, prices rise faster for some income groups than for others, the changes in the distribution of purchasing power will be misestimated by the change in current price inequality. Under many circumstances there may be no reason to expect income-group-specific price indices to move very differently over time, but in the context of major freeing of markets and the attendant, sometimes substantial, changes in relative prices, such an assumption is not so defensible. For example, countries of Eastern Europe which saw a reduction of the rationing systems and freeing of prices of staples may well have undergone differential price changes by group. The same goes for countries that have opened up quickly to international trade; in most developing countries this has led to declines in the relative prices of a number of luxury goods (such as cars), which may mean that the relative cost of the market basket consumed by the rich has fallen vis-à-vis that of the poor.[23]

Another concern, which may technically be viewed as a special case of the previous one, involves public consumption goods. All of the country distribution data used here refer only to private income; though everyone recognizes the need to take account of the distribution of public good consumption, the practical difficulties have precluded it as a general practice.[24] Given the widespread decline in public expenditure in recent years, it is probable that distributional trends would look somewhat different, and very likely

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19   Altimir (1987) re-estimated inequality in several Latin American countries using plausible assumptions about the level and distribution of capital income; the adjusted Gini coefficients were typically 2-6 Gini points higher.

20   It is also the case that the bias due to under-coverage of capital incomes in individual countries might have very little reflection at the global level if the problem mainly characterized middle-income countries—not impossible since data accuracy is generally higher in rich countries and the capital share itself may be lower in poor countries in which case the biasing impact of its being underreported would also be muted.

21   The fact that the available figures assume away all intra-family inequality appears to create only a small downward bias in measured inequality, as demonstrated by Haddad and Kanbur (1993).

22   The list would include the possibility that inclusion of public goods would change the observed patterns of inequality change, that improvements to household surveys are making them more accurate as time goes on and that this leads to observed trends being different from actual trends, changes in the distorting effects of the way PPP conversion is carried out, and so on.

23   Both of these scenarios would tend to mean that a common price assumption would lead to a downward bias in the estimation of changes in inequality.

24   Early important case studies were those of Selowsky (1979) for Colombia and Meerman (1977) for Malaysia. For no country, to our knowledge, has an attempt been made to include public goods in the estimates of inequality on a continuing basis such as to allow one to see how their inclusion affects trends in inequality.

more negative, were public consumption included in the data, though the increase in targeting of certain services may have had a sufficiently strong positive effect to prevent this outcome or even reverse it.[25] [26]

The above biases involve the estimation of inequality at the country level as opposed to the merging of country data for the world-level estimate. In both cases there is a reasonable theoretical presumption (related to the processes of liberalization and globalization) that the bias will have risen since 1980, and a modest amount of empirical evidence has been brought forward in support of that conclusion (e.g., de Ferranti and others, 2004: 235). Overall, these limitations suggest that, for the period in question, the available (conventional) measures of income inequality are more likely to err on the side of undue optimism (i.e., to overestimate improvements in the distribution of income or to underestimate deteriorations). Thus any picture painted by the data is unlikely to be overly pessimistic. Allowing for these possible (or probable) biases might suggest a 'best guess' that the level of world inequality, instead of falling a little from 1980-2000, was very close to staying constant, or might even have risen a little. It is worth emphasizing that, although there has been a considerable convergence of results around the 'modest decline in world inequality' conclusion for at least the last two decades of the twentieth century, most of the major remaining possible biases in the estimates (especially the most glaring ones noted above) are common to all of the studies. Thus it is quite possible that all of them are significantly off the mark in the same direction.

Milanovic (2002: 72), relying exclusively on household survey data for both mean income and its distribution, estimated that between 1988 and 1993, the Gini coefficient for the world income distribution had risen from 0.628 to 0.660 for a common sample of countries. This suggested that, if his methodology was indeed the correct one, not only was world inequality increasing, it was doing so very rapidly. The message contrasted significantly with that of the other available and comparable studies that, as noted above, pointed to a smallish decrease since 1980. In fact, the difference between the two approaches turns out to have been much less than first met the eye since, when Milanovic added 1998 estimates, these showed an inequality decline between 1993 and 1998 and hence a more modest increase from 1988 to 1998 of 1.8 Gini percentage points, from 0.623 to 0.641 (Milanovic, 2005: 118). From 1990 to 2000, our estimated Gini coefficient fell from 0.648 to 0.639 (table 4). Milanovic also undertook estimates using national accounts-

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25   Another source of imprecision lies in the fact that the ICP (International Comparisons Project of the Center for International Comparisons) conversion indices used here do not provide fully accurate translation of per capita income levels between countries; whereas use of nominal exchange rates tends to exaggerate income differences between richer and poorer countries, the ICP indices tend to understate them (Dowrick and Quiggin, 1997). Dowrick and Quiggin (1997) derive an alternative index with desirable properties which, in the Organisation for Economic Cooperation and Development (OECD) context, implies that income convergence occurred between 1980 and 1990 whereas the ICP indices yielded no clear results. But Quiggin (2002) reports that the opposite appears to be true when a sample including poor countries is used, and that there is no general presumption that the use of this index would lead to more frequent findings of convergence.

