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The Global Distribution of Income in 2050

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Summary. — Several recent papers have explored the history of the global income distribution and point to some improvements: a falling global Gini coefficient, a falling poverty rate, and falling poverty headcounts. This paper uses the simple accounting procedure (SAP) discussed by Bhalla [Bhalla, S. S. (2002). *Imagine there's no country: Poverty, inequality and growth in the era of globalization*. Washington, DC: Institute for International Economics] and the International Futures Model [Hughes, B. B., & Hillebrand, E. E. (2006). *Exploring and shaping international futures*. Boulder, CO: Paradigm Publishers] to project the global distribution of income in 2015 and 2050. The results suggest that unless the OECD countries start growing more slowly than is now commonly assumed or broad swaths of the developing world substantially improve their economic performance beyond that experienced in the last 25 years, the global income distribution will soon start to worsen again.

Key words — global, world, poverty, inequality, income distribution, forecast, development

1. INTRODUCTION

The global distribution of income has shown extraordinarily large shifts in the last two centuries, with a small group of rich countries referred to in this paper for convenience as the OECD countries [1] growing much faster than the rest of the world—ROW, for short. Total output in the OECD rose from 28% of world product in 1820 to a peak of about 59% in 1968. In *per capita* terms, the results were even more dramatic: OECD average *per capita* income started in 1820 about twice as high as ROW incomes, and peaked at about seven times the ROW level in 1992 (Table 1).

A copious literature has been developed that combines country GDP and *per capita* GDP with country-by-country income distribution data to produce global income distribution measures and estimates of poverty headcounts. This paper attempts to extend the Bourguignon and Morrisson (2002) long-run inequality estimates using the methodology developed by Bhalla (2002). The International Futures (IFs) Model (Hughes & Hillebrand, 2006) is used to generate long-run global growth scenarios that show the sensitivity of global inequality and poverty to various policy and conjectural factors. Although there is much debate in the literature between the backward-looking poverty headcounts of Bhalla (2002), Sala-i-Martin (2002a, 2002b), Milanovic (1999, 2005), and Chen and Ravallion (2001, 2004a, 2004b), [2] my poverty forecasts will necessarily start with some backward-looking estimates, but only to establish a plausible base for forecasting, not to try to settle the debate among the authors cited.

2. GLOBAL INEQUALITY ESTIMATES

Early attempts at estimating global inequality [3] assumed for convenience that all incomes within a country were the same, average *per capita* GDP. These calculations gave a population-weighted global inequality measure that is better than just looking at GDP by countries as the unit of measure but not very helpful for understanding poverty. Bourguignon and Morrisson (2002), among others, attempted to

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Table 1. *Real GDP, billions of 1990 international dollars (panel A) and real per capita GDP, 1990 international dollars (panel B)*

	1820	Year of peak divergence	Last year of Maddison's data	Extended by author
		1968	2001	2005
Panel A				
OECD	194	7,358	19,308	21,176
ROW	501	5,095	17,886	22,737
OECD share of world output	28.0%	59.2%	51.9%	49.3%
Panel B				
OECD	1,109	19,016	22,525	24,222
ROW	578	2,718	3,380	4,085
OECD/ROW	1.92	7.00	6.66	5.93

Source: Maddison (2003), extended through 2005 using PPP GDP growth estimates from the World Bank and other sources.
Note: Maddison's "international dollars" indicates that national currency figures have been converted at PPP conversion rates, not market exchange rates.

combine measures of income distribution within countries with comparable cross-country GDP measures to try to get a better measure of the global distribution of income. Their paper tells a dramatic and straightforward story. Global inequality was high in 1820 (Gini of 0.5) and it rose over the next 160 years, peaking at about 0.66 in 1980. In the early 19th century, most inequality was due to differences within countries, but most of the rise since 1820 has been due to differences in growth rates among countries, not changes within countries. Global inequality stabilized or fell—depending on which of their three measures is used—during 1980–92, the last year of their calculations, presumably because of a relatively slower economic growth in the OECD.

Subsequent work by Bhalla (2002) and Sala-i-Martin (2002a, 2002b) extended the analysis to more recent years and found a pronounced downward trend in global inequality, driven in large part by rapid economic growth in China and India. Some of Bourguignon and Morrisson's (2002) estimates of the global Gini coefficients during 1820–1980 are shown in Table 2, compared with Gini estimates for more recent years produced by Bhalla (2002), Sala-i-Martin (2002b), Milanovic (2005), and this paper.

In its extensive work on global poverty, the World Bank has not published official estimates of world Gini coefficients but Bank economist Milanovic (2005) has recently published his own figures showing results similar to the others, but with a less clear-cut downward trend. The official World Bank poverty headcount estimates (Chen & Ravallion, 2004a), like the other sources cited, show a continuing decline in both the poverty headcount and the ratio of extreme poverty (Tables 3 and 4).

All of these figures—and the figures I am going to produce—are estimates. The estimates are based on imperfect data, and on many different, challengeable, assumptions about how to put the data together to come up with the global inequality measures and poverty headcounts. The first three estimates of the global Gini coefficient I have cited (Bourguignon & Morrisson, 2002; Bhalla, 2002; Sala-i-Martin, 2002b) use national income accounts data—

Table 2. *World Gini estimates*

	1820	1970	1980	1988	1992	1993	1998	2000	2005
Bourguignon/Morrisson	0.50	0.65	0.657		0.657				
Bhalla			0.686		0.678		0.654	0.651	
Sala-i-Martin			0.662		0.645		0.633		
Milanovic				0.619		0.652	0.642		
Hillebrand			0.653					0.651	0.634

Sources: Bourguignon and Morrisson (2002), Bhalla (2002), Sala-i-Martin (2002b), Milanovic (2005), and author's estimates.

