How Long Will It Take to Lift One Billion People Out of Poverty?

Martin Ravallion[1]

Alternative scenarios are considered for reducing by one billion the number of people surviving on less than $1.25 a day. The low-case, "pessimistic" path to that goal envisages the developing world outside China returning to the slower pace of economic growth and poverty reduction of the 1980s and 1990s, but with China maintaining its progress. This path would take 50 years or more to lift one billion people out of poverty. A more optimistic path is identified that would maintain the developing world's (impressive) progress against absolute poverty since the turn of the century. This path would lift one billion people out of poverty by 2025–30. The optimistic path is consistent with both linear projections of the time-series data and nonlinear simulations of inequality-neutral growth for the developing world as a whole. JEL codes: I32, O15

At the time of this writing (in 2012), the available data indicate that 1.2 billion people in the world live in poverty, as judged by the frugal standards used for defining poverty in the world's poorest countries—giving an international poverty line of $1.25 a day (at 2005 purchasing power parity). This paper draws on recent research on global poverty to assess how long it might take to lift one billion people out of such extreme poverty. The paper identifies both "pessimistic" and "optimistic" paths to that goal.

International development institutions and almost all developing countries track poverty measures, and the results are keenly watched. The development literature has devoted less analytic attention to the important task of benchmarking performance.[2] When can we say that performance against poverty is "good" or "bad"?

Setting poverty-reduction goals can help motivate their achievement. The Millennium Development Goals (MDGs) were clearly conceived with that intention. As Hume (2009, p. 4) states, the MDGs aimed to "stretch ambitions and mobilize political commitment and public support."[3] The first MDG was to halve the developing world's 1990 "$1-a-day" poverty rate by 2015. Using the $1.25-a-day poverty line in 2005 prices, the first MDG was attained in 2010, a full five years ahead of the goal (Chen and Ravallion 2012). Even so, that important achievement leaves over one billion people living in extreme poverty.

To motivate extra effort, the goals must not be either too easy or too hard. Past experience can provide useful data for assessing proposed benchmarks for future performance. At the time that the first MDG was set, there were very few time-series observations to draw on. Fortunately, the situation has changed dramatically. Although the data are still far from ideal, we now have a firmer empirical basis for considering alternative goals that are within the range of experience.

The benchmarks proposed here rest on explicit scenarios for future economic growth and distributional change, informed by knowledge of recent past performance in reducing poverty and current expectations about economic growth prospects across the developing world. Unavoidably, there is a measure of conjecture in the establishment of any targets. But it is hoped that this paper's analysis will help guide assessments of our performance toward eliminating extreme poverty over the coming decades and help mobilize future efforts toward that goal.

The first of the two main benchmark trajectories proposed here assumes that the faster pace of poverty reduction that we have observed in the developing world since the 1990s will not be maintained. Rather, a series of economic and policy reversals would require the developing world outside China to return to the slower pace of poverty reduction observed in the 1980s and 1990s, although with China staying on its track. On this trajectory, it would take 50 years to lift one billion people out of extreme poverty.

One can speculate on many more optimistic paths. At one extreme, one might imagine that poverty could be eliminated tomorrow, and for ever after, by using perfectly targeted transfers to close the aggregate poverty gap—bringing everyone to (say) $1.25 a day. However, such perfect targeting has never happened, and it appears unlikely to ever happen (in part because of its likely incentive effects, which would create 100 percent marginal tax rates on poor people). Arguably, such a goal would be too optimistic to mobilize serious effort.

Instead, the focus here is on an optimistic trajectory that is within the range of experience rather than well outside that range. That trajectory assumes that the developing world's recent success in reducing the incidence of extreme poverty will be maintained going forward. It assumes that China continues on its path toward eliminating extreme poverty and that the developing world outside China

remains on the encouraging new path of more rapid poverty reduction that we have observed since the turn of the century.

It is reasonable to expect that this optimistic trajectory will lift one billion people out of extreme poverty by 2025–30. That would require the developing world to be successful across multiple dimensions of poverty reduction, including fostering the conditions for continued, reasonably rapid, economic growth, avoiding major crises (financial and agro-climatic) and assuring that poor people are able to participate fully in that growth, which will in turn require that they have access to schooling, health care, labor-market opportunities and financial resources when needed.

After reviewing what we know about recent economic growth, distributional change, and poverty reduction in the developing world, the paper discusses the proposed benchmark paths for poverty reduction. Two main methodological approaches are used, one based on time-series evidence and one based on simulations. The final section concludes.

Recent Trends in Growth, Redistribution, and Poverty Reduction

The measure of poverty obtained for a given distribution of consumption (or income) depends on the mean of that distribution (relative to the poverty line) and the extent of "inequality" in the distribution.[4] The following discussion will focus first on the mean and then turn to inequality.

Prior to about 2000, poor countries were not typically showing much sign that they would eventually catch up to rich countries in terms of mean income; the convergence process was weak or absent. Indeed, this was often seen as a "stylized fact" of economic development, and it motivated various theoretical explanations centered on the idea of a "poverty trap;" see, for example, Azariadis (2006). Under certain conditions, these models predict that positive economic growth at a low initial capital stock will not be sustainable; rather, dynamic economic, and possibly political, forces will pull the economy back to its initial (low) level in due course. An example of the (potentially many) ways that a poverty trap can arise is when low life expectancies in poor countries dissuade saving and, hence, investment, which in turn keeps life expectancy low. Under certain conditions, this type of "vicious cycle" entails that a small amount of extra investment will not bring a lasting output gain, but a sufficiently large injection of capital will do so—moving the economy out of its trap into a "virtuous cycle" of progress toward a sustainably higher long-run level of income. Such theories have prompted policy arguments in favor of a substantial increase in development aid to poor countries (as in Sachs, 2005).