26   Although intracountry trends do not usually have a major impact on world trends unless they are dramatic, they may have been playing a role here. Thus, Bhalla (2002: 39) reports significant declines in inequality in both Mexico and Brazil between 1980 and 1999; the general view among specialists is that inequality has risen markedly in Mexico since 1984; prior to that the comparability of surveys was weak, making it difficult to judge trends. In Brazil, most sources (including ourselves) indicate a smaller decrease in inequality than does Bhalla—his Gini falls by six percentage points between 1980 and 1999 while ours falls by one percentage point over 1980-2000. It would require a very detailed and careful comparison to sort out which differences show up in the mildly different estimates of world distribution trends. Almost all developing countries still suffer major problems and ambiguities in their data on distribution. Much of the statistical error and the non-comparability across surveys at different points of time are likely to be fairly random, such that it might not affect estimates of inequality trends much. The major possible sources of error in estimation of the time trend, in particular the inaccurate reporting of capital incomes, are present in all studies undertaken thus far. It would be useful to undertake simulation exercises to test for the sensitivity of trend estimates to plausible errors in this aspect of intracountry inequality.

based figures for mean per capita income of each country, and in that case found the Gini coefficient to fall from 0.641 in 1988 to 0.635 in 1998, figures almost identical to our own for 1990-2000. This suggests that the main difference between his preferred result and ours reflects the use of different figures for mean per capita income of countries (survey-based incomes in his case and national account-based incomes in our case) rather than a number of other differences of methodological detail or the fact that the end years are a little different. This leaves us with two interesting questions arising from Milanovic's results, where they contrast with others.

First, was there, in fact, a rather sudden increase in world inequality between 1988 and 1993 as his figures show (albeit less markedly in his 2005 publication than in that of 2002)? Sorting out this question would require an analysis of the statistical sources of that increase to discern whether they more likely reflected true trends or statistical error and is well beyond the scope of this study.

Second, what can be said about the relative merits of using household survey-based estimates of per capita income in each country versus national accounts-based estimates? This is also a complicated matter that cannot currently be resolved on the basis either of theory or available empirical evidence. All approaches have to use distribution data from household surveys so the weaknesses of that information show up in all estimates. The difference between the two is the choice of the mean income measures. Milanovic's approach uses the mean per capita income measure derived directly from household surveys with its likely underestimation of true mean income (mainly because of the underreporting of capital income) while our method uses national accounts-based per capita income figures (which is not without its own measurement problems). However, it is not accuracy of measurement that is the critical issue here. The main argument for using national accounts estimates of per capita income is that the methodology is likely to produce less variability in the errors of observation over time than the household survey data. Given the underreporting of capital incomes in survey data it is unclear how this effect plays out over time with respect to the distribution of global income. Capital incomes do vary over time and, at this point, our knowledge of the distribution of capital income in developing countries is too limited to allow more than conjecture as to patterns of change and consequent effects on income measures.

It should be emphasized that which methodology is best and which sources of bias are the most serious depends on exactly what one wants to learn from the data. One methodology may be better at approximating true inequality at a point of time but worse at identifying trends—our main interest here. One may be better at approximating the distribution of consumption expenditures and the other at approximating the distribution of income. If the former is one's main interest, household surveys (when there are enough of them and they are comparable enough) are likely to provide the better approach, since the capital income reporting problem becomes close to irrelevant. Meanwhile, studies of changing inequality in given countries do not confront many of the challenges involved in dealing with world inequality.

Our focus here is the direction of changes in world inequality among persons. For that purpose, we suspect that the use of national accounts-based per capita income measures is superior to the use of household survey-based figures. However, accepting that this is, nevertheless, debatable, it is somewhat reassuring that the apparent impact of that methodological choice is less than it appeared to be when Milanovic (2002) was published. Over 1988 to1998, the difference in change in the Gini coefficient, according to Milanovic's (2005: 118) calculations is 2.4 percentage points—a 1.8 percentage point increase using the survey-based means and a 0.6 point decrease using the national accounts-based means.

A clarification with respect to studies showing increasing inequality of world distribution

Most of the confusion and ambiguity as to what has been happening to world inequality has been due, not to the methodological issues discussed in this paper, but to two others: whether the individual person or the country is the unit of comparison and whether per capital incomes are converted to a common base using official or market exchange rates or using PPP conversion rates. All of the studies previously referred to in this paper, with the exception of Korzeniewicz and Moran (1997), share with us the practice of converting national data to a 'common' base using PPP conversion ratios and using the individual as the basic unit of observation.

When the country rather than the individual is the unit of observation, one is, in effect, giving equal weight to each country; China with several hundred times more people than Costa Rica, is given the same weight as that country. This treatment inevitably means that what happens in the many small or relatively small countries becomes the main determinant of 'world inequality'. China and India, with between them around 40 per cent of the world's population, have only between 1 and 2 per cent of the weight in these cal-culations. If most countries fell in about the same size range, it would not matter much whether one weight-ed by population or did not; but in fact, countries vary enormously in size, as the just-cited figures indicate. Hence, it does matter. Among those who have focused on this 'unweighted' measure of world inequality is Castells (1993). The very widespread view that global inequality has been rising has been supported by these simple comparisons of growth rate in richer versus poorer countries and, ironically, has often been fuelled by statements coming from such establishment institutions as the World Bank and the International Monetary Fund (IMF).[27] Milanovic (2005: 39-44) presents a time series covering 1950-2000 that shows a modest increase in unweighted intercountry inequality from a Gini coefficient of 0.44 in 1950 to about 0.47 around 1980, followed by a very sharp increase to about 0.54 at the end of the century. Over the fifty years as a whole, most of the increase comes from what happens in Africa (as one might guess from the fact that there are so many small countries there and they have done relatively badly compared to other developing coun-tries), but the concentrated increase since 1980 does not have that origin, it is, instead, due mainly to events in Latin America and in the middle-income countries of Eastern Europe and the former Soviet Union.