Table 3. *World poverty headcount at "$1" a day, millions of people*

	1980	1981	1984	1987	1990	1992	1993	1996	1998	1999	2000	2001	2002	2005
Chen/Ravallion		1482	1277	1171	1219		1207	1097		1095		1089		
World Bank GEP					1218								1011	
Sala-i-Martin	1095	1043	950	952	963	1067	917		843					
Bhalla	1479				1056						647			
Bourguignon/Morrisson	1390					1294								
Hillebrand	1279	1258									1112	1096		965

Sources: Chen and Ravallion (2004a), World Bank (2006, 2007), Sala-i-Martin (2002b), Bhalla (2002), Bourguignon and Morrisson (2002), and author's estimates.
Note: $1 a day actually refers to $1.08 a day in 1993 PPP $ according to World Bank usage. Bhalla adjusts that to $1.50 in 1993 PPP $, to account, mainly, for undercounting in NIA data. The Hillebrand calculations raise Bhalla's $1.50 to $1.56 a day to account for price changes, 1993–95.

Table 4. *World poverty headcount ratio at "$1" a day, percent*

	1980	1981	1990	2000	2001	2005
Chen/Ravallion		40.4	27.9		21.1	
Bhalla	43.5			13.1		
Hillebrand	34.9	33.7		21.5	20.8	17.4

Sources: Chen and Ravallion (2004a), Bhalla (2002), and author's estimates.
Note: World poverty headcount divided by population of non-OECD countries.

massaged into PPP terms by Maddison (1995, 2001, 2003), or the Penn World Tables team (Heston, Summers, & Aten, 2002), or the World Bank—and estimates of within-country consumption or income distributions based on household surveys. The Bourguignon and Morrisson study (2002), going back farther in time, had to rely on much more estimated data than the more recent studies, but there are many data gaps requiring strong assumptions in all the studies.

Milanovic (1999, 2005) rejects the use of national income accounts data and uses household survey data to measure absolute consumption levels as well as the distribution of consumption among households. Bhalla (2002) and Sala-i-Martin (2002a, 2002b) choose to use consumption figures from national income accounts to generate their estimates of poverty headcounts, but even then different authors appear to have included different items in "consumption."

Bhalla (2002) spends a great deal of time in his book asserting that the household survey data greatly understate the true figure, especially for China and India and thus he believes that the true poverty figures are much lower than the World Bank shows. Sala-i-Martin (2002b) produced even lower poverty headcount estimates than Bhalla (2002), but he points out that his figures are similar to those of the World Bank if one uses a consumption-based definition of poverty rather than an income-based definition.

(a) *A methodology for looking backward and forward*

I have chosen to use the Bhalla (2002) methodology because it is intuitively and computationally simple (he calls it the SAP—simple accounting procedure), and it seems just as useful for looking forward as well as backward although Bhalla does not use it that way.

Starting with 1980–2001 GDP data (in 1990 PPP dollars) for 148 countries from Maddison (2003), I rebased the numbers to 1995 by multiplying by 1.131, the ratio of the US GDP deflator 1995 over 1990. To match the list of 182 countries in the current version of the IFs model, I added data for 34 more countries using the World Bank's World Development Indicators data bank (World Development Indicators, 2006). The data were extended to 2005 using PPP real GDP growth rates taken mainly from the World Bank. [4] For income—or preferably consumption—distribution by quintiles or deciles I took data from the United Nations University World Income Inequality Database (WIID2a, June 2005). [5] While these are the most comprehensive data available, they do not contain data for all countries and

all periods, and many of the underlying surveys for each country are not time consistent. There are data for 96 countries that had a reasonably consistent survey from the early 1980s and from the late 1990s or early 2000s—surveys that appeared to measure the same concept (e.g., household or person) in the same way (e.g., consumption or gross earnings). Aggregate private consumption was calculated by taking the ratio of consumption *per capita* to GDP *per capita* from the Heston and Summers data bank (PWT6.1), and multiplying by the GDP figures.

Using the income quintile or decile from the WIID2a database I estimated Lorenz curves for 1980 and 2000 using the Kakwani (1980) approach, as described by Bhalla (2002, p. 211):

$$L(p) = p - a * [p^b] * [(1-p)]^c, \quad (1)$$

where p represents the bottom p percent of the population and $L(p)$ is the corresponding share in income.

Taking logs and rearranging terms gives the regression equation:

$$\log[p - L(p)] = \log a + b * \log(p) + c * \log(1-p). \quad (2)$$

One starts with 10 (or 5) points on an imagined Lorenz curve. Estimating this regression equation allows one to estimate the incomes of each percentile of the population and hence fill in the Lorenz curve. For this paper I estimated 96 country distributions, and missing-country averages for Latin America, East Asia, sub-Saharan Africa, North-Africa/Middle East, for 1980 and for 2000.

I applied the estimated percentile consumption [6] distributions to each country's GDP and then rank-ordered the resulting 18,200 estimates of individual country percentile incomes and their associated populations. From this rank ordering it is easy to draw the Lorenz curve and to calculate the Gini coefficient from the 18,200 observations. These calculations are marred by the fact that the country population percentiles are not equal—the Lorenz curve is not perfectly smooth—but this is probably not a large source of error given the number of observations. To calculate the poverty headcount, I applied the same percentile distribution to the country estimates of private consumption, then rank-ordered all 18,200 observations and noted the numbers below any arbitrary poverty line. Using the 2000 consumption/income distributions I also calculated the poverty numbers for 2001 and 2005 based on the GDP estimates for those years.

(b) *Results for the historical period*

These calculations show a halving of the $1-a-day world poverty headcount ratio (OECD countries are excluded in poverty ratios) — from 34.9% in 1980 to 17.4% in 2005, [7] and a drop of over 300 million living below the $1-a-day standard to 965 million. The global Gini coefficient (OECD countries are included in inequality measures) fell over this period from 0.653 to 0.634. China and India, whose economies grew very strongly during 1981–2005, together account for a poverty headcount drop of 518 million people. Sub-Saharan Africa, at the other extreme, registered a poverty headcount increase of about 228 million.

Since this methodology generally follows the Bhalla approach one might expect the estimates for 1980–2001 to resemble Bhalla's figures rather than the World Bank's, but this turns out not to be the case. My estimates of the global poverty headcount for 2001 and percentage declines since the early 1980s are much closer to those reported in the Chen and Ravallion (2004a) paper than those Bhalla reports in his 2002 book. One major difference between my work and Bhalla's is that he uses a much higher ratio of consumption to GDP than I do using the Penn World Tables data. It is also possible that the Bhalla calculations were forced to assume unchanging income distributions in many countries for which we now have better estimates over time, using the WIID2a database.