Turning to recent evidence, we have seen a marked acceleration in the developing world's economic growth since the turn of the century. The developing world as a whole has been maintaining a growth rate for GDP of approximately 6 percent over most of the last decade, although it dipped substantially (and temporarily) in 2008–09 because of the global financial crisis. It is noteworthy that this rate is a full 2 percentage points higher than the average economic growth rate of approximately 4 percent from the 1960s through to the mid-1990s. This growth was fuelled (in part) by substantially greater investment in developing countries since 2000 (from both domestic and external sources), and this was not just in China and India (Lim, 2012).

Has this growth come with higher average household living standards? Macro-level economic growth, as measured in the national accounts (NAS), does not automatically translate into similar growth in average household living standards, as measured by the mean for the distribution of household consumption or income on which poverty measures are based. There are invariably gaps between NAS aggregates and the grossed-up consumption or income aggregates from the household surveys used to measure poverty. There are a number of reasons for these gaps. In practice, the way that the NAS are constructed means that there is nothing exactly corresponding to household consumption as measured in surveys, so full agreement should not be expected. Measurement errors in both sources also play a role, as do differences in accounting periods and sampling problems. A likely source of discrepancies between the two data sources is underreporting of incomes or consumptions in sample surveys or selective compliance in the randomized assignments that are used in implementing the surveys. The rich will undoubtedly have a stronger incentive than the poor to underreport their incomes or consumption and will be less likely to be available for interviews. Indeed, in one assessment (using data for the United States), selective compliance—in which the rich are less likely to participate in surveys than the poor—resulted in a sizeable underestimation of inequality using the unadjusted sample survey data but made little difference for poverty measures (Korinek et al. 2006).

Compiling evidence on how average living standards have been evolving over time in the developing world requires a large number of household surveys, which come irregularly over time. Thus, the calculations are slightly more complicated than when using annual NAS data. Drawing on some 900 household surveys for 125 countries, Chen and Ravallion (2012) provide estimates of poverty measures for "reference years" spanning 1981–2008 at three yearly intervals, which have been updated to include 2010 for this paper. Given the irregular and unsynchronized spacing of surveys, Chen and Ravallion (2010, 2012) use an interpolation method that employs growth rates in private consumption from the NAS for those dates when surveys are unavailable. The survey means are a mixture of consumption and income, depending on what is available in the

surveys. For the Chen-Ravallion poverty measures, two-thirds of the surveys use consumption, which is preferred to income as a welfare metric. (Income is only used when consumption is unavailable.)

On calculating the overall survey means for the Chen-Ravallion reference years, one finds that the trend rate of growth over 1981–2010 was 1.9 percent per annum with a standard error of 0.3 percent. (The trend rate of economic growth is defined here as the regression coefficient of the log mean on time.)

However, as was seen in the NAS data, there was a marked break in the trajectory around the turn of the century. The trend growth rate prior to 1999 was 0.9 percent per annum (standard error = 0.1), while it was 4.3 percent (0.2 percent) from 1999 onward.[5] (The difference in trends is statistically significant: $t = 3.32$, $p = 0.009$.) It is especially notable that this break reflects the higher economic growth rate of the developing world outside China, which rose from 0.6 percent (0.1 percent) prior to 1999 to 3.8 percent (0.3 percent) from 1999 onward.

The key point to emerge from these observations—drawing on both NAS and surveys—is that the output and living standards of the developing world as a whole have been growing at faster rates than for the rich world since the turn of the century, reversing a prior pattern of little or no progress toward economic convergence. How this happened is not yet clear. Possibly, the (private and public) capital flows to developing countries since 2000 have been sufficient to get out of past poverty traps. Or the conditions required for the existence of poverty traps may not in fact hold in practice (as argued by Kraay and Raddatz, 2007), or they may only hold for certain countries or for pockets of poverty within countries, but not in the aggregate. Then, it was just a matter of time, aided by more supportive policy environments (including political stability), before the catching up process would be revealed. Less optimistically, given the uncertainties about the dynamics of the processes involved, one cannot yet rule out the possibility that the forces creating the earlier traps are still there and will reemerge in due course in the form of setbacks to continuing economic growth.

Economic forecasters have never seemed particularly good at predicting reversals or even significant slowdowns. It is possibly not surprising then that current expectations amongst mainstream forecasters are that this stronger new convergence process since the turn of the century will continue. At the time of this writing, the World Bank's economic growth projections assume that a full-blown Euro crisis will be avoided and that the annual growth rate of GDP for the developing world will continue to be 6 percent in the coming few years (having fallen slightly this year) (World Bank 2012b). Given current population projections, a 6 percent growth rate in the GDP over the coming decade would represent a 4.9 percent rate for GDP per capita. (The compound rate of population growth over 2012–17 and 2012–22 is 1.1 percent per annum.) Although the recent growth has not been even across all regions, the three regions that account for the bulk

of absolute poverty—East Asia, South Asia, and sub-Saharan Africa—have observed strong GDP growth rates in recent years: approximately 8 percent in East Asia, 7 percent in South Asia, and 5 percent in sub-Saharan Africa. Current expectations are that these rates will be maintained, although most forecasters acknowledge that serious risks persist that further crises emanating in the "rich world" will spill over significantly into economic growth and poverty reduction in the developing world; see, for example, the discussions in World Bank (2012a, b).