Conclusions about world inequality trends are also very sensitive to whether conversion of national data to an international 'currency' takes the PPP route or uses official exchange rates.[28] The United Nations Conference on Trade and Development (UNCTAD) was one of the institutions, along with the UNDP (1999) to report a major increase in inequality at some point in the last few decades, with the Gini coefficient rising from 0.66 in 1965 to 0.74 in 1990 and the ratio of the richest quintile to the poorest rising dramatically from 31.1 to 60.1 (UNCTAD 1997: 81). The report drew on Korzeniewicz and Moran (1997). The authors were aware that the choice between market exchange rate conversion and PPP conversion matters. They judged that the latter was the more appropriate way to gauge relative welfare conditions but followed Arrighi (1991: 22-23) to the conclusion that exchange rates provide a better "indicator of the command that different countries have over the human and natural resources". However, most users of these estimates are basically concerned with the distribution of welfare and, by implication, access to locally available resources at domestic prices—suggesting the use of PPP exchange rates. Thus, as Firebaugh (2003: 37) puts it, "virtually all recent studies of between-nation or global income inequality use income data adjusted for purchasing power parity differences".

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27   Thus "The average income in the richest 20 countries is 37 times the average in the poorest 20-a gap that has doubled in the past 40 years" (International Monetary Fund, 2000: 50, cited in Firebaugh, 2003: 18).

28   Although there are tricky issues within the broad PPP approach (see Milanovic, 2005; Dowrick and Akmal, 2003; Dowrick and Quiggin, 1997; and others) these appear to matter much less to most results than does the choice of any variant of this general approach as opposed to official exchange rates.

Poverty trends and patterns

Trends in the incidence of poverty naturally depend on where the poverty line is drawn. Rather than choosing one line, inevitably somewhat arbitrary, we estimate poverty incidence for three different levels, 500, 1000, and 1500 1985 international dollars (annually).[29] We diverge from the standard $1 and $2-a-day poverty lines partly because ours are income-based poverty lines, in contrast to the consumption-based approach used by the World Bank and United Nations. Given average national levels of private consumption relative to total income, the $1-a-day (or $365-a-year) consumption based poverty line is likely to be fairly close to our $500 income poverty line.[30] In effect, then, our $500 and $1,000 poverty lines can be considered roughly comparable to those $1 and $2-a-day consumption lines. Persons with income below $500 can be reasonably considered extremely poor, those with income of $500 or greater but less than $1,000, very poor, and those with income of $1,000 or greater but less than $1,500, moderately poor.

For the world as a whole, it is noteworthy that poverty, when measured by the 500-international-dollar poverty line, continued to decline rapidly during the 1980s but the pace slackened markedly in the 1990s (table 8). During the 1980s, the share of people below this line fell sharply in East Asia, mainly reflecting the growth of China and also in South Asia, while remaining about constant in Africa (table 9).

Table 8.
World poverty incidence (Alternative poverty lines, 1980-2000)

The world			
International poverty lines (in fixed 1985 international dollars)	Per cent of total world population		
	1980	1990	2000
Income groups with average income of < $500	25.7	14.6	12.1
Income groups with average income of < $1000	53.8	43.6	28.5
Income groups with average income of < $1500	60.5	54.1	44.8
The world without China			
Income groups with average income of < $500	18.6	12.6	12.2
Income groups with average income of < $1000	40.4	35.9	27.1
Income groups with average income of < $1500	46.9	45.8	42.2
The world without China and India			
Income groups with average income of < $500	12.1	9.0	10.1
Income groups with average income of < $1000	26.7	24.4	20.2
Income groups with average income of < $1500	32.8	32.3	31.4
The world without Eastern Europe			
Income groups with average income of < $500	27.4	15.4	12.8
Income groups with average income of < $1000	57.3	46.2	29.7
Income groups with average income of < $1500	64.5	57.3	46.9

Sources: Authors' calculations using data from the WDI (World Bank), UN Common Database (UN), Penn World Tables – Mark 5.6 (CIC) and WIID (WIDER).

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29   The use of international dollars as measures of growth and income distribution is designed to ensure uniformity of purchasing power across countries. In effect, anyone with an income of 500 international dollars should have the same purchasing power regardless of which country they live in.

30   Direct translation from consumption to income using the national average ratio between these two variables gives about $540 per year, but this would be an overestimate because people with lower incomes generally tend to consume more of their income than do those with higher incomes.

Table 9.
Rates of poverty by region

Regions	Poverty lines (in 1985 international dollars)								
	$500			$1000			$1500		
	1980	1990	2000	1980	1990	2000	1980	1990	2000
Sub-Saharan Africa	56.9	57.5	58.0	74.8	75.3	71.4	85.2	85.8	80.8
East Asia	36.8	15.3	7.6	73.8	53.3	27.6	82.6	66.4	46.9
Eastern Europe and Central Asia	..	..	..	..	..	4.2	..	..	4.2
Middle East	3.3	3.1	..	30.2	20.0	13.2	40.4	29.8	23.1
North America	..	..	..	4.2	4.6	..	4.2	4.6	4.8
South Asia	36.1	21.3	20.0	80.0	67.5	46.0	88.0	81.0	72.1
South and Central America	..	..	..	15.4	17.3	17.3	21.8	31.6	32.8
Western Europe	..	..	..	2.7	..	..	5.4	3.2	..

Sources: Authors' calculations using data from the WDI (World Bank), UN Common Database (UN), Penn World Tables – Mark 5.6 (CIC) and WIID (WIDER).

Notes: Because the estimation produced is based on population units, some of which are large in relation to the less populated regions, the estimates are approximations. Though direction of change should almost certainly be correctly indicated, both absolute levels and degree of change can be biased.