The difference among these various measures is much less significant than their differences with earlier measures of poverty headcounts. In the World Bank's World development report 2000/2001 (subtitled Attacking poverty) the numbers and the trends were less encouraging. The poverty headcount according to that work (based on Chen & Ravallion's, 2001 paper) had increased by over 100 million during 1987–98. The United Nation's Human development report of 2002 emphasized that the trends were "ambiguous" citing Bourguignon and Morrisson (2002), Schultz (1998), and Milanovic (1999). The additional years of data—and perhaps refinements in massaging the data—suggest that the ambiguity is gone, that there have been real and substantial declines in the poverty headcount in the last two decades. The World Bank and the numbers in this paper show the

poverty headcount ratio nearing the 15% Millennium development goal; Bhalla's numbers show it already crossing that threshold.

While the global results are encouraging, they would have been much better if within-country distributions had not moved—on average—toward less equality. If the 1980 within-country distributions had existed in 2005, the global poverty headcount would have been 220 million less and the global poverty headcount ratio would have been 13.4% in 2005. Increasing inequality within China and India accounts for the bulk of this change (Table 5).

We cannot know for sure what the truth is; the data are not good enough. The major research efforts cited from the literature show similar results—declining global poverty, perhaps declining global inequality, mainly due to fast growth in China and India—but much variation in the estimates remains. My poverty numbers, based, on a new manipulation of the data are similar to the most recent World Bank numbers [8]; my Gini numbers are similar to Bhalla's, Sala-i-Martin's, and Milanovic's. I propose to use this methodology to extrapolate from the 2005 estimates, using simulations from the IFs model. If one prefers Bhalla's or the World Banks' starting numbers, the results are easy to transform.

3. GLOBAL POVERTY IN 2050

What will global poverty look like in 10 or 20 or 45 years? Chen and Ravallion (2004a, p. 33), suggest that it will drop, but their estimate is based on two time series regressions (one for East Asia, one for South Asia) based on past changes in the poverty headcount relative to growth. They assume that the poverty ratio in Africa will continue to be 45%. Their modeling and assumptions add up to a world poverty rate of 15% in 2015, thus meeting the millennium development goals. New work by the World Bank reported in Global economic prospects (2006 and 2007) suggests that the world (non-OECD) poverty rate—in a "medium growth scenario"—will fall to 10.2% in 2015 and 7.6% in 2030. These forecasts apparently use a cross-country regression that posits a constant elasticity of poverty reduction to *per capita* income growth adjusted by the estimates of changes of within-country inequality.

Bhalla concludes that the world poverty rate has already gone below 15% and will continue to go lower. Bhalla estimated a reduced-form equation to calculate the elasticity of the poverty headcount ratio to growth in incomes or consumption and then used this regression model to forecast future poverty levels assuming that the distribution of income or consumption within countries remains the same.

The constant elasticity assumption is not very reliable for extending projections very far in the future given that we are talking about movements below or above a fixed poverty threshold. A country with incomes just below the threshold can cross the threshold with only a low level of growth and a country with incomes far below the threshold can have high rates of growth without moving many people out of extreme poverty. [9]

This paper uses an alternative methodology. If we have estimates of future GDP, if we assume that the within-country distribution of income and consumption remains constant, and if we assume that the ratio of consumption to income is constant, we can simply read off the percentiles of income and consumption using the same accounting framework we did in the historical

Table 5. *Poverty headcount at "$1" a day, millions of people and percent*

	Actual results				Results if within-country distributions had not changed	
	1980	%	2005	%	2005	%
World (excluding OECD)	1,279	34.9	965	17.4	745	13.4
China	457	46.6	131	10.0	0	0.0
India	355	52.3	163	15.0	94.4	8.7
North Africa/Middle East	8.6	4.7	27	7.9	31.9	9.3
Rest of Asia and Oceania	218	20.1	161	10.5	136	8.8
Sub-Saharan Africa	198	51.9	427	58.5	430	58.9
Latin America	43	11.9	56	10.0	53	9.5

Source: Author's calculations.

analysis. All three of these key "ifs" are problematic. There is no scientifically sound methodology to forecast global incomes and consumption decades in the future. Most long-term projections, including this one, rely on scenarios. The researcher posits a set of assumptions about the key drivers of growth and produces projections that are presumed to be part of a range of plausible outcomes. The assumption of unchanging within-country distribution is also one that is often made in long-run forecasts (see Chen & Ravallion, 2004a), mainly because there is little scientific basis for predicting long-range changes and the existing empirical work on the subject shows such divergent results (see World Bank, 2007 *vs*. Higgins & Williamson, 2002). Consumption-to-income ratios could also change for endogenous economic reasons or because of political decisions, but are assumed in this paper to remain constant.

This technique allows us to focus on economic growth—the variable that, according to Bourguignon and Morrisson (2002), had by far the greatest impact on global income inequality, 1820–1992. [10] The IFs model is convenient because it contains detailed growth models for 182 states, because the model contains numerous policy levers that have been calibrated based on recent empirical work at the World Bank and elsewhere, and because the model already contains numerous well thought-out long-range growth scenarios.

(a) *The "Market First" scenario*

I used the "Market First" scenario, currently embedded with version 5.21 of the model. [11] It is the high-growth, high-globalization, world peace scenario that is similar to many other optimistic projections that are often used as a starting point for discussing global futures. [12] The World Bank elaborated a similar scenario in its *Global economic prospects: Managing the next wave of globalization* (2007). As in the World Bank work, the numbers used here are not a forecast but a scenario based on assumptions about changes in population, capital stock, and productivity gains. Projected productivity gains include assumptions about both the creation and introduction of new technology into the production process, and the adoption of previously developed technology by the less-developed countries. There is clearly much scope for the latter leading to the possibility of enhanced growth rates, but there is also no scientific way of forecasting how much convergence will be achieved nor what growth-enhancing or growth-retarding polices will be followed in each country.