Let us turn now to the other key variable determining the extent of poverty, namely, inequality. The concept of "global inequality" that is relevant to the measurement of global poverty pools all residents of all countries and measures the inequality among them as if they were one country. Figure 1 plots one such measure of inequality, the mean log deviation. The mean log deviation is a theoretically sound measure with the useful property of exact decomposability by population subgroups (Bourguignon 1979). Thus, we can cleanly separate the "between-country" component of total inequality from the "within-country" component. Figure 1 provides this breakdown of total inequality in the developing world.

We see that there has been a trend decrease in total inequality; over the period as a whole, there is a small but statistically significant negative trend, at −0.002 per year (standard error = 0.001), compared to a mean log deviation of 0.57. However, the bulk of the decline in overall inequality was in the period until the late 1990s. There is an indication of rising overall inequality since 2005.[6]

The future evolution of overall inequality will be crucial to the trajectories of overall poverty measures. It might be conjectured that higher rates of economic growth will (at least initially) put upward pressure on inequality within low- and

Figure 1. Inequality in the Developing World
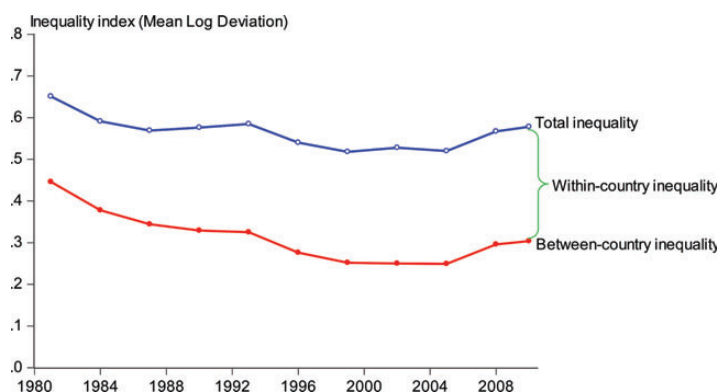
Source: Update to Ravallion and Chen (2012).

possibly middle-income developing countries, as predicted by the famous Kuznets Hypothesis (Kuznets 1955). However, this conjecture is not consistent with past evidence, which indicates that inequality within growing developing countries falls about as often as it rises (Ravallion 2001; Ferreira and Ravallion 2009). Moreover, a number of high-inequality, economically growing, developing countries have succeeded in attenuating and even reducing inequality. The available evidence leads one to doubt that higher inequality is a necessary "price" of higher economic growth and lower absolute poverty (Ravallion 2005).

However, as is evident from figure 1, inequality between countries matters more to the evolution of total inequality. Recent economic growth in India and (especially) China has played an important role in the evolution of the between-country component. Given their initially low average incomes and high population weights, economic growth in China and India has been a strong force for global inequality reduction. This is likely to change when these countries reach the overall mean for the developing world. That has not yet happened but will soon happen in the case of China, where mean consumption in 2010 was 95 percent of the mean for the developing world as a whole ($5.03 per person per day). Continuing improvement in sub-Saharan Africa's economic growth performance would work in the opposite direction, putting downward pressure on overall inequality.

We have seen that substantial economic growth in the developing world as a whole over the 1980–2010 period has come with falling inequality, though with signs of rising inequality since 2005. What then has been the record for poverty reduction?

Following past practice, the incidence of poverty is measured here by the standards used to define poverty in the poorest countries of the world. On this basis, the World Bank's current international poverty line is $1.25 per person per day at 2005 purchasing power parity (Ravallion et al. 2009). The latest (survey-based) estimate of the proportion of the population of the developing world living below $1.25 a day is 21 percent for 2010 (representing 1.2 billion people), down from 33 percent in 2000 and 43 percent in 1990. Figure 2 plots the full series over time.[7] The overall poverty rate ("headcount index") has been falling at a robust 1 percentage point per year over 1981–2010, and this was maintained after 2005. The regression coefficient of the poverty rate on the year in figure 2 is −1.04 (standard error = 0.05; n = 11). The "$1.25-a-day" poverty rate for the developing world as a whole in the year of writing (2012) is estimated to be 19 percent (standard error = 0.6 percent), representing 1.1 billion people.

The extent of the linearity in time is a striking feature of the series for the headcount index in figure 2. This linearity is clear from looking at the graph, but it is also confirmed statistically using a standard test for nonlinearity in the function form.[8] Such linearity is not what one would expect if the overall growth rate

Figure 2. Poverty Measures for the Developing World, 1981–2010
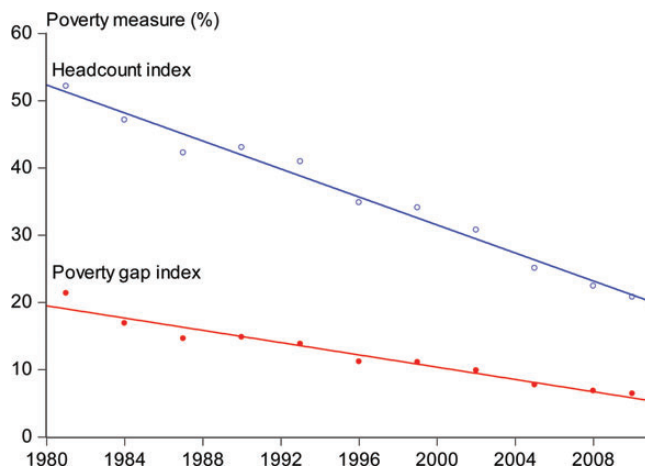
Note: Both measures use a poverty line of $1.25 a day at 2005 purchasing power parity.
Source: Chen and Ravallion (2012) and author's calculations.

in the mean was constant and the elasticity of the poverty rate to the mean also remained constant; then, one would expect the annual rate of decline in the poverty rate to fall over time as the poverty rate fell. However, these conditions have plainly not held. Instead, we have observed higher economic growth rates over time in developing countries and falling overall inequality for the period as a whole, which would tend to increase the elasticity of poverty to economic growth (Ravallion 1997). These forces have been strong enough to keep the annual pace of poverty reduction roughly constant. But that will not happen automatically in the future and rather will require sustained effort. The discussion will return to this point.