.. The approximation procedure produced a figure of zero in these cases, i.e., there was a downward bias due to the fact that the average income of the lowest income group used in the calculation was above the poverty line in question.

In the 1990s, though it had already been lowered considerably, poverty by this definition was again roughly halved in East Asia. However, the rate of improvement fell sharply in South Asia due to increasing inequality in India (although per capita income growth increased slightly) and the fact that income groups were much less clustered close to that line than previously.[31] Poverty incidence again held about constant in sub-Saharan Africa. Thus, these two decades saw modest poverty reduction (by this definition) in the world outside China, and very little indeed in the world outside China and India—from 12.1 in 1980 to 10.1 in 2000. In both these latter two cases there was some reduction in the 1980s followed by a loss of ground in the 1990s.

The distinction between the 1980s and the 1990s is dramatically different when the poverty line is set at $1000. For the world as a whole and for the world minus China, the percentage point decline was greater in the 1990s and substantial in absolute terms (table 8). For the world outside China and India, there was only a very marginal decline in each decade. This reflects the fact that in South Asia (and, more particularly, India), the worsening distribution of income that muted the effect of rising overall income for the lowest income groups had a less dramatic effect in this intermediate range as well as the fact that fewer income classes were located near that poverty line in 1980 than in 1990.[32] Through both decades, the Middle East continued to record moderate declines in poverty, but in South and Central America, the retrogression of the 1980s was not erased in the 1990s (table 9).

At the higher poverty line of $1500, the pattern is again different. Poverty, by that definition, declines only moderately for the world as a whole, a little when China is excluded and marginally over the two decades when both India and China are excluded. In terms of the regional distribution, only East Asia and

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31   In fact, in 1980, 10 per cent of the total South Asian population had incomes between 400 and 500 international dollars. In 1990 only 2 per cent lay in that range.

32   Essentially because some of the income groups in the upper part of this range in 1990 were less adversely affected by the worsening income distribution.

the Middle East record large declines in poverty defined by this line, while South Asia recorded a moderate decline and Africa, surprisingly, a modest decline as well. However, increasing proportions of the Eastern European, and the South and Central American populations fell below that level over the two decades.

The area for concern, then, with respect to world poverty trends involves the bottom decile or so of world population, who are still below or close to the $500 line and who have been climbing above this line at a slower rate than higher deciles historically did. As has been widely noted, this new challenge has a strong regional component. As of 1980, the average income of the poorest quintile of the population was strikingly similar across South Asia, sub-Saharan Africa and East Asia (table 10). The succeeding two decades have seen a remarkable divergence in the fates of these groups, with average incomes rising rapidly in East Asia and moderately in South Asia but falling slightly in sub-Saharan Africa. By 2000, the average income of East Asia's bottom quintile was 50 per cent above that of the corresponding quintile of South Asia and over three times that of the bottom sub-Saharan African quintile. The extent of the collapse of incomes in sub-Saharan Africa is further illustrated by the fact that that bottom quintile was earning a higher proportion of total income in 2000 than it was in 1980, but the purchasing power of its income had dropped!

Table 10.
Fortunes of the bottom quintile by regions

Regions	Average income (in 1985 international dollars)			Proportion of total income		
	1980	1990	2000	1980	1990	2000
Sub-Saharan Africa	207	177	190	3.3	3.0	3.5
East Asia	265	396	609	2.8	3.0	3.4
Eastern Europe and Central Asia	2,664	2,847	1,872	9.1	8.8	7.8
Middle East	759	892	1,136	4.2	5.1	5.7
North America	2,465	2,374	2,927	3.8	3.1	3.1
South Asia	234	346	418	5.9	6.3	5.4
South and Central America	1,044	757	882	4.8	3.9	3.9
Western Europe	3,265	3,832	4,260	6.6	6.4	6.0
World	326	431	507	1.7	2.0	2.1

Sources: Authors' calculations using data from the WDI (World Bank), UN Common Database (UN), Penn World Tables – Mark 5.6 (CIC) and WIID (WIDER).

The two regions with the largest populations in poverty have been reducing poverty rapidly, while the third one has been going in the opposite direction. But the net positive outcome—a significant decline in world poverty incidence—seems to have run out in the 1990s. An improvement on the performance of that decade, in particular in sub-Saharan Africa, and more equitable growth in South Asia will be necessary for poverty reduction to regain the momentum of the earlier decades.

Summary and conclusions

In the light of divergent income trends across other regions, rapid and sustained expansion of the Chinese economy, and the more moderate, but consistent growth in India, were critical to the modest expansion of the world economy during the 1980s and 1990s. World inequality among persons fell during both the 1980s and the 1990s, according to all of our indicators—marginally according to some (including the Gini coefficient) and more markedly according to others (including the Theil coefficient). Income share was transferred from deciles seven to nine to the bottom six deciles and to the top decile. This outcome can be seen as the net result of two offsetting trends: falling intercountry inequality and rising intracountry inequal-

ity in wealthier countries and some of the developing ones (most prominently China). In fact, the observed improvement in the distribution of world income can be attributed entirely to the fact that the lessening of income gaps between countries was sufficient to offset the rising inequality within countries. As a result, the world's poor were, generally speaking, substantially better off in 2000 than in 1980 and, accordingly, world poverty incidence continued its long downward trend. The rate of poverty reduction (in the world as a whole) was brisk in the 1980s, continuing the pattern of the 1960s and 1970s, as East and South Asia (the home of the majority of the world's poor) expanded at a significantly faster rate than the rest of the world. However, despite continued growth in these regions in the 1990s, we see that increasing intracountry inequality (particularly in China and India) and the fact the most of the remaining poor had incomes well below the poverty line, combined with increasing poverty in Africa, led to a near cessation in the reduction of extreme poverty globally.