These assumptions produce another golden age of growth, with world growth and growth in most regions higher than in the last 20 or 50 years (Table 6). With economic growth at this high pitch, world poverty shrinks dramatically. The number of extreme poor shrinks from 965 million people in 2005—by my estimate—to 792 million in 2015 and 353 million in 2050 (Table 7). Strong economic growth leads to the eradication of extreme poverty in both China and India. Sub-Saharan Africa cuts its poverty rate substantially, but, assuming continuing high population growth rates, [13] the number of people living in extreme poverty continues to grow past 2015. A few countries in East

Table 6. *Economic growth in the Market First and Trend scenarios compared to historical growth rates*

	1951–73	1981–2005	Market First scenario 2006–50	Trend Growth scenario 2006–50
Average annual rates, per capita, PPP GDP				
World	2.9	1.9	2.5	2.2
OECD	3.7	1.9	2.1	2.0
Rest of World	2.8	2.4	3.1	2.7
East Asia, Pacific	3.2	5.2	3.7	3.8
China	2.9	6.4	4.4	4.2
South Asia	1.3	3.6	3.6	3.5
India	1.4	3.9	3.9	4.0
Latin America	2.4	0.6	2.4	0.7
Middle East/North Africa	3.9	0.3	2.9	1.0
Sub-Saharan Africa	2.0	−0.1	2.6	0.1
Eastern Europe/former Soviet Union	3.5	0.0	2.6	1.6

Sources: 2006–50 from IFs, Market First scenario, model version 5.21, and by assumption. Historical data from Maddison (2003) with extensions by author.

Table 7. *Market First scenario*

	Constant within-country distributions			Lessening inequality within countries[a]	Increasing inequality within countries[b]
	2005	2015	2050	2050	2050
Millions of people with consumption below $1 per day					
World	965	792.4	353.4	248	468
Share of world population	14.8%	10.6%	3.8%	2.6%	5.0%
Share of non-OECD population	17.4%	12.2%	4.3%	2.9%	5.6%
Sub-Saharan Africa	427	472.2	306.0	236.2	411.3
Share of population	58.4%	51.2%	17.4%	13.5%	23.6%
India	163	45.5	0	0	0
Share of population	15.1%	3.0%	0.0%	0.0%	0.0%
China	131	79.3	0	0	0
Share of population	10.0%	5.0%	0.0%	0.0%	0.0%
Gini	0.634	0.635	0.610	0.593	0.623

Source: Author's calculations based on the Market First scenario.
[a] Estimates, based on Higgins and Williamson (2002) estimates for 2050.
[b] Estimates, based on World Bank (2007) estimates for 2030.

and South Asia—Afghanistan, Bangladesh, Pakistan, Nepal, and North Korea—and Haiti account for most of the rest of the people still living in extreme poverty in 2015. By 2050—assuming *per capita* income growth over 2% a year—the poverty headcount in sub-Saharan Africa has started to fall but is still over 300 million people. By 2050, in this high-growth scenario, the global poverty rate is 4.3%.

The world Gini coefficient falls to 0.61 in 2050, but still remains high compared to most within-country distributions because economic growth is assumed to continue to be strong in the OECD and other rich countries. The Lorenz curve—it is hard to see—crosses: the 2050 curve is outside (to the right) of the 2005 curve at the lower income levels suggesting that the recorded fall in the Gini coefficient by 2050 is an ambiguous measure of inequality since the share of global income going to the very poorest groups actually declines (Figure 1).

Sub-Saharan Africa stands out although even there the poverty headcount eventually starts to decline. Economic growth in this scenario is not low by world historical standards and good by African standards—GDP *per capita* is projected to rise by 2.6% per year for the region. The average of country growth rates is similar at about 2.4% per year, but the IFs projections show a wide range of country growth rates, [14] from −0.6% per year in Eritrea to 4.6% per year in Uganda. These rates of growth are enough to bring the poverty rate down sharply in the region, but population growth is so high and the starting level of income is so low in most countries that it takes a GDP *per capita* growth rate of approximately 2% per year or more to bring the poverty headcount down. Angola, Eritrea, and the Democratic Republic of the Congo [15] are among the weakest performers—and 16 out of the 47 countries projected show higher poverty headcounts in 2050 than in 2005. High projected economic growth in Tanzania and Uganda and several other countries helps cut the poverty headcount. The Republic of South Africa, however, eliminates extreme poverty not because of high economic growth but because it had so few people below the threshold in 2005 that it does not require much positive *per capita* economic growth to push almost all of the population above the poverty threshold (Table 8). In all these projections I assume that the distribution of income within countries and the ratio of consumption to GDP remain constant at the last observed ratios.

Some researchers have attempted to forecast changes in within-country income distribution. Using data from the 1960s through the 1990s, Higgins and Williamson (2002) find a strong relationship between trends in income equality and demographic shifts: inequality decreases as the higher-earning middle-age cohorts grow in proportion to the rest of the population. They forecast very large decreases in within-country inequality over the next 50 years, with

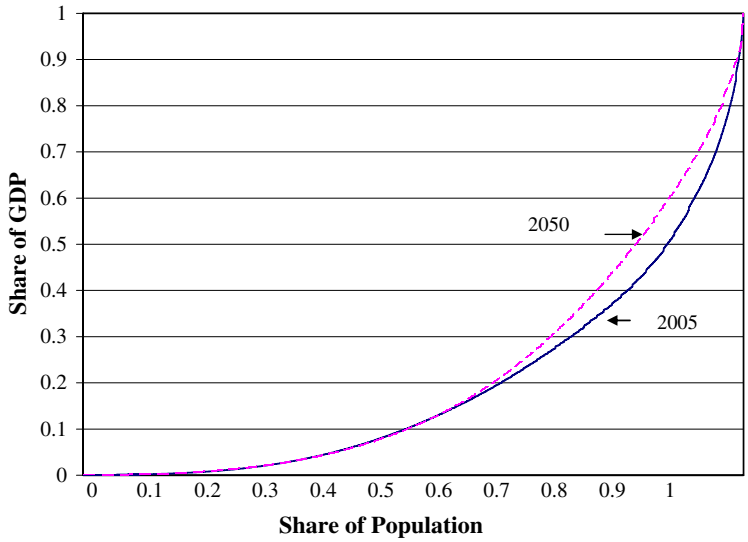

Figure 1. *Lorenz curves: 2050 in the Market First scenario compared to 2005.*

Table 8. *Sub-Saharan Africa: poverty headcount in the 10 most populous countries*