Figure 2 also provides the series for the poverty gap (PG) index, which is the mean gap below the poverty line as a proportion of the line, expressed as a percentage. Equivalently, the PG index is the product of the headcount index and the income gap ratio, given by the difference between the poverty line and the mean consumption or income of those living below the line, expressed as a percentage of the line. The PG index fell from 21 percent to 6 percent over the 1981–2010 period. The regression coefficient of the index on year is −0.46 (standard error = 0.04; n = 11). The income gap ratio also fell, from 0.41 to 0.31.

Progress in poverty reduction has been uneven across regions. Table 1 shows the regional breakdown for selected years. Figure 3 shows the series for three regions accounting for 95 percent of those living below $1.25 a day (in 2008). For East Asia, the rate of poverty reduction has been approximately double the

Table 1. Regional Breakdown of Poverty Incidence and Projections for 2015

	1990	1999	2008	2015
Poverty rate (% of the population living below $1.25 a day)				
East Asia and Pacific	56.2	35.6	14.3	7.7
Europe and Central Asia	1.9	3.8	0.5	0.3
Latin America and Caribbean	12.2	11.9	6.5	5.5
Middle East and North Africa	5.8	5.0	2.7	2.7
South Asia	53.8	45.1	36.0	23.9
sub-Saharan Africa	56.5	58.0	47.5	41.2
Total	43.1	34.1	22.4	16.3
Number of poor (millions living below $1.25 a day)				
East Asia and Pacific	926.4	655.6	284.4	159.3
Europe and Central Asia	8.9	17.8	2.2	1.4
Latin America and Caribbean	53.4	60.1	36.8	33.6
Middle East and North Africa	13.0	13.6	8.6	9.7
South Asia	617.3	619.5	570.9	418.7
sub-Saharan Africa	289.7	376.8	386.0	397.2
Total	1,908.6	1,743.4	1,289.0	1,019.9

Source: Chen and Ravallion (2010) and World Bank (2012a).

Figure 3. Poverty Rates for the Three Poorest Regions
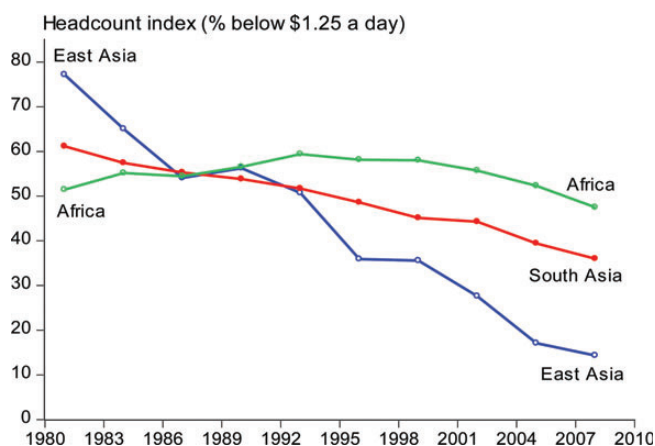


Source: Chen and Ravallion (2012).

average, at slightly over 2 percentage points per year; for South Asia, it has been slightly less than 1 percent, and for sub-Saharan Africa, it has been about zero over the period as a whole. (The coefficients (standard error) are -2.24 percent (0.14) for East Asia, -0.88 percent (0.04) for South Asia and -0.09 percent (0.14) for Africa.)

China's success in reducing absolute poverty has (understandably) attracted much attention. (For further discussion, including discussion of the reasons for this success, see Ravallion and Chen 2007.) However, a less widely appreciated fact is that the developing world outside China has moved to a steeper trajectory of poverty reduction since 2000 (in keeping with the survey means). There have been clear signs of a positive trend emerging in Africa in the 2000s, similar to South Asia. Chen and Ravallion (2012) show that the 2000s have achieved progress in reducing poverty—with both a falling incidence and falling numbers of poor—in all six regions of the developing world (Eastern Europe and Central Asia, Latin America and the Caribbean, and the Middle East and North Africa, in addition to those in figure 3).

If we focus on the developing world outside China, the rate of poverty reduction (again using the regression coefficient on time and the headcount index for $1.25 a day) over the 1981–2010 period was −0.6 percentage points per year (standard error = 0.05; n = 11). It was China's success that pulled the overall rate up to 1 percentage point per year.