It might be argued that the overall pattern of world income distribution over the period 1980-2000 was one of convergence; but with such a finding resting largely on the performance of a single country (China), its meaning would be open to question. When India is excluded along with China, the pattern is unmistakably one of divergence. In the world outside those two countries, overall per capita economic growth fell by close to 50 per cent in each successive decade after the 1970s, the distribution of income became markedly more unequal and poverty levels were roughly unchanged. Thus, the two decades spanning the period 1980 to 2000 can be described as manifesting strong pressures towards divergence, offset plus a little by the rapid growth of the two largest low-income countries. In short, these two countries can be considered to have rescued the world from a dismal overall performance, on the equality front, in the closing decades of the twentieth century.

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Appendix A

Table A1. World and regional per capita incomes (GNP) and regional rankings

Regions	1980			1990			2000		
	Per capita income		R A N K	Per capita income		R A N K	Per capita income		R A N K
	Current int. dollars	1985 int. dollars		Current int. dollars	1985 int. dollars		Current int. dollars	1985 int. dollars	
North America	11,078	13,050	1	19,135	15,495	1	27,656	18,716	1
Western Europe	8,672	9,987	2	15,380	12,047	2	21,346	14,141	2
Eastern Europe	4,812	5,865	3	7,603	6,457	3	6,699	4,820	3
Latin America	3,639	4,390	4	4,785	3,845	4	6,676	4,480	4
Middle East	3,161	3,630	5	4,222	3,478	5	5,800	3,981	5
East Asia	1,653	1,876	6	3,387	2,654	6	5,544	3,586	6
Sub-Saharan Africa	1,112	1,269	7	1,426	1,168	7	1,603	1,096	8
South Asia	668	789	8	1,356	1,095	8	2,272	1,548	7
World	3,247	3,792		5,375	4,312		7,351	4,918	

Sources: World Bank, World Development Indicators (online edition); UN Common Database (Online edition).

Table A2. Measures of interregional income inequality

Inequality measure	1980	1990	2000
Gini	0.486	0.471	0.450
Theil	0.426	0.393	0.370
Atkinson (0.5)	0.192	0.182	0.175
Atkinson (1.0)	0.347	0.325	0.309
Atkinson (2.0)	0.535	0.499	0.479
Ratio of highest to lowest (average) regional incomes	16.6	14.1	17.3

Sources: Authors' calculations using data from the WDI (World Bank), UN Common Database (UN), Penn World Tables - Mark 5.6 (CIC) and WIID (WIDER).

Table A3. Measures of intraregional income inequality
(as distributed among persons)

Region	Year	Gini	Theil	Atkinson (0.5)	Atkinson (1)	Atkinson (2)
Sub-Saharan Africa	1980	0.565	0.578	0.291	0.439	0.603
	1990	0.571	0.607	0.297	0.455	0.642
	2000	0.579	0.610	0.303	0.457	0.627
East Asia	1980	0.647	0.763	0.349	0.534	0.683
	1990	0.625	0.698	0.322	0.503	0.662
	2000	0.575	0.575	0.266	0.437	0.611
Eastern Europe and Central Asia	1980	0.270	0.123	0.058	0.115	0.225
	1990	0.283	0.134	0.064	0.125	0.237
	2000	0.365	0.229	0.106	0.205	0.372
Western Europe	1980	0.308	0.200	0.084	0.181	0.433
	1990	0.313	0.195	0.084	0.177	0.387
	2000	0.320	0.203	0.088	0.184	0.390
South and Central America	1980	0.466	0.379	0.175	0.315	0.506
	1990	0.481	0.418	0.189	0.342	0.547
	2000	0.489	0.429	0.192	0.349	0.557
Middle East and North Africa	1980	0.509	0.456	0.207	0.366	0.560
	1990	0.443	0.342	0.156	0.290	0.475
	2000	0.419	0.302	0.138	0.260	0.446
North America	1980	0.407	0.340	0.142	0.289	0.555
	1990	0.448	0.428	0.172	0.348	0.648
	2000	0.460	0.430	0.179	0.350	0.627
South Asia	1980	0.395	0.261	0.125	0.230	0.388
	1990	0.391	0.252	0.123	0.223	0.368
	2000	0.429	0.307	0.148	0.265	0.428

Sources: Authors' calculations using data from the WDI (World Bank), UN Common Database (UN), Penn World Tables - Mark 5.6 (CIC) and WIID (WIDER).

Table A4. Distribution of world income without Eastern Europe and Central Asia

|	Income shares by decile of world population (%)			Change in prop. of total world income	Annual income growth (1985 PPP value of income)	
	1980	1990	2000	1980-2000	1980-1990	1990-2000
Decile 1	0.64	0.71	0.72	0.08	2.5%	1.9%
Decile 2	1.09	1.28	1.25	0.16	3.0%	1.5%
Decile 3	1.43	1.67	1.81	0.38	3.0%	2.6%
Decile 4	1.85	2.07	2.31	0.46	2.5%	2.9%
Decile 5	2.34	2.54	2.96	0.62	2.2%	3.3%
Decile 6	3.15	3.60	4.05	0.90	2.7%	3.0%
Decile 7	4.97	5.09	5.90	0.93	1.6%	3.3%
Decile 8	10.33	9.12	9.84	-0.49	0.1%	2.6%
Decile 9	23.91	22.14	20.79	-3.12	0.6%	1.1%
Decile 10	50.28	51.77	50.37	0.09	1.7%	1.5%
World	100.00	100.00	100.00			
	Measures of inequality			20-year change		
Gini coefficient	0.675	0.669	0.652	-0.023		
Theil coefficient	0.954	0.899	0.844	-0.110		
Atkinson (0.5)	0.377	0.367	0.347	-0.030		
Atkinson (1)	0.615	0.593	0.570	-0.045		
Atkinson (2)	0.798	0.780	0.774	-0.024		
Ratio of top to bottom decile incomes	78.8	73.0	70.3			

Sources: Authors' calculations using data from the WDI (World Bank), UN Common Database (UN), Penn World Tables - Mark 5.6 (CIC) and WIID (WIDER).