	Poverty headcount (millions) and headcount ratios (%)						Change in millions, 2050 from 2005	Average annual growth, GDP *per capita*, 2006–50 (%)
	2005	Ratio	2015	Ratio	2050	Ratio		
Nigeria	100.5	71.5	109.6	62.8	52.3	16.4	−48.2	2.8
Ethiopia	42.9	62.0	40.0	45.5	2.5	1.4	−40.4	3.2
Congo, DR	58.3	97.0	78.2	95.7	136.4	70.7	78.1	2.5
Rep. of South Africa	8.3	19.4	8.6	18.9	0.0	0.0	−8.3	1.4
Sudan	23.3	58.0	21.6	43.6	12.0	15.6	−11.3	2.0
Tanzania	26.3	70.6	26.4	56.5	1.6	1.9	−24.7	3.7
Kenya	16.0	49.4	18.0	44.2	0.8	1.1	−15.2	3.3
Uganda	13.6	49.9	13.2	36.2	0.0	0.7	−13.6	4.9
Ghana	5.1	24.2	5.0	19.3	0.0	0.0	−5.1	2.9
Madagascar	10.8	60.0	13.5	58.4	2.0	4.3	−8.8	4.5
47 countries	427.1	58.5	472.4	51.4	306.0	17.4	−121.1	2.6

Source: Author's calculations from Market First scenario.

the weighted-average African Gini falling from 46.4 in the 1990s to 37.8 in 2050, and the Latin American and Pacific Rim region experiencing similar proportionate declines. Higgins and Williamson also report estimated changes in the ratio of income of the highest to the lowest quintiles (Q5/Q1 ratios) for the three regions.

While the Higgins–Williamson regional income distribution estimates do not give a clear linkage to the country income and consumption distributions used in this paper, I used their forecasts of the declines in Gini coefficient and Q5/Q1 ratios to generate forecasts of country distributions, and then calculated the resulting headcounts to show the sensitivity of the poverty and Gini numbers to the Higgins–Williamson forecast. The new country-distribution estimates used in this simulation captured the essence of the Higgins–Williamson estimates: the three regional Gini coefficients fell by the same ratio and the change in the Q5/Q1 ratios fell by the same amounts. The postulated change in within-country inequality, motivated by shifting demographics, reduces the global poverty headcount estimate in 2050 from 353 million people to 248 million.

Researchers at the World Bank (2007), however, have recently used other empirical work suggesting a conclusion opposite to the Higgins–Williamson: as the shares of older workers rise in proportion to the total work force, inequality rises "because wage dispersion within these groups tends to be high." [16] The World Bank report suggests an increase of about 0.04 in the African regional Gini coefficient by 2030, and an increase of 0.033 in the Asian Gini, and a decrease of 0.016 in the Latin American Gini. I generated rough estimates of what the World Bank numbers would mean to the percentile distributions used in this paper; the inferred Q5/Q1 ratios rising in Asia and Africa, instead of falling as in the Higgins–Williamson case. The shifting within-country distributions push up the 2050 global poverty headcounts to 468 million people.

While these numbers are necessarily imprecise, overall they tell a good-news story. The extreme poverty headcount is shrinking in most regions by 2015 and in all regions by 2050. The Millennial Development global poverty headcount ratio goal—15% by 2015—is easily met. While I have been focusing on the numbers at the $1-a-day standard, the improvements at the more generous $2-a-day standard are even more impressive, from 2,337 million (42.2% of non-OECD population) in 2005 to 887 million (11.1%) in 2050. Even in the pessimistic scenario in which demographic shifts lead to worsening within-country distributions (the World Bank scenario), the global poverty headcount still shrinks dramatically because of good economic growth.

The trouble with this good-news story, however, is that it is just a scenario; there is no way of knowing if world economic growth rates will be anywhere near this high or how within-country distributions will change. The growth rates assumed in the Market First scenario are, after all, almost everywhere higher than those that actually occurred in the post World War II "golden age" period of global growth when so much of the poverty rate reductions calculated by Bourguignon and Morrisson occurred.

Economic growth above 3% per year in *per capita* terms in the non-OECD countries is certainly possible over the next 45 years. Most of the countries in this group are so far behind the OECD countries in productivity levels that they have enormous growth potential by gradually adapting modern techniques and gradually converging toward OECD-levels of productivity. The long-term growth rates envisioned in the Market First scenario for Africa, Latin America, and the Middle East are actually quite close to the actual growth rates achieved in 2002–06, coinciding with an unusually high period of world economic growth. But even assuming that resource constraints or climate difficulties do not intrude, maintaining such high growth rates will involve enormous changes in governance, institutions, and attitudes in many countries. Economists at the World Bank and elsewhere are in general agreement on the nature of governance and institutions that work best to promote long-run economic growth:

- Free markets and private property are better at generating growth than centralized government control of production, but a strong government role is nonetheless essential to enforce the rules of peaceful economic behavior and alleviate inevitable market failures.
- Trade and financial market liberalization is needed to spur competition and the flow of investment funds, including increased access to developed-country goods and capital markets.
- Democratic accountability of government is helpful, to keep both corruption and predation from destroying incentives to work, save, and invest, and to encourage pro-growth spending on education, health, and infrastructure. [17]

But despite wide—not universal—acceptance of these principles there is little agreement on how countries can or should transition to modernity. No well-meaning expert has the ability to design a fail-safe program to guarantee economic success even in countries with governments willing and eager to reform, and the sequencing of reforms is in much dispute. [18] There is also much outright political opposition to many of the tenets of this market-oriented approach to economic governance and it is very easy for political leaders to resist or overthrow reform efforts for reasons of intellectual disagreement, ignorance, domestic politics, or personal advantage.