However, it has not yet been widely appreciated that there was a marked positive change in the trajectory for the developing world outside China around the turn of the century, as figure 4 shows. For the period up to the late 1990s, the trend rate of poverty reduction for the developing world outside China was −0.4 percentage points per year (standard error = 0.03; n = 6). For the period from 1999 onward, the rate rose (in absolute value) to −1.0 percentage points per year (standard error = 0.04; n = 5).[9] The difference in trends is significant

Figure 4. Poverty Rates for the Developing World Outside China
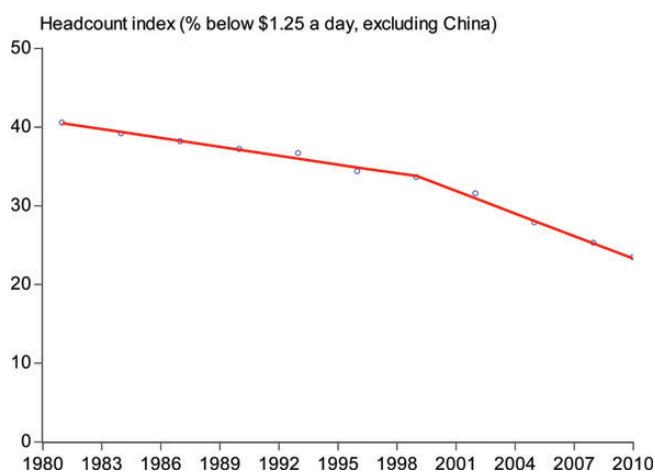
Source: Author's calculations.

($t = 10.01$, $p < 0.00005$). If the pre-2000 trajectory had continued, then 29.6 percent of the population of the developing world outside China would have lived below \$1.25 a day in 2012 instead of 23.4 percent, representing an extra 280 million people who would otherwise have lived below \$1.25 a day.

As an aside, the clear signs of a trend break in about 2000 in figure 4 might be taken to suggest that the MDGs have helped because they were officially ratified that year at the Millennium Summit. It is also notable that we would expect the MDGs to have had an impact outside China, notably in Africa; this is what we see in the data. However, attribution to the MDGs must to await a fuller consideration of other possible explanations for the break in trajectories at about 2000.

Pessimistic and Optimistic Trajectories

In the following analysis, whether one is "optimistic" about future progress in poverty reduction depends on whether one thinks that the new path for the poverty rate in the developing world outside China since 2000 will be extended into the foreseeable future. Current population projections imply that lifting one billion people out of poverty, measured against the \$1.25-a-day standard, would require a poverty rate of only 3 percent (to the nearest integer).[10] In describing the two paths to that goal, the discussion will focus on three dates: 2022 (10 years from the time of this writing), 2030, and the date at which the 3 percent target is reached.

The low-case trajectory of poverty reduction implies that the developing world will not reach that 3 percent target by 2030 or even well beyond that date. By this trajectory, the developing world outside China will return to its pre-2000 pace of poverty reduction from 2012 onward, although China will remain on track. Projecting the series forward linearly from 2012 but at the pre-1999 rate of poverty reduction, this trajectory implies a poverty rate of 17.7 percent for the developing world outside China in 2022 and 14.7 percent by 2030.[11] China's poverty rate would have fallen to zero. Given that current population projections indicate that China's share of the developing world's population will be 21 percent by 2022 (and 20 percent by 2030), the overall poverty rate would fall to 14.0 percent by 2022 and to 11.8 percent by 2030. The number of poor would fall from 1.1 billion in 2012 to 0.9 billion in 2022 and 0.8 billion in 2030. In this low-case trajectory of poverty reduction, it would not be until 2060 that one billion people would likely be lifted out of poverty.

The guiding principle for the optimistic benchmark is that the recent success against extreme poverty in the developing world as a whole will be maintained. Two main ways are used here to quantify such a benchmark. The first is based on time-series projections of past experience, while the second method (in this section and the next) uses simulations.

A simple linear projection of the series in figure 2 gives a poverty rate for 2022 of 8.6 percent (standard error = 1.0 percent), or 0.6 billion people, falling to 3.4 percent (standard error = 1.2 percent), or 0.2 billion people, by 2027. The 95 percent confidence interval for the 2027 poverty rate is (1.0 percent, 5.8 percent). The precise date at which the 3 percent target is expected to be reached is 2027.4 (standard error = 1.16 years); the 95 percent confidence interval for the year in which the 3 percent target is met is (2025, 2030).

The linear projection is an implausible specification for the PG index since it implies that the PG index goes to virtually zero by 2022. (The projected value is 0.3 percent, which is not significantly different from zero; standard error = 0.97 percent.) A log specification for projecting the income gap ratio clearly performs better and gives a projected PG index of 3.9 percent for 2017, 2.3 percent for 2022, and 0.9 percent for 2027.[12] Notice that these projections (allowing for nonlinearity) imply only a modest decline in the income gap ratio under the optimistic trajectory, from 0.31 in 2010 to 0.26 in 2027. The main driving force for the lower PG index is expected to be the decline in the headcount index.

Despite the strong linearity in reducing the headcount index over time (as evident in figure 3), the method of linear projection can be questioned as a means of setting the optimistic benchmark for future progress. The method may suffer from a form of "aggregation bias." As we have seen, past progress has been quite uneven across regions (and countries). China has naturally had a high weight, and we can reasonably expect the virtual elimination of extreme poverty there by 2022.[13] Then, we should recalculate the projection setting China's poverty rate to zero in 2022. For 2022, the linear projection for the developing world outside China is 18.5 percent living below $1.25 a day. With a projected 79 percent of the developing world's population living outside China by that date, we would see an overall poverty rate of 14.6 percent. However, this calculation ignores the clear acceleration that we have seen in the progress of absolute-poverty reduction in the developing world outside China since the mid-1990s. If instead we project forward from 1999 as the baseline, the poverty rate in the developing world outside China would fall to 11.9 percent by 2022, implying an aggregate rate of 9.4 percent—only slightly higher than the simple linear projection.