Chart A1. Evolution of world income inequality
(Gini coefficient Values)
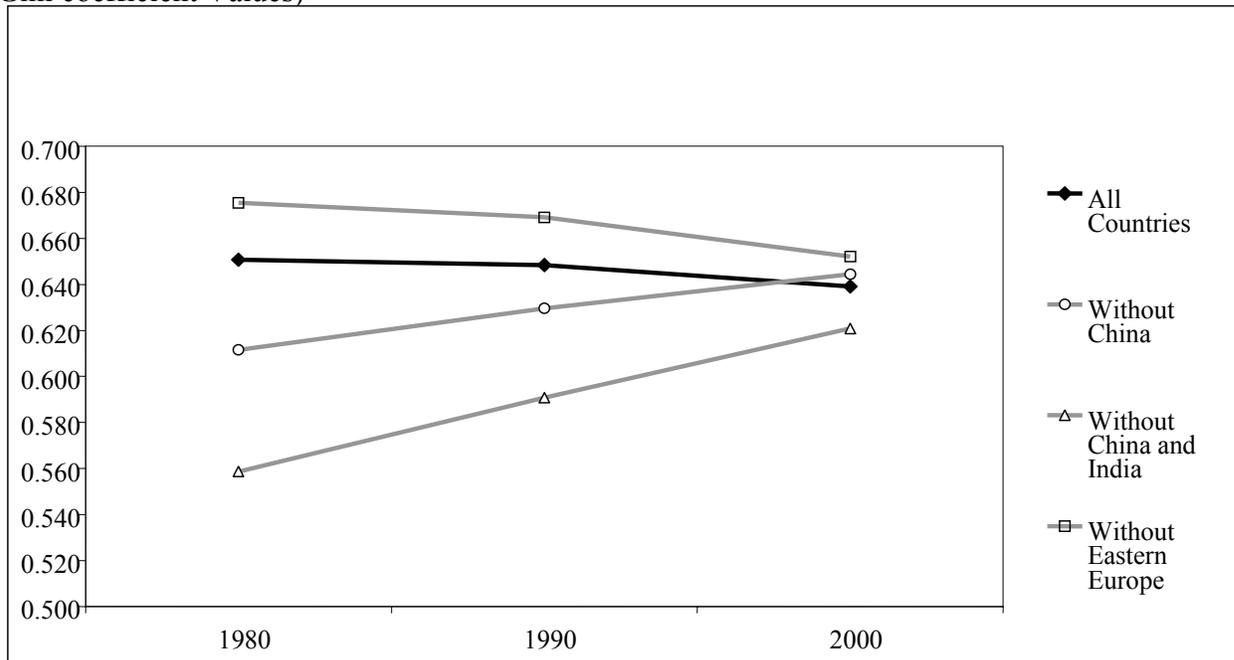
Sources: Authors' calculations using data from the WDI (World Bank), UN Common Database (UN),
              Penn World Tables - Mark 5.6 (CIC) and WIID (WIDER).

Appendix B

Table B1. World Bank and adjusted estimates of Chinese GDP

Year	World Bank estimates of GNP (Trillions of current international dollars)	Our estimates of GNP (Trillions of current international dollars)
1980	455,826	588,547
1990	1,586,011	1,624,306
2000	4,965,740	4,041,983

Source: World Development Indicators (World Bank).

Table B2. Sensitivity analysis (of world inequality and output measures) with respect to output and growth assumptions for China

Assumptions/ measures	World inequality measures using official (World Bank) data				Change in inequality coefficients between 1980 and 2000								
	1980	1990	2000	Change (1980-2000)	(1)	(2)	(3)	(4)	Working assumption	(6)	(7)	(8)	(9)
(a) Percent official undervaluation of 1987 GNP					5	5	5	10	10	10	15	15	15
(b) Percentage points overestimation of GNP growth					2.0	2.5	3.0	2.0	2.5	3.0	2.0	2.5	3.0
Gini	0.660	0.649	0.630	-0.029	-0.015	-0.011	-0.008	-0.015	-0.012	-0.008	-0.016	-0.012	-0.008
Theil	0.940	0.849	0.779	-0.161	-0.105	-0.092	-0.078	-0.102	-0.089	-0.075	-0.099	-0.086	-0.072
Atkinson (0.5)	0.361	0.344	0.323	-0.038	-0.021	-0.017	-0.012	-0.021	-0.017	-0.012	-0.021	-0.017	-0.012
Atkinson (1)	0.609	0.572	0.541	-0.068	-0.045	-0.039	-0.033	-0.044	-0.038	-0.032	-0.043	-0.037	-0.031
Atkinson (2)	0.810	0.775	0.759	-0.051	-0.035	-0.031	-0.027	-0.033	-0.029	-0.026	-0.031	-0.028	-0.024
	1980–1990	1990–2000	Average		Output growth, 1980-2000								
World output growth	2.91	2.60	2.76		2.68	2.65	2.63	2.69	2.66	2.64	2.7	2.67	2.65
Per capita output growth	1.21	1.20	1.20		1.12	1.10	1.08	1.14	1.11	1.09	1.15	1.12	1.10

Sources: Authors' calculations using data from the WDI (World Bank), UN Common Database (UN), Penn World Tables - Mark 5.6 (CIC) and WIID (WIDER).