The Market First scenario also assumes that the OECD countries continue to grow at high rates—high in *per capita* terms compared to historical norms. This is not implausible. The OECD countries have economic and political institutions designed to generate good economic growth, and large expenditures for research and development are expanding the knowledge frontier in a way that could well

lead to significant productivity gains for decades to come. Growth in the countries at the technological frontier depends mainly on human capital development and there is no physical limit on that. [19]

High OECD growth by itself does not help the global inequality numbers, but it is helpful to economic growth—and hence poverty reduction—in the non-OECD countries. The OECD countries, however, face their own set of problems, especially those dealing with a rapidly aging population that threatens to undermine the social contract that underpins economic success. It is easy to imagine a scenario with much lower economic growth in both the OECD countries and the rest of the world.

(b) *The Trend Growth scenario*

In an alternate scenario I calculate what would happen to global poverty if the benign assumptions that drove convergence of the less-developed countries in the Market First scenario did not occur. Instead, most countries are assumed to continue on the same trajectory they have been on for the last 25 years. For some countries, notably China and India, that is a very good trajectory. But for Latin America, Africa, and the Middle East, recent economic history has not been favorable at all (Table 9). In Latin America, GDP *per capita* grew an average of only 0.6% per year, 1981–05, while growth averaged 0.3% a year in the Middle East/North African region. In sub-Saharan Africa, GDP *per capita* declined an average of −0.1% per year, pushing the poverty rate up by 6.6 percentage points and increasing the poverty headcount by nearly 230 million people. [20]

In the Trend Growth scenario *per capita* growth rates in the non-OECD countries as a whole are less than a half percentage point per year below than in the Market First scenario, but the growth assumptions are cut drastically in the countries where most of the poverty is—sub-Saharan Africa, North Africa, and a few Asian states. As we saw, the Market First scenario assumes very large increases in economic growth in these countries, compared to the recent past.

What happens to global poverty if economic growth rates do not improve from the levels recorded in 1981–2005? In some regions the trend-growth assumptions do not do much to raise poverty—even at the $2-a-day definition—because there is not much extreme poverty to begin with in the region (i.e., Latin America, although some countries such as

Table 9. *Poverty headcounts and poverty ratios in the troubled regions*

	Average annual growth, PPP GDP *per capita*, 1981–05 (%)	Poverty headcount (at $1 a day, millions of people)		Poverty headcount ratio (%)	
		1980	2005	1980	2005
Latin America	0.6	43	55	11.9	9.9
Middle East/North Africa	0.3	9	27	4.7	7.7
Sub-Saharan Africa	−0.1	198	427	51.9	58.4
Non-OECD	2.9	1,279	965	34.9	17.4
World	1.7	1,279	965	29.0	14
		Poverty headcount (at $2 a day, millions of people)			
		1980	2005		
Latin America		100	142	27.8	25.3
Middle East/North Africa		46	95	25.3	27.9
Sub-Saharan Africa		290	605	76.0	82.5
Non-OECD		2,382	2,337	64.9	42.2
World		2,386	2,337	54.1	36.3

Source: Author's calculations.

Table 10. *Poverty headcounts (millions of people) in the troubled regions*

	2005	2015		2050	
		Market First	Trend Growth	Market First	Trend Growth
Latin America	55	53	59	15	68
Middle East/North Africa	27	22	26	2	27
Sub-Saharan Africa	427	472	542	306	1,039
World	965	792	869	353	1,237

Source: Author's calculations.

Haiti are badly hurt) or because the trend rates of economic growth are high (i.e., India and China). Sub-Saharan Africa, however, which was helped in the Market First scenario by some extremely favorable assumptions about policy changes—if not regime changes—is seriously hurt. By 2050, the extreme poverty rate rises to over 1 billion people (Table 10).

In the Trend Growth scenario, the brief move toward global income equality is reversed sometime after 2015. From a global Gini of 0.634 in 2005, the Market First scenario pushes it down to 0.610 in 2050. In the Trend Growth scenario, the global Gini rises to 0.708 by 2050 (Figure 2).

The absolute income gaps between the North (the OECD) and the South (ROW) do not shrink in either scenario. In the optimistic Market First scenario, income gaps tend to rise, from about $22,793 per person in 2005 (in PPP dollars, 1995 price levels), to $28,521 in 2015, to $52,233 in 2050. The ratio of OECD to ROW *per capita* income falls sharply, from 5.9 to 3.9, but the absolute gap almost doubles.

However lamentable, a widening of the gap in absolute terms is almost inevitable unless the OECD countries stop growing. If the OECD failed to grow at all for the next 45 years (*vs.* 2% or a little more in our two scenarios), it would take a ROW growth rate of 4% per year (*vs.* 3.1% in the Market First scenarios) for the absolute gap to disappear by 2050. Even if one thought this were a desirable result, it is likely that lower growth in the OECD would lead to lower growth in the rest of the world—it is hard to imagine the ROW countries growing robustly if the OECD countries are stagnant. [21]

In all of these scenarios, extreme poverty becomes much more highly concentrated in sub-Saharan Africa because higher economic growth in Asia—particularly in India and China—removes hundreds of millions of people from the global poverty headcounts. Assuming 2% per year population growth, sub-Saharan Africa needs 2% per year *per capita* GDP growth (and constant within-country distributions) just to keep the extreme poverty headcount from rising by 2050. Faster growth—2.6% per year in the Market First scenario cuts the headcount from 427 million to 306 million, and higher growth rates are possible. In addition to raising GDP growth, however, lowering population growth or flattening