An alternative method of checking for aggregation bias is to use simulation methods that apply country-level growth projections to baseline distributions at country level and then aggregate up to the global level. This calculation is more complicated. (Note that the base-year distribution is projected forward for each country separately. A constant elasticity is not assumed, as this is unlikely to hold.) However, reassuringly, the calculation is in close accord with the prior calculation based on aggregate trends. Trajectories for poverty in 2015 by this method are reported in the 2012 Global Monitoring Report, drawing on the

Bank's country-specific economic growth projections. These projections give a poverty rate of 16.3 percent for 2015 (World Bank 2012a),[14] which is very close to that implied by the first method, namely, 15.9 percent. Table 1 includes the forecasts by region for 2015 from the Global Monitoring Report. As is clear from table 1, success in reducing poverty in South Asia and sub-Saharan Africa will be crucial to overall progress in poverty reduction. Consistent with the more optimistic scenario above, 80 percent of the projected extreme poverty count for 2015 is in these two regions (about equally).

A further concern is that a constant annual-percentage-point decline cannot continue indefinitely. The trajectory can be expected to slow, becoming nonlinear in time. What is much less clear is when the trajectory is likely to slow. The next section will use a version of the simulation method (as described above for addressing aggregation bias) to determine whether the linear trajectory for the overall poverty-reduction rate is consistent with the expected economic growth rates associated with the optimistic path under explicit assumptions about income distribution.

An Alternative Approach Using Simulations

We have observed that the linear projection of the time series of poverty measures for the developing world suggests that one billion people could be lifted out of poverty by 2027. However, the above discussion has also pointed to some concerns about whether the linearity will hold that long. This section approaches the problem of quantifying an optimistic trajectory in a rather different way, without relying on the time-series evidence.

The key assumption driving the following simulations for the optimistic path is that the overall level of inequality does not increase going forward. In other words, all income levels across the developing world as a whole grow at the same rate, maintaining overall inequality at the same level. As discussed above, while inequality has declined over the period as a whole, new forces may well emerge to put upward pressure on inequality, and we have seen an indication of such upward pressure since 2005 (figure 1). For example, starting in the near future, China's economic growth will begin to put upward pressure on overall inequality in the developing world. Whether Africa maintains its higher average economic growth rates since 2000 or so will be key to whether the 3 percent target will be reached by 2025–30.

To quantify the implications of an inequality-neutral process of economic growth in the developing world as a whole, one can use the baseline distribution and project this forward with a higher mean until any given poverty rate is met and then determine what growth rate is required. This method automatically

accounts for the nonlinearity in how the cumulative distribution function of consumption varies with the poverty line relative to the mean. (Note that nonlinearity can hold, yet the path of poverty-reduction measures over time can still be a roughly linear trajectory.) Thus, we ask the following question: will a continuation of the higher economic growth rates seen in recent times in the developing world be sufficient to lift one billion people out of poverty without a change in the relative distribution of income?

The results of this exercise are found in table 2, column (1), which gives the growth rate in household consumption per capita needed to bring the $1.25-a-day poverty rate down to various levels by 2027, assuming no increase (or decrease) in inequality within the developing world as a whole. The calculations in column (1) are anchored to the 2008 distribution (the latest reference year in *PovcalNet*). For each targeted poverty rate, one solves backward to find the growth rate needed to reach that target, holding constant the 2008 Lorenz curve.

This analysis indicates that without any increase in overall inequality, a growth rate of 4.5 percent in mean household consumption per capita (which is very close to the trend rate of growth in the mean of 4.3 percent since 1999) would get us close to the 3 percent poverty rate in 2027. This simulation suggests that the optimistic target of lifting approximately one billion people out of poverty by 2025−30 is attainable with a continuation of the relatively higher economic growth rates observed in the developing world in the last 15 years or so as long as this does not come with rising overall inequality.

Table 2. Growth Rates for the Developing World as a Whole Required for Various Target Poverty Rates at a Fixed Level of Overall Inequality within the Developing World

Target poverty rate for 2027 ($1.25 a day)	(1) Required annual growth rate in household consumption per capita at 2008 level of inequality	(2) Required annual growth rate in household consumption per capita at 1999 level of inequality
1%	7.6%	6.1%
2%	5.5%	4.0%
3%	4.5%	3.4%
4%	3.7%	2.8%
5%	3.3%	2.3%
6%	2.9%	2.0%

Note: These are the required annual growth rates for survey means over the 2008−2027 period. The calculations in column (1) are based on the distribution of consumption for the developing world in 2008, whereas those in column (2) are anchored to the 2008 mean but use the Lorenz curve for 1999, which gives the lowest overall inequality during the 1981−2008 period. For each target poverty rate, the author solved backward to find the growth rate needed to reach that target, holding constant the Lorenz curve at either 2008 or 1999.

Source: Author's calculations using *PovcalNet*.

The goal could be comfortably achieved even if recent economic growth is not maintained as long as overall inequality falls, and the drop in overall inequality would be within the range of recent experience. To illustrate the magnitudes, column (2) of table 2 gives the economic growth rates needed to attain each poverty rate in 2027, using the relative distribution of 1999. The year 1999 was the year of lowest total inequality in the series in figure 1, with an inequality index of 0.52, compared to 0.57 in 2008. This lower level of inequality will entail lower poverty but will also foster a more poverty-reducing pattern of growth going forward. We now see that if mean consumption grew at 3.4 percent (with no further change in inequality), we would reach a 3 percent poverty rate by 2027.