Appendix C

Selection criteria, data sources and sample size

Inclusion:

A. Estimates of output growth (tables 1 and 2)
    All countries with output data in both domestic currency and current international dollars
    (PPP) for the period 1970 to 2000.

B. Inequality measures and poverty lines
    All countries with income data in both domestic and current international dollars from
    1980, 1990 and 2000 (or sufficiently close to allow estimation).

Number of countries in the sample used for this paper:
    136 countries for tables 1 and 2 (measuring output growth) and 163 countries for the
    remaining tables (measuring income distribution).

Main data sources:
    World Development Indicators (online edition), The World Bank;
    UN Common Database (online edition), The United Nations;
    The Penn World Tables (The Mark 5.6 Database), University of Pennsylvania;

Coverage:

	1980	1990	2000
Total population of countries included (millions)	4,259.0	5,043.5	5,801.2
Percent of world population	95.5	96.0	95.8
Percent in countries of over 25 million[33]	85.6	85.2	84.7

Countries of substantial size (in terms of population) missing from the sample, due to
insufficient data, and their estimated 2000 population (in millions):

Afghanistan	(26.6)
Iraq	(23.3)
Myanmar	(45.6)
North Korea	(23.6)

Methodology for estimating the distribution of world income between persons
Based on the best estimates of the distribution of income among persons in 1980, 1990 and 2000,
all countries with populations of 25 million or greater in 2000 were subdivided into sub-national
(or intracountry) income groups. The exception was the Democratic Republic of Congo (for
which there was no relevant distribution data). Countries with population between 25 million and
200 million (a total of 31) were divided into population quintiles. Countries with populations
above 200 million but less than one billion (Indonesia and the United States) were subdivided
into population deciles. China and India, with populations of over a billion, were each
subdivided into forty groups of equal population but varying average incomes. The income

proportions for the forty population groups were estimated through interpolation. Basically, beginning with a decile distribution, income is subdivided (into forty equal population groups) in a manner that reproduces the same Gini coefficient of the original distribution.

Using this method, 35 large countries were mapped to 255 sub-national income groups covering approximately 85 per cent of the total sample population in each year. The remaining small countries (128 in all) were treated as single income groups. Though this created a heterogeneous mix of data points (referencing both income-based, sub-national groups and whole countries) our sensitivity analyses indicate that further subdivision (of countries) would have had little discernible effect on distribution measures (for the world and regions) but would greatly increase data demands.

The distribution estimates used for translating country incomes (GNP or GNI) into the income of sub-national income groups were measures of the division of GNI by quintile or decile (or more) of persons. Thus, for example, a country with a quintile distribution of income of 6 per cent, 12 per cent, 19 per cent 26 per cent and 37 per cent for a particular year, could be divided into five sub-national groups, each consisting of 20 per cent of the country's population but with 6 per cent, 12 per cent, 19 per cent, 26 per cent and 37 per cent of the national income respectively.

However, the available distribution data was not always in the form of income per person. A significant proportion of distribution data is expenditure based and/or uses households (rather than persons) as the enumeration unit. There is no fixed derivable conversion factor between those various measurement methods because of the variation in spending patterns and average household sizes across countries and income groups. However, it is not a great stretch to assume that the relationship between those measures would not change radically from year to year within a single country, and that it would be similar for countries with similar social and economic structures. We, therefore, used implied conversion factors (i.e., we assumed that the relationship between different distribution measures was roughly constant across time within the same country and similar across countries that are alike in terms of income and geographic location or structure). Thus, for example, the (computed) relationship between estimates of the distribution of household expenditure by quintile of households and the distribution of income by quintile of persons, both measured in 1988 for France, could be used to convert a 1980 estimate of the distribution of expenditure by quintile of households to an approximate distribution of income by quintile of persons for France in that same year. That same implied conversion matrix can be credibly used to convert a similar measure for Germany in 1990, though not for a clearly dissimilar country, such as Iran, or even for Germany in 2000.

Data was also limited in terms of available years. Distribution data was not always available for the exact years of 1980, 1990 or 2000. More often, data would be for other years close to those years (e.g., 1981, 1992, etc). We worked on the assumption that data for one to three years from 1980, 1990 or 2000 could serve as proxies for those years (e.g., 1982 for 1980). In a few cases, where compatible measures bracketed the year in question (e.g., 1978 and 1982), the desired distribution was derived by interpolation.

Data limitations also meant that, for some countries, available data was not sufficient to indicate distribution changes for both of the sub-periods (1980-1990 and 1990-2000). Where such data was not available, we assumed no change in the distribution of income. Though this assumption is necessarily somewhat incorrect, it avoids the imposition of an arbitrary judgment on how inequality may have changed. Since the evidence from intracountry Gini coefficient changes strongly suggest that income distribution worsened in a majority of countries, the assumption of no change almost certainly biases estimates of changes in world intracountry income distribution downwards.

Though many sources were used for distribution estimates, the main sources were the UNDP-WIDER Income Inequality Database and the 2001 World Bank World Development Indicators.

The Atkinson coefficients

The Atkinson coefficient is not a single measure but a class of measures individually differentiated by the degree of aversion to inequality (or implied welfare cost of inequality) represented by the parameter e. The e term can also be treated as an inequality sensitivity index.