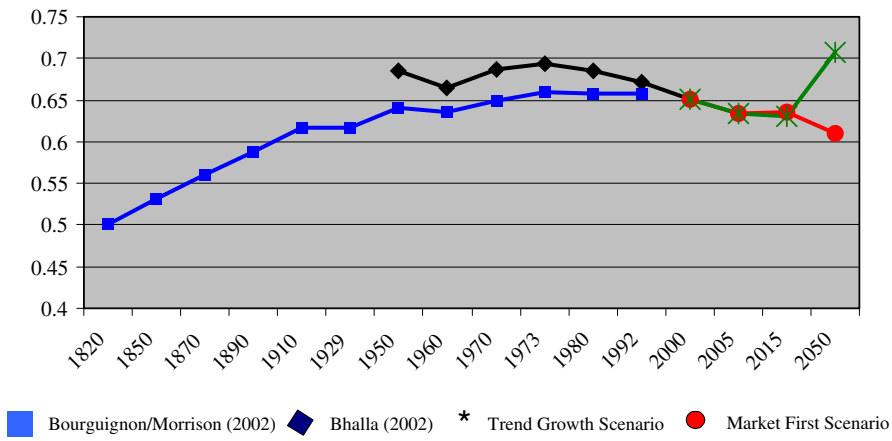

Figure 2. *Global Gini: estimates and projections.*

within-country distributions could also help reduce the poverty headcount. If somehow, sub-Saharan Africa could cut its population growth rate in half but still manage GDP *per capita* growth of 2.6% a year, the 2050 poverty headcount would fall below 200 million people. If we combine the 2.6% GDP *per capita* growth assumption with the low population growth assumptions (1% per year), and with the Higgins–Williamson favorable distribution forecast, the sub-Saharan poverty headcount would fall to less than 150 million people.

4. CONCLUSIONS

This paper has taken a long view of economic growth, poverty, and inequality—a view from 1820 to 2050. While acknowledging that the data are far from perfect and the methodology to fill in the gaps requires a substantial amount of guesswork, key contributions in the literature—especially Maddison (1995, 2001, 2003), and Bourguignon and Morrisson (2002)—have established that world economic growth has been, on average, very high since 1820, high enough to cause global poverty rates to fall dramatically. More recent work—especially Chen and Ravallion (2004a, 2004b), Bhalla (2002), and Sala-i-Martin (2002a, 2002b)—has shown that the downward trend in the global poverty rates accelerated after 1980 and even the poverty headcount has started to show a significant decline.

This paper has projected world poverty rates, headcounts, inequality measures, and absolute income gaps out to 2050, based on two different scenarios for global economic growth. In the optimistic growth scenario the global poverty rate at the $1-a-day standard falls sharply, from 17.4% in 2005 to 12.2% in 2015, to 4.3% in 2050, and the extreme poverty headcount is cut by 612 million people during 2005–50. The absolute gap between *per capita* incomes in the OECD and the ROW, however, almost doubles to over $52,000, and the global Gini coefficient decreases only slightly. Even though African economic growth is assumed to rise substantially from its weak performance of the last 25 years, hundreds of millions of people are still estimated to remain in extreme poverty in 2050. It would take far more growth—even with the favorable within-country distribution shifts estimated by Higgins and Williamson (2002)—to bring the poverty headcount down to levels expected for the rest of the developing world.

In the alternate scenario, we assume that the regions that have been lagging—sub-Saharan Africa, the Middle East, and Latin America—do not transition onto a high-growth path. This results in a sharp increase in poverty headcounts—884 million more people living on less than $1 a day in 2050 than in the first scenario, and 272 million more than in 2005. This is a depressing scenario, but a plausible one. It only assumes that economic growth in the troubled regions of the world does not improve over recent performance.

NOTES

1. The 23 OECD countries as of 1992: France, Germany, Italy, the United Kingdom, Belgium, the Netherlands, Denmark, Spain, Portugal, Greece, Switzerland, Sweden, Finland, Luxembourg, Austria, Iceland, Norway, Ireland, the United States, Canada, Australia, New Zealand, and Japan. Other definitions of the "rich" countries or the "North" are of course possible.

2. Not to mention the dissenters. Wade (2004), for one, says that the data—household survey, national income accounts, income distribution, and purchasing power parity (PPP) calculations—are so bad that there is no way to be sure if the poverty headcount is going up or down, but this seems unlikely given the economic growth in China and India in the last two decades. See also Dowrick and Akmal (2005) who also criticize the existing PPP calculations and assert there was no discernable decline in the global Gini coefficient during 1980–93.

3. For example, see Boltho and Toniolo (1999).

4. I used data from the World Bank's World Development Indicators (2006) for most of the other data points through 2005, and home currency real GDP growth rates for the very few observations not covered by the World Bank.

5. This is an update and extension of the original World Bank database compiled by Deininger and Squire (1996).

6. Or income distribution if consumption distributions were not available. Consumption distributions were available from WIID2a database for about half the cases for the non-OECD and for none of the OECD countries. Where the WIID2a data bank contains estimates of consumption and income distributions for the same country year, the consumption-based Gini estimates are usually substantially lower. Thus estimates used here based on income distributions could tend to overstate the poverty headcount.

7. World Bank and UN millennium development goals literature usually define the global poverty headcount ratio as the number of poor people in the developing world divided by the total number of people in the developing world although this could easily be confusing. Unless explicitly stated otherwise, this paper will state the global poverty ratios following World Bank usage. All references to the global Gini coefficient, however, reflect total world population and incomes.

8. Both those in Chen and Ravallion's (2004a, 2004b) papers or those currently available at the World Bank's "Povcal" website, http://iresearch.worldbank.org/PovcalNet/jsp/index.jsp.

9. In the forecasts below I show how the Republic of South Africa fits the former case and the Democratic Republic of the Congo fits the latter case.

10. The 1980–2005 reductions in poverty headcounts reported in this paper confirm and extend the Bourguignon/Morrisson conclusions.

11. The model is freely available at the website of its creator, Professor Barry B. Hughes of the University of Denver (http://www.du.edu/~bhughes/ifs.html).

12. See, in particular, the United Nation's *Global environment outlook 3* (2002), the "Davos World" scenario from the National Intelligence Council's Mapping the global future (2004), and the World Bank's *Global economic prospects* (2007). The global growth numbers presented in the Market First scenario are only slightly higher than those presented for 2006–30 in the World Bank's "central scenario." The World Bank report does not include detailed numbers for a higher and lower growth scenario.

13. The population growth rates embedded in the IFs forecasts closely track the United Nation's mid-range population forecast.

14. Mainly because of different assumptions about policy changes by country, and between-country historical differences in translating policy changes into economic growth.