Naturally, a higher economic growth rate would most likely achieve the poverty-rate target ahead of that date. For example, an extra 1.2 percentage points in the economic growth rate at the lower inequality path of column (2) would lift one billion people out of poverty five years ahead of time, by 2022. At the higher inequality path of column (1), this would require an extra 1.6 percentage points.

Conclusions

The developing world as a whole has seen enormous progress against absolute poverty. While China has contributed greatly to that progress, it goes well beyond China's borders. The developing world outside China saw slow progress in reducing poverty until around the turn of the century, but that progress has accelerated since then. The acceleration in growth since 2000 casts doubt on the idea (which is still common in the development economics literature) that the typical, less developed economy is in some form of a poverty trap. Perhaps capital flows or enhanced productivity of capital through policy reforms, or both, has meant that the developing world as a whole is in the process of escaping whatever trap it found itself in (if indeed there was one). Or perhaps the countervailing (economic and political) forces creating the trap will soon reemerge to retard continued progress and even bring lasting setbacks.

In thinking about how we might judge future progress in reducing poverty, a natural choice for a low-case, "pessimistic," trajectory is to assume that the developing world outside China does indeed regress back to the relatively slow progress of the 1980s and 1990s. This trajectory implies that the proportion of the developing world's population living below $1.25 a day would fall to 12 percent over the coming 15 years, from 19 percent in 2012. On this path, it would take another 50 years or so to lift one billion people out of poverty. This would surely be judged to be poor performance. This paper has attempted to suggest what good performance might look like.

Goals that can motivate extra effort to do much better than this pessimistic trajectory must represent real progress in reducing the incidence of extreme poverty below that trajectory, but they cannot be so far outside the range of experience as to be deemed impossible. This paper's proposed optimistic benchmark for the $1.25 poverty rate in 10 years' time is 9 percent. This "staying-on-the-path" scenario clearly represents very good economic performance, maintaining an impressive recent trajectory of poverty reduction. In the 20 years from 1990 to 2010, the developing world halved its overall poverty rate from 43 percent to 21 percent. On this trajectory, it would be halved again in a mere 10 years.

The optimistic trajectory suggests that we can be confident that the goal of lifting one billion people out of poverty (relative to the count of the number of poor in 2010) would be reached by 2025–30, with 2027 as the most likely date. However, this assumes that the robust linear path that we have observed for the reduction of the poverty rate over time will be maintained. That challenge will not be easy to meet. Instead, it might be conjectured that the pace of poverty reduction will begin to decline at low levels—below, say, 10 percent—thus making it more difficult to reach the goal. From what we know, we cannot be confident about when such a slowdown might be expected.

The paper has also provided simulations to determine what combinations of economic growth and distributional changes might attain the optimistic trajectory. The simulations suggest that a continuation of the economic growth performance of the developing world as a whole since 2000 can be expected to lift one billion people out of poverty by 2027 provided that there is no further deterioration in overall inequality. Although overall inequality in the developing world has been fairly stable since the 1990s, there have been signs of its recent rise. If this continues, then higher economic growth rates than those seen since 2000 will be needed to reach the proposed poverty reduction target. By contrast, a reduction in overall inequality would enable one billion people to be lifted out of poverty with lower economic growth than we have observed in recent times; lower inequality will both directly reduce poverty and make subsequent economic growth more poverty reducing.

In choosing among the multiple solutions for lifting one billion people out of poverty, the sustainability of poverty-reduction efforts is clearly important. We do not want to reach the poverty-reduction target only to fall back in subsequent years. On an encouraging note, recent research has suggested that lower initial levels of absolute poverty at a given mean consumption foster higher subsequent rates of growth in average living standards in developing countries and help to ensure that economic growth itself is poverty reducing (Ravallion 2012). Thus, a "virtuous cycle" can be anticipated that would help to ensure the sustainability of the reduction in poverty.

Environmental sustainability is also important. An economic-growth path that consumes all of a country's natural resources in 15 years may attain the proposed poverty-reduction target, but the poverty rate would likely bounce back. However, existing measures of poverty reduction do not tell us whether the changes observed are actually sustainable; they relate only to the current time period, which might be quite short. Thus, we would need a separate check on the sustainability of observed poverty reduction. The best data that we currently have for that check appear to be the "adjusted net savings" rate based on Hamilton and Clemens (1999).[15] The sustainability of a reduction in poverty that came with reduced (or negative) adjusted net savings would clearly be questionable.

The best sustainable route will naturally vary from country to country. The economic growth projections underlying these benchmark trajectories are grounded in the economic realities of both the particular countries concerned and the global economy. However, the policy challenges of ensuring that poor households share sufficiently and sustainably in that economic growth at country level still need to be addressed.