The measures can be defined as one minus the ratio of an equity sensitive estimate of mean income over the arithmetic mean income.

$$A(e) \ = \ 1 \ - \ \frac{\overline{y}(e)}{u}$$

The equity sensitive mean income is defined by the equation:

$$\overline{y}(e) \ = \ \left(\sum p_i \cdot y_i^{1-e} \right)^{\frac{1}{1-e}}$$

where p_i is the population weight for income group i and y_i is the average income for income group i. Thus the direct formula for the index is:

$$A(e) \ = \ 1 \ - \ \left[\sum p_i \cdot \left(\frac{y_i}{\mu} \right)^{1-e} \right]^{\frac{1}{1-e}} \qquad\qquad e \geq 0, \ \ e \neq 1$$

$$A(e) \ = \ 1 \ - \ \exp\left[\sum p_i \ln\left(\frac{y_i}{\mu} \right) \right] \qquad\qquad e \geq 0, \ \ e = 1$$

The weight attached to a marginal increase in the income of the highest income group relative to the same increase in income for the lowest income group is determined by the weighting factor (x) that is related to the sensitivity parameter e by the formula:

$$x = \frac{1}{z^e}$$

where z is the ratio of the income of the richest group to that of the poorest. Thus, given z, as e increases, the equity sensitive mean income, and thus the Atkinson index, becomes increasingly

sensitive to income changes at the bottom end of the distribution. By the same token, as *e* increases, the equity sensitive mean income is less and less responsive to income increases at the top end of the distribution but, because the arithmetic mean remains just as sensitive, the Atkinson index is also increasingly sensitive to such changes.

For e=0 (meaning that x=1) no additional weight is attached to the income of the poorest (or any) group (the equity sensitive mean income is identical to the arithmetic mean). Absolute income inequality is acceptable since the Atkinson (0) is always equal to 0. At the other extreme, if e=∞ then all weight is attached to the income of the poorest group and thus the equity sensitive mean is always essentially zero and the Atkinson (∞) is always 1. All inequality is extreme (or, put differently, no price is too high to pay for income equality).

More reasonably, if e=0.5 and z=10 (meaning *x*=0.316), then, a marginal increase in the income of the highest income group causes the equity sensitive mean to increase by roughly one-third (31.6 per cent) of the amount by which it would have increased if that same (marginal) income had gone to the lowest income group. But since the arithmetic mean does not differentiate, the increase at the top end causes the inequality measure to *increase* (the second term in the *A(e)* equation above gets smaller) while the increase in income at the lower end causes it to *decrease*. Put differently, if a marginal dollar were to be transferred from the highest income group to the lowest income group, but 68.4 cents (i.e., 100-31.6) of that income was lost in the act of transfer, then the equity sensitive mean income would be identical before and after transfer!

If e=2 and z=10, then *x*=0.01. This means that a marginal increase in the income of the highest income group would increase the equity sensitive mean income by only 1 per cent (one one-hundredth) of an identical (absolute) increase in the income of the lowest income group. In fact, put in dollar terms, the equity sensitive mean would respond equivalently to a $1 increase in the income of the lowest income group and a $100 increase in the income of the highest income group!

Thus, the A(2) is much more sensitive to income inequality than is the A(0.5). The A(1), of course, is between those two extremes and its values tend to be close, in terms of both magnitude and sensitivity, to those of the Theil indices.

Appendix D

Regional grouping of the countries included in the sample

Sub-Saharan Africa	East Asia	South Asia	South and Central America	Middle East and North Africa	Eastern Europe and Central Asia	Western Europe	North America
Benin	Australia	Bangladesh	Antigua and Barbuda	Algeria	Bulgaria	Austria	Bahamas
Botswana	China	India	Argentina	Bahrain	Czechoslovakia	Belgium	Canada
Burkina Faso	Fiji	Nepal	Barbados	Egypt	Hungary	Cyprus	Mexico
Burundi	Hong Kong, China	Pakistan	Belize	Iran	Poland	Denmark	USA
Cameroon	Indonesia	Sri Lanka	Bolivia	Israel	Romania	Finland	
Central African Rep.	Japan		Brazil	Jordan	Countries of the former Soviet Union	France	
Chad	Korea, Rep.		Chile	Morocco		Germany	
Comoros	Malaysia		Colombia	Oman		Greece	
Congo, Dem. Rep.	New Zealand		Costa Rica	Qatar		Iceland	
Congo, Rep.	Papua New Guinea		Dominica	Saudi Arabia		Ireland	
Cote d'Ivoire	Philippines		Dominican Republic	Syria		Italy	
Ethiopia	Singapore		Ecuador	Tunisia		Luxembourg	
Gabon	Solomon Islands		El Salvador	United Arab Emirates		Malta	
Gambia	Thailand		Grenada			Netherlands	
Ghana			Guatemala			Norway	
Guinea-Bissau			Guyana			Portugal	
Kenya			Haiti			Spain	
Lesotho			Honduras			Sweden	
Madagascar			Jamaica			Switzerland	
Malawi			Nicaragua			Turkey	
Mali			Panama			United Kingdom	
Mauritania			Paraguay				
Mauritius			Peru				
Mozambique			St Kitts, Nevis				
Namibia			St Vincent and the Grenadines				
Niger			Suriname				
Nigeria			Trinidad and Tobago				
Rwanda			Uruguay				
Senegal			Venezuela				
Sierra Leone							
South Africa							
Swaziland							
Togo							
Uganda							
Zambia							
Zimbabwe							