15. The numbers for the Democratic Republic of the Congo (Congo, DR) are particularly discouraging. Maddison's GDP *per capita* figures for the Congo, DR (Zaire in his work) are very low, about $200 in 2001—roughly one-third the figure reported by the World Bank. From this base, even the *per capita* GDP growth of over 2.5% per year posited in the Market First scenario does not reduce the Congo's poverty headcount. Using the higher World Bank figures would result in a somewhat smaller poverty headcount in 2005 and a substantial reduction in the headcount by 2050. The World Bank does not publish poverty headcount numbers for the Congo, DR.

16. Global economic prospects (2007, p. 85).

17. See Williamson (2004) for a discussion of the "Washington consensus."

18. Sachs (2005) is more optimistic than most. Dani Rodrik (2006) provides a useful discussion of the current state of the Washington consensus.

19. See Beckerman (2002) or Gordon (2003) for optimistic discussions about the prospects for world growth.

20. *Per capita* GDP growth was also negative in Eastern Europe, the former Soviet Union, and Iraq, due mainly to a one-time regime change of a massive order. Recent trend growth in these countries and regions is not very meaningful and it is thus not treated in the same way as the other three sub-performing regions in this scenario. In addition, growth rates in China, India, and a few other Asian countries are assumed to decline from their recent high rates. Growth rates from the Market First scenario are used for these high-performing countries.

21. Simulations with the IFs model suggest that long-run sub-Saharan African growth would fall between 40% and 140% as much as OECD growth depending on assumptions about protectionism and technology pass-through. African economic growth in the IFs model is also quite sensitive to the level of foreign aid. Raising foreign aid contributions, gradually, to 0.75% of OECD GDP has no discernible impact on OECD growth, but it increases sub-Saharan African growth by almost 1 percentage point a year and reduces the sub-Saharan poverty headcount by 120 million people by 2050. The model simulations implicitly assume that most of the aid (an extra $6 trillion over 50 years) goes to investment in physical and human capital.

REFERENCES

Beckerman, W. (2002). *A poverty of reason: Sustainable development and economic growth*. Oakland, CA: The Independent Institute.

Bhalla, S. S. (2002). *Imagine there's no country: Poverty, inequality and growth in the era of globalization*. Washington, DC: Institute for International Economics.

Boltho, A., & Toniolo, G. (1999). The assessment: The twentieth century—achievements, failures, lessons. *Oxford Review of Economic Policy, 15*(4), 1–17.

Bourguignon, F., & Morrisson, C. (2002). Inequality among world citizens: 1820–1992. *American Economic Review, 92*(4), 727–744.

Chen, S., & Ravallion, M. (2001). How did the world's poorest fare in the 1990s?. *Review of Income and Wealth, 47*(3), 283–300.

Chen, S., & Ravallion, M. (2004a). How have the world's poorest fared since the early 1980s? Mimeo, World Bank Development Research Group, Washington, DC.

Chen, S., & Ravallion, M. (2004b). How have the world's poorest fared since the early 1980s?. *The World Bank Research Observer, 19*(2), 141–169.

Deininger, K., & Squire, L. (1996). A new data set measuring income inequality. *World Bank Economic Review, 10*(3), 565–591.

Dowrick, S., & Akmal, M. (2005). Contradictory trends in global income inequality: A tale of two biases. *Review of Income and Wealth, 51*(2), 201–229.

Gordon, R. (2003). Exploding productivity growth: Context, causes, and implications. *Brookings Papers on Economic Activity, 2003*(2), 207–279.

Heston, A., Summers, R., & Aten, B. (2002). The Penn World Tables, version 6.1. <http://pwt.econ.upenn.edu/>.

Higgins, M., & Williamson, J. G. (2002). Explaining inequality in the world round: Kuznets curves, cohort size, and openness. *Southeast Asian Studies, 40*(3), 269–288.

Hughes, B. B., & Hillebrand, E. E. (2006). *Exploring and shaping international futures*. Boulder, CO: Paradigm Publishers.

Kakwani, N. (1980). *Income inequality and poverty: Methods of estimation and policy applications*. New York: Oxford University Press.

Maddison, A. (1995). *Monitoring the world economy, 1820–1992*. Paris: OECD.

Maddison, A. (2001). *The world economy: A millennial perspective*. Paris: OECD.

Maddison, A. (2003). *The world economy: Historical statistics*. Paris: OECD.

Milanovic, B. (1999). True world income distribution, 1998 and 1993, First calculation based on household surveys alone. World Bank Policy Research Paper 2244, Washington, DC.

Milanovic, B. (2005). *Worlds apart: Measuring international and global inequalities*. Princeton: Princeton University Press.

National Intelligence Council (2004). Mapping the global future. Washington, DC. <http://www.cia.gov/nic/NIC/globaltrend2020.html>.

Rodrik, D. (2006). Goodbye Washington consensus, hello Washington confusion? *Journal of Economic Literature, 44*(4), 973–987.

Sachs, J. (2005). *The end of poverty*. New York: Penguin.

Sala-i-Martin, X. (2002a). The disturbing 'Rise' of global income inequality. NBER Working Paper 8904, Cambridge, MA, April 2002.

Sala-i-Martin, X. (2002b). The world distribution of income (estimated from individual country distributions). NBER Working Paper 8933, Cambridge, MA, May 2002.

Schultz, T. P. (1998). Inequality in the distribution of personal income in the world: How it is changing and why. *Journal of Population Economics, 11*(3), 307–344.

United Nations (2002a). Human development report. New York.

United Nations (2002b). Global environment outlook 3. New York.

United Nations (2005). Millennium development goals report 2005. New York.

United Nations University (2005). World income inequality database, WIID2a. <http://www.wider.unu.edu/wiid/wiid-introduction-2005-1.htm>.

Wade, R. H. (2004). Is globalization reducing poverty and inequality? *World Development, 32*(4), 567–589.

Williamson, J. (2004). A short history of the Washington consensus. Mimeo, Institute for International Economics.

World Bank (2000). World development report 2000/2001: Attacking poverty. Washington, DC.

World Bank (2006). Global economic prospects: Economic implications of remittances and migration. Washington, DC.

World Bank (2007). Global economic prospects: Managing the next wave of globalization. Washington, DC.

World Development Indicators (2006). Washington, DC: World Bank.