The bulk of the work needed to reach this global poverty-reduction target will need to be done at the country level. A similar benchmarking exercise for individual countries would be desirable. Naturally, this work would need to reflect the specific conditions and resource base of each country. One should be cautious in attempting to use cross-country comparisons to infer what any one country can accomplish by a specific year, even when such comparisons control for observable differences; there are invariably idiosyncratic factors at country level that cannot be addressed by such cross-country comparisons. This work should ideally accompany a reasonably clear plan of how the lower poverty-reduction targets would be achieved. Various tools for economic analysis exist that can inform such plans, ranging from computable general equilibrium models to microsimulations tools, all of which have strengths and weaknesses.[16]

Monitoring performance against these benchmarks poses a number of serious data challenges. There has been huge progress in collecting primary household survey data. When the World Bank's current global poverty-monitoring effort began in 1990, the estimates used 22 surveys for 22 countries (Ravallion et al. 1991). Today, approximately 900 surveys are used by the Bank's researchers, spanning 125 countries, with more than six per country. The latest estimates use a "global" sample of 2.1 million households. However, many problems remain. There are persistent lags and uneven coverage. (The surveys used here cover 90 percent of the population of the developing world as a whole in 2008, but this varies from 94 percent in East Asia to only 50 percent in the Middle East and North Africa.) Understandably, there are continuing concerns about the comparability of the surveys over time and across countries. Furthermore, there are concerns about underreporting and selective compliance in household surveys; the rich are difficult to interview, and this task is not

becoming any easier. Moreover, the weak integration of macro and micro data is a long-standing concern that warrants more attention than it has received. Better data will help to determine how close—or far—we are from reaching our development goals, including poverty reduction, and in assessing the efficacy of alternative policies for attaining those goals.

Notes

1. The author is the Edmond D. Villani Professor of Economics at Georgetown University; his email address is mr1185@georgetown.edu. At the time of this writing, the author was Director of the World Bank's research department. The author is grateful to Jim Yong Kim for encouraging him to think about this issue and for helpful discussions with Kaushik Basu, Francois Bourguignon, Shaohua Chen, Stefan Dercon, Shanta Devarajan, Francisco Ferreira, Hiroki Uematsu, Sri Mulyani Indrawati, Peter Lanjouw, Ernesto May, Johan Mistiaen, Mahmoud Mohieldin, David Rosenblatt, Jaime Saavedra, Warrick Smith, Hans Timmer, Jos Verbeek, Nobuo Yoshida, Dominique van de Walle and seminar participants at the Overseas Development Institute, London, the UK Department of International Development, London, and the World Bank.

2. The only careful attempt to benchmark performance at the country level appears to be Newman et al. (2010), who draw on time-series evidence across developing countries. They use the empirical distribution of absolute changes in the poverty rate as data to inform the establishment of performance benchmarks for countries in Latin America and the Caribbean.

3. The MDGs were not the first such effort at goal setting; Hume identifies a number of antecedents, including the UN Declaration of Human Rights.

4. Inequality is in quotation marks here because this is not "inequality" as normally defined but rather a more complex function of relative distribution, as discussed in Datt and Ravallion (1992). However, for the present purposes, it is defensible to refer to this simply as "inequality."

5. Two further tests were used. First, the calculation was repeated dropping the 2010 observation because weaker survey coverage means that the estimate is more affected by NAS consumption growth rates used for interpolation. However, the growth rate for the recent period was almost identical (4.3 percent with a standard error of 0.4 percent). Second, these calculations do not constrain the predicted values of the log mean to be identical in 1999. If one prefers to impose that constraint, then the trend growth rates for the two subperiods are slightly lower, at 0.7 percent per annum (0.1 percent) and 4.1 percent (0.2 percent), respectively.

6. Note that these are aggregate indices for the developing world as a whole. Different regions have observed different patterns in how average inequality across countries has been evolving; Ravallion and Chen (2012) provide details by regions.

7. The estimates of absolute poverty measures used here are from Chen and Ravallion (2012), who discuss data and methods. (The update for 2010 is 20.8 percent below $1.25 a day, representing 1.227 billion people.) A fuller discussion of the absolute measures (with various tests of robustness) can be found in Chen and Ravallion (2010).

8. The Ramsey RESET test using the squared fitted values indicated that one could not reject the null hypothesis of linearity; the t statistic for the squared fitted values was -0.83. Moreover, the null could not be rejected on adding a cubed term.

9. If one constrains the predicted values of the poverty rate to be identical in 1999, then the trend-based annualized rates of change become -0.4 percent per annum (0.02 percent) and -0.9 percent (0.04 percent).

10. The required poverty rate falls from 3.3 percent in 2012 to 2.8 percent in 2030. The Bank's current population projections in millions for the developing world, as defined in 2012, are 5,884

in 2012, 6,230 in 2017, 6,561 in 2022 and 7,048 by 2030. Using the 1990 classification of developing countries (to be consistent with *PovcalNet*), the numbers are 6,009, 6,355, 6,687 and 7,173, respectively. This difference does not change the poverty counts reported in this paper at the stated number of statistically significant figures.

11. The projected poverty rate for the developing world outside China in 2012 (based on the trajectory since 1999) is 21.5 percent (standard error = 0.4 percent), and the rate of poverty reduction based on the pre-1999 trajectory is −0.38 percentage points per year.

12. Regressing the log of the income gap ratio (PG index divided by headcount index) on the year, one obtains projections of 0.282 for 2017, 0.271 for 2022, and 0.261 for 2027. The projected PG indices are then obtained by applying these projections to the prior linear projections for the headcount index.

13. Note that China's current official poverty line is $1.80 a day (at 2005 purchasing power parity), above the international line used here of $1.25.

14. These forecasts factor in historical gaps between growth rates in the survey means and growth rates in private consumption per capita in the NAS. For most countries, approximately 90 percent of the NAS growth rate is passed onto the survey means, but for India, it was only approximately half, consistent with the larger gap between the two growth rates for India. In addition, an allowance is made for rising inequality in both China and India. For further details, see World Bank (2008).

15. At the time of this writing, the latest estimates by country are in World Bank (2012c); see table 4.11.

16. A useful compendium of the tools available can be found in Bourguignon et al. (2008). On microeconomic simulation methods, see Ferreira and Leite (2003).

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